

Aug. 7, 1945.

M. CAMRAS

2,381,036

SAFETY TIMING MECHANISM FOR MAGNETIC RECORDERS

Filed Aug. 10, 1942

3 Sheets-Sheet 1

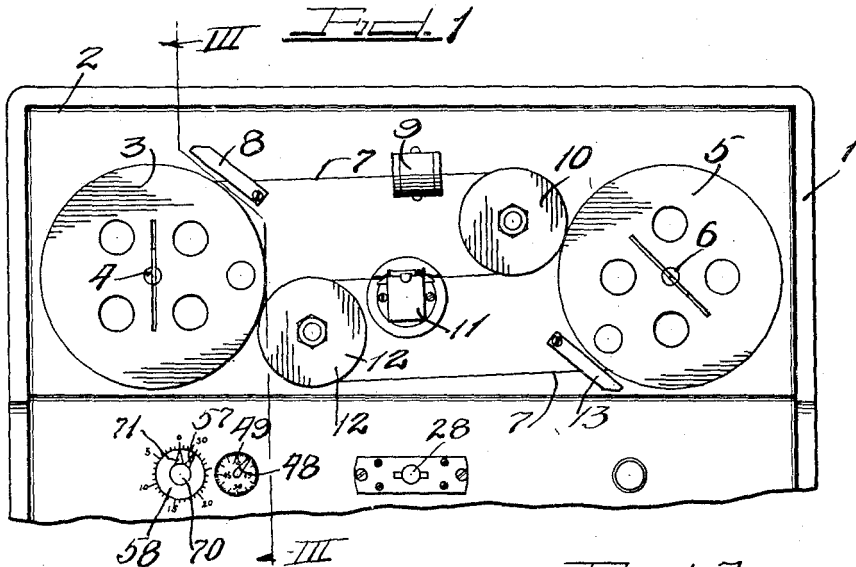


Fig. 2

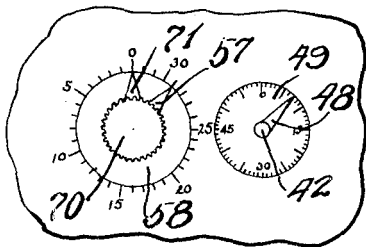
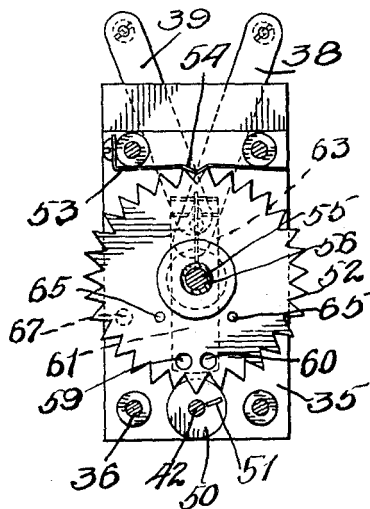


Fig. 7



Inventor
Marvin Camras.

By Charles W. Hills Attorney

Aug. 7, 1945.

