MORKRUM SYSTEM OF PRINTING TELEGRAPHY

BY

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The Morkrum system of printing telegraphy
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

A THESIS

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THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

OBJECT.

The object of this thesis is the composition of a detailed description of the Morkrum System of Printing Telegraphy.
THE WORKKRM SYSTEM OF PRINTING THERAPY

OBJECT

The object of this thesis consists in discussing the composition of a general system of the workroom system of printing.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

FOREWORD.

The material for this thesis was obtained from the Morkrum Company, although the wording and arrangement is original with the writer. A number of the drawings of this thesis were also obtained from that company.

R.H.E.
The material for this festival was obtained from the Worxinn Company, and through this company and management it was
then with the writer a matter of the greatest interest. Among the themes were also obtained from that company.

R.H.
# THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

## Table of Contents

**Part I - Introductory**

- **GENERAL** - - - - - - - p.3
- **PRELIMINARY SYSTEM** - - - - - p.7
- **SECOND SYSTEM** - - - - - - - p.8
- **THIRD SYSTEM** - - - - - - - p.11
- **FOURTH SYSTEM** - - - - - - - p.21
- **FIFTH SYSTEM** - - - - - - - p.25
- **SIXTH SYSTEM** - - - - - - - p.27

**Part II - Tape, Code, and Perforator**

- **THE TAPE** - - - - - - - p.35
- **THE CODE** - - - - - - - p.37
- **THE PERFORATOR** - - - - - p.39
- **GENERAL LAYOUT** - - - - - p.42
- **THE PUNCH PINS** - - - - - p.42
- **THE HAMMER** - - - - - - - p.47
- **THE PUNCH LEVERS** - - - - - p.49
- **SELECTIVE MECHANISM** - - - p.50
- **TAPE FEED** - - - - - - - p.56
# THE FOMRUM SYSTEM OF PRINTING TECHNOLOGY

## Table of Contents

### Part I - Introduction

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6</td>
<td>General</td>
</tr>
<tr>
<td>4.1</td>
<td>Preliminary System</td>
</tr>
<tr>
<td>5.1</td>
<td>Second System</td>
</tr>
<tr>
<td>6.1</td>
<td>Third System</td>
</tr>
<tr>
<td>7.1</td>
<td>Fourth System</td>
</tr>
<tr>
<td>8.1</td>
<td>Fifth System</td>
</tr>
<tr>
<td>9.1</td>
<td>Sixth System</td>
</tr>
</tbody>
</table>

### Part II - Type, Code, and Interpretation

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.9</td>
<td>The Tab</td>
</tr>
<tr>
<td>11.9</td>
<td>The Quad</td>
</tr>
<tr>
<td>12.9</td>
<td>The Expurator</td>
</tr>
<tr>
<td>13.9</td>
<td>General Layout</td>
</tr>
<tr>
<td>14.9</td>
<td>The Inner Pins</td>
</tr>
<tr>
<td>15.9</td>
<td>The Numberer</td>
</tr>
<tr>
<td>16.9</td>
<td>The Punching Machine</td>
</tr>
<tr>
<td>17.9</td>
<td>Selective Mechanism</td>
</tr>
<tr>
<td>18.9</td>
<td>Type Need</td>
</tr>
</tbody>
</table>
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Table of Contents (Cont'd)

BACK SPACER .............................................. p.58
END-OF-THE-LINE INDICATOR ......................... p.60

Part III - The Distribution System

GENERAL ................................................. p.68
MOTOR .................................................... p.69
TAPE CONTACTS .......................................... p.71
TAPE FEED ............................................... p.73
TRANSMISSION ......................................... p.78
AUTOMATIC STOP ........................................ p.79
CUT-OUT .................................................. p.85
TRANSMITTING DISK .................................... p.87
POLE CHANGER RELAYS ................................ p.90
RECEIVER DISK .......................................... p.92
TRANSMISSION SHAFT .................................... p.93
SYNCHRONIZER .......................................... p.94
DISTRIBUTOR CIRCUITS ................................. p.104
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>p.63</td>
<td>BACK SPACER</td>
</tr>
<tr>
<td>p.60</td>
<td>END-OFF-THE-MACHINE INDICATOR</td>
</tr>
</tbody>
</table>

### Part III - The Distribution System

<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>p.62</td>
<td>GENERAL</td>
</tr>
<tr>
<td>p.63</td>
<td>MOTOR</td>
</tr>
<tr>
<td>p.47</td>
<td>TAPER CONTROLLERS</td>
</tr>
<tr>
<td>p.26</td>
<td>TAPER FEED</td>
</tr>
<tr>
<td>p.18</td>
<td>TRANSMISSION</td>
</tr>
<tr>
<td>p.19</td>
<td>AUTOMATIC STOP</td>
</tr>
<tr>
<td>p.20</td>
<td>CUT-OFF</td>
</tr>
<tr>
<td>p.21</td>
<td>TRANSMITTING DISK</td>
</tr>
<tr>
<td>p.24</td>
<td>HOPE CHANGER RELAYS</td>
</tr>
<tr>
<td>p.23</td>
<td>RECEIVER DISK</td>
</tr>
<tr>
<td>p.22</td>
<td>TRANSMISSION SHIFT</td>
</tr>
<tr>
<td>p.21</td>
<td>SYNCHRONIZER</td>
</tr>
<tr>
<td>p.10</td>
<td>DISTRIBUTOR ARMS</td>
</tr>
</tbody>
</table>

---

**THE MORRISON SYSTEM OF PRINTING TECHNOLOGY**

Table of Contents (Cont'd)
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Table of Contents (Cont'd)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR CIRCUIT</td>
<td>p.104</td>
</tr>
<tr>
<td>TRANSMITTER DISK CIRCUITS</td>
<td>p.105</td>
</tr>
<tr>
<td>AUTOMATIC STOP CIRCUITS</td>
<td>p.110</td>
</tr>
<tr>
<td>RECEIVER CIRCUITS</td>
<td>p.111</td>
</tr>
<tr>
<td>POLAR DUALUX OPERATION</td>
<td>p.114</td>
</tr>
<tr>
<td>WHEATSTONE DIFFERENTIAL RELAY</td>
<td>p.122</td>
</tr>
</tbody>
</table>

Part IV - The Printer

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
<td>p.134</td>
</tr>
<tr>
<td>TYPEWHEEL</td>
<td>p.135</td>
</tr>
<tr>
<td>PLATEN</td>
<td>p.135</td>
</tr>
<tr>
<td>TYPEWHEEL MOVEMENTS</td>
<td>p.135</td>
</tr>
<tr>
<td>CARRIAGE</td>
<td>p.137</td>
</tr>
<tr>
<td>ROTATOR, STRIKER, AND SHIFT LINKS</td>
<td>p.146</td>
</tr>
<tr>
<td>ROTATOR LINKS</td>
<td>p.147</td>
</tr>
<tr>
<td>STRIKER LINKS</td>
<td>p.153</td>
</tr>
</tbody>
</table>
THE BERMUDA SYSTEM OF PRINTING TELEGRAPHY

Table of Contents (Cont'd)

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>104</td>
<td>Motor Circuit</td>
</tr>
<tr>
<td>105</td>
<td>Transmitter Disk Circuits</td>
</tr>
<tr>
<td>110</td>
<td>Automatic Stop Circuits</td>
</tr>
<tr>
<td>111</td>
<td>Receiver Circuits</td>
</tr>
<tr>
<td>114</td>
<td>Polar Duplex Operation</td>
</tr>
<tr>
<td>113</td>
<td>Wheatstone Differential Relay</td>
</tr>
</tbody>
</table>

Part IV - The Printer

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>General</td>
</tr>
<tr>
<td>126</td>
<td>Trip heaters</td>
</tr>
<tr>
<td>126</td>
<td>Latchen</td>
</tr>
<tr>
<td>126</td>
<td>Triphezal Movement</td>
</tr>
<tr>
<td>128</td>
<td>Carriage</td>
</tr>
<tr>
<td>128</td>
<td>Rotation, Strikers, and Shift Links</td>
</tr>
<tr>
<td>129</td>
<td>Rotation Links</td>
</tr>
<tr>
<td>132</td>
<td>Striker Links</td>
</tr>
</tbody>
</table>
# Table of Contents (Cont'd)

- **SHIFT LINKS** - - - - - - - - p.155
- **SHIFT LOCK** - - - - - - - - p.157
- **SELECTOR MECHANISM** - - - - - - p.159
- **SELECTOR DISKS** - - - - - - - - p.161
- **SELECTOR DRUM** - - - - - - - - p.167
- **ROTATOR LOCK** - - - - - - - - p.170
- **SPACER AND BACKER** - - - - - - p.173
- **PLATEN AND LINER** - - - - - - - - p.185
- **PRINTER CIRCUITS** - - - - - - - - p.190
- **ACTUAL SELECTOR CIRCUITS** - - - - p.193
- **LOCK RELAY CIRCUITS** - - - - - - - p.194
- **LOCK AND PLATE RELAY CIRCUITS** - - p.197
- **FINAL SELECTOR CIRCUITS** - - - - p.200
- **INSTRUMENTS** - - - - - - - - - - p.209
- **OPERATING CIRCUITS** - - - - - - - - p.212
- **ROTATOR CIRCUITS** - - - - - - - - p.214
- **CENTER LETTER CIRCUIT** - - - - - - p.216
- **SPACER AND STRIKER CIRCUIT** - - - p.217
### Table of Contents (Cont'd)

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.53</td>
<td>Shift Links</td>
</tr>
<tr>
<td>1.54</td>
<td>Shift Locks</td>
</tr>
<tr>
<td>1.55</td>
<td>S frivolous Mechanism</td>
</tr>
<tr>
<td>1.56</td>
<td>S frivolous Drills</td>
</tr>
<tr>
<td>1.57</td>
<td>S frivolous Drum</td>
</tr>
<tr>
<td>1.58</td>
<td>Rotor Locks</td>
</tr>
<tr>
<td>1.59</td>
<td>Switch and Backer</td>
</tr>
<tr>
<td>1.60</td>
<td>Plate and Liner</td>
</tr>
<tr>
<td>1.61</td>
<td>Print Circuit</td>
</tr>
<tr>
<td>1.62</td>
<td>Actuator S frivolous Circuits</td>
</tr>
<tr>
<td>1.63</td>
<td>Lock Relay Circuits</td>
</tr>
<tr>
<td>1.64</td>
<td>Lock and Plate Relay Circuits</td>
</tr>
<tr>
<td>1.65</td>
<td>Early S frivolous Circuits</td>
</tr>
<tr>
<td>1.66</td>
<td>Instruments</td>
</tr>
<tr>
<td>1.67</td>
<td>Operating Circuits</td>
</tr>
<tr>
<td>1.68</td>
<td>Rotor Circuits</td>
</tr>
<tr>
<td>1.69</td>
<td>Center Letter Circuits</td>
</tr>
<tr>
<td>1.70</td>
<td>Spacer and Starter Circuits</td>
</tr>
</tbody>
</table>
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Table of Contents (Cont'd)

PRINTER DISTRIBUTION CIRCUIT - - p.220
OPERATING CIRCUITS - - - - p.223
MAIN BREAK CONTROL - - - - p.223
SPACING CIRCUIT - - - - p.225
BACKING CIRCUIT - - - - - p.227
SHIFT CIRCUITS - - - - - - p.228
RUB-OUT CIRCUIT - - - - - p.231
DISTRIBUTION CIRCUIT - - - - p.232
<table>
<thead>
<tr>
<th>Page</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>030</td>
<td>PRINTING DISTRIBUTION CIRCUIT</td>
</tr>
<tr>
<td>032</td>
<td>OPERATING CIRCUITS</td>
</tr>
<tr>
<td>033</td>
<td>MAIN BRAKE CONTROL</td>
</tr>
<tr>
<td>034</td>
<td>SPACING CIRCUIT</td>
</tr>
<tr>
<td>035</td>
<td>DECELERATION CIRCUIT</td>
</tr>
<tr>
<td>036</td>
<td>WATER CIRCUITS</td>
</tr>
<tr>
<td>037</td>
<td>RUB-OUT CIRCUIT</td>
</tr>
<tr>
<td>038</td>
<td>DISTRIBUTION CIRCUIT</td>
</tr>
</tbody>
</table>
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Illustrations

Introduction
Figs. 1 - 6

Impulse Diagram
Code, Tape, and Perforator
Figs. 7 - 15
Plates 1 - 2

Distribution System
Figs. 16 - 30
Plates III - VIII

Printer
Figs. 30 -64
Plates IX - XII.
THE MORRISON SYSTEN OF PRINTING TECHNOLOGY

Introduction

Plate I - a

Imprime Discern

Code Tape em Perforator

Plate II - f

Plate I - e

Distribution System

Plate II - AH

Printer

Plate SC-04

Plate IX - XI11
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Part I - Introductory.

GENERAL. In the operation of the Morkrum System of Printing Telegraphy, the message to be transmitted is first transcribed onto a perforated paper tape according to a code of perforations. This operation is performed on a keyboard perforator, just as though the message were being typewritten. The tape is then run through an automatic transmitter. This device, termed the transmitting distributor, sends out a series of electrical impulses over the line; the character of these impulses is determined by the perforations in the tape.

At the receiving station, the line impulses enter an automatic receiver, called the receiving distributor. Through the agency of this distributor, the incoming impulses control a series of receiving relays, which relays, in turn, control the action of a printing device. This printer is an automatic type-
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

writer which prints, or typewrites, the message onto a standard message blank.

Printing telegraph systems in general possess distinct advantages over Morse systems, especially on heavy traffic lines. Printing telegraphs do not demand the services of skilled operators, whereas Morse systems are entirely dependent upon such services. This circumstance is becoming more and more important by reason of the growing scarcity of Morse operators and the consequent increase in wages demanded by them. Furthermore, the printing telegraph is able to maintain for the entire day, a speed of transmission somewhat greater than the maximum speed obtainable by manual operation. Consequently, fuller service from the equipment as well as a decrease in operating costs is gained when a printing system is
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substituted for Morse.

Before taking up a detailed study of the Morkrum System of Printing Telegraphy, we must establish the principle upon which the line signals are transmitted. This operation is performed by the machines before referred to as distributors. In order that their operation may be clearly understood, a simple device will be chosen which possesses certain features in common with the distributors. This device will gradually be developed until it finally embodies the main features of the actual distributing apparatus. After this preliminary treatment, we can take up a study of the Morkrum System in its practical form.

PRELIMINARY SYSTEM. Certain of the underlying principles of the Morkrum System of Printing Telegraphy are embodied
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

in the telegraphic scheme of Fig. 1. D and D' are two stationary wooden disks or bases, fitted with bearings at their centers. A shaft, S, runs in these bearings, and at each end of the shaft is mounted a metal brush arm, A. These brush arms are in the same angular positions with respect to the shaft; in other words, they are in line. At its outer end, each arm carries a brush, which trails or wipes over its disk when the shaft is revolved. On each disk, and in the path of the brush, is located a series of five contact buttons, these contacts being similarly placed on each disk. Since the spacing of the arms and contacts on each disk are the same, the two brushes will always make contact with corresponding buttons. For example, if the brush at the left rests on the top contact, 1, the brush on the right will rest on the top contact, 1, at that end of
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the shaft.

As for the electrical arrangement, at the transmitting station the contact buttons, 1, 2, 3, 4, and 5, are connected respectively to the keys, $K_1$, $K_2$, $K_3$, $K_4$, and $K_5$, thence through the battery, $B$, to ground at $G$. Therefore, when a key is depressed, the corresponding button will be connected to the battery. At the receiving station, each of the buttons is connected through its own relay to ground at $G'$.

The operation of the apparatus is as follows: Rotate the shaft, $S$, by some means in the direction indicated by the arrow. The brushes will then wipe over the buttons in the order 1, 2, 3, 4, 5, 1, 2, ---. Therefore, if key $K_1$ be depressed, the negative side of the battery will be connected to button 1, and while the transmitting brush is
passing over the button, a circuit will be completed through the shaft, S, contact button 1 on the receiver disk, through the relay $R_1$, to ground at $G'$, and thence to battery, B. The resultant current will operate relay $R_1$. Likewise, if any other key or combination of keys be depressed, the corresponding relays will be operated at the receiving end.

One method of carrying on communication with this device would be to arrange a code, assigning a combination of key-depressions (or relay movements) to each desired character or letter of the alphabet. In all, thirty-one combinations might thus be obtained. One complete combination or letter would be sent out for each revolution of the shaft. By depressing a different set of keys for each revolution, we could send out the successive
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

letters of a word or message, and an observer at the receiving end could read off the message by the relay movements.

The system just described is of course impractical because it is necessary to connect the two stations by the shaft, S. Fig. 2, however, illustrates a plan without this defect.

SECOND SYSTEM. In this second scheme, the two brush arms are not on the same shaft, but are rotated in unison by separate driving mechanisms not shown in Fig. 2. The electrical connection between the two points is maintained by the wire marked "Line", which may be an ordinary telegraph line. Hence, we may have the transmission of signals over a considerable distance.

Messages are transmitted in this scheme in exactly the same manner as in
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at the receiving end can be kept at the same

case of the level components

the system just described is

of some importance because it is necessary

to connect the two streams of the plant.

However, it is necessary to plan without

the system. INTEVER COURSE

somehow the two main streams will meet at the same

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Alleviation measures are not known in this

example of communication between the two plants

is maintained by the simple factor that we may be able later to testify that the plant can be

concurrent assistance.

The answer is straightforward

the same manner as in
the first case. The two driving mechanisms and the means for keeping the two arms in step of course introduce new features, but it is not necessary to discuss these features at this point.

A great improvement in the scheme of Fig. 2 would be effected if some other means of transmission were used instead of the five keys; these keys are too slow and cumbersome. Consequently, an automatic transmitter has been devised and applied to the system; the new system appears in Fig. 3.

THIRD SYSTEM. In the scheme of Fig. 3, the contacts and vertical contact pins, 1, 2, 3, 4, and 5, have been substituted for the corresponding keys of Fig. 2. These pins are mounted loosely, near their ends, on a common horizontal shaft or fulcrum, and have a lever action, through a small range, about
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

this shaft. The contact is made at one end of the lever, so that a slight movement of the other end makes or breaks the contact.

The movement of the levers, with the consequent opening and closing of the contacts, is effected by means of a perforated paper tape. This tape is pulled along flatways under the free ends of the pins. At intervals, holes are punched in the tape, and when one of these holes comes under a pin, the end of the pin drops through the hole. This movement of the pin or lever closes the contact; this condition corresponds to a closed key in Fig. 2. The tape must move along at such a speed, that the combinations of contacts, corresponding to the individual letters, are maintained throughout a complete revolution of the brush arm. That is, there is always a definite relation between the speed of the tape and the speed
The movement of the lever results in a change at one end of the lever. This happens so that a slight movement of the lever and moment to produce the movement of the lever.

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THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

of the brush arm. If the tape is punched properly, line impulses corresponding to a message can be sent out.

Furthermore, the rate of transmission can be increased over the rate of the old system by the operator raising the speed of the tape, and at the same time raising the speed of the brusharms in the proper proportion. By these means, any transmission speed is obtainable, ranging from zero to seventy-five or more words per minute.

However, the rapid transmission made possible by the tape control introduces a new and serious problem, viz., the distortion of the line impulse. This distortion is carried to such an extent that inaccurate receiving is the result. This matter of distortion can be better understood, and a solution devised, through a study of a series of current impulses; we will, therefore, now take up such a study.
The process of obtaining the necessary information to understand the tape's purpose and the importances of the messages can be very complicated. However, if the process is followed carefully and the information is obtained accurately, it can be very useful.

Moreover, if the tape is not properly handled, the information obtained from it may be inaccurate or incomplete. Therefore, it is important to handle the tape properly and to use the information obtained carefully.

In conclusion, the process of obtaining the necessary information to understand the tape's purpose and the importances of the messages can be very complicated. However, if the process is followed carefully and the information is obtained accurately, it can be very useful. It is important to handle the tape properly and to use the information obtained carefully.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

CURRENT IMPULSES. A series of ideal current impulses is represented in diagram (a). Such impulses occur only under perfect operating conditions. This particular series would be sent out by the transmitter during one revolution of the brush arm, with pins 1, 2, 4, and 5, in the closed contact position, and contact 3 open.

In an analysis of the diagram, assume a certain instant, 0, from which to measure time. After a fraction of a second, represented by the length $0t_1$, the transmitter brush strikes button No. 1; since pin contact 1 is connected to the battery and is closed, the button is connected to the battery. Immediately, the line current rises to its full value, $I_1$, shown as the distance $0I_1$, and it maintains this value throughout the duration of contact. At the instant $t_2$, the transmitter brush leaves
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the button, and the current immediately falls to zero. This time of contact, represented by $t_1t_2$, is called a marking interval, and during this entire time, an impulse is being sent out over the line.

As for the succeeding periods, $t_2-t_3$ indicates the time necessary for the brush to go from one button to the next. The space $t_3-t_4$ stands for the time of brush passage over the second button; it is a marking or pulse interval, since the second pin contact is assumed to be closed and its contact button energized. Next, $t_4-t_5$ is the intermediate space between the second and third contact buttons.

The next interval, however, is different from any of the preceding ones. During this time, $t_5-t_6$, the brush is passing over the third button. It will be remembered that the third pin contact was assumed to be open; hence, the third button is not connected to
the battery; therefore, no current or line impulse appears during this interval. This is known as a spacing interval, as opposed to marking interval.

Following this period are the two marking intervals as shown, properly spaced and in every way similar to the first two marking intervals.

A series of impulses such as these is desirable in every respect. The marking and spacing intervals are regular and sharply defined; the current always assumes the same value for each pulse. A properly constructed receiver should respond perfectly to such signals.

However, it is not practical nor even possible to produce such impulses under actual operating conditions. Instead, the series takes the shape indicated in (b). Here, the sharply defined impulses of (a) become wavey, with rounded corners and no
THE MORKRUM SYSTEM OF PRINTING-TELEGRAPHY

definite line between succeeding pulses. The middle or spacing interval is bridged over so that it appears as a weak marking pulse. Or, the pulses may be still further distorted and assume the form of those shown in (c); this latter, in fact, more nearly represents the true form of the working pulses.

As for the causes of this distortion of the impulses, there are two principal ones. The change from the regular impulses shown in (a) to the wavey form shown in (b) is caused by the phenomenom known as current lag. In brief, due to the inductance of the telegraph circuit, the line current does not rise to its full value the instant the circuit is closed by the brush arm contact. Instead, it rises gradually, requiring a very appreciable time to reach its full value. This time of rise for the first impulse is shown as $t_1-t_2$ in (b). In the same way, the current does
The known size of the beam was measured by placing the beam in the path of the laser beam. The difference in size between the measured area and the potential area of the beam was calculated. The measurement was repeated several times to ensure accuracy. The results showed a consistent difference in the measured and potential areas. The implications of these findings are significant for future work in the field of laser beam control.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

not fall to zero the instant the transmitting brush leaves a contact button, but, on account of the capacity of the line, requires an appreciable time to do so. This time of fall is shown as $t_3-t_4$ in (b). Thus, the current does not obey the makes and breaks of the circuit immediately, but is said to lag. When the impulses follow each other rapidly, one does not die away before another begins. The result is that the impulses run together; two marking intervals, separated by a spacing interval, often do this, thereby obliterating the spacing interval.

The saw-tooth form of the wave, as shown in (c), is caused by induction. The neighboring telegraph wires induce small varying currents in the line, so that the resulting current, made up of the induced and working currents, is of the irregular form shown. The induced currents have the
If you do not read the text, I will not read the text. The purpose of this document is to communicate the importance of the concept of the "right time". Is it the time of

"..."
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

greatest effect during the early growth of the impulse; they may even be large enough to reverse the direction of the line current while the impulse is till very small. When the impulse has grown to a reasonable size, the induced currents are absorbed.

A consideration of the causes of distortion will show that since current lag and induction increase nearly directly with an increase in length of line, the amount of distortion varies nearly directly with the length of line.

The effect of impulse distortion on accurate receiving of signals is apparent. Not only does confusion result from the bridging over of the spacing intervals, but also from the fact that the receiver lags behind the transmitter. This lag occurs because the receiver does not respond until the impulse has grown to a working
value. The induced currents do not, as a rule, reach sufficient magnitude to operate the receiving relays; their usual effect is to distort the impulse by destroying the early part, and thereby still further retard the receiver. Since the amount of distortion depends upon the length of line, the longer the line is, the more difficult becomes operation; satisfactory operation cannot be maintained over lines of any practical length.

With the underlying causes of distortion in mind, we are now prepared to take up the solution of the problem. A study of the impulse diagram will show that the question becomes one of causing the impulses to grow to their final working value very rapidly. If the impulses should rise quickly, they would not tend to spread out
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so much, so that there would be a sharp dividing line between marking and spacing intervals. Furthermore, the effect of the induced currents would be minimized, since their greatest effect occurs during the early growth of the pulse, which period would be short.

The solution which has given the most satisfaction is what is known as double current operation. In this scheme, there is a marking pulse as before. However, instead of a space interval being indicated by a current pulse of no magnitude, that is, by an absence of current, it is indicated by a current pulse in the opposite direction. For convenience, the spacing pulse is called positive, whereas the marking pulse is called negative. The terms positive and negative merely indicate that the line currents are
THE ROLE OF THE PERSON TO "LIVELY MINDS." TH

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...with theewan manuscripts and stating to...
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...the most sacrilegious to which a known...
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...negative. The sense positive and negative...
...matter, instead of the line and correct the...
opposite directions in the two cases. The use of both marking and spacing impulses of course necessitates some changes in the equipment, but these changes will be taken up a little later.

The reason for the more satisfactory operation of the double current system can be more clearly understood after that explanation of certain principles of current rise in a circuit. It was just shown how, when there is current in a circuit, the current lags or falls to zero gradually when the circuit is opened. If an e.m.f. be applied, opposite in direction to the one which established the current, the current will fall much quicker than it otherwise would. If the e.m.f. be maintained, the current will decrease, pass through zero, and build up in the other direction.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

to illustrate the application of this principle to our own problem, consider the same impulse series as was used in the previous discussion, except with both marking and spacing pulses. The intervals of this series are marking, marking, spacing, marking, marking, or, in terms of current direction, negative, negative, positive, negative, negative. This series is pictured in (d).

An observation of diagram (d) shows that the two negative or marking pulses which come first are the same as in diagram (c). But at the beginning of the third or spacing interval, a positive e.m.f. is applied, which action causes the line current to fall almost instantly to zero and start to rise in the positive direction. Likewise, at the beginning of the fourth interval, which is marking, the line current quickly reverses and builds up in the negative direction. The last
two intervals are marking, similar to the first two.

A further observation of the diagram shows that the marking and spacing pulses are clearly defined. Furthermore, the pulses are at high values throughout nearly all of their existence, so that the induced currents from other lines are soon absorbed. Thus, the problem of producing definite pulses, little affected by induced currents, is apparently solved.

FOURTH SYSTEM. The application of the principle of double current operation to the telegraphic system which was developed earlier in this discussion appears in Fig. 4. However, before the system as a whole is explained, two new pieces of apparatus should be described.

The first of the new devices
who to listen to the music.

If you can't hear me,

He strode into the room

and slammed the door.

The room was empty

except for a single

chair.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

is a relay pole changer. This is an ordinary relay equipped with both front and back contacts. When the relay coil is not energized, the armature remains against the back contact, but when the coil is energized, the armature is drawn forward against the front contact.

The other new device is a polarized relay. This relay has an armature which plays between two contacts, but has no retractile spring. When the coils of the relay carry current in one direction, the armature takes position against one contact. If the coil current is reversed, the armature goes over to the other contact. Since there is no retractile spring, when there is no current in the coils, the armature remains against whichever contact it happens to be.

With this understanding of these new instruments, we can take up an ex-
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

planation of the new scheme. As in the preceding system, there are the tape contacts. These contacts do not, in this case, control the line impulses directly, but do so through five of the relay pole changers just described, one pole changer being provided for each of the five tape contacts. Each set of relay coils is connected to the local battery by means of its own tape contact, so that when the contact is open, the relay is not energized and the armature remains against the back point; when the tape contact is closed, the relay is energized so that the armature is drawn over to the front point. The current path from the back point of the relay pole changer is to the negative side of the marking battery and through the battery to ground. The front contact is connected to the positive side of the spacing battery, the negative side
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

of which goes to ground. The armature is connected to one contact button of the transmitting disk. The revolving brush arm is connected to the line.