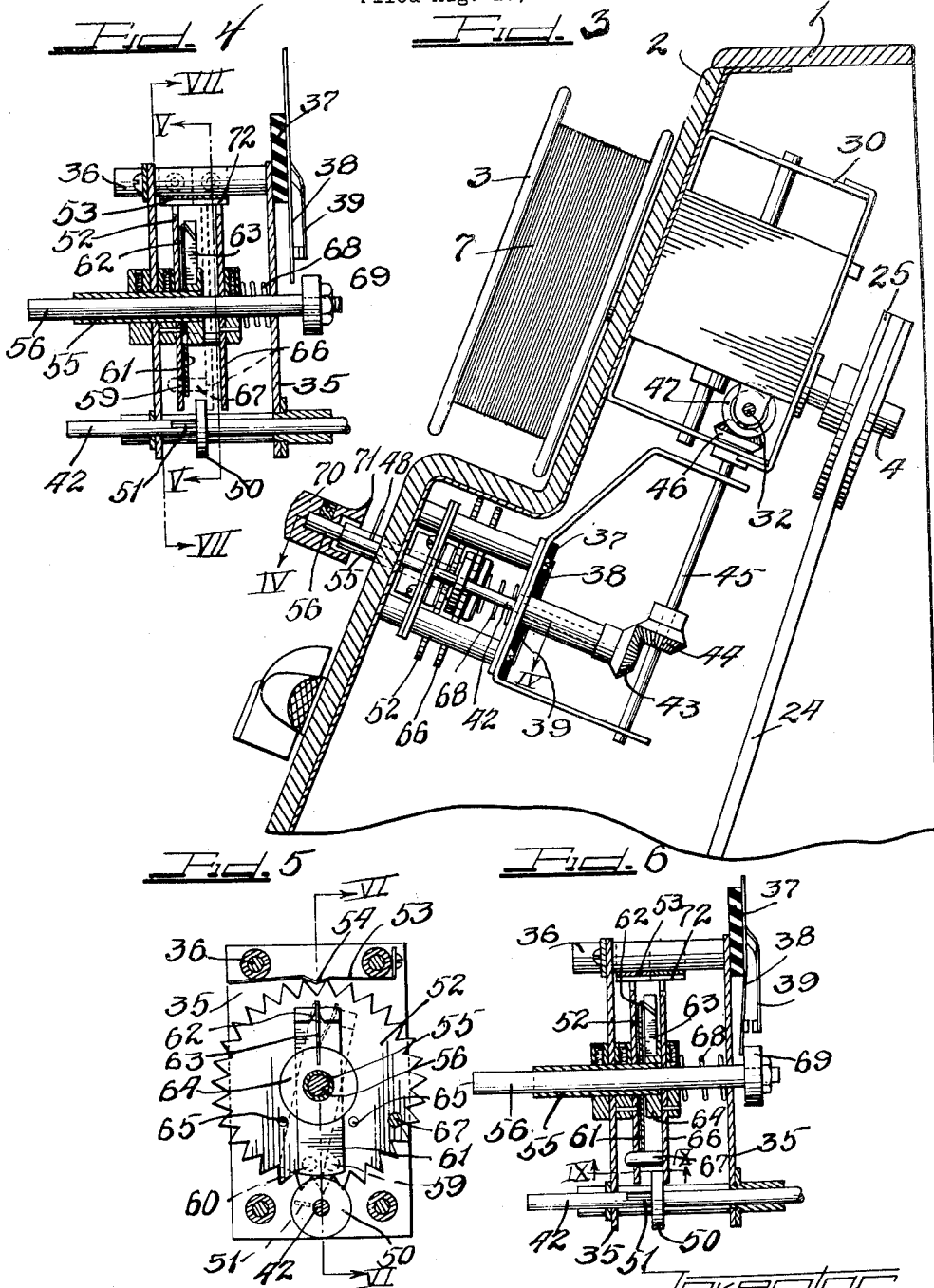
M. CAMRAS

2,381,036

SAFETY TIMING MECHANISM FOR MAGNETIC RECORDERS

Filed Aug. 10, 1942

3 Sheets-Sheet 2



Inventor
Morvit Camras

By Charles Hill ATTORNEY

Aug. 7, 1945.