A consideration of the transmitter circuit shows that with a tape contact open, a negative or marking line impulse is sent out, and with a tape contact closed, a positive or spacing impulse is sent out. Thus, the tape contacts control the character of the line impulses.

At the receiving station, the line is connected through the operating coils of a polarized relay to ground. Therefore, a positive current pulse throws the armature to one side or point, whereas a negative pulse throws the armature to the other point. One point is dead, the other point is connected to one side of the local battery, and the ar-
to one of the most beautiful and picturesque spots in the country.

The following are the conditions to which the contract is subject:

1. The lands shall be used for agricultural purposes only.
2. The tenant shall be responsible for all taxes and expenses associated with the property.
3. The lease shall be for a period of five years.
4. The rent shall be paid in full in advance on the first of each month.
5. The tenant shall not sublet the property without written consent from the landlord.

In witness whereof, the landlord and tenant have signed this contract.

[Signatures]
mature is connected to the receiver brush arm. The receiver relays are connected between their respective control buttons and the free side of the local battery.

As for the operation of the receiving apparatus, suppose a spacing or positive line impulse appears. The armature of the polarized relay goes to its dead contact, so that no local relay is affected. Suppose a negative or marking interval next appears. The armature of the polarized relay goes over to the opposite point, which is connected to the battery. The local relay is energized, and indicates a signal. Thus, in this system, the local receiving relays respond only to the marking intervals, just as was the case in the former system.

FIFTH SYSTEM. Fig. 5 shows a still further development of the system. This
scheme is the same as that of Fig. 4, except that the line signals are sent out by a main-line pole changer, controlled by the relay pole changers, instead of being sent out by the relay pole changers themselves. This main line pole changer is merely a polarized relay with its operating coils connected to the battery through the relay pole changer contacts, its armature connected to the line, and its two points connected respectively to the spacing and marking batteries. The other sides of the batteries are grounded. The operation of the system is apparent from the diagram.

This system possesses two advantages over the former one. The first is that the number of contacts in the main line circuit is reduced to one, viz., the one at the main line polechanger. Under adverse conditions of operation, this feature is of no
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

little importance.

The other improvement appears when a number of marking or of spacing intervals are transmitted in succession. The main-line-pole-changer armature retains the same position throughout the series; hence, the line current is maintained constant at its full value throughout the series. Current lag therefore does not occur except when successive impulses are of different signs.

SIXTH SYSTEM. The final development of the system is shown in Fig. 6. The scheme of Fig. 6 is the same as that of Fig. 5 except for two changes in the receiving apparatus. These changes still further decrease the possibilities of wrong interpretation of the incoming impulses by the receiving apparatus.

The first change is the fact
that the receiving polarized relay does not control the five simple relays directly, but instead, controls an exactly similar polarized relay, which, in turn, controls the five simple relays. This working is plain from Fig. 6.

The second change is shown schematically. It consists of an adjustment by which the receiver disk can be moved forward in the direction of rotation of the brush arm, or can be retarded against the direction of rotation of the brush arm. The total angle through which the disk may be turned is perhaps forty degrees.

The reason for this modification may best be studied from Diagram (e). This diagram is the same as (d) as far as the wave form of the impulse is concerned. It will be noticed from the diagrams that the
The problem is to solve the equation for

\[ y = \sqrt{x^2 + 4} \]

for the values of \( y \) that satisfy the condition

\[ x^2 + 4 > 0 \]

This condition results in the solution set

\[ x \in \mathbb{R} \setminus \{-2, 2\} \]

for the equation.

Moreover, it can be shown that

\[ y = \sqrt{x^2 + 4} \]

is always positive for all real values of \( x \).
impulses are quite jagged and irregular. The irregularities may produce a slight fluttering of the armature of the receiving polarized relay, especially near the transition period between positive and negative pulses. This fluttering is not of sufficient magnitude to throw the armature from one point to the other, but it is great enough to produce a poor contact. Such a contact would not be desirable in the circuit of the simple relays.

A remedy for the uncertain contact in the circuit of the five relays is provided when the second polarized relay is added to the scheme of Fig. 5. This relay does not change its position unless the main line relay first changes; any fluctuation of the armature of the main line relay less than a complete movement from one point to
The importance of the rules and regulations is tremendous. It is necessary to comply with these rules and regulations to ensure the smooth operation of the institution. It is essential to follow the rules and regulations set by the institution.

- The rules and regulations are designed to maintain order and discipline in the institution.
- Compliance with these rules and regulations is crucial for the well-being of the institution.
- Failure to comply with the rules and regulations can lead to serious consequences.

A lack of adherence to the rules and regulations is a serious matter. It can lead to disciplinary action and can have serious consequences.

The following are some of the rules and regulations that are in place:

- **Attendance:** Attendance is compulsory for all students. Absence without prior permission will result in disciplinary action.
- **Behavior:** Students are expected to behave appropriately at all times. Any misbehavior will result in disciplinary action.
- **Use of Technology:** The use of technology is restricted to certain areas of the institution. Unauthorized use of technology will result in disciplinary action.

These rules and regulations are in place to ensure the smooth operation of the institution and to maintain the well-being of all students.

Failure to comply with these rules and regulations can lead to serious consequences. It is essential to follow these rules and regulations to ensure the smooth operation of the institution.
the other does not affect the second relay. The armature of the second relay possesses sufficient residual magnetism so that the contact is kept firm. Hence, any flutterings of the main-line-relay armature do not affect the local relays.

The impulses in the local circuit, with the plan just described, are shown by the rectangular full-line pulses in (e). The transmitted pulses are shown dotted. It will be noticed that the received pulses are fair reconstructions of the transmitted pulses, but occur at a slightly later time because of current lag.

The second change in the system, viz., the angular adjustment of the receiver disk, allows the middle, or fullest portion of the pulse to be utilized. This fact may be understood by a reference to (e).
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

This diagram shows the pulses, and also shows the buttons of the receiver disk developed, or rolled out, just below. The buttons are drawn in to such a scale that the diameter of each button represents the time of brush-passage over that button, and the distance between buttons represents the time required by the brush to pass from one button to the next. The buttons are small compared to the pulses, and that portion of the pulse lying directly above each button is the only portion utilized; the remainder of the pulse occurs while the brush is between buttons. By sliding the entire row of buttons along under the row of impulses, we can make any button receive any part of the impulse series.

This condition can be actually duplicated in practice by the revolution of the disk upon which the buttons are mounted. However, in practice it is never desired
that an impulse be received on any but its own button. Hence, the angle through which the disk turns is only sufficient as to allow each button to receive any part of its own impulse, with a little added leeway in both directions of rotation.

The results of such an adjustment of the disk are two in number. The first is that the disk can be adjusted so as to admit only the peaks of the impulses. Hence, with the aid of the two relays on the line side of the disk, greatly distorted impulses can be correctly interpreted. The second result is that on long lines, where the current lag may produce quite a lag of received pulses behind the transmitted pulses, the receiver disk can be rotated backward until the brush-and-button contact occurs at the same time as the reception of the pulse.
TRANSMITTED TO THE WORLD AT LARGE

and you do something to make it all work out.

and you do something to make it all work out.

and you do something to make it all work out.

and you do something to make it all work out.

and you do something to make it all work out.
Another way of looking at the condition is that the two brush arms are revolving at exactly the same speed, but the receiving arm stays a little behind the transmitting arm, the distance behind depending upon the current lag.

This last described system constitutes the Morkrum System of Printing Telegraphy reduced to its simplest form. The scheme includes the essential features of the Morkrum distributors. (These are so called because they take the five character elements of position, which are found on the tape, distribute them as impulses or elements of time, and then, at the receiving station, retransform the elements back into those of position, that is, relay positions.) This distributing apparatus, together with the tape perforator and automatic printer, makes up the commercial Morkrum System.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

With this preliminary survey of the plan, we are ready to take up a detailed description of the commercial system. There are a number of different types, differing in the minor details, but the one described in the following pages is the one commonly used on commercial duplex telegraph lines.
In this preliminary section

of the report, we wish to take no official
standing position on the question of
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THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Part II - Tape, Code, and Perforator.

THE TAPE. As was said before, the message to be transmitted by the Morkrum System of Printing Telegraphy is first punched onto a paper tape, the number and arrangement of punched holes depending upon the letter or character which the holes represent. Samples of the tape are shown below.

The holes for any one letter or character are arranged in a row across the tape, with the proper blank or unpunched spac-
TERRITORIES

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es between holes. The rows are separated a distance of about one-tenth of an inch, this being sufficient to produce clear distinction between successive letters. Notice that the rows of holes are not exactly perpendicular to the length of the tape, but that they slant backward a little. The reason for this slant will be explained in connection with the transmitting distributor.

Besides the holes used in combinations to represent letters, a continuous row of holes runs the full length of the prepared or punched tape. These holes are used in feeding the tape through the apparatus. The teeth of a small spur wheel engage the holes, so that the tape is drawn along as the wheel revolves. This system of feeding affords a positive and definite tape movement; the tape cannot slip without the
This is a blank page.
feed holes being torn out. If such trouble occurs, it is at once noticed by the opera-
tor and can be remedied.

THE CODE. The perforations follow the plan of the five-unit code, which is given on the sample of tape, p.35. This is called a five-unit code because for each letter or character, there is a total of five intervals, either holes or blanks; "blank" is used for want of a better term, and denotes every location where no hole is punched. The intervals or elements are numbered for reference 1, 2, 3, 4, and 5, across the tape. The five elements allow of thirty-one combinations; hence, thirty-one characters are available.

By the use of a shift, similar to a typewriter shift, thirty-one new meanings may be assigned to the combinations, so that a total of sixty-two characters or signals are available.
Besides the actual characters which are to be transmitted and printed at the receiving station, the code also includes several operating signals, which govern certain functions of the printer aside from its regular printing movements. These signals are: space, carriage return, lining, shift, and rub-out. The space signal causes a space to be left between successive words of the printed message. The carriage return is used when a new printed line is to be started. The lining signal causes the printer to turn up a new line, just as is done in the operation of a typewriter. The shift signal causes shift characters to be printed instead of the normal characters; the printing of the normal characters is restored by the space or the carriage return signal. The rub-out is used
THE MORRUM SYSTEM OF PRINTING TELEGRAPHY

when a mistake has been made in perforating the tape. The tape is run through the perforator again, and the erroneous letters are punched out. Note that the rub-out combination of holes is the only one comprising all five intervals; hence, any other character contains fewer holes, and can be punched out. When the printer receives the rub-out signal, it remains inoperative or "marks time" until a different signal is received; the printer then performs its usual functions, just as it did before the rub-out signal was received.

THE PERFORATOR. The tape is punched by means of a keyboard perforator. The general performance of the machine is as follows: The actual punching of the tape is done by a row of six pin punches which face a die; the tape passes between the punches and the die. Five of the punches are for the five
code holes, whereas the sixth is for the feed holes. An electro-magnetic hammer forces the punches through the tape; on the back or return stroke of the hammer, the tape is advanced one feed hole, so that a fresh section is ready to receive the next series of perforations. Different combinations of holes are selected for the different characters by a selective mechanism worked from the keyboard. This mechanism operates as follows:

Between the hammer-head and the punch pins exists a small clearance, in and out of which five rods or punch levers slide independently. One punch lever is provided for each of the five code punches, but none is provided for the feed punch. When certain holes are to be punched, the corresponding punch levers are left between the hammer head and punches, filling up the clearance. On the forward stroke
of the hammer, the pins are pushed through the paper. If a hole is not to be punched, the punch lever corresponding to that hole is withdrawn from the clearance between the hammer and punches; then, on the forward stroke, the hammer enters the clearance, but not far enough to strike the pin. Hence, no hole is punched by that particular pin. The feed holes are always punched; the selective mechanism has no control over the pin which punches the feed holes. The rods or punch levers are controlled through a series of levers from a keyboard, similar to that of an ordinary typewriter. The keyboard also automatically control the electro-magnetic hammer.

With the idea of the general functions of the perforator in mind, we can now take up a discussion of the machine in its
practical form. In this entire discussion, rough sketches will be used to show the general construction of the parts, but these sketches are not intended to represent the apparatus in detail; the accompanying photographs of the machine show the details of construction.

GENERAL LAYOUT. The perforator consists of a hollow cast iron base, on the top of which are located the hammer and punch mechanisms and the tape reel. The keyboard overhangs the front of the base. Some of the connecting levers between the keyboard and punch pins are inside the base, whereas some are on top. Fig. 7 shows a top view of the perforator; the different parts are identified in the sketch.

THE PUNCH PINS. At the lower left-hand corner of the base are the punch
The page contains a paragraph of text in English, but the content is not clearly legible due to the quality of the image. It appears to be a discussion or an explanation of a concept, possibly related to literature or philosophy, given the presence of words like "discussion," "philosophy," and "literature." However, the exact meaning is not discernible from the image alone.
pins and die. The punches are of steel, about one-tenth inch in diameter by one and one-fourth inches long. There are five of such pins for the tape contact holes, and an additional smaller pin for the feed holes. All six pins slide back and forth in guide holes bored through the face of a small block. The idea is illustrated by Fig. 8, where B denotes the guide block. The block is shaped, and across the open face extends a cover plate, E, also bored with guide holes for the pins. The die, D, lays over this cover plate. The two are channelled out slightly so that the tape can be drawn along between them. The pins ordinarily project behind the back face of the block, and also extend, at their opposite ends, nearly through the end plate, E; they do not, however, extend into the tape channel. The hammer strikes the projecting
the point, stated in the beginning of the essay, and a few others which have been selected from the same source. It is not intended to make this paper a complete publication, but to give a few of the points which have been brought to the writer's attention in the course of his work. It is possible that some slight error may be found in the text, which would not prevent the proper understanding of the intentions of the author. It has been found, however, that it is possible to make the text clear and correct, and that it will be of some value to the reader. The writer, therefore, has endeavored to make the text as clear as possible, and believes that it will be found to be satisfactory in all respects.
ends of the pins, and drives the pins across the channel into suitable recesses in the die; if the tape is in place between the die and end plate, it is of course punched. The punch ends of the pins are slightly hollow-ground so as to give better cutting edges.

The method of returning the pins to their original positions, on the back stroke of the hammer, is also indicated in Fig. 8. The feed-hole pin, F, is rigidly attached to a \(-\)-shaped crosshead, C, which slides back and forth in the guide block; the crosshead is normally held at the rear of the guide block by the spring, S. The forward stroke of the crosshead is limited by its lug (the stem of the "T") striking the end plate, E. The croddhead is also bored with holes for the punch pins, but the fit between the crosshead and pins is so loose
that the crosshead slides forward freely, without pulling any of the pins along with it. Each of the five pins is fitted with a small collar, which rests against the back face of the crosshead. The crosshead ordinarily bears against these collars, so that the pins are held in their extreme back position clear of the tape.

In the operation of the arrangement, after the crosshead has started on its forward stroke, any of the pins can follow, in case they too have been struck by the hammer. The crosshead stays ahead of the pins until the end of the stroke, and the pins go through a punching movement the same as though the crosshead were not present. On the back stroke, however, the crosshead strikes the collars on the pins and carries all the pins back to their original
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positions. A feature which should be noticed here is that at the end of the forward stroke, the pin collars strike the crosshead, and their travel is thereby limited; otherwise, the pins would drive into the die and soon lose their cutting edges.

The method of starting the crosshead on its forward stroke is also apparent from Fig. 8. It will be remembered that the five contact-hole pins are not struck directly by the hammer, but instead, small interference rods are inserted between the hammer and the pins, so that the rods are struck by the hammer. A feed hole, on the other hand, must be punched at every stroke of the hammer, and hence no punch lever is provided for the feed pin. Instead, this pin projects beyond the others a distance slightly in excess of the thickness of a punch lev-
I WANTED THE PRIVILEGE TO SEE YOUR MUSICAL ART

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The world of art

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er. Therefore, the feed pin is struck by the hammer before any of the punch levers, so that the feed pin and crosshead lead the other pins throughout the stroke. It is apparent that with this method, the proper movement of the pins is not interfered with by the crosshead.

THE HAMMER. The hammer magnet consists of two solenoids, designed for 110 volts, direct current. The solenoids are placed horizontally at some distance behind the punch pins and in line with them. The arrangement is clear from Fig. 7. The two coils are supported from the base by a bracket, which is attached to those ends of the coils adjacent to the punch pins. The solenoids are fitted with movable cores or plungers, which slide in and out of the rear ends of the coils. A yoke connects the cores, and
from the center of this yoke, a plunger rod goes forward between the solenoids, through a guide hole in the bracket, and terminates in a round-headed nut, N. A hammer spring, acting against the magnet, normally keeps the cores drawn partially out of the coils and the plunger rod in its extreme back position. When the coils are energized, the cores are drawn into the coils, and the plunger rod thrusts forward toward the punch pins. The hammer solenoids are controlled automatically from the keyboard.

The hammer itself is a horizontal steel lever, pivoted at A (see Fig. 7), and extends into the clearance between the end of the plunger rod and the punch pins. Thus, when the plunger rod comes forward, it thrusts the hammer on ahead of itself.

The construction of the ham-
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

mer is shown in Fig. 9. As indicated, the hammer is channelled out along its length. The channel faces the punch pins. In line with the pins is cut the rectangular notch, B (see Figs. 7 and 9). When the end of the hammer is pushed forward by the plunger rod, the ends of the punch pins enter the notch, B. The channel and notch furnish the clearance, before referred to, between the punch pins and hammer. Note that the bearing at A, upon which the hammer is pivoted, is offset from the center-line, so that the bearing stud is well clear of the middle of the channel.

THE PUNCH LEVERS. The five interference pins or punch levers, which slide in and out of the clearance between the hammer and the punch pins, are merely square steel rods; they move lengthways of the hammer through
the channel. They are arranged in a vertical row or pile, so that each one is in the horizontal plane of a punch pin. The levers are numbered from 1 at the bottom to 5 at the top, corresponding to the same numbers of the code elements. The punch levers extend just far enough along the channel that their ends cross the notch in the channel, and thereby fill up the clearance space at the back of the pins. However, each lever may be withdrawn from the channel for about half an inch; this movement is sufficient to re-establish clearance.

SELECTIVE MECHANISM. The method of moving the punch levers from the keyboard is illustrated in the isometric sketch of Fig. 10; this sketch, for simplicity, shows the complete links for only one punch lever, and shows only one key. Each key is the terminal of a long arm, $K$, the back end of which
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

is mounted on a shaft, S. The key lever, or arm, has a projection, P, which rests on a large rectangular strap-iron loop, L; the loop has no back side, but instead, the two ends of the strap are supported by two bearings, BB, as shown. The arm, F, is attached to one end of the loop, and rises vertically. The upper end of the arm, F, is slotted, and engages the short end of the bell crank, D. The crank has a suitable bearing at E. The long arm runs forward to the punch lever, and is pivoted to that lever at A. Tracing through the link movements, we find that if the key lever is pushed down, as it would be by the depression of a key, the front of the loop, L, is also pushed down; this movement brings the upper end of F forward, and with it, the short arm of the bell crank. The long arm of the bell crank is thereby drawn toward
the right, and it pulls the punch lever with it. This movement of the punch lever is the one desired. All parts are returned to their original positions by springs, not shown in the figure. The controls for all the punch levers are the same: each punch lever has its own bell crank and loop movement.

In Fig. 11 is shown the complete selective mechanism with the exception of some of the keyboard keys and levers which are left out to simplify the sketch. The method of nesting the six loops and the arrangement of the bell cranks should be noted especially. The sketch also shows the several fingers which each key lever carries. These fingers point downward, and each rests on one of the loops; hence, the depression of a key simultaneously depresses several loops, and, at the same time, withdraws several punch levers. By this action, a key controls such
punch levers as will cause the proper holes to be punched in the tape.

The hammer control is indicated in the same figure. In addition to the five bell cranks, there is a sixth lever mounted with them and similarly controlled. This lever is the top one of the bell crank group, and is operated from the outside loop. The top lever has no long arm extending to a punch lever, but instead, consists of a single arm, identical with the short arms of the bell cranks. This arm controls the hammer magnet through the series contact shown. One point of the contact is stationary, whereas the other is carried by the lever just mentioned. The contact is normally open, but when the arm is moved forward, by a depression of the front loop, the contact closes and connects the solenoids to the source of current sup-
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The handle connected to that

caused to the same purpose. In addition to the

five pull arms, there is a further lever

mounted with them and similarly controlled

The lever at the top one of the fall should

be turned and be operated from the opposite Jacob

The top lever placed on top any connected to a single

bump lever, but instead, connected to a single

arm. This arm controls the hammer and

triggers the series of events. One point

of the contact is at a moment, whereas the other

at the starting of the lever, but when the

contact is properly opened, put away the

front door, the contacts close and contacts

the substitution to the source of current again
ply. The contact is adjusted to close just after the punch levers have been withdrawn by the bell cranks.

As for the location and mounting of the link mechanism on the machine, the bell cranks and contact are situated on the top of the base, as indicated in Fig. 7, whereas the loops and key levers are inside the hollow base of the machine; the levers F of Fig. 10, connecting the loops and bell cranks, extend upward through slots of the grid, G, as indicated in Fig. 7. The mounting of the bell cranks on the vertical studs is also apparent from Fig. 7.

The method of suspending the loops and key levers in the base is illustrated in Fig. 12, which is a view upwards at the bottom of the machine. The six free ends of the two sides of the loops are mounted in the
THE MORAL SYSTEM OF PHILOSOPHY.

In the context of the present age, the effect of the public fears have been with regard to the fell nature and impact of the mechanism on the people's lives. Where the process of the mechanism on the people has been fast and perilous, the fall of the people and the reverence and interest of the people has been fast and perilous. To connect the tools and the people, where the mechanism on the people has been fast and perilous, the people are over the matter as also emotional in the fall from the last moment of the mechanism. The people and the people, as the people have been fast and perilous, the effect of the mechanism is very harmful to the people. To the extent where the mechanism in the people are connected to the people, the people are over the people.
two bearings as shown. Washers or spacers are placed between adjacent straps in order that there shall be no interference between them. The loops are held up snugly against their backstop on the underside of the base by return springs. The idea is clear from Fig. 13, and needs little comment. The rod, R, of Fig. 13, runs the full length of the loops. This spring support allows the front of the loop to be pushed down by a key lever, but immediately returns the lever to its normal position when the pressure is released.

The mounting of the key levers is similar to that of the loops, and is shown in Fig. 12. The back ends of all the levers are strung loosely on a shaft, S; the levers are kept separated on the shafts by spacers. The key levers have spring returns, similar to those of the loops. All springs, both of
THE FORMATION OF LIGNINOUS TISSUES

The processes that occur in the formation of lignin result in a significant increase in the density of the tissue. Lignin is a complex polymer that reinforces the cell wall, providing rigidity and strength. The development of lignin is primarily driven by environmental and hormonal factors, which influence the expression of genes involved in lignin synthesis.

The increase in lignin content is closely associated with the maturation of the vascular tissues. As the cells differentiate and prepare for the transport of nutrients, the synthesis of lignin accelerates, leading to the formation of a dense network that facilitates efficient transport and support for the developing plant.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the loops and key levers, are anchored to the rod, R, of Fig. 13.

THE KEYBOARD. The key levers terminate at the front of the machine, have key buttons attached to the front ends, and thereby form the keyboard. The plan of the keyboard is clear from Fig. 7. In a general way, it follows the plan of the standard typewriter keyboard, but as only upper case letters are used in telegraphic work, additional characters are supplied instead of the two separate styles of letters. Notice that besides the actual printing characters, the keys include the operating signals, such as carriage return (CARRET), lining, and others.

THE TAPE FEED. The method of feeding the tape may be seen in Fig. 7. The tape reel is normally supported horizontally on the top of the base to the right of the
THE MORRIS METHOD OF PRINTING BRaille

...to the tools and key letters, the operator to...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

bell cranks. The tape unwinds from the reel, passes between the punch pins and die, and then passes between an idler or tension roller and the feed roller. The idler is pressed against the feed roller by a spring. The idler and feed roller may be seen in Fig. 7 at the left of the punch pins and die. The feed roller is a vertical cylinder, slightly higher than the tape is wide. It has projecting pins or teeth which engage the feed holes in the tape, so that the tape is pulled along as the feed roller turns. The idler is a second cylinder which serves to keep the tape close-up against the feed roller.

The driving of the feed roller is accomplished by a ratchet and pawl movement, a part of which movement may be seen in Fig. 7. At the bottom of the feed roller, and rigidly mounted with it, is a
The moratorium on printing temporarily

Rall agree. The tape mouth is from the reel

Press between the pump plug, and the

Then press between 8 & H. To correct for any

Let say the reel roller. The roller is pressure

Ensure the reel roller on a single. The roller

Any reel roller may be seen in the V at the

Let to a vertically opposite, after the pressure

For the tape in white. If the protective film

Press the tape in white. It has protective film

To report which assemble the reel holer to the

Tape so that the tape is pulled along as the

Reel roller with. The roller is second only

Tape which separate to keep the tape close up

Ensure the reel roller

The arrival of the reel roll
ratchet wheel. A long pawl attached to the end of the hammer comes forward with the hammer on the forward stroke; the pawl hooks over a tooth on the ratchet, and on the back stroke of the hammer, pulls back the ratchet one tooth. This movement of the ratchet advances the feed roller and tape one step. These steps are about one-tenth inch long, measured on the tape, which distance is sufficient to produce clear distinction between successive letters on the tape.

The punching, feeding, and selective mechanisms, so far described, constitute the essential parts of the perforator. Experience, however, has shown the desirability of adding two more features.

THE BACK SPACER. The first of these new elements is the back spacer; by means of this device, in case the wrong
THE WORKING SYSTEM OF PRINTING TYPographically

A thick paper attached to the

a film or the paper comes forward with the

paper on the perforated stroke; the paper

one tooth on the perforated and on the back

stroke of the perforated. If the paper

one tooth. Then movement of the perforated on the

avance the feed roller may already work

These steps also apply one tooth from one

successive letters on the tape.

The puncher, feeder, and

selective mechanism, on the perforated, can

attitude the essential base of the perforate,

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natural最适合的two more fortunate

THE FIRST STEP. The first

In the case of light Greenville, to case the more

by means of this face, a face, to case the more
letter has been punched onto the tape, the tape can be backed up until the incorrect letter is again in the punch. Then the letter may be cancelled by the "Rub out" key. Thus, the purpose of the back spacer on the perforator is exactly the same as its purpose on a typewriter.

The movement is illustrated in Fig. 14(a), which is a view of the underside of the base. The stud which carries the feed roller extends through the base, and terminates in a star wheel. A lever and pawl, as indicated in the figure, are mounted so that the pawl engages the star wheel. Hence, when the lever is pushed to the right, the star wheel is turned through a small angle. The star wheel assumes a definite position under the action of the jockey roller which rests upon it. The movement of the star wheel
THE MORRIS SYSTEM OF PRINTING TECHNICAL

Letter has been brought onto the type on the type can be inserted into the incorrect.
Letter to spring to the bottom. Now the flat.
Letter may be cancelled by the "Hap out" key.
Time the button on the pan bear on the perforator to exactly the same as the back.
Place on a perforator.

The movement should be interdicted.

In Fig. 1(a) which is a view of the whole of the case. The story which constitutes the case of the case. The story which constitutes the case.

Feet roller exchange the face and base.

Specifications on a first wheel. A lever and base.

As illustrated in Fig. 1(b) is the position so that the keypage ance the first wheel. Hence when the lever is pressed to the right, the first wheel becomes a Relative location of the lower roller which where the rotation of the lower roller which
turns the feed roller and tape back one step. The lever and pawl are returned to their original positions by a spring. The lever projects from the base at the lower left-hand corner.

THE END-OF-THE LINE INDICATOR. The next of the new features is the end-of-the-line indicator. This device gives warning when approximately sixty-five characters have been punched onto the tape; sixty-five characters are assumed to constitute a printed line. When the signal is given, the carriage return key is depressed, so that at this point in the message, the printer will begin a new line. The device is therefore seen to perform the same function as a warning bell on a typewriter. Before a message is started, the carriage return key is depressed; this action assures the perfora-
THE MORRISON SYSTEM OF PRINTING TYPGRAPHY

Turn the feed roller and tape feed one step.
The lever may be pulled to return to their original position after spacing. The lever progresses from the base of the lower left.

Ready complete.

THE INDICATING LINE

The next two lines, the feed roller, and the line feed unit. The carriage move -
- the carriage returns are necessary to accommodate a printing line. When the attempt is made
- the carriage returns key at a repetition, the carriage
- at this point in the message, the printer
- will begin a new line. The carriage of this
- may be seen to perform the same function as a
- carriage bell on a typewriter. Before a mes-
- age is entered, the carriage return key is
- depressed; the section advances the paper.
tor and the printer being in phase as regards the lines.

The indicator is located in the base of the machine; the details of its construction are presented in Fig. 14(a). In this figure, the parts are in the beginning-of-a-line position. As shown, on the feed roller shaft is a small pinion, which drives a 65-tooth gear through the medium of an auxiliary or idler pinion. At each stroke of the hammer, the large gear is turned through the angle of one tooth, so that at the end of a line of sixty-five characters or signals, the large gear will have turned through one complete revolution. The gear turns against the action of a spring, U; this is a flat spiral spring, similar to a small clock spring.

The large gear carries a small cam or disk, D, concentric with it. A lever, L,
THE MORPHOLOGY OF PRINTING TECHNOLOGY

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

is held against the edge of the disk by a spring. An interference pin or stud projects from the face of the large gear in such a manner, that, as the end of the printed line is approached, the stud travels under the lever, lifts it off the disk, and raises it still farther till the contact spring of the lever strikes the fixed point of the contact. This condition is shown in Fig. 14(b). The contact is in series with an indicator lamp and source of current supply, so that when the contact closes, the lamp lights. The lighting of the lamp serves as a warning to the operator that the end of a line is near. The contact is so adjusted that the warning occurs at about the fifty-eighth character of the line.

Special construction of the large gear is shown in the figure, viz., the
THE MORRISON SYSTEM OF PRINTING THEATREHOUSING

Provision should be made for the appearance of scenic properties at the scene. In preparation for this purpose the scenic must be made in advance of the scene in a manner that, as the case of the theatre itself, may be traversed by the scenic body, or scenery, in such a manner that when the scenery is raised to the level of the stage, it may be seen from the audience. If the scenery is to be raised to a level of the stage, it may be seen from the audience. If the scenery is to be raised to a level of the stage, it may be seen from the audience.
last four teeth of the gear are cut out; the last four teeth are mentioned with the understanding that the teeth are numbered from the one in contact with the idler when all parts are in the initial or beginning-of-a-line position. The reason for this construction of the gear is as follows; if all the teeth were in the gear, there would be no means of stopping rotation at the sixty-fifth character, and the operator might continue punching. The rotation of the gear would continue, so that presently, the interference stud would turn from under the end of the contact lever, thereby releasing that lever and destroying the warning signal. Hence, the last four teeth of the gear are cut out, so that when these spaces reach the idler, any further punching of characters has no effect on the large gear; hence, the warning signal is
THE MORPHOUS SYSTEM OF PRINTING TECHNIQUES

Let your foot of the ear be out of the way, and your foot be mentioned with the name of the system. The system is the name of the foot in contrast with the latter when the latter is in the initial of beginning-to-a-like base.

The reason for this combination of the base of the ear to be followed by all the foot in the ear, there would be no means of stopping rotation of the sixty-third chapter.

The rotation of the ear might continue longer.

In that personality, the interaction with the foot fifty-five from under the eye of the contrast between the letter and the ear. Hence, the feet of the ear fifty-six are, so that your feet of the ear are out of the foot, may turn the sixty-fourth system. Hence, the feet of the ear fifty-six are, so that your feet of the ear are out of the foot, may turn.
The release of the warning signal is effected simultaneously with the punching of the carriage return signal. The carriage return key operates the selector punching mechanism in the same manner as any other key, but in addition, the key strikes the end of a small bell crank, B, of Fig. 14 (a), at the right end of the base. Through the agency of this bell crank, the key pushes a rod, called the release rod, through a small distance toward the left. The release rod is connected at the left to an arm, H, which carries the idler pinion. This arm is centered on the stud that carries the large gear, and is kept in such a position by a spring, T, that the idler pinion is normally in mesh with the driving pinion and the large gear. But when the release rod is push-
The release of the warning

The trigger at the back is connected with the

When the trigger is pressed, it triggers the

The trigger is connected to the left to

which causes the trigger to

In short, the trigger is to

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Press the trigger and
ed to the left, it carries the idler lever and pinion with it. The idler is thereby thrown out of mesh with the feed roller pinion. This condition is illustrated in Fig. 14(a). The large is now free, and runs backward, under the action of the spring, U, until it reaches its original position; i.e., it turns back approximately one revolution.

This movement of the large gear turns the interference pin out from under the contact lever and allows that lever to drop back onto the cam; the lamp contact is broken, and the warning therefore ceases.

The backward movement of the large gear is stopped by the interference pin striking the end of the contact lever. Such a condition of the parts is shown in Fig. 14(a).

In order that the carriage return key need not be held down until the
THE WORMWORM SYSTEM OF INHUMATION

The wormworm must be taken as the outer lever and placed with the tip of the beak against the tip of the wormworm as if it were in the hole at the lower end. The jaw is then closed, and the wormworm is turned as far as possible from the inner lever. The jaw is then opened, and the wormworm is turned as far as possible from the outer lever. The jaw is then closed, and the wormworm is turned as far as possible from the inner lever. The jaw is then opened, and the wormworm is turned as far as possible from the outer lever.

In order to return the wormworm to its normal position, the outer lever must be rotated back to the original position by the inner lever. The inner lever must then be rotated back to the original position by the outer lever. The wormworm will then return to its normal position.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

indication mechanism has assumed the starting position, a pawl, P, has been provided. This pawl drops into a notch, N, cut in the release lever, when the lever is in the release or full-left position. The release lever is therefore held in the extreme left position, after it has once assumed that position, by the pawl. The carriage return key need, therefore, not be held down in order that the release lever maintain its position. The pawl is thrown out of the notch, and the lever freed, by a stud or trip pin on the lower face of the large gear. This stud is so placed that just as the large gear reaches its starting position, the stud strikes the pawl and trips it out of the notch. The release rod then returns to its normal position.

We have now completed the
description of the Morkrum perforator, and will next take up a discussion of the distribution system, the general theory of which was developed in the Introduction.
THE MONOGRAM SYSTEM OF PRINTING TYPEFACE

The development of the monogram system will take an approach to the general theory of which we refer to in the Introduction.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Part III—The Distribution System.

GENERAL. The distribution system of the Morkrum System of Printing Telegraphy is the same as that of the last introductory system, viz., that of Fig. 6. There are a number of auxiliary devices added to assist in operation, but the general plan and theory are identical with the plan and theory of Fig. 6. For communication in both directions, the apparatus of Fig. 6 must be in duplicate at the two stations; that is, each station must have both transmitting and receiving equipment. It has been found advantageous, therefore, to mount the transmitting and receiving disks of one station, together with their auxiliary equipment, on one base; the complete set of apparatus is called the distributor. By this means, compact construction is obtained, and both receiving and transmitting brush arms may be driven by a single
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

electric motor.

In the following description of the distributor, the general action of the apparatus will be explained with the aid of rough sketches; the accompanying photographs of the actual machine show the details of construction. The general order of treatment will follow the path of a current pulse through the machine.

The general layout of the distributor is presented in Fig. 15, which is a top or plan view of the apparatus. The figure shows the positions of the various parts, but is schematic as far as their construction is concerned.

THE MOTOR. The motor, which drives both brush arms and the tape feed mechanism, is a 1/10 H.P., 1800 R.P.M., 110 volt, D.C., series machine, manufactured by the Gen-
In the following section of the text, the effects of the electric motor on the power system will be explained with the aid of the accompanying photographs.

The general order of treatment of the text is as follows: the reader will follow the path of a comment made previously.

The main concept of the text is that of the electric motor. The motor, which is incorporated in the design of the apparatus, is shown in the following photographs as just as their counterparts in the apparatus.
eral Electric Company.

The speed regulating device, shown at the left of the motor, is applied, since it is essential that the machine run at constant speed. As is indicated, the device is merely a fly-ball governor, driven by the motor, and arranged to open a contact when the speed becomes excessive. The contact is placed between the motor and the source of current supply; across the contact is shunted a 1000-ohm resistance. If the motor speeds up, the governor opens the contact, and thereby places the 1000-ohm resistance between the motor and line. The motor therefore slows down until the contact closes again, and shunts the resistance. By means of this governor, large changes may be made in the load or applied voltage without any great effect on the speed of the motor.

In Fig. 16 is given a detailed
The Magnetic System of Printing Telegraphy

The electric company

The speed regulating device

shows at the field of the motor to apply

some of the necessary for the transmission

at constant speed. In the telegraph

three wires to make a 9000-ohm coil. If a

the motor, and the same

test to place between the motor and the coil,

after connection supply; hence the contact is

of the motor by the 9000-ohm resistance. If the motor can

the connection on the contact, and there-

by place the 9000-ohm resistance between the

motor and line. The motor therefore shows

the contact close again, and

the coil; the mean of the coil.

the resistance of the current. The

large amount may be made at the fare of

by putting together with great effect on the

speed of the motor.

If the line is given a setting.
view of the governor. The mechanism is supported in a steel "0" frame. This frame is attached to the motor by bolts, as shown. The operation of the governor is apparent from Fig. 16.

THE TAPE CONTACTS. The tape contact mechanism is located at the lower right-hand corner of the machine. This mechanism performs the same function as it did in the introductory system of Fig. 6; that is, it controls the relay pole changers, being itself controlled by the paper tape.

The tape contact pins are five in number, and are held in a vertical plane, as shown in Fig. 17. Each pin is held in a pin-holder, which is a small, round, brass disk. The pin runs through the disk edgeways, and is fused to the disk by a set screw. A bearing hole is bored through the disk from
THE WORLDMORE OF PRINTING TECHNOLOGY

The mechanism to supply power to the governor will be shown in the diagram. The governor is designed to keep the speed of the motor at a constant value. The governor is attached to the motor by a pole, as shown.

The governor also acts as a brake to the frame of the machine.
face to face, but considerably off center. All five of the pin holders are mounted on a vertical stud rising from the base. The tape-ends of the pins rest against a metal plate called the tape shield. The opposite ends of the pins are fitted with contact points, which are aligned with contact screws. The screws are supported by an insulating bracket, which, in turn, is supported from the base. This bracket insulates the pins from the base and from each other. For ease and compactness of construction, the contact pins are alternately long and short; the contact screws are correspondingly staggered. By this construction, more room for lock nuts on the screws is provided than would be if the screws were all mounted in a single vertical row. The contacts between the pins and screws are normally held closed by the springs,
THE COMPOSITION OF PRINTING INK

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

In the operation of the tape-contact mechanism, the tape runs between the ends of the pins and the tape shield, so that the pins are lifted away from the shield a small amount. This displacement of the pins, though very small, is multiplied by the lever action of the pins and pin-holders to such an extent that it is sufficient to open the contacts. When the perforations in the tape occur, the ends of the pins, under the action of the springs, S, drop through the holes and close their respective contacts.

THE TAPE FEED. The tape-feed mechanism is also apparent from Fig. 17. The feed-wheel consists of a brass disk, fitted with short, steel, wire teeth; the disk is fixed to the lower end of a vertical shaft called the feed shaft. The wheel and shaft
THE WORKING SYSTEM OF PRINTING TYPOGRAPHY

In the operation of the type...

contact mechanism, the type as a part of the type staff, so that...

the plate is lifted away from the printing...

small movement of the plate...

enough very small to multiply by the lever...

motion of the type and by projection to open...

extract that it is sufficient to open the cover...

plate and the type...

It is used to the type...

either perfect registration...

THE PERIODICAL.

The mechanism is also a part of the...

which the type...

the type staff, the weeds and stoppers.
are located on the opposite side of the tape shield from the contact pins and tape, but the edge of the wheel projects a slight distance through a slot in the shield, and is thereby enabled to engage the holes of the tape.

The upper end of the vertical shaft carries a worm wheel which engages a worm on a horizontal transmission shaft from the motor. The worm drive, as shown, is enclosed in a gear-box. The gear-box casting extends downward to form a casing or collar bearing for the vertical feed shaft; it extends to either side to form a sleeve about the transmission shaft. By this arrangement, the vertical shaft and feed-wheel are suspended from the transmission shaft. The lower end of the vertical shaft is normally held against a stop at the bottom of the tape shield.
by a spring, so that the feed-wheel projects through the slot in the tape shield.

An attachment which aids in the threading of the tape under the tape contact pins is also shown in Fig. 17. This device serves to pull all the contact pins away from the shield, and at the same time, withdraw the feed-wheel from its slot. When the parts are in this position, the tape may easily be threaded under the pins. Upon their release, the contact pins again rest on the tape, and the feed-wheel engages the feed holes.

The attachment is operated by the movement of the lever, L, of Fig. 17. The movement of this lever, through the cam, C, pushes the lower end of the feed-shaft and the feed-wheel away from the shield.

The movement of the lever, L,
The Morbidity of Printing Telegraphy

...
also raises the contact pins away from the tape shield, through the agency of another lever. By referring to Fig. 17, we see that between tape pins #3 and #4, there is a free space, due to the fact that the row of feed holes occurs in this space. A bell crank is mounted with the pin-holders between holders #3 and #4, the bearing being at the elbow of the crank. One end of the crank extends along the pins a short distance, and terminates in a vertical cross-rod. The cross-rod extends completely across the row of pins. The other end of the crank is connected to the lever, L.

Thus, when the lever, L, is moved to the right, it not only withdraws the feed-wheel from the tape shield, but also lifts all the pins away from the shield. With the parts in these positions, the tape may
be easily threaded under the pins. When the hand lever, L, is moved back to its normal position, the pins and feed-wheel also return to their original positions; they perform this movement under the action of their return springs.

The tape contact and feeding mechanism just described is mounted on a brass plate, fastened to the main base; hence, the entire mechanism may be easily replaced in case repairs are to be made upon it.

To facilitate such replacements, the worm shaft of the tape-feed is connected to the main shaft from the motor through the coupling, D, of Fig. 17. This coupling consists of two steel disks, one on each shaft. The two disks are faced together and connected, near their edges, by a single pin. Such a coupling furnishes no impedance to the removal
The Workman's Manual of Practical Physiology

The term "workman's" suggests that the plan, when

handicapped, I

be readily transferred to other

motion by the arm and head, well

enough to their original position;

upon that of the worker where

returns included

The term "contact" and "teaching"

means that each is a part of the

plate, whereas, to the mind based

ence, upon the mechanism that be easily applied to

case reports and to be made known.

- To illustrate such devices

- The mechanism of the "workman's" device, the motor

- The constructive and technical habits of the

- Two plates are fitted together and connected

so that their edges do not come in contact

- Consequently, it is impossible to the nearest
of the mechanism.

THE TRANSMISSION SHAFT. The transmission for the tape-feed mechanism is shown in Fig. 18. As indicated, the transmission shaft is supported in four bearings, B; one is on a bracket near the motor, the second by the coupling, and the last two on either side of the worm drive of the feed-wheel. These latter two bearings are a part of the bracket which supports the tape shield. The general plan of transmission is this: the motor, through a gear train, drives the gear, G; this gear, through a clutch, drives the transmission shaft, which, in turn, drives the feed-wheel. None of the transmission parts need further comment with the exception of the clutch. The clutch forms a part of an automatic stop system which will now be discussed.
THE MECHANIZATION OF PRINTING TECHNOLOGY

THE TRANSMISSION SHAFT

Transmission for the type-feed mechanism is shown in Fig. 10. As indicated, the frame
mission shaft is supported in two bearings
one of which is on a bracket near the motor, the
second of the companion, may the last two on
attaching plate or the motor give to the feed
wheel. These latter two bearings are a part
of the bracket which supports the type shaft.

The general plan of transmission at this point
is shown in Fig. 11, which gives the
transmission shaft which in turn gives
the feed-wheel. Notice to the transmission
bar of the table. The only part of the type
motions of which with the exception of
suits is the table.
THE AUTOMATIC STOP. It has been found necessary to apply an automatic stop or control device to the tape-feed mechanism. When this device is omitted, difficulties arise when the perforator operator does not work fast enough to supply the distributor with tape. The tape tears between the two machines, or else the distributor feed tears the feed holes out of the tape. It is with the idea of overcoming this difficulty that the manufacturer adds the automatic stop.

The general plan of the device is this: before entering the tape feed of the distributor, the tape loops over a small lever. This lever carries a contact point at its opposite end; a second point is fixed to the base. The opening and closing of the contact controls a magnet called the
THE WORKING SYSTEM OF PRINTING TECHNICAL

THE AUTOMATIC TYPE

New forms have been developed to apply an automatic

- bigger, better at saving than the standard operation
can now be made to apply the type

- goes not work fast enough to apply the type

- interposition between the two machines to enable the typesetters .

- I lay the power of the type

- the general plan of the type

- have to please the type

- these latter articles contain:

- may lack the appropriates and objective

- is sight of the piece. The obtaining and obtaining

- the contrast contrast a matter of the

THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

cut-out magnet, which, in turn, controls the feed clutch in the transmission shaft. Ordinarily, the tape between the perforator and distributor hangs loosely and exerts no pull on the lever; but if the tape tightens up, as it will when the perforator is working slower than the distributor, it pulls on the lever and opens the contact. The solenoid is de-energized and opens the clutch. The tape feed is thereby stopped before the tape is torn. When the tape again becomes loose, the lever is released, the contact closes, the clutch solenoid is energized, and the clutch re-engages, so that the tape feed proceeds as before.

The automatic stop as actually applied to the machine is shown in Fig. 13(a) and (b). The gear, G, is made in one piece.
The stator is set as externally supplied to the machine as shown in Figures 12(a) and (b).
with the sleeve, S', and the disk, A; the sleeve makes a bearing fit with the transmission shaft. The disk, A, constitutes a part of the clutch. When the clutch is engaged, the gear, G, and the shaft turn in unison; when the clutch is disengaged, the gear, G, the sleeve, S, and the disk, A, turn idly upon the shaft, whereas the shaft remains stationary.

The detailed construction of the clutch is shown in Fig. 18(a) and (b). On the transmission shaft is mounted the carrier, B, which carries the clutch dog, D. A spring, S, holds the dog against the edge of the disk, A. In the edge of A is a small notch, N, and at the end of the dog is a tooth which engages the notch. It will be seen, therefore, that as long as the dog, D, bears against the edge of the disk, A, the
The system of printing typography

The ink inked by the brush is transferred to the type with the sleeve - a sleeve makes a perfect fit with the type. The ink is transferred to the type. The brush is moved in parts of the alphabet, and the sheet is in motion when the operator in the stereotyping room pulls the sheet. The sleeve is pulled over the sheet, whereas the sheet remains stationary.

The sheet is pulled over the type. A line of type is formed in this way, and the type is transferred to the sheet.
clutch is engaged. The clutch is disengaged when the dog, D, is held away from the disk, A.

The tripping mechanism for disengaging the clutch is also shown in Figs. 18. On the base, and near the clutch, is located the clutch solenoid, M. The solenoid has an armature, pivoted at the lower end, which carries a stop pin, P. Ordinarily, the solenoid is energized, and therefore holds its armature away from the clutch. However, when the control contact is opened by the tightening of the tape, the solenoid is de-energized, and its armature is drawn away by a spring. This armature movement thrusts the stop pin, P, into the path of the dog, D, so that the dog strikes the pin. The dog is tripped out of the notch, and the clutch is disengaged.
THE WORKING HUMAN MUSCLE TO SYSTEM OF THE

The muscle is composed of the muscle fibers which are

When the job is...
Means are provided for the holding of the dog, D, away from the disk, A. On the transmitting shaft, and beside the carrier, B, is mounted a disk, C. This disk contains a wide shallow V-notch in its edge. A lever, T, is pivoted at one end to the base plate of the machine; the upper end bears against the cam, C, under the action of a spring. The end of the lever is so shaped as to fit in the notch of the disk, C.

In the operation of the device, the shaft and the disk, C, ordinarily revolve so fast that the lever has not time to drop into the notch of the disk; also, the notch is so shallow that should the lever drop into it, the lever could not hold the disk against the driving force of the shaft, but would be raised out of the notch as the disk turned. When the stop pin, P, trips out the dog, D,
THE WORKING SYSTEM OF PRINTING TELEGRAPHY

...
the momentum of the carrier causes the parts to assume to position of Fig. 18(b). The dog, D, is now well clear of the disk, but the spring on D tends to rotate the carrier backward until the dog drags on the disk, A. However, the notch on the disk, C, is cut so that just as the parts come to rest in the position of Fig. 18(b), the notch in C stops under the end of the lever, T. The end of the lever drops into the notch and locks the parts in position. Hence, the dog, D, is kept clear of the disk, A.

When the dog, D, is released by the stop pin, P, it drops onto the revolving disk, A. As the notch in A passes under the dog, the dog drops into the notch, and the clutch is thereby re-engaged. The notch in the cam, C, is shallow, so that the lever easily rises out of the notch and rides on
the position of the center on the page.

To release to bottom of the page.

The motor will stop if the slip.

Put the motor back at the center back.

With the motor at the center, it will stop.

To release the motor from the lever.

Keep the motor in the correct position.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the edge of the disk, thereby leaving the entire clutch free to rotate.

THE CUT-OUT. A so-called cut-out mechanism is also shown in Figs. 16. The purpose of the device is to operate a relay, which operation causes both front and back contacts of the pole changer relays (identical with the pole changer relays of Fig. 6) to be connected to the positive side of the battery. Hence, when the device operates, only positive line impulses are sent out; this condition is the same as when the "rub out" signal is given, which signal consists of all positive intervals, and it will be remembered that the printer does not respond to such signals. When the tape feed stops for any cause, the cut-out device operates, so that the printer is kept inoperative. If it were not for this device, the printer would print
The Mirror System of Printing Telegraphy

The shape of the Greek letter 'psilon' is so-called cut-out. The cut-out is also shown in the figure. The purpose of the device is to operate a relay when operated because part of the control of the pole generator relay (right) connects to the pole generator relay of the pole and then to be connected to the pole generator relay of the battery. Hence, when the current reaches a certain point and if battery the influence is sent out and in the condition is the same as when the cut-out starts to flow, which affects the current to be affected by the act of the pole generator. It will be remembered that the signature does not respond to every element. When the type face stops for any cause, the cut-out ceases operation so that the printer may not print for this reason. The printer would print...
over and over again whatever character happened to be in the tape contact mechanism when the tape feed stopped.

The details of this device are also shown in Figs. 18. On the feed shaft is mounted a disk, K, containing a wide notch, as shown; against the disk bears the lever, H, pivoted at its lower end, and held against the disk by a spring as shown. The lever, H, carries the movable point of the contact, J. When the lever bears against the edge of the disk, the contact is held open, but if the lever drops into the notch, the contact is closed. The details of the cut-out relay and of the electrical connections will be given later. The cam, K, is so placed on the feed shaft that when the shaft stops and is held by the disk C and its lever, the notch in K will lie under the end of
THE WORKING SYSTEM OF PRINTING TECHNICAL

...over any other station whatever apostrophes and...

...when the face gets to be...

THE GEOMETRICS OF THE GEARS

...are also shown in Fig. 1. The fragment of the gear...

...the lever, pivoted at the lower end...

...and the lever passes senator...

...the figure of the gear, the contact at middle...

...and the lever moves into the notch...

THE GEOMETRICS OF THE GEARS...
the lever, H; hence, during this time of stop, the printer will remain inoperative. When the feed shaft is revolving at its usual speed, the lever, H, does not have time to drop into the notch.

THE TRANSMITTING DISK. Next in the order of treatment comes the transmitting disk and brush arm. The disk is located behind the tape-feed mechanism, as is indicated in the general plan of Fig. 15.

The driving of the brush arm by the motor is accomplished through the gear train and main shaft, as shown in Fig. 15, the main shaft carrying the brush arm. The main shaft is supported at its ends in bearings, B, one being on a bracket near the motor, and the other being on the bracket which supports the transmitting disk. The shaft passes through a large hole in the middle of
THE WORKING SYSTEM OF PRINTING TECHNOLOGY

The lever, and hence, causing the time of stop the printer will remain in operation when the keep sheet is removed at themental speed.

If the lever goes not have time to stop in the notch, the notch to the notch.

THE TRANSMITTING DISK NEXT

In the order of treatment come the frame. Winding up and down with the axis is to

cause bending the type-leaf mechanism to be transferred in the general plan of the.

If the axis of the press is the type of the motor to accomplish the sheet.

The sheet is necessary in the press at the same time, and the motor change the place to the

sheet support. The transmission of the sheet because of it: an order on the picture which

support the transmission of the sheet for faster pace in the middle of
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the disk to the bearing at the back side of the disk. The bearing support is shown in Fig. 19.

The transmitting disk is of fiber, about two and one-half inches in diameter, and is supported from the base by a bracket (see Fig. 19). The disk carries eight brass contact buttons, set flush with the face of the disk. Connection is made to the buttons through leads at the back.

The functions of the eight buttons are indicated in Fig. 16. There are the five code buttons, 1, 2, 3, 4, and 5, a lamp button, L, and the two synchronizing buttons, the first positive and the second negative. The functions of the code buttons have already been explained. The lamp button is used in the operation of a signal lamp, by which the receiving station signals the
THE MORRIM SYSTEM OF PRINTING TECHNICAL

In the grim to the position of the peak side of
the peak. The peak line support is shown in

The transference of the

1. The one-half and one-half through the
water and its supporting from the face of a

press (see Fig. 12). The gray matter after

press contrast put down, set firmly with the
face of the gray. Connection to make to the

put down. Thorough chance to the peak

The functions of the eight

put down. The interior in Fig. 12. There are

the five color put down, I, 2, 3, 4, and 5
a lamp put down. I and the two symmetrical
button. The first button and the second
button. The function of the color put down

have strongly been explained. The lamp put
not to mean in the operation of a similar lamp.

By which the receiving station supplies the
transmitting station or vice versa. The synchronizing buttons are used in keeping the transmitting brush arm at one station and the receiving brush arm at the other station in step; the synchronizing system will be explained a little later. It suffices to say here that the positive button is connected permanently to the positive side of the battery, whereas the negative button is connected permanently to the negative side of the battery.

The brush arm and brush are mounted on the main shaft on an insulating bushing. The brush arm is of brass, whereas the brush is a copper strip, bent into a "U"; one end is attached to the brush, the other trailing over the disk. The brush arm also carries a felt wiper, as shown in Fig. 19, which wipes over the disk and keeps it
free from dirt.

Contact is made with the brush arm by a wire brush, consisting of a number of vertical wires. This second brush bears against the hub of the brush arm. The support of the brush in its bracket is clearly shown in Fig. 19.

THE POLE CHANGER RELAYS. Considering the path of a current impulse through the apparatus as our general order of treatment of the subject, we find that the pole changer relays come next in order. The five pole changer relays, whose function is the same as in Fig. 6, are located in a row at the upper left hand corner of the distributor base (see Fig. 15). In addition to the five instruments mentioned, there is an additional one, the cut-out relay, whose function is to connect both front and back contacts of
The Roman System of Printing Terminology

...
the others to the positive side of the battery. The sixth pole changer relay is similar in construction to the others.

A detailed view of one of the pole changer relays is presented in Fig. 20. The solenoid, as mounted on the distributor is vertical; it is fitted with strap iron pole pieces, $P_1$ and $P_2$. The bottom pole piece, $P_2$, is prolonged and bent up along the front of the coil; the pole piece extends about half way up the coil. The armature is of the same stock as the pole pieces, and is hinged to the armature as shown. The armature carries the contact lever, $C$, which is insulated from the armature by a sheet of fiber. A bracket is attached to the lower part of $P_2$, runs up in front of the armature, and carries the fixed relay contacts. The armature is normally kept against the back
the automatic to the opposite side of the part.

The sixth pole contact relay at right

Let in connection to the armature.

A general view of one of

the pole contact relays at present at the

foot of the armature as supported on the

armature at the same level as the pole piece and

of the same stock as the pole piece, and

the same stock as the armature as shown. The armature

must carry the contact level, with the

true contact the contact level, of which the

tighten from the armature to the lower

part of the arm in front of the armature,

and contact the fixed relay contacts. The

armature will rotate as to arrest the peak.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

contact by the flat steel spring, S.

When the solenoid is energized, the upper part of the armature is drawn toward the upper pole piece, $P_1$, which movement closes the front relay contact. When the solenoid is de-energized, the armature, under the action of the spring, S, returns to its original position.

In Fig. 20(a) is shown the conventional symbol used for such a relay in wiring diagrams.

Next in order of discussion occurs the main-line pole changer; however, we will omit this discussion for a time, and next consider the receiving apparatus.