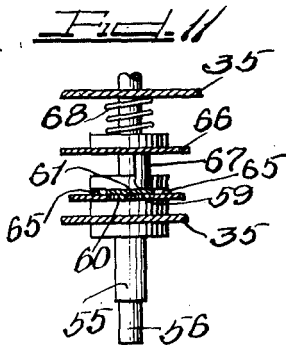
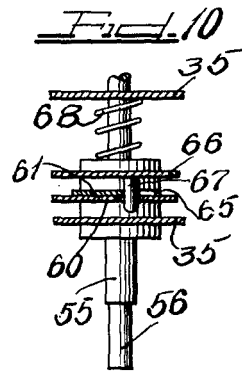
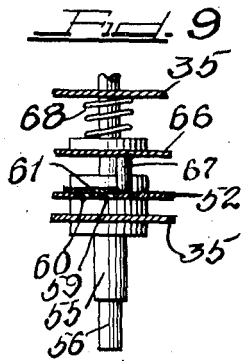
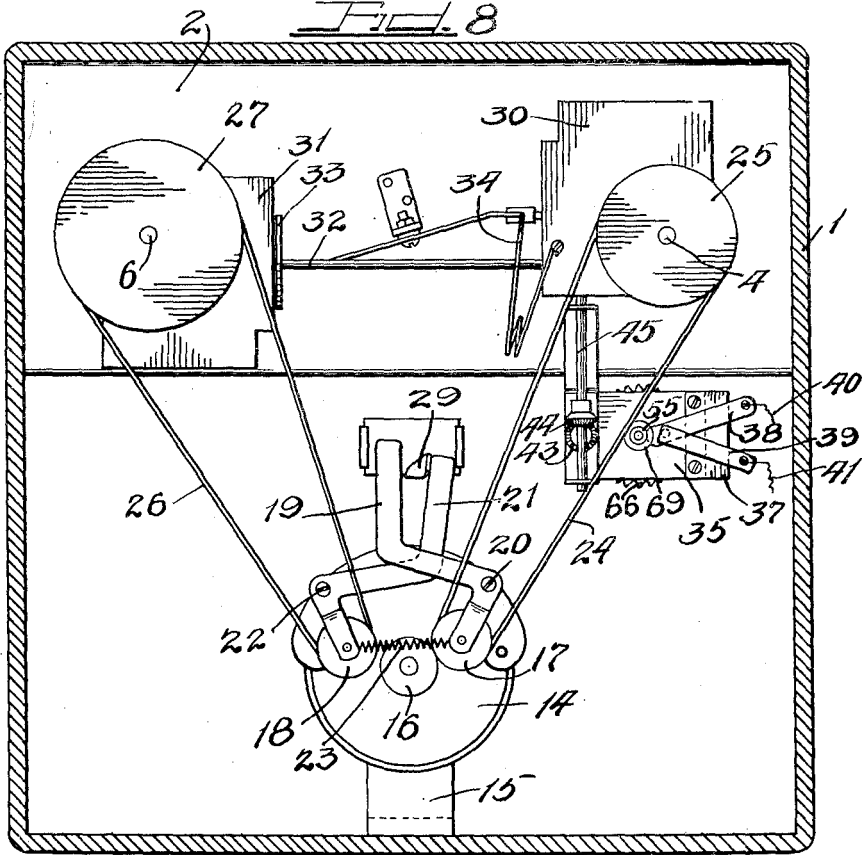
M. CAMRAS

2,381,036

SAFETY TIMING MECHANISM FOR MAGNETIC RECORDERS

Filed Aug. 10, 1942

3 Sheets-Sheet 3



Inventor
Marvin Camras

Wm. Charlesworth ATTORNEY

UNITED STATES PATENT OFFICE

2,381,036

SAFETY TIMING MECHANISM FOR MAGNETIC RECORDERS

Marvin Camras, Chicago, Ill., assignor to Armour
Research Foundation, Chicago, Ill., a corpora-
tion of Illinois

Application August 10, 1942, Serial No. 454,215

6 Claims. (Cl. 161—1)

This invention relates to improvements in safety timing mechanism in the nature of mechanism which may be timed to automatically stop after a predetermined amount of operation or before inconvenience or injury can result through continued operation, the invention being highly desirable for use in connection with a magnetic recording device, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In a magnetic recorder wherein a wire, tape, or other elongated member of paramagnetic material is utilized, such wire or other member may be unwound from one spool while being wound upon another spool, the recording by magnetization of the wire taking place between the spools. Frequently, it is desirable to rewind the wire upon the first spool, and then operate the machine in its original direction for purposes of reproducing what has been recorded upon the wire. At other times, the wire may be moved backwards and then again forward in order to erase a recording thereon or to make a new recording, the wire being quite often reversed in direction, wound upon one spool and then upon the other, in the normal operation of the recorder. Many times it is important to know just how long it will take to reproduce a recording upon the wire. Many times there are dozens of recordings upon a single wire, and it is desirable to know how long a wire should be wound upon either spool in order to have the desired recording in position for reproduction. It is also desirable to have some insurance that the wire will never be wound entirely off one of the spools. In other instances it is desirable to stop the machine at a predetermined time.

With the foregoing in mind, it is an important object of the instant invention to provide a mechanism which serves as an index for a pair of spools on which an elongated member may be wound on one while being unwound from the other, and operated in reverse direction if so desired.

Another object of the invention is the provision of a timing mechanism for use in a magnetic recorder which gives readings directly in minutes and seconds as to the elapsed time of a particular recording.