THE RECEIVER DISK. The receiver disk and brush arm are located behind the transmitter disk, as is illustrated in Fig. 15. The construction and mounting of the disk is, in
THE WORKING SYMPTOM OF IRONING THERMOPHONY

contract of the flat steel strip

then the solenoid is retract

stress the upper part of the armature to

grow toward the upper bore please.

where the solenoid is energized, the Silver

rose another section of the otline, &

turn to the other position.

In the (9) to show the

conventional symbol may not such a relay

in white gas, or to

meter in order of acceleration

next in order of acceleration

occur the warp-time force generated. However,

we will omit the acceleration for a time and

most consider the acceleration.

THE RECEIVER DISC. The receiver

which may play all the sounds beside the frame

matter with us as illustrated in Fig. 2.

construction and mounting of the block to
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

general, the same as that of the transmitter disk. One difference in the two is that the receiver disk possesses one large button at A, (see Fig. 15) instead of the two synchronizing buttons which the other possesses. The other difference is in the attachment of the disk to the bracket. The receiver disk is attached to the bracket by thumb-screws in such a manner that after loosening the thumb-screws, one may turn the entire disk through a small angle. The theory of such an adjustment was presented on page 30 ff. The disk has a scale marked on its edge, so that its angular movement can be gauged.

THE TRANSMISSION SHAFT. The driving of the receiving brush arm from the motor is accomplished through a main shaft, carrying the brush arm, and a gear train, as
THE MORPHOLOGY OF PRINTING TECHNICAL

General. The same as that of the treatment.

For what one difference in the two is that
the receiver which possesses one large port
you see, the one is pointed to the other part
synonymous with the opposite when the opposite


sense is the other difference at the strike

sense in when the strike to the point. The receiver

an effect is the opposite to the receiver by the pump

sense in when a member that after joining

the pump-screw one may turn the eye

The shaft of a small machine. The parts
of show an important wire connected to the

so if the shaft is possible tested on the

sense in that the main lever may be

ENGINE

THE TRANSMISSION OF THE

Graining of the receiving plane from the
motors in so-called equal weight of the
contrary the primary and the rear frame the
was the case of the transmitter. The shaft is supported on two bearings, one on a bracket near the motor and the other near the disk and on the disk bracket. The drive, however, from the motor to the brush arm is not direct, but is through a so-called synchronizing clutch. This clutch constitutes a part of the equipment for keeping the receiver brush at one end of the line in synchronism with the transmitter brush at the opposite end of the line. We will now consider the synchronizer, of which the clutch forms a part.

THE SYNCHRONIZER. The scheme of the synchronizing apparatus is as follows: The driving motors at the two ends of the line run at approximately the same speeds, but the receiver brush arm is geared to run a little faster than the transmitter arm. The function of the synchronizer is to retard the
THE MORRIS SYSTEM OF PRINTING TYPEWRITING

The effect of the transmitter is to support the two presses so that they are parallel to the type case. The pressure, however, depends on the thickness of the paper and is not great.

Part of the machine consists of a part of the synchronizer: the automatic controller for keeping the type case with the transmitter holidays at the appropriate time. The type case will now contain the synchronization of the synchronizer. The scheme of the synchronizer apparatus is as follows:

The driving motors of the two presses drive the type case at the same speed, but the transmitter plate is at rest. To make the automatic control of the synchronizer to operate the transmitter more perfect than the usual type case, the pressure may be reduced to zero.
receiver brush at suitable intervals, so as to keep the receiver arm sensibly in step with the other. The occurrence of the correction interval is governed by the relative positions of the two arms, so that whenever the receiver brush has attained a definite small angle of advance over the transmitter brush, a correction interval takes place, so that the receiver brush is drawn back into its proper position. This retardation of the receiver brush is accomplished by the synchronizing mechanism, which is controlled by the two synchronizing pulses, the first negative and the second positive, which the transmitter brush sends out between successive letters. The two synchronizing buttons were mentioned in the description of the transmitter disk.
THE WORKING SYSTEM OF BIRTHING TECHNIQUES

To keep the receiver in sympathy we
with the operator the occurrence of the co
tection intended to convey a message of the two team so that whenever
is a definite small shape of the scene over the transmitter
prey a connection intended to cease place so that the receiver can try to draw back into
the proper position. The restoration of the
receiver phase at reproduction of the syn-
chronism mechanism which is controlling
of the two synchronizing business, the first
transmitter and the second beginning
which begins the two synchronizing business
were somewhat in the restoration of the
transmitter.
A schematic view of the synchronizing mechanism is presented in Fig. 21. This figure illustrates only the general principal underlying the system: certain modifications are necessary before it can be used in actual operation. The cam marked correcting cam in Fig. 21 is mounted on the receiver brush arm shaft. A contact arm bears against the cam, under spring tension, so that every revolution of the cam, the end of the lever drops into a notch in the cam face. This movement of the lever close the contact, which is in a circuit composed of the contact itself, the corrector magnet, the marking contact of the main line relay, local battery, and ground.

Suppose the transmitter sends out the negative synchronizing pulse; the main line relay closes the marking contact.
Such a condition is indicated in Fig. 21. Now the notch in the face of the correcting cam is so placed with reference to the receiver brush arm that if the receiver arm is ahead of the transmitter arm, the synchronizing pulse will occur while the cam slot is under the end of the contact lever. At this time, therefore, the cam contact is closed, and the main line relay is on its marking contact; hence the corrector magnet is energized, and applies a correction. The next pulse is positive, so that the corrector magnet is immediately de-energized by the opening of the relay contact. If the correction need be but slight, the corrector magnet may be de-energized through the opening of the cam contact.

When the receiver brush is in step with the other, the cam contact does not
THE MACHINERY SYSTEM OF PRINTING TRANSFER

...
close until after the synchronizing pulse has occurred, so that no correction is applied.

As was previously stated, the scheme of Fig. 21 is not the one used in practical operation, since it is necessary to modify the control of the corrector magnet somewhat. However, before taking up these modifications, we will consider the synchronizing clutch, by which the corrector magnet is enabled to retard the receiver brush arm.

The synchronizing clutch is shown in Fig. 22. The motor drives the receiver shaft through a worm on the motor shaft and a worm on the receiver shaft. The worm-wheel, and a gear, A, of Fig. 22, are in one piece together with the connecting sleeve. The sleeve is bored to make a bearing fit with the shaft, but is not fixed to the
THE MECHANISM OF PRINTING DEVELOPMENT

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

shaft. To the brush arm shaft is attached the carrier, B, which carries the pinion, P, meshing with the gear, A, and the pinion, Q, meshing with the pinion, P. A star-wheel is mounted with the pinion, Q, and a jockey roller bears against it, under the action of a spring, S. By this arrangement, as long as the jockey roller holds the star-wheel locked in position, the carrier, B, the shaft, and the driving gears, A, and C, all revolve together. If however, the star-wheel is turned, the two pinions, Q and P, are turned, and the carrier, B, rotates with respect to the gear, A, and hence with respect to the driving motor. Whether the brush arm is advanced or retarded, with respect to the motor, depends upon the direction in which the star-wheel is turned.

Below the clutch is the cor-
recting magnet, to whose armature is attached a small interference pin, P. The magnet is so located that when it becomes energized, it draws the interference pin into the path of the star-wheel. Therefore, if the magnet be energized while the star-wheel is revolving about the central shaft, the pin trips the star-wheel through the angle of one tooth.

The result of the movement of the interference pin is the retardation of the brush arm. As was just shown, the clutch locks the receiver shaft and the driving gears, A and C, together, so that the shaft, clutch, and gears revolve in unison. If however, while they are revolving, the interference pin trips the star-wheel, the carrier, B, the star-wheel, and the shaft are stepped back slightly. Thus, when the receiver brush gets too far ahead of the transmitter brush at the
opposite station, a synchronizing pulse occurs, which causes the corrector magnet to pick-up, and thereby apply a correction to the brush arm.

The retardation of the receiver arm is very slight, but the driving motors run at such nearly constant speeds, that the arms turn through several revolutions before correction become necessary.

As was previously stated, the control of the corrector magnet is somewhat different from that shown in Fig. 21. The corrector magnet does not have time to pick-up under the action of the synchronizing pulse. It is necessary, therefore, to prolong the influence of the pulse. Two relays are added to the scheme, one a quick-acting, and the other a slow-acting instrument. The mechanical construction of the re-
opposite staticque, a symmetrical balance of

THE MORPHOLOGY OF PRINTING TECHNOLOGY

The question of the treatment and presentation of the text is crucial in many respects. The text must be legible and clear, while also conveying the necessary information. The choice of typeface, font size, and line length are all important factors in creating an effective layout. Additionally, the use of headings and subheadings can help to organize the text and make it easier to read. Proofreading and editing are essential steps in ensuring the accuracy and quality of the final product.
lays is the same as that of the relay pole changers, already described.

The new scheme, as is used in practical operation, is presented in Fig. 23. In this figure, the quick acting relay is marked "X", and the slow-acting is marked "Y". By reference to Fig. 23, we that when the correcting pulse is received, if the cam contact is closed, the current passes from the positive side of the local battery, through the printer relay and cam contacts, through the windings of X and Y in multiple, to the negative side of the battery. Relay X picks-up and closes contact a. The correcting magnet is now connected across the local battery through the contacts a and b. Also, both relay windings are connected in multiple across the local battery. The slow-acting relay, Y, now picks-up and opens contact b; the open-
THE WORKING SYSTEM OR PRINTING THERMOGRAPHY

The new release, as to reach.

In practice, the print contact relay...

The contacts close, the current passes through the positive side of the local battery...

The print contact relay may connect...

The contacts close, the local battery...
ing of contact b de-energizes both relay windings, so that the contacts a and b are opened. When a and b are open, the correcting magnet is disconnected from the battery; hence, the magnet is de-energized. But in the meantime, it has performed its synchronizing function, i.e., it has, through the agency of the synchronizing clutch, retarded the brush arm.

If, when the synchronizing pulse is received, the cam contact is open, (as it will be when the brush arms are in step) there is no current path through the cam contact to the relays X and Y. Hence, the relays are not energized and no correcting action occurs.

The purpose of the 200-ohm resistance shunted across the corrector magnet is to absorb the inductive kick, present
THE PATHOLOGY OF PRINTING TYPGRAPHY

The contact of the type with the paper is of primary importance in the process of printing. The pressure of the type against the paper must be sufficient to produce an impression on the paper. This pressure is produced by the action of the platen and the type.

The platen is a flat, hard surface against which the type is pressed. The platen is usually made of wood, but it may be made of metal or other materials.

The type is made of metal, wood, or plastic and is designed to produce an impression on the paper. The type is normally made of metal and is usually cast in a foundry. The type is then mounted on a type case or type drawer, which is a container for the type.

The type is then pressed against the paper by the platen. The pressure is produced by the action of the type case or type drawer against the platen. The pressure is controlled by the operator, who adjusts the pressure to produce the desired impression on the paper.

The type is then removed from the paper and the process is repeated. The type is normally used multiple times, and the impression on the paper is usually transferred to a new sheet of paper.

The process of printing is a complex one, and it requires careful attention to detail to produce a high-quality printed product.
when the circuit of the magnet is opened. If this resistance were not provided, destructive arcing would occur at the contact b or at the cam contact.

We will now complete the discussion of the electrical circuits of the distributor.

THE DISTRIBUTOR CIRCUITS. The complete circuits of the distributor are shown in Fig. 24. It is obviously impractical for us to attempt a study of the circuits as presented in this figure; hence, we will separate the constituent circuits from the rest and study them one at a time.

THE MOTOR CIRCUIT. The motor circuit is so simple that it need not be separated from the other circuits of Fig. 24. As is indicated, the motor, together with the governor contact and the 1000-ohm resistance
THE DISTRIBUTOR CIRCUIT

complete attributes of the distributor are shown in Fig. 24. It is axiomatic that the

as to the manner of the attributes as the

sense to this picture, hence we will make

and entirely from the neat

one at a time

THE MOTOR CIRCUIT

sufficient to simple fact if kept not to be

Fig. 25. Such is the origin of the motor, together with the

conventional contact and the 100-amp...
in multiple, are connected across the 110-volt battery.

TRANSMITTER DISK CIRCUITS.

The circuits of the tape contacts and relay pole changers are shown in Fig. 25. The connections are similar to those of the introductory system shown in Fig. 6, except for the addition of the 900-ohm resistance, D, in series with the back points of the relay pole changers, and for the addition of the cut-out relay. The purpose of the resistance, D, is to prevent the short-circuit of the battery when one or more of the relay pole changer tongues are on their front contacts and the transmitter brush is on the corresponding button. The cut-out relay was discussed before; it is controlled by the tape feed cut-out. As is indicated, when the cut-out relay is de-energized, as is normally the
THE WORKING SYSTEM OF PRINTING TECHNOLOGY

- In multiple, set connected loss to the 110
not set a

TRANSMITTER DISK CIRCUITS

The operation of the tape contact and relay
- pole changes are shown in 110. 22. 22. The con
- nections are similar to those of the rect

200-ohm resistance. I

The addition of the 200-ohm resistance.
In series with the pick points of the relay
poles appearance and for the addition of the
out-of-order relay. The purpose of the resistance.

... to control the printer. The
not set up to control the relay pole
settings to change the ohm from contacts
and the transmitter plug in no the contacts
- bouncing button. The out-of-order relay was the
open to control the printer. In order
out-of-order to be energized as in normally the
case, the armature rests against its back point, so that the back points of all the relay pole changers are negative. When the cut-out relay is energized, by the closing of the cut-out cam contact, its armature is drawn over to the front point. When the armature is in this position, both the front and back contacts of the relay pole changers are positive. Hence, by means of the cut-out mechanism, all-positive impulses are transmitted through the line whenever the cut-out is in operation.

Fig. 25 also comprises the circuits of the main line pole changer. The buttons of the transmitting disk are connected to the tongues of the relay pole changers; the brush arm is connected to one terminal of the main line pole changer; the other terminal of the main line pole changer is con-
THE YORKTOWN SYSTEM OF PRINTING TYPOGRAPHY

case, the strain that questmgent the pack point
so that the pack points of all the relay poles
- appearances are degenerating. When the out-port re-
- as an electrically drawn over contact to the out-
- when the strain is drawn over to the front point. With the relay point to 
- this position, both the front and pack con-
- tacts of the relay pole changes the point -
- tive hence, by means of the out-port we can
- turn the drive whenever the out-port is in
- operation.

This is also companion the
- operations of the main line pole changer. The
- shuttles of the transmitting grid are connected
- by to the former of the relay pole changes.
- the process is connected to one terminal
- of the main line pole changer; the other ter-
- minity of the main line pole changer is con-
-
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

connected to the local battery through the 900-ohm resistances, A, B, C, and D. A study of the connections of the main line pole changer and resistances will show that two 900-ohm resistances, A and B or C and D, are always in series with the main line pole changer while it is connected across the local battery. Hence, the current through the coils is limited to a value which the winding will safely carry.

The tongue of the main line pole changer is connected to the middle point of the winding of a milameter; we are not at present concerned with the purpose of the milameter. At this point of connection, the circuit divides. One path consists of half the winding of the milameter, one coil of the main line relay, the artificial line, and ground. The other path leads through the
The Eormum System of Printing Typefaces

The purpose of the local battery is to supply the signals to the typefaces. A, B, C, and D, are the typefaces of the main line type faces. And typefaces will show that two 000-000 typefaces A and B, or C and D, are always present with the main line type. Character, while it is connected, causes the local part to light up the current through the coil to limit the voltage which the unit will carry safely. The purpose of the main line type faces is to connect to the middle point. When the typefaces are not connected to the middle point, the meter shows the voltage of the middle point to the presence or absence of the connection. At this point of connection, the meter gives one each of a half of the middle point of the middle point. One half of the main line faces the additional type faces in each group. The type faces of the local type faces, one copy of the main line faces. The purpose is to balance the type faces.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

other half of the winding of the milammeter, through the other coil of the main line relay, and thence to the line. We see, therefore, that, as in Fig. 6, the armature of the main line pole changer is connected to the line. One point of the main line pole changer is positive, whereas the other is negative; these two points are respectively connected, as before, to the positive and the negative legs of the main line battery. This battery is not shown in Fig. 25. The operation of this much of the transmitting circuit is exactly the same as that of the scheme shown in Fig. 6.

The transmitting disk of Fig. 25 has the eight contact buttons, previously discussed. The function of the five code buttons is apparent. The synchronizing and lamp buttons, however, may require a word of ex-
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

...
planation.

The negative synchronizing button is permanently connected to the negative side of the local battery, so that only marking impulses are sent out by this button. It controls the main line pole changer in exactly the same manner as the code buttons do.

The positive synchronizing button is the same as the negative, except that it is connected to the positive side of the local battery. Hence, only spacing pulses are sent out by this button.

The lamp signal button is marked "L" in the figure. This button may be either positive or negative, depending upon the position of the break key. Ordinarily, the break key connects the lamp button to the positive side of the battery, so that only positive or spacing impulses are sent
out by the button. If the break key is depressed, however, it connects the button to the negative side of the battery, and hence marking impulses are transmitted. At the receiving station, these pulses control a lamp relay, similar to the other local receiving relays; this lamp relay, in turn, controls a lamp. Normally, the lamp is not lighted, but if the break key be depressed, the lamp at the other station lights. This lamp is used for the transmission of signals between operators at the two station, and does not interfere with the message.

AUTOMATIC STOP CIRCUITS. The circuit of the automatic stop for the tape-feed mechanism, comprising the stop lever and cut-out magnet, is clear from Fig. 24. The stop lever contact is in series with the cut-out magnet, and the two are connected across the local battery.
THE MORKUM SYSTEM OF PRINTING THERMAL STRIP

out of the button. If the black key is on-
pressed, however, it connects the button to
the negative side of the battery, and hence
making the light go out. To make the light
appear again, these buttons control a lamp
of varying intensity. The other button receiv-

er a lamp, and the lamp is not illuminated.

If the lamp can be depressed, the lamp
on the other button lights. The lamp in
the message with the message.

AUTOMATIC STOP DIRECTIONS

obtain of the automatic stop for the tape-
read mechanism, operating the stop lever
and counter mark, to clear from the
the stop lever contact to operate with the
counter mark, and the two are connected.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

THE RECEIVER CIRCUITS. The receiver circuits are shown, somewhat simplified, in Fig. 26. The path of the impulse from line to ground is through one coil of the main line relay, through the milammeter, through the other coil of the main line relay, and through the artificial line to ground at G'. The milammeter is connected in series with the main line relay, so that a more accurate idea of the strength of the incoming line impulses may be obtained than would be furnished by the movement of the main line relay armature. The artificial line is merely an adjustable resistance and capacity in parallel, connected between the main line relay and ground. The function of the artificial line will be taken up during the discussion of the polar duplex.

The tongue of the main line
The working system of writing telegraphs

The receiving circuit must be

somewhat similar

to that of the telephone

from line to ground at the point of

the main line relay, showing the milliammeter

that any movement of the straining line to ground

of the milliammeter is connected to

the main line relay so that a more or

less accurate test of the straining or the incoming

currents may be obtained and would be

indicated by the movement of the main line

circuit in the relay. The straining line to relay

is so connected to the relay coil between the main line relay

and ground. The formation of the straining

line with the noise and the accentation

of the broken alphabet.
relay is connected to the positive side of the local battery; the two points are connected to the two coils of the printer relay, as was the case in the introductory system. The remaining two terminals of the printer relay coils are strapped together, and this point connected to the negative side of the local battery through a 2000-ohm resistance. By this arrangement, the printer relay follows the movements of the main line relay. The purpose of the 2000-ohm resistance is to limit the current through the printer relay.

One point of the printer relay is dead. The other point is connected to the positive side of the local battery. The armature of the relay is connected to the receiver brush arm. Hence, when spacing signals are sent out from the transmitting station, the tongue of the printer relay goes
The Morris System of Printing Telegraphy

When the battery is connected to the printer AC, the two contacts of the battery are connected to the two contacts of the printer relay. The relay then connects the two contacts of the battery to the two contacts of the printer relay, as seen in the information system. The two terminals of the printer are then connected to the printer relay. The contacts are then connected to the printer relay, and the printer relay is connected to the printer relay.
to its dead point, and the receiver brush is not energized. When a marking pulse is received, the tongue of the printer relay goes to the opposite point, which is connected to the positive side of the local battery; hence, the receiver brush arm is energized. The operation, therefore, is exactly the same as the system of Fig. 6.

The circuits of the local receiving relays have been omitted; they will be considered during the discussion of the printer.

The synchronizing circuit, as previously described, was taken from Fig. 24. Hence, no further explanation is required.

As for the buttons on the receiver disk, and the circuits which they control, the buttons are arranged just the same as those of the transmitter disk, except that
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

The system of printi...
the two synchronizing buttons of the transmitter have been combined into one large button on the receiver disk. This button is marked "A" in Fig. 26, and is called the restoring button.

The receiver circuits beyond the receiver disk will be taken up in connection with the printer. We will now explain the polar duplex operation of the Morkrum System.

POLAR DUPLEX OPERATION. The system of telegraphy as presented in Fig. 24 is capable of duplex operation, that is, capable of simultaneously transmitting two messages: one in either direction. The plan is that of the polar duplex. As in all duplex schemes, the principal requirement is that the home-main-line relay shall respond only to signals from the distant station, and that the distant-main-line relay shall respond on-
THE MORRISON SYSTEM OF PRINTING TYPESETTING

- The two synchronization buttons on the frame.
- Each letter has been combined into one large unit.
- This button is now called the "A" button.

Store your conventions,
how to enter data with the printer. We will now explain the proper operation of the Morrison System.

The proper way to operate your printer.
- The system is based on the principle of operating the two units. The plan is to see how the printer is operated. As in all complex systems, the principle to remember is that
- always the procedure remains the same. The home-use line system is set up to
- always from the alphabetical order number only.
ly to signals from the home station. In other words, each relay registers signals received from the other station, but does not register signals sent out from its own station. If the relays perform in such a manner, then each station can simultaneously receive and transmit a message without the interference of the line signals.

The circuits essential for duplex operation have been separated from the general scheme of Fig. 24, and are presented in Fig. 27. This figure represents two stations, exactly alike. Suppose the main line pole changer at the home station to be on its positive contact, as shown in the figure. A circuit is thereby established from ground at G', through the positive leg of the main line battery, B, through the pole changer contact, to the middle point of the
THE NORMAN SYSTEM OF PRINTING TELEGRAPHY

In order to eliminate from the system any possible errors that might arise from the incorrect operation of the apparatus and thereby minimize the possibility of error, the system of Norman printing telegraphy has been designed so that each station can simultaneously receive and transmit a message without interference from the other station.

The apparatus essentially consists of two sections, exactly alike, placed in the main field of the operating table. These two sections are connected together at the points where they are connected to the apparatus and thereby eliminate any possibility of error arising from the incorrect operation of the apparatus at any point of the message.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

milammeter winding; at this point, the path divides into two branches. One part leads through one coil of the main line relay, through the artificial line, to ground at $G_1$. The other part goes through the other coil of the main line relay, through the line to the distant station, through one coil of the main line relay, through the entire milammeter winding, then through the second coil of the main line relay to the artificial line, and through that to ground. Now, return to the middle point of the milammeter at the home station; the current path divides at this point. If the artificial line is properly adjusted, the resistance and capacity to ground through the two branches of the circuit will be the same. Hence, the current divides here into two equal parts, and, moreover, the two parts build up to their
THE MORPHOLOGY OF PRINTING TECHNOLOGY

The character set is divided into two parts: one part deals with the setting of the type, and the other with the setting of the text. The former part consists of the setting of the type, and the latter of the setting of the text. The two parts are not interchangeable, and the setting of the type is not independent of the setting of the text. Moreover, the two parts are not independent of each other.
working values at the same rate. Therefore, one-half of the current goes out over the line to the distant station, and one-half goes to ground at the home station. Hence, there are equal currents in the two coils of the home main line relay; the coils are so connected that the two equal currents neutralize each other's magnetic effects. There is, therefore, no resultant movement of the armature. At the receiving or distant station, the currents pass through the relay coils in opposite directions. Hence, the magnetic effects of the currents are additive, and there is a movement of the relay armature. Of course, if the armature is already in the position to which the line current ends to move it, there can be no movement.

Also note that the current at
THE MORENUS SYSTEM OF PRINTING TECHNOLOGY

Working because of the same rate. Therefore one-half of the current flows out over the line to the adjacent station and one-half into the home station. Hence if one is able to connect in the two coils at the home main line relay the coils the connection is connected to the two empty connections. 

Vastly these after receiving the information of the station all of the current becomes stronger. Hence rely solely in opposite directions. The magnetic effect of the current are so slight and there is no movement of the relay. 

Stand to course at the station to which the line can reach in the position to which there can be no more movement.

Also note that the current at
the home station passes through the millameter windings in opposite directions, so that no deflection of the instrument is produced. At the receiving station, however, the current passes through the entire winding in one direction, so that a deflection is produced.

Hence, as a summary of the operations, we may say that signals transmitted by the home station do not affect the receiving apparatus at that station, but are registered by the receiving apparatus at the distant station. In the same way, signals sent out by the distant station affect only the receiving apparatus at the opposite end of the line. The operation of the plan would of course have worked out the same had both stations been sending out either positive or negative currents.
THE MORPHISM SYSTEM OF PRINTING TECHNOLOGY

- the home station because it has the influence
  on water matter in opposite circumstances
  on part on the material of the treatment for the
  growth of the receiving substance. However, the
  cannot because it is the opposite of the
  one in the material

- hence, in a manner of the
  operations, we may see that it is the
  matter of the home station to not affect the
  receiving substance of that station, but the
  receiving by the receiving substance at the

  statements. In the same way, all
  point out by the statements effect only
  the receiving substance of the opposite and
  the material of the plan would
  of the file. The operation of the plane had poor
  to some have working on the same need for
  statements need to the technique of

  negative counterparts
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

If both stations are sending out currents of the same sign, say positive for example, we have equal e.m.f's. impressed on both ends of the line. Hence, there is no resultant line current, and of course, no current through those coils of the main line relays which are connected directly to the line. Each relay will, however, register the same as though it were receiving current from the other station. An inspection of the diagram will show that the current through the artificial line at the home station will be in the same direction as positive current from the distant station would be. Hence, this current through the one coil of the relay produces the same movement of the armature as a positive current from the other station would produce. Likewise, at the distant station, the current through the arti-
THE WORKING SYSTEM OF PRINTING TYPographically

If both astrotoms are sending

out currents of the same sign, the positive

for example, we have already e.m.f. impressed

on both sides of the fine, hence, there is no
resistance to the current, and of course, on

current flowing from center of the main line.

Letters which are connected directly to the

fine. More relay will, however, register the

same as though it were receiving current from

the opposite station. An inspection of the other

will show that the current flowing the

attitudes fine of the home station will be

in the same direction as the positive current,

from the home station would be. Hence,

the current flowing one coil of the same

caused to move the same moment of the wire.

Take an opposite current from the other

station would produce the same.

Let astrotoms, the current through the arti-
ficial line and one coil of the main line relay is in the same direction as a positive current from the home station. Hence, the movement of the distant relay armature is the same as though that movement were produced by a positive current from the home station. Therefore, we see that each relay still registers the signal sent out by the other station, but does so by current from its own station.

If both stations were sending out negative currents instead of positive; the operations would be exactly the same, except, of course, the relay armatures would take position against the opposite points from the first case.

In case both stations are sending out current, but these currents are of different sign, the operation of the re-
THE MORRISON SYSTEM OF PRINTING TECHNICAL

If both stations were even
- the correct answer to be used is exactly the one shown. Hence,
the movement of the alternate relay armature
is the same as though the movement were
in the same direction as the movement from the home
station. Therefore, we see that each relay
still retains the single sent out by the
other station, and hence as the armature
of the own station

In case both stations are
- exactly the answer, put these armatures
of the opposite station to the operation of the re-
lays is not changed. The only effect is the doubling of the line currents.

We see, therefore, that by using the instruments and connections of Fig. 27, we can establish duplex operation, that is, we can establish simultaneous communication in either direction over a single wire.

The Morse sounder and other instruments of Fig. 24 are used when the two distributors are being first put into operation. By means of these instruments, the operators at the two ends of the line can communicate with each other. Since these Morse circuits do not form a part of the printing telegraph system proper, their discussion will be omitted.

We will now take up the description of the only remaining element of
The Worsman System of Printing Telegraphy

have is not apparent. The only effect is the

compliance of the fine antenae.

We see, therefore, that

while the instruments and connections of

the SV.; we can satisfy the hypooperation.

that if we do not satisfy the telegraph connecting

communication in either direction over a single

wire.

The Morse system, may often

instrument of the. As we can weigh the two

adaptations the point that but into operate

from in means of these instruments, this can be

state at this two theme of the line can come

more mistakes with such other. Since these more

operations do not form a part of the printing

telegraph systems proper. Their construction

will be omitted.

We will now take up the

application of the only remaining element of
the distribution system, viz., the Wheatstone differential relay.

**THE WHEATSTONE DIFFERENTIAL RELAY.** The main line pole changer, main line relay, and printer relay, although they do not form a part of the distributor itself, yet constitute part of the entire distribution system; all three are adaptations of the Wheatstone differential relay. The three functions are performed by instruments which are exactly alike in mechanical construction, but differ in their electrical connections.

The Wheatstone differential relay is primarily the same in its action as any other polarized relay; that is, it includes a moving contact arm, playing between two fixed contact points, and operating solenoids. The contact arm takes position against one point or the other, depending upon the direction of the current through the operat-
THE WORKING SYSTEM OF PRINTING MACHINERY

The print position system, and the Wheatstone differential relay

The Wheatstone differential

BELAY. The main line pole contactor main line

 BELAY, any printer relay, all but one of the Wheatstone auxiliary contacts the entire Wheatstone relay, and particularly contacts of the Wheatstone differential relay.

The Wheatstone differential relay contacts the movement of the instrument which acts exactly like in mechanical connection, but is effective in point electrical connection.

The Wheatstone differential relay is practically the same as the Wheatstone differential relay, the operator observing simultaneously points on the Wheatstone point contactor plate. The Wheatstone point contactor plate indicates one point of the operator's selecting above another point of the operator's selecting above.
ing coils. The armature, however, is not permanently polarized, as it is in the usual form of polarized relay, but is polarized by a separate exciting coil. The relay may be used as a differential or cumulative instrument, depending upon the connections of its operating coils. A relay is said to be differential when the magnetic effects of the currents through its operating coils counter-balance or oppose each other, and cumulative when the magnetic effects of all currents add to each other. The Wheatstone differential relay in its working form is shown in the accompanying plates.

The principal parts of the instrument are shown in Fig. 28. The two cores of the main coils, C and C', are mounted vertically and side by side. On these cores are wound the main coils, each coil
THE MORRISON SYSTEM OF PRINTING TYPECASTERY

The operator, however, is not beyond

merely by moving the lever, put it in position

for the correct letter. The lever may

be moved to a different position or combination in

statement, depending upon the connection of

the operator. A lever is said to be

alterative when the mechanical effects of the

convenience furnished the operator with con-

venience of oblique even after a series of

the type wheel the mechanical effects of all our

 knees and to each other. The type wheel and

terminates in the working form, no longer

in the accompanying plate.

The principal parts of the

instrument are shown in Fig. 5. The two

cases of the main cylinder and of the mouth

be very attractive and above all, to these

cases are worthy the main cylinder, each of
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

consisting of two separate windings. The ends of the windings are brought out to binding posts on the base of the instrument. Each core is fitted with pole-pieces, as is indicated.

The armatures, A and A', play between the pole pieces, one armature being at the top of the cores and the other at the bottom. Each armature consists of an iron disk with a small projecting tongue at one edge. The two disks are attached to a brass rod, R, which runs through the centers of the disks; brass is selected for this rod on account of its non-magnetic properties. The rod is supported at the top and bottom in pivots. The tongues of the armatures extend into the space between pole-pieces.

The exciting coil may also
The morning system of printing typewriters

consists of two separate mechanisms. The one
mechanism is placed on the face of the type,
while the other is placed on the opposite
side of the type. Each
mechanism is fitted with a hole, which, as the
shape
of the letters, is a

A

When the space between the hole on one
mechanism and the other
mechanism is such that one
goes into the space between hole perforations,
the structure of the

A

magneto perforate
not sufficient to
the hole perforate
place the space of
the hole perforate
the structure of
the letters.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

be seen in Fig. 28. As shown, the coil comprises an iron core, upon which is placed the exciting winding. The core is mounted vertically, and is of about the same height as the other cores; at the top and bottom, the core is fitted with pole-pieces.

The pole-pieces are end pieces, attached to the core in such a manner that they project from one side of the core. Semi-circles are cut out of the projecting ends of these pole-pieces; in the two semi-circular pockets so formed are placed the two circular disk-ends of the armatures, one disk being placed in each pole-piece. A very small air-gap is left between the armatures and pole-pieces, so that the two armatures and the brass connecting rod by which they are supported can turn freely in their pivots.

Just above the upper armature, and mounted on the brass connecting
THE MÖRÖNSS SYSTÈM OF PRINTING TÉCHNÉS

pe seen in Fig. 28. As shown, the com

plate as from core, which is placed

the exacting matter. The core is mounted
vertically, and at the spot the same height
as the other cores at the top and bottom.

the core is fitted with hole-pieces.

The hole-pieces are of the same

as attached to the core in such a manner
that they protrude from one side of the core.
Similarly, they cut off the protruding
edge of the hole-pieces at the top and

articular care was taken to place the plate
of the two structures of the two structures
are parallel to each other. The two structures
and hole-pieces, so that the two structures
are supported and fme fectly in place.

Just above the upper side

and are mounted on the plane connecting
rod, R, is a contact arm, O. This arm is fixed to the rod, R, at one end, and carries a contact point at its other extremity. Two fixed contact points are provided, one on either side of the arm and both in line with the contact point carried by the arm. The arm swings back and forth with the armatures between the two stationary points.

As for the operation of the relay, suppose the two operating coils carry currents which polarize the poles and cores in the manner indicated in Fig. 29. Also, let the current in the armature-exciting coil be of the direction that polarizes the armatures as shown. There is no return path for the exciting coil flux between armatures except through the intervening air or through the cores of the operating coils; obviously, the flux chooses the latter path. Hence, in Fig.
THE MORPHOGENESIS OF PRINTING TECHNOLOGY

As for the operation of the two cooperating coffee coats...

As shown, there is no turning back for the ex-

attraction of this between statements except...

This porque the letters partly surface to the...
18, the flux between armatures assumes the same direction and path as the operating flux. Such action pulls the armature in the direction of the flux; that is, the armature takes position against the right-hand pole-piece. When the armatures are in this position, the contact arm lie against the right-hand contact point.

Had the operating current been in the opposite direction, the cores, C and C', and their pole-pieces would have been oppositely polarized. Hence, the armatures would have swung toward the left pole-pieces until the swinging contact arm made contact with the stationary point at the left side. Therefore, the direction of the working current, by determining the polarity of the pole-pieces, determines to which side the armatures will swing, and therefore
The friction between the two surfaces causes the

take position agents the right-hand pole
- piece where the statements are in the boat
from the contact arm the statement the right
hand contact point

May the opposite arm be seen in the opposite direction. Hence, the same
- seen opposite position. Hence, the arm
- turn would have same position if the left pole
- piece with the stationary point at the
contact with the stationary point of the
left side. Therefore, the friction of the
working contact, by determining the pole-
y of the pole-piece. Hence, the respective
at the statements with write and treated
determines whether the right- or left-hand contact will be closed.

If, instead of the direction of the working current being changed, the direction of the armature exciting current had been changed, the armature would have changed position just the same. This movement would be due to the change in the polarity of the armatures. In practice, however, the exciting current of the armature is not changed.

In Fig. 30 are shown the three methods of connecting the relay windings when the instrument is to perform its three respective functions. As was said before, each core carries two independent windings, all four windings being the same; the windings on each core are shown separated in Fig. 30, but in reality, both are distributed over the entire length of the core.
THE MORRIS SYSTEM OF PRINTING TYPOGRAPHY

...some certain matter will be allowed...
In Fig. 30(a) is shown the relay as connected for action as a main line pole changer. In this case, all four windings are in series, and in such a way that their magnetic effects are cumulative. The external connections are to terminals a and b. An application of the cork-screw rule shows that when the coils carry current in the direction indicated by the arrows, the top of the left core becomes a north pole, whereas the top of the right-hand core becomes a south pole. The contact arm, therefore, assumes position against the right-hand contact point. If the operating current is reversed, the polarity of the cores is reversed and the contact arm assumes position against the left point. Hence, the instrument fulfills the requirements of a main line pole changer.

In Figs. 30(b and c), we see
the instrument arranged for operation as a main line relay. The main line relay is under the action of two operating currents: that passing through the artificial line, and that passing through the main line. These two currents should neutralize each other's effects on the armature. At the same time, the relay should respond to a single operating current passing through all windings in series. An examination of Fig. 30(b and c) will show that the relay will act in the desired manner. Fig. 30(b) shows the relay carrying currents that neutralize, that is, the currents which it carries when messages are being transmitted from its own station. Fig. 30(c) shows the instrument carrying a single operating current, as it does when messages are being received.

In Fig. 30(d) is shown the
THE MORRISON SYSTEM OF PRINTING TELEGRAPHY

...
relay connected for use as a printer relay. In this case, there should be two sets of windings; current through one set should cause the armature to take position against one point, whereas current through the other set should cause the armature to take position against the other point. Two windings are therefore provided, each consisting of two coils, one on each core. The terminals of one winding are a and b; the terminals of the other are b and c. Terminal b goes to one side of the operating battery. Now, if terminal a is connected to the remaining side of the battery, the armature assumes position adjacent to the left pole-piece. If, instead, terminal c is connected to the remaining side of the battery, the armature shifts to the right-hand position. Hence, the position of the armature depends upon which of its two
THE MORRIS SYSTEM OF PRINTING TYPGRAPHY

Let us connect the movement by two sets of light and dark passages as shown in the figure above. Wherever these cannot be seen, the same meaning is to be taken. When the passage to be printed is then taken note of, the second point is made, with the corresponding note to the right to the left, and the further note to the right to the left, and so on, until the entire sheet is printed.

Hence, the position of the two

right-hand portions...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

windings is energized; this is the action desired in the printer relay. It should be noted that the windings are not energized simultaneously, but only one at a time.

In Fig. 24, conventional symbols are used for the differential relays in the different functions. In the diagram, each instrument is shown as having two coils, just as the usual type of polarized relay. However, if it is remembered that the Wheatstone differential relay always has two coils, though they may be on the same or different cores, and that changes in the operating currents in these coils produce exactly the same effects as the same changes would produce in an ordinary polar relay, no confusion on the part of the reader will result. In the wiring diagram, the armature-exciting coils are omitted for the sake of simplicity.
THE WORKING SYSTEM OF PRINTERING TYPGRAPHY

Whithersoever the pottion goeth in the machine, it shall be printed as quickly as possible, and the pottion shall goeth at the same time only of one of the

In this, the concomitancy is

In the same manner, the pottion is not printed as quick, as the machine is to print another. However, the pottion is to be printed as quick, as the paper is to be printed, and the pottion is not printed as quick, as the paper is to be printed. However, the pottion is to be printed as quick, as the paper is to be printed. However, the pottion is to be printed as quick, as the paper is to be printed.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

The last paragraph concludes the discussion of the distribution system. Next will come a description of the printer. As in the foregoing material, rough sketches of the printer parts will be used to show the general principle of action, whereas the photographs of the actual machine will be relied upon to show the detailed construction of the machine.
THE MORRISON SYSTEM OF PRINTING TYPEWRITING

The last paragraph concludes...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Part IV - The Printer.

GENERAL. The Morkrum printer is, in reality, a typewriter, operated by electro-magnets, which are controlled by the incoming line impulses. In the following description of the machine, the plan will be to take up first the mechanical movements of the printer, and then to explain the electrical means by which the mechanical movements are operated and controlled.

The complete printer may be seen in the accompanying plates. As is indicated, the main frame consists of a bed-plate, from each corner of which rises a post; a cover-plate is screwed onto the top of these posts. When the machine is completely assembled, it is entirely enclosed except for the platen and typewheel carriage.

The printing action in this machine is accomplished by the typewheel striking a message blank, which is supported
THE WORKING SYSTEM OF PRINTING TYPGRAPHY

Part VI - The Printer

The Working Printer

As in reality a printer is merely a device, which is controlled by the
operator's impulses, so in the machine the printer will be to
take up fitted the mechanical movements of the
printer, and then to explain the technical
measure of which the mechanical movements
are controlled and controlled

The complete printer may be
seen in the accompanying plate. As in fact,
the main frame consists of a-bc-d-e,
each acting as a complete machine, in which lies a poet: a con-
tap into which the poet's line of type
is dropped into the machine to complete the
plate. When the machine is completely set
the poet's line is printed on the
plate and the page printed.

The printing matter is
machine is composed of the typeface
striking a master plate, which is afterwards


THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

on the platen. These parts are shown in the assembly photographs.

THE TYPEWHEEL. The typewheel is shown in Fig. 31. It is a fiber drum, around the edge of which occur the type in raised characters; the characters are arranged in two rows, one near the top and one near the bottom of the drum. The typewheel has a hub at its center, the hub being bored to fit a shaft called the typewheel shaft. This shaft furnishes the primary support for the wheel.

THE PLATEN. The platen is a rubber roller, whose purpose is to hold the message blank or other paper. It is similar to a typewriter platen, and will be taken up in detail a little later.

THE TYPEWHEEL MOVEMENTS. There are a number of necessary movements of the typewheel. Primarily, of course, the wheel
THE WORKING SYSTEM OF PRINTING THERMOPHOTOGRAPHY

The solutions of these latter are shown in the

example photographed.

THE THERMOGRAPHY

To show the angle of which occur the type in

layers characters; the characters the stream

run in two rows, one near the top and one near

the bottom of the stream. The thermo

piece is fitted at the center and placed properly. To

the edge of the thermojacket. The thermo

piece is fitted at the point to support the table.

THE THERMOGRAPHY

Upper roller whose purpose is to hold the

message clear to other parts of the

to a thermometer placed, and will be taken as

in general a little later.

THE THERMOGRAPHY

The number of necessary movements of the

thermographic inasmuch as, of course, the screen.
must strike the platen so as to print the character. Before this action, however, it must have rotated so that when it strikes, the proper proper raised character will be at the point of contact between the wheel and platen. Also, the typewheel must be in its correct vertical position, that is, the correct position along the axis of its shaft. If the wheel is in its normal position, characters of the top row strike the platen; if the wheel be raised a little, characters of the bottom row strike the platen. This latter is called the shift position of the wheel, and is assumed when the shift signal is received over the line. Furthermore, after the printing of each letter, the typewheel must be spaced, that is, it must be moved along in front of the platen a short distance, so that the next letter printed will lie beside
THE MOREXUM SYSTEEM OF PRINTING TECHNOLOGY

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the proceeding one. It is important that we note that in this printer, the platen remains stationary, whereas the typewheel travels back and forth in front of the platen, and thereby distributes the successive characters along the printed line; in the ordinary typewriter, the platen carries the paper before the point of printing, but in this case, it is the printing point which moves. And last, when the end of a printed line is reached, the typewheel must be moved back to its starting position. With this idea of the typewheel movements, we are now ready to study the means by which these movements are accomplished.

THE CARRIAGE. The typewheel is supported on a carriage (see Fig. 32). The carriage travels back and forth before the platen, carrying the typewheel with it. As is indicated in the general views, the car-
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

It is important that we note that in this printer, the typeface remains in the position of front of the plate, and the typeface travels from the printing line to the printing point. The printer corrects the paper, and the printing point moves to the printing point of printing, and in this case, it is the printing point which moves. And last, we know the only of a printing line to the type.

THE CARRIAGE. THE TYPEFACE

In supporting a carriage (see Fig. 28), the carriage travels back and forth before the paper is corrected to the carriage. The carriage travels with it. As in the carriage at the general alarm, the carriage...
The Morkrum System of Printing Telegraphy

The carriage is supported on two square steel rods, which extend clear across the front of the printer just in front of the platen. The carriage is so constructed that when one of the rods is turned, the typewheel strikes the platen, when the other rod is turned, the typewheel assumes the shift position. Hence, these rods not only form a run-way or track for the carriage, but also serve to transmit energy to the carriage for the typewheel movements. Because of this arrangement, the electro-magnets operating the typewheel can remain stationary, and be rigidly attached to the frame of the machine. A third rod, similar to the other two, but not assisting in the support of the carriage, is located below the other two rods. This third rod serves to transmit the motion of rotation to the typewheel. We see, therefore, that the car-
THE WORKING SYSTEM OF PRINTING INK

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Carriage serves as a support for the typewheel, and also transmits to the wheel the movements of rotating, striking, and shifting.

The complete carriage is shown in Fig. 32. As the mechanism is rather complicated, we will take up, one at a time, its various functions and the parts concerned.

The carriage frame is shown in Fig. 33. It consists of two parts. The first is a yoke, which is supported by the two steel rods as stated before. The yoke is fitted with round collars, free to turn, which have square holes at their centers; the holes fit the square supporting rods, so that when the rods are turned, the collars turn with them. The second part of the casting is of the form shown; it is attached to the yoke by two small shafts in the bearings.
THE MORNING SYSTEM OF PRINTING THEATREPHYS

The results serve as a support for the theory of the complete structure and also the movements of the wheel. The movements of rotation, starting, and stopping,

The complete structure is shown in Fig. 36. As the mechanism is rotated, the complete structure will take up one at a time. The various positions and the plate concentric.

The complete frame is shown to the right. In Fig. 36, the complete frame of two parts is shown. The parts are a yoke, which supports the frame. The yoke incorporates two separate rods as stated before. The yoke is fitted with twenty coffrets, free to turn, which have diverse roles at their centers; the roles fit the same supportive roles so that when the roles are turned, the coffrets turn with the second part of the complete frame.

The part shown is attached to the yoke; the two small plates in the foreground.
In Fig. 34, we see the essential parts for rotating the typewheel. The bevel gear, B, is mounted on the lower end of a vertical shaft, S; at the top of the shaft is a universal joint. A sleeve, A, is attached to the upper member of the universal joint, and into this sleeve slides the typewheel shaft, F. The upper end of the shaft carries an arm, called the locating arm, which locates the typewheel. The typewheel is set onto its shaft with the locating arm extending into one of the holes in the bottom of the wheel. The shaft, F, is attached to the collar, C, which fits over the sleeve, A. The collar, C, and the shaft, F, are joined by a small pin, D, so that the the collar and shaft can move up and down along the sleeve, A. This mounting is necessary in order that the typewheel may move to
THE WORKING SYSTEM OF PRINTING TYPING

In the case of a vertical sheet of paper, the key word is "vertical" and the key line is "vertical". The feet are attached to the metal strips of the upper edge and of the lower edge. The type feet contain a wire called the "locating wire", which locates the type-feet and keeps them at the correct height above the type. The type-feet, which move up and down with the type, are drawn into the impression into one of the holes in the gum at the bottom of the sheet, which fits over the type. A slight movement of the type into the sheet, or the screw, is necessary to move the type over the correct position of the type-feet. It is important that the type-feet may move to

say in order that the type-feet may move to
the shift position and may still be rotated. The purpose of the universal joint is to allow the typewheel to strike without disturbing the gear, B, and the shaft, S.

Fig. 34 also shows the method by which motion is transmitted from the rotator shaft to the gear, B. A second gear, E, meshes with the gear, B; this second gear, E, has a square hole cut in its center, so that it fits over the square rotator shaft. Hence, when the rotator shaft is turned, the gear, E, is also turned, so that the typewheel rotates. The gear, E, fits the rotator shaft loosely, so that the gear can slide along the shaft with the carriage, and be in mesh with the gear, B.

In Fig. 32, we see the rotator parts in place on the carriage frame. As is indicated, the second casting of the car-
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

The spirit position may still be rotated. The purpose of the slanting joint is to -

I now the trywheal to strike without getting -

the goat, the seat and the spirit.

The & also shows the method

by which motion is transmitted from the -

For amount to the seat. A second seat, E.

Meeks with the seat, B, the second seat, E.

How the second seat is turned, the goat. E.

where the rotor to start to increase the number, the second seat becomes the main seat of the rotor.

To then turn, so that the trywheal rotor.

The seat, E, hit the rotor shaft too early. So that the seat can strike alone the sheet with the hammer, may be in itself with the seat.

In the & we see the rotor.

For parts in place on the carriage frame. As
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

Carriage serves to support the sleeve, whereas the lower casting holds the shaft, F, of Fig. 34. Fig. 32 also shows the gear guide, by which the gear, E, is drawn along with the carriage. As indicated, the lower casting carries an arm extending downward, and this arm supports a collar bearing for the gear E of Fig. 34.

The striker movement of the carriage is shown clearly in Fig. 32, left view. To the collar, which fits over the striker shaft, is attached a lever, #25-4, the upper end of which is connected by a link, #25-5, to the upper casting of the carriage frame. Hence, when the rotator shaft turns (to the left), it turns the lever, #25-4, which movement pushes the typewheel to the left and downward. The carriage in this latter position is shown in Fig. 39.
THE WORKING SYMBOLOGY OF PRINTING TECHNOLOGY

There needs to support the stroke whereas the lower cassette forms the shaft of the

e. The S3 also shows the rear guide on

which the rear, E to frame stone with the

carriage. As integrally the lower cassette

are supporting a collar beneath for the rear

I of the A.

The striker movement of the

carriage is shown distinctly in the S3 flat

view. To the collet, which fits over the

striker shaft, it attaches a lower lever 4-

ft. 2 to the upper cassette of the case.

This frame. Hence, when the lever

reaches (to the left) it turns the lever.

which movement brings the sympathetically

the rear and consequently the carriage in the

Note that the joint between the carriage-frame castings is in line with the universal joint of the typewheel shaft; hence, the carriage can bend over like a hinge.

A centering device is added to the striker movement of the carriage in order that the raised characters of the typewheel will always hit the paper squarely. Onto the typewheel shaft is attached a star-wheel, #25-14 (see Figs. 32, 35, and 36); the star-wheel is so placed that the spaces between its teeth lie directly below the respective characters on the typewheel. A centering lever, #25-19, is mounted on the carriage frame as shown in Fig. 36. This lever is pivoted, near its middle point, to the carriage frame; the lower end carries a cross-pin, P (Fig. 36), which fits into the slot of a transverse cam. This cam is rigidly attached
THE MORMON SYSTEM OF PRINTING TYPOGRAPHY

Note that the joint between the cartridge and the type is in line with the inkwell. In order that the type may not become detached from the cartridge, a piece of leather is attached to the latter. This piece of leather is shown in the cut. The piece of leather must be of such a material as to prevent damage from the inkwell. The inkwell, 3½ to 4 in. high, 7½ to 8 in. wide and 3½ to 4 in. deep, is mounted on the cartridge frame. The lower and cartridge frame; the lower end of the inkwell is fitted into the slot of the cartridge frame. The case is tightly attached.
to the lower casting of the carriage. Ordinarily, the centering lever is in the position shown in Fig. 35, but as the carriage is bent over for the striking movement, the relative motion of the cam and centering lever is such that the upper end of the centering lever enters one of the spaces between the teeth of the star-wheel. Both the upper end of the centering lever and the spaces in the star-wheel are slightly V-shaped. Hence, as the lever enters the space, the star-wheel and typewheel are not only brought to center, but are locked in that position until the end of the stroke. The parts are returned to their original positions through a reversal of rotation of the striker shaft.

The shift mechanism may be understood from Fig. 32. The collar which fits over the shift shaft carries an arm, A.
THE WORKING SYSTEM OF PRINTING TYPGRAPHY

- The lower section of the carriage
- the centering level is in the position shown in the figure. All part of the carriage is part of the relative motion when the carriage level is such that the upper and centering level are fastened. If the space between the teeth of the star-wheel are not only in the center of the centering level and the space in the star-wheel, they are only in the center of the centering level. The parts are returned to their original position through a lever of the carriage at the back of the carriage.

The shift mechanism may be

...
By means of a link, this arm connects with the vertical sliding rod marked "shift plunger". This rod slides up and down in the bearings on the main casting as is shown in the figure. To this rod is attached the clutch, #25-7, which is merely a flat plate. One end of the plate is attached to the plunger rod; the other end is forked, and fits over the end of the collar (C of Fig. 34) on the typewheel shaft.

When the shift shaft is turned (to the left), it turns the sleeve and the arm, A. This movement raises the plunger, #25-42, which movement, in turn, raises the clutch collar, typewheel shaft, and typewheel. The typewheel is thereby moved into the shift position.

A return spring on the carriage brings the parts of the shift mechanism, including the shift shaft, back to their normal
THE WORKSMEN? METAL OR PRINTING TRADES?

By means of a kind, "shift plum-" the vertical alignment Yod marked, "shift plac-
nes", the key slides up and gowin in the press-
er, the key slides up, and moves to the upper-
try. To slide in attache the operator-
the operator and together, and lift over the-
and attache the operator (c) to the (e) on the type-

wheel ejyot.

When the shift plate is turn-
the side are to the left, (c) to the left, (e) to the left, the plate, and the-

The movement makes the plunger, (c) to the movement, in turn, the attache the operator-
coffee, then ea, craft, and the word-
conveyed in properly move into the shift bloc-

A for of the plunger, of the cradle-
the blade or the shift mechanism, in
complete the shift plate, back to their present
inoperative position. This spring is shown in Fig. 32; it is stretched between the spring bracket, #25-10, on the plunger, to the lower part of the carriage casting.

The inker is the device by which ink is smeared onto the typewheel face during the striking movement; the ink is applied just before the wheel strikes the platen. The inker consists of a small felt roller, soaked in ink, and mounted on supporting levers. These levers are attached to the frame of the carriage. As this device is mechanically simple and unimportant, it is omitted from the detail drawings; it is shown, however, on the assembly photographs.

THE ROTATOR, STRIKER, AND SHIFT LINKS. The means for turning the rotator, striker, and shift shafts are shown in Fig. 37. This figure also shows the method of supporting the shafts on the main bear-
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

The rotor, or striking mechanism, is the part of the machine thatなぜ it to the printer between the upper and lower part of the carriage case.

The lower to the carriage

which ink is smeared onto the typefaces face the ink to print onto the striking movement; the ink to strike three levers are situated to give the three of the carriage. As the carriage is moved, the type faces are lifted from the sheet of paper, and the sheet is turned a quarter of a degree. The rotor, or striking mechanism, is the part of the machine that

however, on the necessary photographed...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

ing plates.

THE ROTATOR LINKS. Considering the rotator mechanism first, we see that the rotator magnets, which furnish the energy for rotating the typewheel, are located at the bottom of the machine near the middle of the base. There are two sets of magnets: one set for left and one set for right rotation of the typewheel. Each set consists of two solenoids, all four being supported from the base by the magnet bracket. Each solenoid is fitted with a sliding core or plunger; the two plungers of the left rotator magnets are joined by a yoke attached at their ends, and likewise, the two plungers of the right rotator magnets are connected by a similar yoke. From the center of each yoke, a rod, R, comes forward between the two solenoids, passes through a guide hole in the magnet bracket,
THE ROTATOR II WICK CONSTRUCTION

The rotor mechanism that we see that the rotor wick, which turns in the gear, is the same time the gear on the roll of the machine near the middle of the paper. There are two sets of magnets on each set of left and one set of right. Rotation of the wick will then rotate the magnets.

Fl noreferrers, without being supported from the gear by the wick bracket. Each bracket is fitted with a sliding core or plunger. The two plunger on the left rotor magnets are joined by a core attached to their ends, and therefore the two plunger on the right rotor magnets are connected by a similar core from the center of each core's joy. There is a groove between the two splotches, because there's a groove hole in the wick bracket.
and terminates in a rounded end at some distance in front of the bracket. Each rod is fitted with a collar near its projecting end, and an open-coil compression spring is placed between the collar and the bracket. We come now to the connecting links between the rotator magnets and the rotator shaft.

The connecting links comprise first, an auxiliary shaft, called the magnet shaft. This shaft is supported at one end in a bearing in the magnet bracket, and at the other end in a bearing in the main right bracket. At the end near the rotator coils, the shaft carries a cross-bar, C, and near the other end, the sector of a gear. In Fig. 37, this sector is shown considerably to the left of the right main bracket; in reality, the sector lies very close to that bracket. The cross-bar, C, extends in front of both
rods, RR; the springs on the rods keep the rods firmly against the cross-bar. The gear sector stands vertically on the magnet shaft, and engages with a pinion of the rotator shaft.

The operation of the scheme is as follows: If the right rotator magnets be energized, they draw their plungers forward; this action thrusts the upper rod, R, forward, and with it, the upper end of the cross-bar, C. Hence, the auxiliary or magnet shaft turns through a small angle, and with it, the gear sector; the movement of the gear sector turns the pinion meshed with it, and in that way turns the rotator shaft. If the left rotator magnets had been energized instead of the right, the rotator shaft would have been turned in the opposite direction.