Another object of the invention resides in the provision of a safety mechanism for use in a magnetic or other recording device which automatically stops the machine a predetermined interval of time before the end of the recording medium has been reached.

It is also a feature of the invention to provide a safety timing mechanism for use in a magnetic recorder in which sounds are recorded on a mag-

netized wire, which mechanism will stop the machine a predetermined length of time before the end of the wire is reached in one direction, and will stop the machine a predetermined length of time before the end of the wire is reached when it is run in reverse direction, so that there will be no opportunity of totally freeing one end of the wire or breaking the wire if an end thereof is securely anchored.

A further object of the invention is the provision of a timing mechanism for use in a magnetic recorder, which may be set to automatically stop the machine at the end of any predetermined time interval.

Still another feature of this invention resides in the provision of a safety timing mechanism for a magnetic recorder, which may be adjusted to stop the recorder at the end of any predetermined time interval, and which may be reset instantly to permit further operation beyond that time interval, if so desired.

It is another object of the invention to provide a safety timing device highly desirable for use with a magnetic recorder wherein a wire or other elongated member travels in either direction from one spool to another, which mechanism may be set to stop the recorder at a predetermined time, and which mechanism need not be set or adjusted when one of the spools is removed and another spool placed in position.

It is also an object of this invention to provide a safety mechanism for association with a magnetic recorder wherein wire is wound back and forth from one spool to another, which mechanism not only gives an accurate reading in minutes and seconds of any particular interval of elapsed time, but in addition may be set to automatically stop the recorder at the end of a predetermined interval of time, may be instantly reset to permit further operation after stopping, and also automatically stop the machine before the wire is totally unwound from either spool.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary front elevational view of a magnetic recording device equipped with timing mechanism embodying principles of the instant invention;

Figure 2 is a fragmentary enlargement of the indicating means seen in the lower left-hand portion of Figure 1;

Figure 3 is an enlarged fragmentary vertical sectional view, with parts omitted, taken substantially as indicated by the section line III—III of Figure 1, looking in the direction of the arrows;

Figure 4 is a fragmentary plan sectional view, with parts shown in elevation, of a portion of the timing mechanism, taken substantially as indicated by the line IV—IV of Figure 3;

Figure 5 is a vertical transverse sectional view through the timing mechanism taken substantially as indicated by the line V—V of Figure 4;

Figure 6 is a plan sectional view similar in location to Figure 4, but taken substantially as indicated by the section line VI—VI of Figure 5, illustrating the timing apparatus in a different stage of operation;

Figure 7 is a vertical transverse sectional view taken substantially as indicated by line VII—VII of Figure 4, and illustrating substantially the same structure as Figure 5, but from the opposite side;

Figure 8 is a vertical sectional view through the casing wall, illustrating the drive mechanism for the timing structure from the rear;

Figure 9 is an enlarged fragmentary plan sectional view of a portion of the timing mechanism at an initial stage of operation, this figure being taken substantially as indicated by the section line IX—IX of Figure 6;

Figure 10 is a view similar to Figure 9 and taken in the same location, but illustrating the timing mechanism in a different stage of operation; and

Figure 11 is a view similar to Figure 9 and taken in the same location, but illustrating an adjustment of the timing mechanism to resume operation after the apparatus has once been stopped by the timing mechanism.

As shown on the drawings:

In the illustrated embodiment of this invention, the timing means is shown by way of example in association with a magnetic recording device. The illustrated apparatus includes a casing 1 having a front panel 2 which acts as a support for the major part of the illustrated mechanism including the safety timing arrangement.

Disposed on the front side of the panel 2 is a spool or reel 3 keyed to a rotatable shaft 4, and at the opposite end of the front panel is a similar reel 5, similarly mounted on a shaft 6. In the operation of the magnetic recording device, a wire 7 or other elongated member which functions as a recording medium is unwound from one reel and wound upon the opposite reel, the wire being reversible in direction whenever desired. Assuming that the wire travels from the reel 3 to the reel 5, it first passes through a level winding apparatus 8 associated with reel 3, next through an erasing or demagnetizing head 9, which may be in the form of a coil through which alternating current passes, thence around a guide pulley 10 through a portion of a magnetizing or recording head 11, around another guide pulley 12, and through a level winding apparatus 13 to the reel 5.