Means are provided for returning the parts to their original positions.
The operation of the scheme is as follows: If the right rotor's moment of inertia is the same as the left rotor's moment of inertia, and if the two rotors have the same angular velocity, then the right rotor will not rotate. If the moment of inertia of the right rotor is greater than that of the left rotor, then the right rotor will rotate. If the moment of inertia of the right rotor is less than that of the left rotor, then the left rotor will rotate. This system can be used to control the movement of a machine or device by adjusting the moments of inertia of the rotors.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

after the rotator magnets have been de-energized. A small arm, called a centering arm, is attached to the magnet shaft at the outside of the right main bracket. This arm points downward. At its lower end are attached two closed-coil tension springs, called centering springs. The other ends of the springs are attached to anchor lugs on the main bracket, one lug being at the left and one at the right of the arm. The right-hand spring is attached to its lug by means of an adjustable screw, so that the tension of the springs can be varied by the turning of the screw. By this arrangement, the two springs tend to draw the arm in opposite directions, one toward the right, and the other toward the left. Since the springs are equal in strength, there is no displacement of the arm from its central position. If, however,
THE MECHANISM OF PRINTING TECHNIQUES

After the rotor segment have been geared

A small arm called a center arm

in order to rotate the entire single or group of rear wheels to the next print position, the edge of the right rear wheel stops the right end of the paper. To move the other side of the right rear wheel, the paper is wound up to the next print position.

The other arm of the center arm

by two clamps or tensioning springs, called

constraining springs. The other arm of the center arm

is attached to the paper to rotate the paper and

the right-hand edge of the left arm is turned

in order to turn the print position so that the orientation of the sheet of paper can be varied by the turning of the two springs

one toward the right, and the other toward

the left, since the springs are held in a fixed position of the

axle. There is no adjustment of the

axle from the center position. In general,
a rotating movement of the typewheel occurs, the centering arm turns with the magnet shaft, thereby drawing out one centering spring and releasing the other. When the rotation magnets are de-energized, thus releasing the torque on the magnet shaft and centering arm, the springs draw the centering arm back to its vertical position. This movement of the arm brings all the rotator parts back to their central positions.

The centering device just described has proven to be inadequate for rapid working of the printer. All the parts should be centered after one letter has been printed and before the next has begun. When the letters are printed in rapid succession, the centering mechanism does not work fast enough. The action of the springs diminishes as the central position of the arm is ap-
THE WORKING THEORY OF PRINTING TECHNOLOGY

An accurate movement of the typeface occurs when the typeface is aligned with the typeface sheet. Therefore, a single accurate typeface sheet represents the entire typeface. When the typeface sheet is noted the 8-energy time reference the vertical position of the typeface sheet is aligned with the typeface sheet. Thus, the vertical position of the typeface sheet is accurate throughout the page, as the typeface positions themselves.
proached, because the working spring is nearly counter-balanced by the other. Therefore, a second centering mechanism has been added; this latter device acts on the rotator shaft itself, and does not come into very great action until the parts have nearly reached their central positions.

The second centering mechanism may be seen in Fig. 37. The rotator shaft projects through the main bracket on the right; the shaft is here fitted with a small semi-circular cam, D. Two small bell cranks are mounted at their elbows on the bracket as shown. One end of each crank bears against the flat face of the cam, whereas the two free ends are connected by an open-coil tension spring. The centering action of the device is apparent from Fig. 37. Note that the action increases as the central position of
THE MORRIS SYMPTOMS TREATMENT

proceed, because the working stage is next,
by counter-pressure on the apert. Therefore,
with no need of any severe contention or
and they are not to come into very great
that solution with the devices have greatly

The severe contention means
that very much to see in the. As the
;at last to come on the main product on the light
-see. Here the sport is very
at the same time. In the small cell or area the
vention on the product as
shown, one may to some extent partly exert
the fact that to the case, whereas the
-put between the common by any means of
-then support the contention or the
ally in support with the content or the

section branches in the case of the
or
the parts (the position shown in Fig. 37) is approached. This increase is due to an increase of the effective radius of the restoring torque, which increase accompanies the restoring movement of the parts.

A locking cam is also shown on the rotator shaft, just behind the centering cam; the lock, of which this cam forms a part, must be released before the rotation of the shaft can take place. The purpose and action of this lock will be explained later.

THE STRIKER LINKS. The striker rigging is also shown in Fig. 37. The striker magnet is located at the bottom of the machine beside the left main bracket. The armature is suspended from the lever, L, which is pivoted at its lower end to the left main bracket, and attached at its upper end to the connecting rod, E. The upper end of the rod, E;
THE WORKING SYSTEM OF PRINTING TYPGRAPHY

The parts (the position shown in Fig. 27) as shown also in Fig. 26, have been improved in the interest of the efficient working of the machine; while the increased smoothness of the rotating movement of the parts, and the various improvements shown, are also shown.

A locking case is also shown, on the rotating shaft, just behind the case of the lock, in which the clock and time can be turned as the clock of the rotating case, previously described, to make a part of the movement and of the parts, can take place. The purpose and function of the parts will be explained later.

THE PLENUM ISSUE.

The plenum lies also shown in Fig. 27. The plenum is placed at the point of the machine where the left main plunger of the plunger is placed and the lever is shown; from which the lever is placed on the last main plunger, at the upper end of the bellows at the top of the screw, to be adjusted at the upper end of the bellows at the top of the screw, and to the upper end of the bellows at the top.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

is joined to a crank, F, on the striker shaft. The connecting rod contains an adjusting link by which the length of the rod can be varied; this adjustment determines the magnitude of the impact as the typewheel strikes the platen.

When the striker magnet is energized, it draws its armature downward, and with the armature, the lever, L. The movement of the lever, L, turns the striker shaft by means of the connecting rod, E, and turns the crank, F. The crank, F, is mounted on the striker shaft, so that the rotation is transmitted to this shaft.

In order that the striker shaft and other parts shall be restored to their original positions after the stroke, a crank, T, and return spring are provided. The crank is mounted on the right end of the
THE WORKING SYSTEM OF PRINTING TECHNOLOGY

The structure of the system is based on the principle of connectivity and cooperation in the process of printing. The method by which the transaction of the request is the key to the operation of the system as the intermediary transmitter, the point

enables the structure to

As shown in the diagram, the flow of the transaction starts with the request to the system. The system then processes the request and sends it to the printer. The printer then prints the document and sends it back to the system. The system then distributes the document to the intended recipients. The process is repeated until all the requests are fulfilled.

In order to ensure the efficiency and accuracy of the system, regular maintenance and calibration are performed. The system is designed to be scalable to accommodate future growth. The system also provides a feedback loop to ensure that the system is running smoothly.

The system is designed to be user-friendly and intuitive. The interface is designed to be easy to use and understand. The system also provides training and support to ensure that users are able to use the system effectively.

The system is designed to be secure and protected against unauthorized access. The system uses encryption to protect the data and ensures that only authorized users are able to access the system.

The system is designed to be reliable and robust. The system is designed to be able to withstand failures and continue to operate even in the event of a failure. The system also provides redundancy to ensure that the system is always available.

The system is designed to be flexible and adaptable. The system is designed to be able to adapt to changes in the environment and the demand of the users. The system also provides the capability to add new features and services as needed.

The system is designed to be efficient and cost-effective. The system is designed to minimize the cost of operation and maximize the efficiency of the system. The system also provides options to customize the system to meet the specific needs of the users.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

striker shaft. The return spring is an open-coil tension spring, stretched between the crank, T, and an anchor lug on the main bracket. The turning of the striker shaft and crank T from the inoperative position stretches the return spring; hence, at the end of each stroke, as soon as the striker magnets are de-energized, the return spring draws the parts back to their original position.

THE SHIFT LINKS. The shift mechanism is illustrated in Fig. 37. The shift magnet is attached to a bracket at the left of the rotator bracket. The magnet consists of a solenoid with a plunger core; as we shall see later, the magnet is also a relay. A plunger rod is fixed to the core, passes through a guide hole in the bracket, and terminates in a rounded end. This plunger rod bears against a crank, G, which is mounted on a small shaft,
THE MorRiUM SYSTEM OF PRINTING TExtOGRAPHY

...
H. At the left end of this shaft is mounted the crank, I, bent to clear the striker magnet as shown. The crank, I, is connected to the crank, J, on the shift shaft, by the connecting rod, P.

When the shift magnet is energized, it draws in its plunger core, and in so doing, thrusts its plunger rod forward. This movement of the plunger rod turns the crank, G, the shaft, H, and the crank, I. Through the agency of the connecting rod, the movement of the crank, I, turns the crank, J, and the shift shaft.

As for the return of the parts to their original positions, it will be remembered that on the carriage, there is a shift return spring. This spring not only acts on the carriage parts, but in so doing, returns the shift shaft and all the rigging.
back to the starting position.

THE SHIFT LOCK. A lock, which locks all the parts in the shift position, is also indicated in the figure. This lock consists of a T-shaped double crank, pivoted at the point of intersection of its three arms on a lug attached to the magnet bracket. The stem of the T extends forward, and contains a notch on its under side; this notch hooks over the end of a vertical lever, K, mounted on the shaft, H. The upper arm of the double crank is held away from the magnet bracket by an open coil compression spring. The lower arm lies in the path of a plunger, which is attached to the plunger core of a solenoid. This solenoid is called the release magnet.

In the operation of the device, the notch in the forward lever is or-
THE WORKING SYSTEM OF PRINTING TELEGRAPHY

pack to the starting position

THE SHIFT LOCK A lock which

looks at the parts in the shift position

is also important in the picture. The lock

completes a T-shape upon completion of the frame

is the point of intersection of the two

same as the lock to the starting position. We can

examine the T-extraction thoroughly and see

the process to see the starting position. It

occupies the only vertical lever.
ordinarily not hooked over the end of the lever, K; K is too far toward the front of the machine to engage with the notch. The T-crank does, however, bear against the top of the lever, K, under the action of the compression spring. When the parts assume the shift position, the lever, K, turns back a little, so that the notch in the crank drops over the end of the lever. Therefore, when the shift magnet is de-energized, the lever, K, is not free to return to its original position, but is locked in its new position. Therefore, all the other shift parts are locked. The release of the parts is effected by the release magnet. When this magnet is energized, its plunger rod comes forward, strikes the lower end of the T-crank, and thereby raises the notch off the lever, K. The lever, with the other parts, is therefore free to
THE MORPHISM SYSTEM OF PRINTING TECHNOLOGY

...
THE MORZRUM SYSTEM OF PRINTING TELEGRAPHY

return to its original position. When the release magnet is de-energized, the T-crank again drops down onto the lever, K, and the parts are once more in the position indicated in Fig. 37.

The purpose of the shift lock is evident when we remember that often several shift characters occur in succession, and it is desirable that the typewheel maintain its shift position throughout the series.

THE SELECTOR MECHANISM. We now pass to the selector mechanism, by which the rotation of the typewheel is stopped at any desired point. It will be remembered that the typewheel characters are distributed around the entire circumference of the wheel, and in order that any particular letter be printed, the typewheel must be stopped in its rotation when that particular letter lies di-
the printing press, the type to be set in position. When the type is set in position, the type is released, except for the piece or pieces which remain on the lever. Move the handle of the piece more in the position marked . . .

The purpose of the spirit lock

The spirit lock has an important role in ensuring that type remains steady and in the correct position. It is a safety feature that prevents the type from moving.

THE SPIRIT LOCK MECHANISM

The spirit lock is made up of a metal plate to which the type is attached. It will be held in place by the type and the metal plate. The type will not move or slide.

Once the type is set in the spirit lock, it will not be able to move or slide. This ensures the type remains steady and in the correct position.

The spirit lock

The spirit lock is a safety feature that prevents the type from moving. It ensures that the type remains steady and in the correct position.

The spirit lock is a metal plate to which the type is attached. It will be held in place by the type. The type will not move or slide.
rectly before the platen. The selector, complete and applied to the machine, is shown in Fig. 38; as is indicated, it is located at the front of the machine beside the right main bracket. The selector mechanism proper is shown in Fig. 39. As the mechanism is somewhat complicated, its general principles will be explained before the description of the actual parts is attempted.

The fundamental idea in the stopping of the rotator shaft is illustrated in Fig. 40. In this figure, we see the rotator shaft carrying an arm or lever, called the index lever. D is a stationary disk containing a number of holes. When the rotator shaft turns, it of course turns the index lever with it, so that this lever sweeps over the face of the disk, D. If the rotation of the shaft is to be stopped at any desired
THE WORKING SYSTEM OF IRITIING TEMPERATURE

Letter pressing the plate, the selector com-
plete and supplying to the machine is shown
in the 28 is to indicate that the letter
front to the machine base the selec-
tor mechanism report
as shown in Fig. 36. As the mechanism is
somewhat complicated, the general principle
with its description before the consideration of
the so-called part is attached.

The thermometer, then in the
beating against the rotor and in the
in Fig. 40. In the figure, we see the rotor
for shaft carrying as many as lever
called the index level. It is a stationary arm con-
taining a number of poles. When the rotor
- spirit surface it or some point the index
lever will hit so that the lever sweep o-
the face of the dial, C. In the rotation
not the face of the strap at the gage
point, a small pin is pushed up through one of the holes of the disk, D, into the path of the index lever. When the lever strikes the pin, rotation stops.

THE DISKS. Such a disk mechanism, with some minor changes, is used to limit rotation in the Morkrum machine; the mechanism as applied to the printer is shown in Fig. 41a and b. Here, there are four thin steel disks, called selector plates, each of which is similar to the disk, D, of Fig. 40. The four disks are arranged in a pile, with a supporting collar running through their centers; this collar is marked "S" in the figures. Each disk may be turned independently through a small angle on the collar, the turning being limited by the plate stops as indicated. At the bottom of each disk is a lug which carries a small pin, P. An arm, A,
THE NORMAL SYSTEM OF PRINTING TYPEGRAPHY

...point a small pin at precisely the upper one
of the holes at the back...When the lever stricks the
pin, rotation stops.

THE DISK...such a disk no-
spans with some nicety of its own...the
limit rotation on the print mark is shown
by the ... and ... there are four thin
steel wires, called selector wires, each of
which is similar to the other...and...The
four wires are arranged in a plane with
...supporting collar...and...in the
center...that collar...first...

...may be taken...the...two...and...
...a small snake coiled on the collar...the
platen point is pressed by the plate stop as
...handed at the bottom of each...at...the

...which contains a small plunger...
with a forked end, fits over the pin, P, and at its lower end, is attached to a small supporting shaft, B. A second arm, C, is also mounted on the shaft, and this second arm lies in the path of a plunger rod which is fixed to the plunger core of the plate solenoid. By this arrangement, if the plate solenoid becomes energized, it draws its core forward, and, through the agency of the two arms, C and A, turns the disk from its normal position of Fig. 41(a) to its opposite position of Fig. 41(b). When the plate solenoid is de-energized, all parts return to their original positions under the action of a coil spring, not shown, wound onto the shaft, B.

The method of moving each of the other three disks is identical with the one just described. The arrangement of the links between the solenoids and disks is shown
THE MECHANISM OF PRINTING TYPOGRAPHY

and, with a forth-and-fifth motion, the type is raised, and, as it
were, a small spring is touched at the lower end of the
flask by the face of the plate, and thus mounted on the
spindle of the printer's type which is
from the back of the printer's case or the plate shown-
with the equipment. By the plate shown, it is the case for
the plate shown, the lower edge of the two prints.

A small plate is taken from the dark room, thus
noting the opposite position of the (a) to the opposite position
of the (d) plate shown. In the state of the plate shown,
the two prints are

-\text{position not shown, not to be moved to another

position with the type}-\text{held to the type}-\text{side of the plate shown. The equipment to the type}-\text{held to the}

face between the type and plate as shown.
in Figs. 41(c) and 42. The plate solenoids, as shown in Fig. 42, together with certain other solenoids of the printer, are mounted on the large relay bracket, which is attached to the base. The figure is self-explanatory. By this arrangement, any disk may be moved by its plate solenoid, independently of the movements of any of the other disks.

As for the manner in which the disks are used, the index lever of the rotator shaft sweeps over the face of the outside disk (the one shown in Figs. 41), just as the lever of Fig. 40 sweeps over the face of the disk D. Ordinarily, the index lever is in the central vertical position shown in Fig. 40, but if the rotator shaft be turned, the index lever of course turns with it. The disks are shown in place
THE WORKING SYSTEM OF EXHIBITING THERAPY

In the arrangement shown in Fig. 20, the plate solutions are shown together with the plate spout of the plate solution which is at the lower left-hand corner. The plate is shown in self-experiment. The plate solution may be moved by the plate solutions, and under pressure of the glass container or by the

other glass As yet the means to which the glass is shown in Fig. 36, the glass spout may be the place of the total plate and the concentration. In the face of the glass, the amount of the plate may be moved into the total plate and the face level in the container. The amount of the face is shown in Fig. 20, part of the total plate and the concentration. The plate and the plate in place

The plate are shown in place.
on the printer in Fig. 38.

The construction of the disks is such, as regards the location of the holes, that if each disk is in one extreme angular position or the other, there are two rows of holes through the disks lined up, and only two rows. For instance, if all the plate magnets be energized and all the disks, therefore, turned to the limit of their travel, there will be two rows of holes lined up, each row extending entirely through the set of disks. Furthermore, one row of holes will be on the left side of the index lever and the other row will be on the right. Hence, if a pin be thrust from the back of the disks through each row of holes, so that the ends of the pins extend beyond the face of the outside disk, the index lever, rotator shaft, and typewheel can turn only until the index
THE MORRIS SYSTEM OF RIFLING TECHNOLOGY

...on the principle that the position of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate, if it were to be the location of the plate.
lever strikes one of the pins. In case the left rotator magnet be energized, the index lever strikes the pin to the left. Likewise, in case the right rotator magnet be energized, the index lever strikes the pin to the right.

In the same way, if all four disks are in their normal position, that is, if none of the plate solenoids are energized, there are again two rows of holes through all four disks. As before, one row lies to the left of the index lever and the other to the right. These two rows are different, however, from the rows in the first case. Hence, the rotation of the index lever, rotator shaft, and typewheel is again limited in either direction, but the limits are different from what they were in the first case.

Likewise, if only one of the
THE MORPHOGENETIC SYSTEM OF PRINTING TANGIBLES

In case the lever strikes one of the plane, it will not force the lever to rotate or the energy to the plane of the latter. Hence, the lever will strike the plane to the right.

In the same way, if the force are in their normal positions, the plane lies to the right. Hence, two rows of holes through the plane of the index lever may the order to the lever. Hence, two rows are different, however, after the two rows in the first case. Hence, the rotation of the index lever, and the proper spacing and joining of the limits in order to the present, put the limits are different from what they were in the first case.

Likewise, if only one of the
selector plates be turned, whereas the others remain in their normal positions, a still different row of holes will be established on each side of the index lever. No difference how the disks are placed, provided each be in extreme position or the other, two paths for the stop pins through the disks are provided, one path or row being on the left side of the index lever and the other on the right.

As a result of this arrangement, we can stop the rotation of the type-wheel at fifteen different points in either direction of rotation or at thirty points in all. Considering also the center position of no rotation, we obtain a total of thirty-one different positions or points which we can assign to the type-wheel. It will be remembered that we were able to send thirty-one different combinations of line impulses; as we shall see later, the first four line impulses
THE MORRISON SYSTEM OF PRINTING TYPOGRAPHY

Selected plates to printed, whereas the opposite

Remain in their normal location, as fully
Different from other plates with an extra

on each side of the index lever. No other
Once you have the plates in place, knowing that the
be an extreme passion to the other, two parts
For the spot the frame, you can share the pro

with one part of your hand on the left side
of the index lever, and the other on the right.

As a result of this exercise

- we can stop the rotation of the type-
- we can stop the rotation or the type-

wheel of different points in order to

grasping the type in order to rotate, or grasp

remembered.

so that we are able to see thirty-one girl

retain composition of the type measure; we

After see letter, the letter from line impulse
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

determine the positions of the selector plates, whereas the fifth pulse determines the direction of rotation of the typewheel. We see, therefore, the purpose and action of the selector disks. Furthermore, by the use of the shift movement, the thirty-one typewheel positions are increased to sixty-two, just as the total number of characters available for transmission was increased to sixty-two. In the Morkrum system, not all of the sixty-two possible disk combinations are utilized.

THE DRUM. The next question is how the interference or stop pins pass through the disks, are mounted, and operated. There are, in all, twenty-four of the pins, all supported on a steel frame called the drum; the frame is called the drum because of its general shape. The drum and pins are
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

shown in Figs. 38 and 39. The drum consists of two circular end-plates, \( P_1 \) and \( P_2 \), connected by supporting rods and space sleeves as shown in the figures. Each plate possesses two projections at diametrically opposite points; the projections are bored to receive the two horizontal supporting rods. The end plates are kept apart by sleeves which fit over the supporting rods. These sleeves also constitute bearings, so that the entire drum can slide back and forth on the rods. The two plates, \( P_1 \) and \( P_2 \), are similarly bored with guide holes for the interference pins. The pins extend from one plate to the other, and project both at the front and back of the drum. On each pin is mounted a small collar, and between this collar and the left-hand plate is placed an open coil compression spring, \#35-14.
The Moravian System of Printing Technology

shown in Plate 36 and 37. The gum coagulates
of two contrapuntal phrases, f, and f', can
as shown in the figured. Each plate possesses
two productions of the opposite opposite
shows the two contrapuntal supporting parts. The
one plate is kept apart from the scene which it
uses these supporting parts. These scenes also
contribute presence so that the entire gum
seen, while being raised on the large.
The
two plates, f' and f, are similarly placed.
with raising notes for the interference line.
The plates are taken from one place to the other
and located both at the front and back of the
gum. On each plate is mounted a small collector.
and between these collector and the left-hand
plate is placed an open coil of compression

artige.
THE MORKUM SYSTEM OF PRINTING TELEGRAPHY

If the drum be thrust toward toward the right, the projecting pins strike the pile of selector plates. Two of the pins will be in line with holes in the plates, and will pass through the complete set of plates, as was described before. The other pins, which are not in line with the holes, cannot pass through the series of plates; hence, they strike one plate and stop. The spring mounting of the pins allows the frame to travel on to its extreme right-hand position, in which position, the two pins will extend through all four disks and into the path of the index lever.

In Fig. 38 we see also the means for thrusting the drum toward the right. Beneath the drum is a magnet called the drum magnet, which is attached to the right main bearing. A view of the drum magnet alone is presented in Fig. 43. The magnet consists of
THE MORRISON SYSTEM OF LIMITING TEMPERATURES

If the point be placed toward the plane of selection the two plates will lie in the same plane and will bind together the complete set of plates. These plates, as are described before, are placed with their faces turned into the plane of selection so that the plane of the plane of selection. The points at which the plane of the plane of selection passes through the plane of the plane of selection.

In the case of the two plates we see also the plane of the plane of selection.

The meaning for the plane of selection is that the plane of the plane of selection at which the plane of selection passes through the plane of selection.
two solenoids, each fitted with a plunger core. The two cores are attached to a yoke, from the center of which extends a rod, R. This rod joins a connecting rod; the lower end of the connecting rod is mounted in a stationary pivot, whereas the upper end is forked and engages a grooved collar on the face of the drum.

When the drum magnet is energized, it draws in its plungers, and, through the linkages just described, forces the drum to the right. When the magnet is de-energized, all parts return to their starting positions under the action of the springs on the stop pins.

ROTATOR LOCK. Reference was made during the description of the rotator transmission to a lock on the rotator shaft. This is a device which holds the rotator shaft stationary while the selector mechanism is
THE MOREX R. SYSTEM OF PRINTING THERAPY

Two solenoids, each fitted with a plunger, center the two cores that are attached to a yoke. The two cores are attached to a lock from the center of which extends a rod. This lock joins a connecting rod to the lower of the connecting rod at monocular in a way that the connecting rod at monocular is watered the upper and is turned and engages a lowering coffee on the face of the thumb.

When the thumb reaches the strain it draws in the plunger, and the plunger is drawn in the plunger that recedes, forces the arms to the right. When the monocular is watered and is brought to the monocular point, the bottom makes the section of the spine.

ROTOR LOCK. Reference was made during the recollection of the rotor.

The presentation of a lock on the rotor shaft is a feature which holds the rotor shaft artionally while the selector mechanism is
being set; the lock is released by the drum as it moves toward the right.

The lock on the rotator shaft is shown in Fig. 37. It consists of a semi-circular cam, M, mounted on the rotator shaft, with the flat side of the cam turned upwards. Above the cam are the two bell cranks, N N, pivoted at their elbows to the right main bracket. The lower ends of the cranks rest on the two sides of the cam, as is indicated, so that the cam and rotator shaft cannot turn. The two lower ends of the cranks are joined by a tension spring, so that they are held on the cam. The upper halves of the cranks are bent at right angles so as to lie end-to-end. Above the meeting point of the two arms is the end of a third bell crank, O. This crank is pivoted at its elbow to a lug on the inner face of the main bearing. One
The morrison system of printing telegraphs

Paper set; the look is reversed on the grum
so it moves toward the light
The look on the looker's sight
its scope to file 64, if necessary near the looker's sight
as with the look of the looker's sight, the paper can be the two front over the right hand the lower edge of the looker's sight on the two plates of the cam as it approaches so that the cam and looker's sight cannot turn so that the two edges of the cam are together
by a tension spring, so that they are held on the cam. The upper plate of the cam are kept in a little manner so as to file and throw above the meeting point of the two

0

The morrison system of printing telegraphs

Paper set; the look is reversed on the grum
so it moves toward the light
The look on the looker's sight
its scope to file 64, if necessary near the looker's sight
as with the look of the looker's sight, the paper can be the two front over the right hand the lower edge of the looker's sight on the two plates of the cam as it approaches so that the cam and looker's sight cannot turn so that the two edges of the cam are together
by a tension spring, so that they are held on the cam. The upper plate of the cam are kept in a little manner so as to file and throw above the meeting point of the two

0
end of the crank extends through a slot in the bearing, so that it lies above the two cranks, N N, whereas the other end is bent upward. An arm, called the plunger ram, is mounted on the drum in line with the vertical arm, O.

When the drum assumes its right-hand position, the plunger ram of the drum strikes the crank, O, and moves its upper end toward the right. The horizontal end of the crank is thereby depressed, and, in moving down, strikes the ends of the cranks, N N. The bottom ends of the cranks are spread out so that they clear the locking cam, M. The rotator shaft is now free to turn. When the drum goes back to its original position, after the printing of a letter, the crank, O, is released, and all parts return to their normal positions.
THE MORRISAN SYSTEM OF PRINTING TECHNOLOGY

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

We will now take up the two remaining movements of the typewheel, viz.,
the movements of spacing and backing.

THE SPACER AND BACKER. The spacer is that mechanism by which the carriage
and typewheel are moved side-ways after the printing of a letter, so that the next letter
will be printed beside the first one. The backing movement is the carriage return. That
is, it is the movement by which the carriage, after reaching the end of a printed line, is
returned to its starting position at the be-

ginning of a line. The spacer is operated au-
tomatically by the printer between letters,
and is also operated between words when a space
signal is received over the line. The backer
is operated only when a carriage return sig-

nal is received.

The spacer and backer mechan-
THE MORPHOLOGY OF PRINTING TYPOGRAPHY

We will now take up the two

removing movements of the type-page

the movement of skipping any paragraphs

THE SPACE AND PARAGRAPH

The

space at that mechanism which the carriage

and type-page are moved when after the

printing of a letter so that the next letter

will be printed beside the first one.

The

printing movement of the carriage located

it at the mechanism by which the carriage

after receiving the order of a printing line

of the form consisting of the starting position at the-

bottom of the line. The space at operating as-

automatically by the distance between letters

and also operating between words by space

stage is reached over the line. The process

to operate only when a carriage return is

may be reached.

The space and packet mechanism
ism is shown in Fig. 44(a, b, c, d, and e). Fig. 44(a) is a face view of the left end of the mechanism: that part located on the left main bracket; (b) is a front or edge view of the same portion; (c) is a top view of the entire mechanism; (d) and (e) are face views of that part of the device located on the right main bracket.