With reference to Figure 8, the drive mechanism for the reels 3 and 5 will be seen. The drive mechanism includes an electric motor 14 which may be supported both by the front panel 2 and by a suitable support 15 from the base of the housing 1. The shaft of the motor is provided with a friction drive disk 16 which, when the apparatus is idle, is engaged by both of a pair of friction drive pulleys 17 and 18, and when the apparatus is operating may be selectively engaged by either of the pulleys depending on the desired direction of travel of the wire 7. The drive pulley 17 is

carried on the end of a dog leg lever 19 pivoted to a suitable frame member as indicated at 20, and the drive pulley 18 is similarly carried on the end of a dog leg lever 21 pivoted as indicated at 22. A spring 23 connects the ends of the dog leg levers 19 and 21 adjacent the pulleys 17 and 18 and tends at all times to urge the pulleys together so that both will contact the friction disk 16. The drive pulley 17 is connected through a suitable belt 24 to a pulley 25 fixed to the aforesaid shaft 4 so that the drive pulley 17 will cause direct operation of the spool or reel 3. Likewise, the drive pulley 18 is connected through a suitable belt 26 to a pulley 27 fixed to the aforesaid shaft 6, so that the drive pulley 18 will cause direct operation of the spool or reel 5.

Selective drive of one or the other of the reels 3 and 5, depending upon the desired direction of travel of the wire 7, is obtained by the actuation of a lever 28, seen in Figure 1, which is mounted on the front of the panel 2. This lever 28 is connected through a suitable toggle mechanism to a lever 29 (Figure 8) which projects between the upper ends of the dog leg levers 19 and 21. By actuating the lever 28 to the right or left as it is viewed in Figure 1, the lever 29 is moved to the right or left, and when so moved it pivots the respective dog leg lever 19 or 21 so as to move the corresponding friction drive pulley 17 or 18 away from contact with the disk 16, leaving the other drive pulley in contact with the disk for operation of the apparatus. As seen in Figure 8, the drive pulley 17 is in contact with the disk 16 and so the pulley 25 and consequently the reel 3 is receiving a positive drive from the motor. The opposite reel 5 receives its drive through the recording medium or wire 7. When the lever 28 is thrown in the opposite direction, the spring 23 throws the drive pulley 18 into contact with the disk 16, and the lever 29 pivots the dog lever 19 and lifts the drive pulley 17 away from the disk 16. Under these circumstances, the pulley 27 and consequently the reel 5 receives a positive drive from the motor, and the reel 3, which may then rotate freely, is actuated through the medium of the wire 7.

The pulley 25 is associated with a frame structure 30, and the pulley 27 is associated with a frame structure 31. These frame structures give proper spacing and support for the various pulleys, gears, and shafts. The frame structure 31 is in effect a gear housing, and by suitable gearing therein the shaft 6 operates a cross-shaft 32 (Figure 8) which carries a cam 33 and suitable spring mechanism 34 for operating the aforesaid level winding members 8 and 13.

The safety timing mechanism for controlling the operation of the apparatus above described is shown mounted on a lower portion of the panel 2 substantially beneath the reel 3 and frame 30. This timing mechanism includes an open-sided box-like frame construction 35 held in position upon the panel 2 with the aid of corner bolts 36, as seen clearly in Figures 4, 5 and 6. On one side of the frame 35 an insulation block 37 is mounted to support a switch in the form of a pair of contact members 38 and 39. Each of these contact members is in the nature of a leaf spring, with the member 38 being longer than the member 39, and the resilient tendency of these members is always to remain in contacting or closed position as seen in Figure 4. As seen in Figure 8, conductors 40 and 41 lead away from the contact members 38 and 39 respectively, and these conductors may be connected in

any well known manner to the electrical circuit including the motor 14, so that when the contact members 38 and 39 are separated, as seen in Figure 6, the circuit through the motor is broken and the motor must stop. The timing mechanism is arranged to open the contact members 38 and 39 at predetermined intervals selectively established by the operator, and also a relatively short period of time before the wire 7 can be totally unwound from either of the reels 3 or 5.