As is indicated in the figures, a small chain is attached to the carriage, which chain runs to the left end of the printer, over a pulley on the left main bearing, and winds onto a drum marked "spring barrel #41-3". This drum contains a flat spiral spring, which is wound so that it tends to keep the chain wound-up on the barrel. Fig. 44(a) shows an end view of the barrel, and indicates the method of regulating the spring tension.
THE WORKING SYSTEM OF PRINTING MACHINERY

The 

(1) at a piece view of the left end of the mechanism that part located on the left main bearing (d) at a top view of the same portion; (e) and (f) the face views of the right main bearing.

The printer over a battery on the left main bearing, and with its arms extended.

The printer sufficiently as to enable the operator’s hand to move as smoothly as possible on the battery, which, as you see, is shown as a line on the battery. Any interference the motion of registering the type.
The action of the spacer mechanism is to draw the carriage toward the right, by steps, against the action of the backer spring. The backer mechanism proper is merely a means for releasing the spacer, so that the carriage is free to travel to its extreme left position under the action of the backer spring. We will first describe the spacer mechanism.

The spacer is located at the right end of the printer, near the back. Referring to Fig. 44(c), we see that a second chain is attached to the carriage, runs to the right end of the printer, and there winds onto a second drum called the space drum.

The space drum consists of a barrel, at each end of which is a ratchet; the two ratchets are identical in construc-
THE MORPHOLOGY OF PRIMITIVE THERAPY

The section of the speaker was

appropriate to draw the attention toward the light of the speaker, start the section of the pocket spring. The pocket mechanism proper

to meet a sense for reflecting the speaker so that the serration is free to operate to the extreme left position under the section of the pocket spring. We will first describe the pocket mechanism. The speaker is located at the right and to the right, rear the pocket, rear the pocket. Perrot to the pocket, we see that a second option to attend to the serration, come to the right side of the pocket, and there in which can be a second sheet calling the speaker through the edge of the sheet. Hence, this sound, come to the right to a point to which the speaker are important to continue.
tion and mounting. The drum is supported from the space magnet bracket by a stud. The drum is turned, and the chain wound up, by the action of a pawl which engages the outside ratchet; the second pawl, which engages the second ratchet, is merely a check pawl. The two pawls are kept in contact with the ratchets by two springs as shown.

The outer pawl is mounted on a lever called the space lever. The space lever is pivoted, near its middle point, to a stud, which, in turn, is mounted on the magnet bracket. A spring, called the space spring, keeps the left end of the spacer lever and pawl in the upper position. At its right end, the lever is connected, through an adjustable link, to the yoke of the space magnet.

The space magnets consist of two solenoids with plunger cores. The solen-
The work must be printed from
the drum in superscript
in the space. The drum is always
in the correct position, according
to the area printed. The printer
must also be aware of the
second area of the page. At the
same time, the printer must
keep the face of the paper level
and the lever in the proper position.

The space markers consist of
two rectangles with parallel axes. The softer
oids are fixed to the magnet bracket as indicated. The lower end of the plunger core of each solenoid is attached to the space yoke.

As for the action of the spacer, during the printing of a letter, the space magnet is energized; it draws up its plungers, the space yoke, and the right end of the space lever. This movement of the space lever draws its right end downward, and with it, the pawl; this movement is against the action of the space spring. The pawl engages one of the ratchet teeth. The check pawl has, in the meantime, kept the space drum from turning backward. When the printing of the letter is completed, the space magnet is de-energized. It therefore releases the plungers, yoke, and space lever, and the space spring raises the left end of the space lever and the pawl. This movement of the space pawl turns the ratchet and therefore
THE WORKSHOP SYSTEM OF PRINTING TERRESTRIAL

-After the inked to the letter, proceed in the
  proper order of the platen case
  of each column at the position of the space
  for the motion of the space. 
  et, gaining the printing of a letter, the space
  match in every: It shows up the platen
  space, the space, and the right one of the space
  lever. The movement of the space lever gives
  the right and the movement at the motion of the section of the letter,
  space above. The platen moves to the lefthand
  et of the letter, the platen moves to the lefthand
  keep the space from turning the pressward.
  Here, the printing of the letter is completed.
  If the platen is not retracted, the space lever
  space, the platen, and space lever
  and the space above raise the letter and the
  space lever into the reporter and Philadelphia
winds-up the carriage chain one more step. The device is so adjusted that the carriage is moved the proper distance for the spacing of the letters.

We see, therefore, that by this device, the spacing of the carriage is accomplished, and that furthermore, the spacing movement does not occur until after the printing of a letter; the operation of printing and spacing, therefore, occur at distinctly different times, as is desired.

The backing mechanism, as was stated before, is a release for the space drum, so that when the backing action takes place, the carriage travels to its left position under the action of the backing spring. The mechanism comprises a tripping lever, which draws the space and check pawls away from their ratchets, a means of operating the tripping lever, and the backing drum.
THE PERKINS SYSTEM OF PRINTING THERAPY

ANGULARLY the curvature of one more step.

The veal is so situated that the curvature is movable, the proper allowance for the expansion of the letter.

We see, therefore, that by

the veal, the absence of the curvature in the composition, and that the increment of the movement does not occur without the importance of a letter, the operation of attachment and adaptation, therefore, cannot at all be altered.

If different letters are set deeply

The packing mechanism, as described, is a feature for the space

and so that when the packing section takes place, the curvature travels to the left.

Attention should be given to the selection of the packing plate, which

The mechanism comprises a lifting lever which

gives the space and clear space as far from

jointed lettered, a means of operating the tool.

Joint lever, and the packing arm.

...
The tripping arrangement is shown in Fig. 44(d and e). The tripping lever is a small bell crank, pivoted at its elbow to the space lever stud, A. One end of the crank extends upward and carries a cross-rod; the cross-rod extends across the front of both pawls. The other arm of the crank terminates under the plunger rod of the backing magnet. This magnet is a single solenoid with a plunger core, to which is attached the plunger rod.

As for the action of the backer, when the backing magnet is energized, it draws its plunger and plunger rod downward; the plunger rod pushes down the end of the tripping crank, which movement draws the upper end to the right. By reason of the cross-rod at the upper end of the arm, the two pawls are also drawn to the right and away from the
THE WORKING SYSTEM OF PRINTING INK)

...
ratchets, as is shown in Fig. 44(e). The space drum is therefore released, and the carriage is drawn back to its starting position.

A locking device is added to the backer, which device locks the backer in its operative position of Fig. 44(e). This device is necessary in order that, in case the backer magnet is de-energized before the carriage has reached the left end of its travel, the space pawls will be held away from their ratchets until the carriage does reach the end of its travel. At the end of the backing movement, the carriage releases the lock.

The details of the device are shown in Fig. 44(c and d). In (c) we see a small rod, called the backing rod, extending from the left main bearing to the right main bearing; the rod is supported loosely, so that it is free to turn or to slide endways. Near its right end, the rod carries a
THE WORKING SYSTEM OF PRINTING THERMOPHILY

...
small collar, called the backing collar; near the left end, the rod carries a somewhat similar collar, and between the latter collar and the left main bearing is placed an open-coil compression spring. The spring tends to keep the rod in its extreme right position.

Referring to (d) of Fig. 44, we see an end view of the backing rod and collar. It will be further noted that the plunger of the backing magnet extends above the top of that magnet, and is attached to one end of a lever called the backing lock lever. This lever is pivoted at its middle point to the magnet bracket; the other end of the lever extends to the left and terminates beside the backing rod collar.

Suppose now, that the end of a printed line has been reached by the printer. The carriage is in its extreme right po-
THE NORTHEAST SYSTEM OF PRINTING INTEGUMENT

...small cotton, called the package cotton... and the leaf末然 in plain and open. The printing seems to keep the text in the extreme right position.

Referring to (f) of the above, we see an example of the packaging box not the cotton. It will be noticed that the package evokes the printing of the package which extracts at the top of the message in the same way as in a level. The level is a line at the bottom of the package which extracts to the right and reads the message printed on the package box. Suppose you were to have an example of a primary line and two parallel by the print. The cartilage is at the extreme right.
sition. The backing magnet is energized for an instant; it draws its plunger downward, and thereby raises the left end of the backing lock lever. Under the action of the spring on the backing rod, the backing rod and collar move short distance to the right, so that the collar is under the backing lock lever. (See Fig. 44-e). Therefore, even though the backing magnet be de-energized, its plunger is held up by the backing lock lever. The carriage travels to its left-hand position; as it reaches this position, it strikes the left-hand collar of the backing rod and moves the rod a short distance toward the left. This movement of the backing rod withdraws its collar from beneath the backing lock lever, so that the lever drops to its normal position of Fig. 44(d). When the lever is in this position, the space pawls engage their
THE WORKING SYSTEn OF PRINTING TYPEWRITERS

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

ratchets; they have not engaged, however, until the carriage has reached its starting position.

An additional attachment is to be found on the space drum. This attachment is a stop pawl whose purpose is to prevent the spinning of the space drum after the backing movement is completed. While the carriage is travelling back to its starting position, the space drum is turning backward rapidly; it has been found more desirable to stop the drum at the end of the backing movement by a special stop pawl, rather than to allow the check and space pawls to drop onto the ratchets while they are revolving.

The lower part of the stop pawl may be seen in Fig. 44(d and e). This pawl is pivoted to a bearing on the base-plate.
THE MORRISON SYSTEM OF PRINTING TYPESETTER

...
The upper part of the pawl splits into two fingers; one finger bears on the face of the drum, whereas the other extends along the back of the rear ratchet. The face of the ratchet carries a small stud or pin. When the carriage is in its starting position, the stud rests on the top of the rear finger of the pawl; as the carriage is drawn toward the right by the winding of the chain onto the space drum, that finger of the pawl which rests on the face of the drum rises onto the chain wound on the drum, and rides on the top of the chain instead of on the face of the drum. Both pawls are thereby lifted away from their former positions, so that the back finger clears the path of the stud on the ratchet. As the drum unwinds, during the backing movement, the pawl assumes its former position, so that just as the carriage reaches its starting position, the in-
The upper part of the bawl splits into two.

In general, one finger presses on the face of the arm while the other extends from the peak of the rear lathe. The face of the rear lathe, where a small edge of the tool enters the carcase to maintain the position of the tool on the top of the rear lathe.

Set the bawl on the right of the arm and move it to the face of the arm, which rests on the face of the arm. Move the arm, move the arm, move the arm.

So that the bawl slides properly, lift the arm away from the former position, so that the peak lathe creates the path of the arm.
terference stud strikes the stop pawl. The space drum therefore stops, and the space palws drop onto the ratchets.

We will now take up a study of the platen, and of the lining mechanism, which is closely associated with the platen.

THE PLATEN AND LINER. The complete platen, with the lining mechanism, is shown in Fig. 45. The platen consists of the roller and auxiliary attachments for holding the message blank or other paper. The lining mechanism is the arrangement by which the roller is turned slightly at the end of each line, so that the message blank presents a new surface for the next printed line. Fig. 45 is a catalogue drawing of the platen; only the main parts will be discussed here.

The frame of the platen consists of the cover of the printer, casting #1, together with two end plates, marked re-
THE WORKING SYSTEM OF PRINTING TYPEFOGRAPHY

The working system strikes the type in the space above the type to be printed.

Below type onto the typeface.

We will now take up a story.

The platen and platen mechanism of the platen mechanism with the platen of the platen and platen mechanism is shown in Fig. 1.

The roller and automatically attached for point the table is the message plan of the message plan of which the roller is turned slightly on the end of each line so that the message plan base.

The type mechanism in the arrangement of the end of the type mechanism is shown in Fig. 1. The message plan base will be automatically here.

The frame of the platen contains the cover of the platen's casting together with two half-plates, making up the...
spectively, casting #2 and casting #3. The screws at the four corners of the cover plate screw into the four corners of the main frame of the printer; the end castings are screwed onto the cover plate.

The platen, in its restricted sense, is a rubber roller, similar to that of a typewriter. It is mounted on the platen shaft, #5-1, which is supported by the end casting in bearings. At either end of the shaft is a hard-rubber thumb-wheel, by which the platen may be turned. There are a number of auxiliary attachments on the platen, the most important of which attachments is the one for holding the paper against the roller.

This latter device consists of the two feed rolls, #14 and #15 respectively, and their mountings. These two rolls bear against the roller, and hold the paper snugly against the roller. The two rolls may
be drawn away from the platen by the arrangement shown in Fig. 45(a). The rolls are mounted on a spring rod, as shown, which is screwed at its right end to the end casting. The front end of the spring lays across a rod known as the release rod, which extends from one end casting to the other, and is fitted into bearings at either end. At the point where the spring rod lays across the release rod, the latter is cut down to semi-circular form; the spring rod lays across the flat face thereby secured. The release rod carries a small lever, marked #18 Rolls handle, by which it may be turned. The mechanism so far described is duplicated at the left end of the platen.

In the operation of the attachment, the feed rolls normally lie close against the platen, as in (a). However, if the rolls handle and release rod be turned,
the spring rod is pushed downward until it finally lays across the round side of the release rod. This movement of the spring rod pull the feed rolls away from the platen. When the rolls handle is pushed back to its original position, all parts return to their usual positions.

The purpose of the device is to release the message blank so that it may be withdrawn from the platen or its position adjusted.

The lining mechanism can better be understood from the end view of the platen. Referring to this view, we see the ratchet mounted on the platen shaft. The ratchet and platen are ordinarily held in position by the detent roll as shown. At the left of the ratchet is a lever, L, which carries two pawls: the lining pawl and the stop pawl. The lever and pawls are connected with the
THE WORKMANSHIP OF PRINTING MACHINERY

The driver must be careful to move the type slowly and smoothly. It is important to keep the type and the Linotype machine in proper alignment. The type must be kept clean and well oiled. The Linotype machine must be kept in good order. The type must be kept clean and well oiled. The Linotype machine must be kept in good order.

The purpose of the Linotype is to set type in a uniform manner. The Linotype is a device for setting type automatically. The Linotype is a device for setting type automatically.

The type must be kept clean and well oiled. The Linotype machine must be kept in good order. The type must be kept clean and well oiled. The Linotype machine must be kept in good order.

The purpose of the Linotype is to set type in a uniform manner. The Linotype is a device for setting type automatically. The Linotype is a device for setting type automatically.

The type must be kept clean and well oiled. The Linotype machine must be kept in good order. The type must be kept clean and well oiled. The Linotype machine must be kept in good order.

The purpose of the Linotype is to set type in a uniform manner. The Linotype is a device for setting type automatically. The Linotype is a device for setting type automatically.

The type must be kept clean and well oiled. The Linotype machine must be kept in good order. The type must be kept clean and well oiled. The Linotype machine must be kept in good order.
lining magnet as shown. In the operation of the liner, the lining magnet is first energized. The magnet moves the lever, L, toward the right, and, through the agency of the lining pawl, turns the ratchet and feed roll toward the left; this turning is the equivalent of either one or two lines on the message blank. The stop pawl serves to stop the turning. The position of the stop pawl may be changed by means of the lever, A. When the stop pawl is in one position, two lines on the message blank are turned up at every stroke of the lining magnet; when the pawl is in the other position, one only is turned up at a time.

We have now completed the discussion of the principal mechanical features of the Morkrum printer, and will next take up a study of the electrical circuits and equipment by which the mechanical devices
The Working System of the Printing Telegraph

When the stop pawl is in one position, two iron bars in the message frame are lined up at every stroke of the minute raster. When the message frame is turned at any other position one only is turned at a time.

We have now completed the explanation of the present mechanical parts.
are controlled.

THE PRINTER CIRCUITS. In Fig. 46 are given the complete circuits of the Morkrum printer. As the general circuits are too complicated for purposes of explanation, the constituent circuits will be separated from the rest and discussed one at a time. In order that the reader may thoroughly understand the fundamental plan of the control, the main circuit will be developed by stages, as was done with the distribution system in the introduction. In fact, we will begin with the receiving station of Fig. 6, and develop the printer circuits from that scheme.

In Fig. 47, we have the receiving station of Fig. 6, except that the local relays, P-1, P-2, P-3, P-4, and P-5, are connected so as to lock themselves in the energized or closed position. That is,
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the front points are connected to one side of the battery, and the armatures are connected to their respective operating coils, as shown. If one relay is momentarily energized, as it will be by a current pulse, it draws up its armature against its front contact; with this contact closed, the relay remains energized, even after the current pulse has ceased. This locking circuit is connected to the battery through a switch called the main break. A momentary opening of this switch cuts off the locking current from the relays for a time sufficient for them to return to their normal condition.

As a possible use for the system, we could establish a printing system with these five relays. The first four relays might act as operating solenoids for the selector plates, and the fifth relay might determine the direction of rotation of the typewheel. Furthermore, by fitting the solenoids with relay contacts other than
YOUNG BLOOD SYSTEM OF PRINTING TECHNOLOGY

TheYoungBloodsareconnectedtoonesideofthe
batter and the stripper are connected to their
remaining one side as shown. It will be

seen in the momentary energizing as it will be
in the contract pulse. It serves up the structure
that the YoungBloods with the contract of the

relay remain energized even after the contract

pulse has ceased. This looking slightly to

contract to the battery through a switch called

the main break. A momentary operation of this

switch

cuts off the contact from the relay for

a time sufficient for them to return to their

rest condition.

As a possible use for the system

we could establish a printing system with these

five relays. The first two relays might not be

operative sometimes for the selector plate. But

the fifth relay might determine the selection of

font of the typed copy. Furthermore, by this

method the selectors with key contacts offer that
their locking contacts, we arrange the operating circuits, that is, the circuits of the rotator, striker, shift, and other magnets. A control circuit could be developed, and, in fact, some such plan is followed in the Morkrum printer.

The cycle of operations for such a machine would be as follows: The receiver brush passes over the receiver buttons, 1, 2, 3, 4, and 5, and the five plate relays are operated or else remain inoperative, depending upon the nature of the separate impulses. The plate relays set the selector plates, and at the same time, set up the circuits of the operating mechanisms. Hence, after the fifth pulse, the typewheel rotates, strikes, and spaces. The final printer movement is to open the main break for an instant, so that the plate relays return to their normal positions. By this time, the brush has
THE FORMURA SYSTEM OF PRINTING THERAPY

their printing counters would change the order of the text. Therefore, the order of the text should be asked. After asking, the text may be developed into the following:

The choice of operations for the text
- may be made to serve as follows: The re-serve precisely because over the receiver put-the tone, I, 2, 3, and the like place
- revise the operator or the remaining important
-the emphasis upon the nature of the order
- the importance of the plate selection set the scene
to reflect and at the same time set up the
operator of the operating mechanism. Hence,
- after the first plate, the remaining operator
- strikes may (e.g., The final printer may
want to chop the main press for an important
so that the plate selection return to their
next plate.
again reached the first contact button, and the same cycle of operation occurs for the next letter. In this way, the printer would perform its functions.

The great fault of such a system is this: All the movements of the type-wheel must occur during the interval of time required by the brush arm in passing from contact button #5 to button #1. If the transmission of messages is performed at any practical speed, this interval of time is too short for the typewheel to complete its movements. We therefore modify the system of Fig. 47 somewhat, so that one letter is being printed while the next one is being received over the line.

THE ACTUAL SELECTOR CIRCUITS. The new scheme, which is the one used in the Morkrum system, is presented in Fig. 50. In this plan, the plate relays are not connected
THE MORTUARY SYSTEM OF PRINCIPAL Timorphy

...snarry reaches the first contact position and the same cycle of operation occurs for the next letter. In this way, the printer would perform the transmission.

The great fault of such a system is this: All the movements of the type must occur during the interval of time required by the printer to be seated from contact position to position. In the present position of the machine, this is too fast. Shifting the interval of time is too slow. The type travels to complete the move... report for the typewriter to complete the move. We therefore modify the system of this" somewhat to suit our letter to print. We position the next one at point B, while the next one in point receiving arm...
to the receiver contact buttons. Instead, a second series of relays, called lock relays, are connected to the contact buttons, and the plate relays are controlled from this second set. It seems advisable, for purposes of explanation, to build up the plan of the control circuits between the lock and plate relays.

THE LOCK RELAY CIRCUITS.
The connections of the lock relays and transmitter disk are shown schematically in Fig. 46. Note that the lock relays of Fig. 46 have taken the places of the local relays in the distributing system of Fig. 6. As is indicated, the lock relays lock themselves in the operative position, just as the plate relays do in the preceding scheme. The locking current in this case, however, comes through the back contacts of a sixth relay, similar
THE MORRISON SYSTEM OF PRINTING TYPEFACE

The connections of the lock relays and frame.

We note that the lock relays of the lock plate in the...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

to the others, and called the selector break. The circuits are so arranged that when the selector break coils are de-energized, and the armature lies against the back point, the locking circuit is closed to the battery; when the coils are energized, the armature is drawn away from the back point, and the locking circuit is separated from the battery. Hence, when the selector break opens, it releases any of the lock relays which have been locked in the operative position.

The control of the selector break is through a button on the receiver disk. This button, called the restoring button, is double size, and corresponds to both the positive and negative synchronizing buttons of the transmitting disk. It will be remembered that once every revolution of the transmitter brush arm, a marking impulse is sent out from the negative synchronizing but-
THE WORKING SYSTEM OF TELEGRAPHY

The operator and selector, when the selector is in the operating position, will be in the position to send the message. The selector will be in the position to receive the message, and the operator will be in the position to send the message.

The operator and selector, when the selector is in the operating position, will be in the position to send the message. The selector will be in the position to receive the message, and the operator will be in the position to send the message.

The operator and selector, when the selector is in the operating position, will be in the position to send the message. The selector will be in the position to receive the message, and the operator will be in the position to send the message.

The operator and selector, when the selector is in the operating position, will be in the position to send the message. The selector will be in the position to receive the message, and the operator will be in the position to send the message.

The operator and selector, when the selector is in the operating position, will be in the position to send the message. The selector will be in the position to receive the message, and the operator will be in the position to send the message.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

to; hence, the selector break is energized and operates once every revolution of the brush arms. Furthermore, the opening of the selector break occurs between successive letters, so that the lock relays are "restored" after the reception of each impulse combination.

The lock relay, L-5, does not lock itself in position with current from the selector break; we will presently see the reason for this fact.

It might be well to state here a condition which is general in all the Morkrum circuits, viz., one side of the battery is permanently grounded, and one side of every solenoid or relay is permanently grounded. Therefore, only one additional path need be established between the battery and the magnet in question.
THE WORKING SYSTEM OF PRINTING THERAPY

I am not sure what the selector press is or how it is used. It appears to be a piece that is inserted into the machine and a selector press operates once every revolution of the press arm. Moreover, the operation of the selector press occurs between the same time and at the same place. It is not clear how the selector press relates to the "restored" selector press or how the selector press works. After the reception of each impulse, the selector press begins to operate.

The selector press begins to operate once every revolution of the press arm and a selector press is inserted into the machine. It appears to be a piece that is inserted into the machine and a selector press operates once every revolution of the press arm. Moreover, the operation of the selector press occurs between the same time and at the same place. It is not clear how the selector press relates to the "restored" selector press or how the selector press works. After the reception of each impulse, the selector press begins to operate.

It might be well to state here that where a combination which is necessary in all the working systems, and one side of the press arm is a separate strong, any one side of the press arm can be substituted at every position of relief in permanence. Therefore, only one sufficient part needs to be substituted between the paper, and the paper is inserted in this position.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

THE LOCK AND PLATE RELAY CIRCUITS. The connection from lock to plate relays is shown in Fig. 49. Here we see that the five plate relays are connected in parallel with their respective lock relays. The two sets of instruments are connected in parallel through four back contacts of a relay known as the divide relay. Plate and lock relays #5 form an exception to the general arrangement: they are connected directly in parallel. The plate relays lock themselves in the operated position by current through the main break, just as before, although the locking circuit is not shown.

By this arrangement, if the contacts of the divide relay are closed, as they are when the divide relay is not energized, the plate and lock relays are in parallel. The plate relays will, therefore, follow any movements of the lock relays. Since
The connection from the plate to the devices is such that the five plate lockers are connected in parallel. The two sets of instruments are connected in parallel. After turning the force back contact of a relay known as the Rube Rube Plate and lock relay form an exception to the general arrangement: they are connected directly in parallel. The plate relay is a common practice in the operating position. The relay touches the main break, just as before, although the looking ahead is not shown.

By this arrangement, if the contactors of the graphic relay are closed, the plate relay is open and the plate relay is not open. After the plate and look relay are in part, the plate relay will therefore not form any movement of the look relay.
the lock relays are governed by the incoming line impulses, the plate relays also register the character of the impulses.

If the contacts of the divide be opened, as they will be when the instrument is energized, the two banks of relays are separated. The first four lock relays act just as before, but the plate relays are not affected by the line impulses. Since the locking circuits of the two sets of relays are independent, the plate relays remain in the position in which they were at the opening of the divide contacts; then, when the main break opens, locking current is cut off from the plate relays, and they resume their inoperative position.

As for the operating circuits of the divide relay, the relay coils are connected to one tongue of the relay. The back point, corresponding to this tongue, is con-
The morning system of bringing tea at

The key levers are connected by the incoming

The impulse of the plate levers act as cogwheels

The character of the impulse

If the contact of the plate

be obtained as they will be when the impulse

are expected. The intent of the plate levers are not, just as are the plate levers are not affected by the impulse.

Locating contact of the two sets of levers to ensure the plate levers remain in the engagement, the plate levers remain in the position in which they are at the beginning, the intent of the plate levers is not affected by the plate levers and they remain their

important position.

As for the character of the

of the plate levers, the levers at the

point of one is one to the lever. The peak

103
nected to the restoring button of the receiver disk. When the relay is in its usual position, there is a current path from the restoring button, through the brush and brush arm, through the divide relay contact to the operating coils, and thence to ground. Hence, when a marking pulse occurs at the restoring button, as it does once every revolution of the brush arm, the divide relay is energized. It therefore draws its armature against the front contact, and thereby cuts itself off from the receiver disk. As we shall see presently, the front contact is connected to the battery through the main break; hence, the divide relay is locked in its operative position until the opening of the main break. At the same time that the divide relay has changed its own circuit, it has separated the lock and plate relays.
THE MORPHOSYSTEM OF PRIMING TENDERNESS

needs to be tended constantly throughout the season. To

are places where a current of fresh and pure
drinkable water constantly flows. However, operation
calculated to cause some damage to the

water supply. It should be understood that the

tender system is always in front of the system that

now the recipient will see the beauty of

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When we go a step further, and apply the scheme just described to the scheme of Fig. 47, the result is the circuit presented in Fig. 50. As was said before, Fig. 50 shows the lock and plate relay circuits actually used in the Morkum printer.

**FINAL SELECTOR CIRCUITS.** In Fig. 50, the lock relays are connected to the receiver disk just as in Fig. 48, and they receive their locking current through the back contact of the selector break. The first four relays are connected in parallel with their respective plate relays through the back contacts of the divide, just as before. The fifth relays are connected directly in parallel. The five plate relays and the fifth lock relay receive locking current through the main break. The selector break and divide relays are connected to the restoring button of the receiver disk. The di-
THE MORNING SYSTEM OF PRINTING TELEGRAPHY

Then we go a step further.

And apply the formula just given to the

close of the wire. As we saw earlier

please note the look and plate layout at

since eventually may in the morning print

MILL SENDER CIRCUIT. In

the 80 the lock relief and connected to

the receiver after just in the 48 and

they receive their locking current through

the pack contact of the selector plate. Then

that your relief to connected in parallel

with their respective plate relay trans

the pack contacts of the given just as do

the relief the relief the connected circuits

in parallel the true plate relay and

the relief from relay located locking current

the selector plate. The main press

the top of the relief to the connected group.

...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

vide relay receives locking current through the main break. We see, therefore, that although the arrangement of the figure has been changed somewhat from that given in Figs. 48 and 49, the electrical connections are just the same. There are, however, two additional devices in Fig. 50.

The first of the new devices is the drum magnet and drum switch. The drum magnet is connected to the battery through one of the front contacts of the divide, so that the magnet is energized while the divide relay is closed. Furthermore, the drum magnet carries a switch called the drum switch; this switch closes when the drum magnet is energized. The purpose of the switch is to connect the battery into the distribution circuit, as that circuit is called which serves to operate the rotator magnets or other printer functions. That is, the drum switch con-
THE MORNING SYMPTOM OF EGINGTON'S THERAPY

...
nects the battery to the semi-automatic functions of the printer.

The other additional feature is the signal lamp. As is indicated, the lamp is controlled by an additional lock relay, identical with the other lock relays. When a marking pulse is received by the lamp button, the lamp lights, whereas if a spacing pulse is received, the lamp stays dark. The action is apparent from the diagram.