This timing mechanism embodies a driven shaft 42 which carries on its inner end a bevel gear 43 in mesh with a bevel gear 44 on the lower portion of a vertically disposed shaft 45. Another bevel gear 46 at the upper end of the shaft 45 meshes with a bevel gear 47 carried on the aforesaid cross-shaft 32, so that through the shafting and gearing just described, the driven shaft 42 is operated from the shaft 6 by gearing in the box frame 31. The gearing is so timed that the shaft 42 preferably rotates at the rate of one revolution per minute, and on the outer end, in front of the panel 2, this shaft carries a pointer 48 traveling over a dial 49 divided into seconds, as seen clearly in Figure 2.

Keyed to the shaft 42 is a collar 50 carrying a projecting lug 51 which will contact a tooth on a gear wheel 52 at every revolution of the shaft 42 and thus rotate the gear the equivalent of the width of a tooth every minute. Consequently, one revolution of the gear 52 requires as many minutes as the gear has teeth. This gear is prevented from slipping or over-running by momentum with the aid of a spring detent 53 extending between a pair of the supporting posts 36—36 at one end of the frame 35. The spring detent is centrally bent as indicated at 54 in a V-shape to extend between adjacent teeth of the gear 52, and the action of the collar 50 in rotating this gear is against the restraining tendency of the spring 53.

The gear 52 is fixed to a sleeve 55 which floats on a reciprocable shaft 56 that normally does not rotate. At the outer end thereof, in front of the panel 2, the sleeve 55 carries a pointer 57 which rotates over the face of a dial 58 indicating minutes. Accordingly, the minutes and seconds of any particular operation of the machine will be indicated by pointers 48 and 57 on dials 49 and 58.

As seen best in Figure 7, the driven gear 52 is provided with a pair of spaced apertures 59 and 60 near the outer margin of the gear. These apertures are normally covered on one side by a diametrically disposed plate 61 which is rotatable with the gear 52, and which is pivotal relative to the gear 52 around the sleeve 55. The opposite end of the plate is notched as indicated at 62 and a leaf spring 63 extends into the notch. The leaf spring is imbedded in a collar 64 fixed to the sleeve 55. Consequently, the leaf spring tends to hold the plate in the full line position seen in Figure 5 so that both apertures 59 and 60 are covered by the plate. The plate may be pivoted in either direction relative to the gear 52 against the action of the spring 63 by means not yet described, and to avoid any possibility of overstraining the spring 63 by such pivotal movement, a pair of stop members 65—65 are mounted on the gear 52, one on each side of the plate, as seen best in Figure 5.

The reciprocable shaft 56 carries a gear 66 of the same size and number of teeth as the gear 52. This gear 66 has extending outwardly therefrom a pin 67 of a size to enter either of the apertures 59 and 60 in the driven gear 52. The shaft 56

together with its gear 66 is biased outwardly by a coil spring 68 disposed between the collar of the gear 66 and one of the frame members 35. Outward movement of the shaft 56 and gear 66 is normally prevented by the pin 67 bearing against the surface of the driven gear 52. However, whenever one of the apertures 59 or 60 approaches the pin 67, the aforesaid pivoted plate 61 is held against rotation by the pin and assumes a pivoted position relatively to its gear 52, as indicated by dotted lines in Figure 5, and the pin enters one of the apertures. Such entry of the pin into an aperture 59 or 60 permits a forward movement of the shaft 56, and an insulated collar 69 carried on the inner end of this shaft abuts the longer contact member 38 and separates contact members 38 and 39 as clearly seen in Figure 6, thus causing the entire mechanism to stop by virtue of breaking the circuit through motor 14.

On the outer end thereof and in front of the panel 2, the reciprocable shaft 56 carries a knob 70 which in turn carries a pointer 71 also disposed in front of the minute indicating dial 58. By means of the knob 70, the shaft 56 together with its gear 66 may be rotated relatively to the intermittently driven gear 52 to effect a timing adjustment either during operation of the apparatus or when it is stationary, as may be desired. As seen in Figures 4 and 6, a spring detent 72, of the same construction as the aforesaid spring detent 53, holds the setting gear 66 in a desired position of adjustment, and any movement of this gear by the knob 70 is against the tendency of this detent to hold the gear stationary.

In operation, the timing mechanism is extremely simple and highly effective. It not only provides a means for stopping the recording device after a predetermined time interval, depending upon the setting of the gear 66 by the knob 70, but also provides a safety feature in that the machine will be automatically stopped before the wire 7 can be unintentionally wound entirely off either of the reels 3 or 5. For the purpose of clarity, the automatic stopping of the machine, without any setting of the gear 66, will be first discussed.