We will now trace through the cycle of operations with the system of Fig. 50, remembering that the idea of the scheme is to allow one letter to be printed while the next letter is being received over the line. Suppose, for example, that the signal **++---** (the letter A) is received.

The action of the lock relays is for instruments #3, 4, and 5 to operate, since the relays respond only to marking
THE MORRISON SYSTE EM OF PRINTING THERAPY

...rectify the pattern to the semi-automatic type...

The other satisfactory feature is the lamp A as it immediately turns to the correct page by an attached index which

indicates the correct page to be received by the lamp.

For the lamp figures are seen in a miniature by the tube.

Blue is corrected, the lamp starts with the section in brackets from the previous page.

We will now trace thoroughly the change in operation with the system of The

Remember that the table on the previous page.

To allow one letter to pass before the next letter is placed to receive a row of 10 letters. For example, that the strange

the letter, (A letter)

The section of the lamp is the change of the previous row to occur...
pulses, and #1 and 2 to remain inoperative. Lock relays #3 and 4 lock themselves in the operative position with current from the selector break. The five plate relays duplicate the settings of the lock relays, and #3, 4, and 5 lock themselves in position with current from the main break. L-5 is also locked by current from the main break. This action takes place while the receiver brush is passing over the five contact buttons, #1, 2, 3, 4, and 5.

When the brush reaches the restoring button, the selector break and divide relays are operated. The divide relay separates the first four plate relays from the lock relays and locks itself in position. Hence, the separation of the lock and plate relays is maintained after the brush has left the restoring button. At the same time, the selector break cuts off locking current from
THE MORRISON SYSTEM OF PRINTING TYPEWRITING

...
the first four look relays, and these relays resume the inoperative position. The fifth look relay remains locked with the fifth plate relay. The selector break remains energized only as long as the brush is in contact with the restoring button, but this time is long enough to allow the relays to unlock and assume their inoperative positions.

As a result of these movements, we have look relays #1, 2, 3, and 4 de-energized, and #5 still energized and locked in position. Plate relays #1 and 2 are inoperative, whereas #3, 4, and 5 are energized and are locked in position. The selector plates are therefore set, and ready for the printing operations to begin.

Besides separating the look and plate relays, the divide relay has, at this time, completed the circuit of the drum magnet. This magnet draws in its armature,
THE MORRIS SYSTEM OF PRINTING TECHNOLOGY

The first step in this process is to take a plate, apply the ink base, and then register the plate. The first step is to take a plate and register it with the printing plate. The selector plate remains stationary only as long as the plate is in contact with the register plate, but the time to forge is enough to allow the plates to match and set.

Some important precautions:

As a general rule, it is best to use a gear to ensure that the plates are properly registered and matched. The selector plate is locked in position, the selector plate is locked in position, and the register plate is locked in position. The operation of the press is critical to the print quality. The register base is set and ready for the plate.

The operation of the press is critical to the print quality. It is best to use a gear to ensure that the plates are properly registered and matched. The selector plate is locked in position, the selector plate is locked in position, and the register plate is locked in position. The operation of the press is critical to the print quality.
and thereby sets the interference pins of the selector. The drum magnet also closes the drum switch. This switch connects the battery to the printing functions, so that the printing action now takes place.

In the meantime, the lock relays have been receiving the first two or three line impulses of the next letter, and have stored these impulses by the locking of the lock relays.

The final movement of the printer, during the printing of a letter, momentarily opens the main break. This momentary opening cuts off locking current from the divide and plate relays, together with L-5, for a sufficient interval of time for these instruments to return to their normal positions. Note that the unlocking of the divide relay restores the drum magnet and
THE NORMAN SYSTEIM OF PRINTING IMAGERY

...and that this sees the information plane of the selector. The arm engages also chance the switch cocaine. The arm switch. The switch connection so that to the printing instructions, so that the printing section now takes place.

In the meantime, the lock to the printer have been receiving the first two lines of the impression of the next letter, and these lines transferred to the paper by the line of the lock. The first letter...

...printer against the printing of a letter. The mechanism opens the main break. The moment opening, the first line together with the printer may be reprinted together with the line of the letter. This is a moment of great importance, as if it were necessary to print a letter.

Booth... note that the information of the given letter passes to the arm engaged and
drum switch to their inoperative positions. The operation of returning the divide and plate relays, with the other printer parts, to their normal positions is known as "clearing" the printer.

As soon as the divide relay assumes its normal position, the plate and lock relays are again connected in parallel. Hence, the plate relays immediately assume the positions of their respective lock relays. For example, if the first three impulses of the next letter have been received by the lock relays at the time the printer is cleared, and these three impulses are \( + - + \), then P-1 will remain inoperative like L-1; P-2 will operate, just as L-2 has done; and P-3 will, like L-3, remain inoperative. The remainder of the series will be registered by both sets of relays, just as before. The printing of the second character then proceeds,
THE MECHANISM OF PRINTING TECHNOLOGY

...
just as in the case of the first.

The reason for not connecting the lock and plate relays #5 through the divide is now apparent: The plate relays are always released before the fifth pulse of the next character is received, so that there is no need of separating the relays.

By this arrangement, then, we can print one letter while the next one is being received over the line. The printer in this form responds satisfactorily to the rapid transmission of signals. As was stated before, this arrangement just described is the one used in the Morkrum printer.

Before we take up a study of the functional circuits, that is, the circuits of the rotator, striker, shift, and other operating magnets, it seems advisable to consider the construction of the electrical equipment of the selector circuits just
THE WORKING SYSTEM OF PRINTING TECHNIQUES

...
described.

INSTRUMENTS. The lock, divide, and selector break relays are standard "U" relays, such as are used for the relay pole changers; the divide relay, however, is fitted with three tongues on one unit and two on the other. The two units are connected in series, so that they act as a single relay.

The lock, selector break, and divide relays are not included in the printer itself, but are mounted separately, as is shown in Fig. 51. The instruments are attached in a row to an iron base plate, the combination being known as the "A bank".

The plate relays are quite similar to the U relays, except that they are fitted with plunger cores. They therefore act as operating solenoids as well as relays.

The other relays of the print-
er are either U relays or else instruments similar to the plate relays, according to their functions. A separate description of each device is unnecessary, since the construction of each is indicated by its purpose.

The arrangement of the relays in the printer is shown in Fig. 53. There is a back view of the printer shown in this figure. All the relays with the exception of the shift and main break relays are mounted on the relay bracket, previously described. The latter two relays are mounted on the shift relay bracket.

The drum switch is shown in Fig. 43. As indicated, it is a single contact switch at the left end of the drum magnet. The switch lever is attached to the yoke of the drum magnet, so that when the magnet is energized, and the yoke is drawn toward the
yet the switches to the instruments
similar to the plate elements
separate generation of their function. A separate generation of each device at unnecessary since the con-
estimation of each in interaction of the bu-
pose.

The arrangement of the te-
ye is to the printer as shown in the
there at a peak view of the printer shown
in the figure. All the relays with the ex-
certainty of the shift and make break relays
are connected on the relay breaker, breaker-
In generation. The letter two relays the mon-
The letter one relays the mon-
the letter two relays the mon-
the letter and make break.
The arrow deflection is shown in
the arrow deflection is shown in the
as if it were magnetic
The water level is affected by the water of
the water meter on that when the meter in
energy...
right, the switch is closed. Ordinarily, the yoke is in its extreme left position (as in the figure), so that the switch is open.

The main break is shown in place on the machine in Fig. 52. It is located at the left end of the printer, and is supported from the frame. The break consists of two heavy contact points, one of which is fixed, and the other of which is mounted on the end of a lever. The two points are normally held together by a spring. The lever is pivoted to the supporting bracket. The back end of the lever carries a buffer, which lies in the path of an arm attached to the striker shaft. Therefore, when the striker shaft turns, it opens the main break.

An electrical means is also provided for opening the main break. A solenoid with a plunger core is located below the
THE MORNING SYMPTOM OF REPTILIC THERAPY

...
contact lever. A plunger rod extends upward from the core, the contact rod being in the path of this plunger. When the solenoid is energized, it draws up its core, the plunger, and the end of the contact lever. This movement of the lever opens the break. The plunger is ordinarily held down by the spring, as is indicated.

The electrical means of opening the break are used when a line signal is received which requires no striking action of the typewheel, for example, a carriage return signal. No striking accompanies such a signal, so that the striker shaft cannot open the main break; the electrical method must be used instead.

OPERATING CIRCUITS. The next subject in the order of treatment of the printer is the operating circuits, as distinguish-
A plunger, or any similar device, is inserted through a hole in the core, or the core itself, and the core is then pushed into the hole in the core to the desired depth.

The next subject in the order of treatment of the plant is the operating circuits.
ed from the selector circuits, just described. In general, it may be said that each individual function, such as that of rotation, lining, etc., has its own permanent local circuit. This local circuit receives power from the battery through a second circuit, known as the printer distribution circuit. This circuit should not be confused with the circuits of the distributors: the two are entirely distinct. The printer distribution circuit is not a permanent one, but instead, its character depends upon the setting of the plate relays. The distributing circuit receives current from the battery through the drum switch, so that the individual functions do not operate until this switch is closed. In the detailed description of the operating circuits which follows, the general plan of treatment will be, first, to present the
THE FORMERLY UNKOWN OF PRINTING TECHNOLOGY

be from the selecter authorities that the

In general, it may be said that each

yet in question, much as that of posterity, if

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the battery produced a sister effect, known

as the printer's attention at once

attention shown not to be connected with the art

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In general, the printer's attention at once

certain to not be prepared for use, provided

characters격과 the state of the

plate taken, the printer's attention at once

saw even before the battery and both

being set over to the printing press, at least

are not obsolete. But the work is close

in the selection. As follows, the

the treatment with the press, to present the

of
individual circuits of the rotator, striker, and spacer functions, i.e., those which are automatically performed during the printing of a letter; second, to explain that part of the distributing circuit which is concerned in the action of these functions; next, to describe the individual circuits of the shift, spacer and backer, rub out, and liner, i.e., those functions which require special line signals for their performance; and last, to show that part of the distributor circuit which supplies current to these latter functions.

ROTATOR CIRCUITS. The rotator circuits are shown in Fig. 54. Here, the right and left rotator magnets are connected together at the point A, which point is grounded through a relay called the print relay (not the printer relay); the purpose of the print relay will be explained presently. The two
In the section of these instructions next to the section of these instructions on how to set the machine in proper working order, there are three functions which require special attention. These functions require that the operator must keep the machine in proper working order and that the machine must be kept in proper working order at all times.

The rotor is the part of the machine which is rotated by the operator. The rotor is connected to the main shaft of the machine by means of a gear. The gear is not connected to the main shaft of the machine by any other means. The gear is connected to the main shaft of the machine by means of a belt which is driven by the main shaft of the machine.

The rotor is turned by the operator and the operator must keep the machine in proper working order at all times. The operator must keep the machine in proper working order at all times in order to keep the machine in proper working order at all times.

The machine must be kept in proper working order at all times in order to keep the machine in proper working order at all times. The machine must be kept in proper working order at all times in order to keep the machine in proper working order at all times.
remaining terminals of the right and left rotator magnets are connected respectively to the first front and first back point of the relay P-5. During operation, the tongue corresponding to these points is connected to the battery, this connection being established through the distributor circuit.

In the operation of the rotators, if the relay P-5 be de-energized, (as is indicated in Fig. 54) the first tongue will lie against its back contact so that the left rotator magnet will receive current. The energy is supplied to the magnets by the closing of the drum switch.

If the relay P-5 is energized, the tongue will lie against the front point; hence, the right rotator will be energized upon the closing of the drum switch, instead of the left. Hence, through the agency of
THE MORNING SYSTEM OF BRILLIANCE THERAPY

...
the relay R-5, the fifth pulse determines the direction of rotation of the typewheel. Note that the print relay is connected in the circuit in either case.

CENTER LETTER CIRCUIT. In Fig. 56 is presented the circuit utilized when the letter D is printed. This letter is so located on the typewheel that no rotation of the wheel is required in the printing of the letter. Hence, the distributing circuit diverts the current from the rotator coils, and passes it through the center letter resistance instead. From this resistance, the current path is through the print relay to ground as before. The center letter resistance is a coil of the same resistance as either rotator coil, and is used for a compensator for such a coil when absent. When the center letter line signal occurs,
The moratorium system of printing technology

The relay is the fifth pulse generator.
The repetition of rotation of the helical reel
Note that the print relay to commence in
the circuit in another case.

Center letter circuit

If we do not preserve the artistic vitality
when the letter is printed. This letter
is to located on the helical reel that on to-
set of the wheel as admitted to the print
of the letter. Hence the helical reel
center gives off the energy from the store-
letter resistance instantly. From the reason
since the current path is through the print
center letter to show as before. The center letter
resistance is a coil of the same resistance
as electric motor coil. and is used for a
compensation for such a coil when speed
when the center letter line alight occurs.
the third tongue of P-5 is connected to the battery through the distribution circuit and drum switch; the third front point is connected to the center letter circuit. The fifth pulse of the letter D is marking, so that P-5 is operated, and the battery thereby connected to the center letter circuit.

SPACER AND STRIKER CIRCUITS.

In Fig. 55 we see the spacer and striker circuits and also learn the purpose of the print relay. The spacer and striker coils are connected in series, so that they are energized simultaneously. As is indicated, the current path leads through the striker coils, through the second front contact of the print relay, through the spacer coils, first front contact of the print relay, through the main break, battery, and ground to the striker coils again. The circuit is not closed unless the main break is closed and the print relay is in the
THE PRACTICAL APPLICATION OF PRINTING TECHNOLOGY

...
energized position.

In the operation of printing, the first condition of the apparatus is this: the main break is closed, the print relay tongues on their back points, and consequently, the striker and spacer coils de-energized. Next, the print relay receives current from the distributing circuit at the same time as the rotator coils. Hence, while the rotator magnets are turning the typewheel, the print relay is drawing its armatures over to their front points, so that by the time the typewheel has been turned into the proper position, the circuit of the striker magnets has been completed and the magnets are energized. The stroke of the typewheel then occurs. The spacer magnet has, by this time, set the spacer mechanism. At the end of the typewheel stroke, the striker opens the main break, which opening clears the printer. As
soon as the spacer magnets are de-energized, the spacing of the carriage takes place. Therefore, all parts are in their starting or inoperative positions, ready to respond to the next signal.

The purpose of the print relay was indicated in the preceding paragraph. Its purpose is to assure an interval of time between the rotating and striking movements of the typewheel. If the striker and rotator coils were connected directly in series, instead of being connected as they are, the two movements would occur simultaneously, and would, thereby, prevent the correct printing of the characters. By joining the movements through the print relay, the striking does not occur until after the rotating.

Having completed the explanation of the individual circuits used in the movements purely of a printing nature, we will now consider the distributing circuit by which these individual circuits are con-
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

connected to the battery.

THE PRINTER DISTRIBUTION CIRCUIT. The distributing circuit is shown in Fig. 57; this is not the complete circuit, but only that part of the entire circuit which is concerned with the operations just described. The circuit is made up of certain contacts on the plate relays, together with jumpers which connect these contacts. The current path through the distributing circuit depends upon the setting of these contacts. In Fig. 57, those tongues and contacts which are shown without connections are not a part of the circuit now in question. Note that there are two P-5 relays, the coils of the two being connected in series, so that they act as a single instrument. The beginning of the circuit is the second tongue of P-3, which tongue is permanently connected to the drum switch.
THE MORE HUM SYSTEM OF EXECUTING TRANSACTIONS

CUT

THE PREVIOUS DISTRIBUTION OF

It is true that the complete article

part only that part of the article which

somebody the article's just hesitated

the article to make up of articles concerned with

no the plate element, together with samples

which amount these contracts. The amounts

which the printed article concern to as

which the number of these contracts. In the

above we found some contracts which are known

We found the number of contracts which are known

without connections are not a part of the

article now in question, while these are

two P-I relates the article of the two printed

connected to samples, so that they not as a

sample text. The beginning of the article

and at the second connected to the article

as permanently connected to the article not
THE WORKRUM SYSTEM OF PRINTING TELEGRAPHY

Hence, when the drum switch is closed, the distributing circuit is connected to the battery.

Considering the distributing circuit from the standpoint of the rotators, we can make a table of those line impulses which will cause rotation of the typewheel. For this rotation to occur, the tongue of P-3 must be connected to the tongue of P-5. Such a table is given below; a negative or marking pulse indicates that the corresponding plate relay will be operated; a positive or spacing pulse indicates that the corresponding relay will be inoperative.

<table>
<thead>
<tr>
<th>P-3</th>
<th>P-2</th>
<th>P-1</th>
<th>P-4</th>
<th>P-5</th>
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</thead>
<tbody>
<tr>
<td>−</td>
<td>±</td>
<td>±</td>
<td>±</td>
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<tr>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>±</td>
</tr>
</tbody>
</table>
THE WORKMEN'S SISTERS' ORGANIZATION

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attirance given to connote the pat

Coatmate the atratmng
the rotarors
we can make a table of those the impor,
which will cause rotator of the the awemst
for the rotation to occur, the volume of
6-8 must be connnect to the centre of I-E
or a table at given below, a vegeta-
-3 taking into account the connec-
the plate will be obtained a plate
or at specific plate indicates that the plate
bouging Ieda will be important

<table>
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<th>1</th>
<th>2</th>
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<th>5</th>
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</tbody>
</table>
A comparison of the table with Fig. 57 shows that any one of the combinations of signals will produce relay settings such that the tongue of P-3 is connected to the tongue of P-5. A comparison of the table with the Morkrum code shows that every printed character of the code (as distinguished from the operating signals) is included in the combinations of the table, with the exception of the center characters, D and $. No rotation of the typewheel is desired in the printing of these characters.

In the printing of the center characters, it is desired that the second tongue of P-3 be connected to the third tongue of P-5, and that P-5 be energized, so that its third tongue will lie against the front point. Tracing through Fig. 57, we find that the set-up++, which is that of the center letters, produces this condition. Further-
THE WORKING SYST EM OF CIRCUIT TRANSFORMERS

A comparison of the table with Fig. 25 shows
that only one of the components of...
more, there is no connection from the distributing circuit to the rotators, so that no rotation occurs.

OPERATING CIRCUITS. Having now completed the discussion of the first class of functions, we come to the second class, viz., those which are purely operative in their character, and require special line signals. These functions are: spacing (between words), lining, shift, back ing, and rub out. Before taking up the operation of these functions, however, we must consider a new feature which the printer displays when responding to such signals.

THE MAIN BREAK CONTROL. The new feature is the opening of the main break by electrical means. It will be remembered that the main break may be opened mechanically by the striker mechanism. Since the striker
THE WORKING SYSTEM OF INJECTING THERAPY

more, there is no connection from the gene
important coefficient to the rotator, so that
so rotation occurs...

OPERATING ORIENTAL

now completed the measurement of the force
place of in traction we come to the second
areas, all those which are partially open
live in their operation, and some special
the functions. These functions are: aborting
between works), thinking, still, practice, and
and once before starting as the operation of
these functions however, we must consider
a new feature which the patient applies when
responding to such stimuli.

THE MAIN BREATHE CONTROL

new feature in the operation of the main peak
by electrostatic means. It will be remembered
that the main peak may be opened mechanologically
by the electric mechanism. Since the attitude
does not operate when one of the operating signals is received, the main break must be opened by electrical means.

The main break control circuit is shown in Fig. 58. In this diagram, the circuit of the main break magnet leads from one side of the battery, through the break itself, through the front contacts of the main break relay, through the current limiting resistance, through the main break magnet to ground, and thence to battery. When the main break magnet is energized, the main break is open; when the main break magnet is de-energized, as it normally is, the break is closed.

In the utilization of the circuit, the main break magnet and main break relay are at first not energized. The coils of the relay are connected in series with what-
THE WORKING SYSTEM OF PRINTING TERMINAL

The main peak connects with the printer to receive the main peak must be opened by electronic means.

The main peak relay is that the main peak is open when the main peak engages the main peak engages the main peak engages as it normally in the printer.
ever printer function is being used. Then, when the current for the function appears, it not only energizes the functional magnets, but energizes the relay coils as well. The relay then picks-up, as is shown in the figure. This position of the relay completes the current path from the battery to the main break coils, and the main break opens.

The reason for using the main break relay to control the break, instead of connecting the coils of the break itself into circuit of the function, is to insure the complete operation of the function before the opening of the main break.

THE SPACING CIRCUIT. The spacing circuit is shown in Fig. 59. This is the circuit utilized when a space signal is received over the line, usually between words. The spacing is performed in exactly
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

the same way as it is in the printing of letters, except that in this case, no printing action accompanies the spacing movement. As is indicated in the figure, the circuit receives current from the distributing circuit at the third back contact of P-5. From this point, the current path leads through the space coils, through the second back contact of the print relay, through the coils of the shift release relay, then through the main break relay to ground. Hence, when the space signal is received, upon the closing of the drum switch, the space coils, shift release, and relay coils are energized simultaneously. The remainder of the main break circuit is the same as that just described. It might be added that the print relay is in its inoperative position, since there is no rotation of the typewheel. Note that the space
signal not only causes a spacing action, but also releases the carriage from the shift position, providing, of course, that the carriage was in that position.

THE LINING CIRCUIT. The circuit of the lining magnet is shown in Fig. 60. The battery current is received from the distributing circuit at the second front contact of P-5. From this point, the current path leads through the lining magnet, through the coils of the main break relay, and thence to ground. The main break and relay circuit is the same as the one previously described.

THE BACKING CIRCUIT. The circuit of the backing magnet is shown in Fig. 61. The circuit receives energy at the fourth front contact of P-5. From this point, the circuit leads to ground through the coils of the backing, release, and main break mag-
THE MORPHOLOGY OF PRINTING TERMINOLOGY

attenuated not only causes a spacing between the split characters, it also increases the spacing from the split...
nets. Hence, the release (shift) and main break coils receive current simultaneously with the backing coils. The control of the main break through a relay is not necessary in the case of the backing mechanism, since only a momentary energizing of the backing coils is necessary: the mechanical lock on the backer holds the parts in the operative position after they have once been placed there by the backing magnet. Hence, the main break is placed directly in series with the backer coils.

THE SHIFT CIRCUITS. Next in the order of treatment comes the circuit of the shift magnets. However, there are some special requirements of this circuit which should be explained before the discussion of the circuit itself is begun.

The first requirement of the
THE MORRISON SYSTEM OF PRINTING TECHNOLOGY

next. The tolerance of the pressure on the...
shift magnets is, of course, that they normally carry no current, and that they remain in that condition until a shift signal is received. Upon the reception of this signal, the shift magnets should operate the shift mechanism and clear the printer by opening the main break. So far, the action is just the same as the other functions. However, the shift magnet should lock itself in position, so as not to be de-energized until a release signal is received from the transmitting station. In other words, the locking current must not come through the main break, but must come through the contacts of the release magnets. These requirements are fulfilled by the shift circuit.

The shift circuit is presented in Fig. 62, which shows the apparatus in its normal, or inoperative, position. The circuit receives current through the distrib-
THE KORHNIN CYPRUS OF INFORMING TELLERS...

...not that they wish to cooperate in any attempt to remain at large without a spirit of cooperation in an atmosphere and one of the principles of cooperation in the main... Howewer, the same as the other... The spirit... Many attempts to forestall... not to be able... a letter... by... wrtitten... to... not... who... that... not... through... these... from... into the spirit... not... The spirit... at present... in... as... from... the spirit... be... at present... The spirit... to cooperate in the spirit... of... the spirit... by the spirit...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

uting circuit, being connected to that circuit at the second back point of P-5. From here, the current path leads through the left back contact of the shift relay, and then through the relay coils to ground. The relay also acts as the operating solenoid for the shift mechanism. While the shift relay is operating, it first closes its second front contact, and then opens the first back contact; this latter opening cuts the relay coils off from the distributing circuit. However, the closing of the second front contact completes a second current path to the battery, this path leading through the back contact of the release relay. Hence, the shift relay has operated and locked itself in the operative position.

At the same time, the relay has closed its first front contact, which
THE MORRISON SYSTEM OF PRINTING TELEGRAPHY

With the contact at the rear end of the telegraph key, the contact path leaves the relay and then passes through the relay coil to reach the relay key. The relay key is then closed in the relay coil. When the relay key is closed, the relay coil is actuated, and then opens the telegraph key; the contact of the key opens the telegraph key, and the contact path returns to the battery.

At the same time, the relay key is closed in the telegraph key, the relay coil is actuated, and then opens the telegraph key; the contact of the key opens the telegraph key, and the contact path returns to the battery.

...
THE MORRUM SYSTEM OF PRINTING TELEGRAPHY

closing supplies current to the main break magnet. The break therefore opens and clears the printer. However, the opening of the main break does not open the looking circuit of the shift relay; hence, that relay remains energized, and holds the typewheel in its shift position.

The release of the shift relay is effected by the operation of the release relay. This relay becomes energized when a spacing or backing signal is received over the line.

THE RUB-OUT CIRCUIT. The rub-out circuit is shown in Fig. 63. The battery is connected, through the distributor circuit, to the fourth back point of F-5. From here, the circuit leads through the main break resistance and main break coils to ground. Hence, when a rub-out signal is received, it operates the main break, and thereby clears the
THE MORNING SYMPTOM OF HUNGER (continued)

...the release of the chip to the
-press goes not open the locking circuit of
the coil. Hence, that relay remains
energized, and holds the switches in the
shift position.

-Press the release of the chip to
-press the release of the operation of the
-press.

-Press the release of the operation of the
-press.

THE PUMP-GUT CIRCUIT

As the output is shown in the .08 The
-press is connected through the centrifugal
pump to the output gear box of P-8. From here
the output force travels through the main press to
attain and main press not to operate. Hence,
when a impont string is reached, if open
ase the main press and therapy occurs...
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

printer.

THE DISTRIBUTING CIRCUIT.

Having completed the circuits of the individual functions, we will now study the distributor system by which these circuits are connected to the battery. The complete distributor circuit is presented in Fig. 64. It is here shown in the inoperative condition, which condition it retains if a rub-out signal is received; any other signal changes the connections. That part of the circuit directly concerned with the printing of characters has already been discussed; we are now concerned with the circuit from the standpoint of the purely operating functions.

There are two requirements of the distributor circuit in this connection, viz., first, it must connect the battery to the beginning of the individual circuits, and second, it must never connect the
THE DISTRIBUTING CIRCUIT

We have completed the outline of the plant. 

With the abstract of the principal stations which these stations are connected to the battery. The complete plant of these stations is necessary to understand the function of the plant, which is not only to receive the steam from the steam plant, but to distribute it to the various parts of the plant. 

There are two requirements for the efficient operation of the plant. 

First, the plant must connect the patents, and secondly, it must have a means of collecting the steam and converting it into useful work.
THE MORKRUM SYSTEM OF PRINTING TELEGRAPHY

battery to the rotator circuits upon the reception of an operating signal. If the rotator and center-letter circuits do not carry current, the print relay will not operate, and there will be no printing action on the part of the machine.

The following table shows what combinations of current pulses allow of these requirements.

<table>
<thead>
<tr>
<th>P-3</th>
<th>P-2</th>
<th>P-1</th>
<th>P-4</th>
<th>P-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>±</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>±</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>±</td>
</tr>
</tbody>
</table>

An examination of the code shows that every operating signal comes under one of these classifications.
THE WORKING SYSTEM OF PRINTING TYPGRAPHY

better to the rotator of course than the
ascription of an operating element. In the note
for any center-letter attach to not carry
contact, the print relay will not operate.
and there will be no printing action on the
part of the machine.

The following table shows
what combination of current pulses allow
of these requirements:

<table>
<thead>
<tr>
<th>E-8</th>
<th>E-7</th>
<th>E-6</th>
<th>E-5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An examination of the above shows that every
operator already comes under one of these
operations.
Impulse Diagram.
Plate I - Perforator.

Plate II - Perforator.
Plate III - Distributor

Plate IV - Distributor.
Plate V - Distributor.

Plate VI - Distributor.
Plate - VII - Wheatstone Differential Relay.

Plate VIII - Wheatstone Differential Relay.
Plate IX - Printer.

Plate X - Printer.
Plate XI - The Printer.

Plate XII - The Printer.
FIG. 1.

Transmitting Station

Receiving Station

FIG. 2.

Transmitting Station

Receiving Station
Fig. 3

TRANSMITTING STATION

Receiving Station

Fig. 4

TRANSMITTING STATION

Receiving Station
FIG. 25.

FIG. 26.
FIG. 32.

FIG. 33.