The illustrated recording device is what may be termed a thirty-three-minute machine, in that there are thirty-three minute indications on the dial 58. The pointer 57 corresponds in movement to the gear 52, and there should be just as many teeth on the gear 52 as well as on the setting gear 66 as there are minute indications on the dial 58. With thirty-three minute indications on the dial 58, the machine will operate approximately thirty-three minutes continuously before it is automatically stopped.

Assuming now that the machine is intended to operate continuously, the knob 70 together with its setting gear 66 is adjusted so that the pointer 71 coincides with zero on the dial 58, as seen in Figure 2. The minute indicating pointer 57 is shown out of line in Figure 2, for the purpose of clarity, since at the start this minute hand would be disposed approximately behind the pointer 71 and be invisible. With the minute indicator 57 at zero, the apertures 59 and 60 in the driven gear 52 will be disposed in the position seen in Figure 7, and with the pointer 71 of the setting gear at zero, the pin 67 will be disposed directly over the aperture 59 in the position seen in Figures 10 and 11.

Now, assuming that the machine is operating for recording purposes, that is, the wire is being unwound from reel 3 and wound on reel 5, the

second hand 48 on the shaft 42 will be turning clockwise, while the minute hand 57 on the sleeve 55 will be turning counter-clockwise. The second hand will obviously rotate continuously, while the minute hand 57 will rotate intermittently, since the gear is moved a distance of one tooth periodically by the lug 51 on the collar 50. Such movement of the gear 52 will cause the minute hand 57 to advance the indicated space of one minute over the dial 58.

As the minute hand approaches zero, which will amount to 33 in a counter-clockwise direction, the parts will be substantially in the position seen in Figure 9. At this point, which may be approximately thirty seconds short of a thirty-three-minute time, the gear 52 will have moved so that the plate 61 contacts the pin 67 on the gear 66, as seen in Figure 9. As the gear 52 continues to move, the plate is held by the pin 67 and when the aperture 59, now opened by the holding of the plate, passes beneath the pin 67, this pin will enter the aperture as seen in Figure 10, thus opening the contact members 38 and 39, and stopping the machine ten or fifteen seconds before the thirty-three-minute interval, so that all of the wire cannot be unwound from the reel 3.

It is customary, however, to have more wire upon reel 3, and the amount of wire should be in proportion to the number of minutes indicated on the dial 58. That is, there should be enough wire to last thirty-three minutes if it is a thirty-three-minute dial, or there should be just twice or three times that much wire. Assuming that there is sufficient wire for a recording lasting one hour and six minutes, twice the thirty-three-minute period, and assuming that it is not desired to have the machine stopped at the thirty-three-minute period, or, if stopped, it is desired to immediately start it, this may be accomplished in a very simple manner. It is only necessary to press inwardly on the knob 70 against the action of the spring 68 and hold the pin 67 out of contact with the gear 52. If this is done just prior to the termination of the thirty-three-minute period, and the knob 70 is held for a few seconds in that position, the plate 61 will not have been stopped in its motion with the gear 52 but will have passed under the knob, thus prohibiting the knob entering either of the holes 59 and 60 and stopping the machine. If the machine is stopped as indicated in Figure 10, a quick pressure on the knob 70 will withdraw the pin 67 from the aperture 59, and the plate will be immediately snapped into position over the aperture by the spring 63, so that it extends under the pin 67 as seen in Figure 11. The pin 67 will therefore merely bear against the plate until the plate passes by, and then it will resume bearing against the intermittently traveling gear 52, thus the operation may be continued for another thirty-three minutes.

After a recording has been made, if it is to be reproduced upon the same instrument, it is necessary to rewind the wire back upon the reel 3 from the reel 5, and then start it over again in its original direction in order to make the reproduction. During the rewinding upon the reel 3, it is essential that the wire be not completely unwound from the reel 5. If the rewinding is continued sufficiently long, the machine will be automatically stopped by virtue of the pin 67 entering the aperture 60 in the driven gear 52, in the same manner as above described for the forward operation. This stopping of the machine

will occur ten or fifteen seconds prior to the end of the thirty-three-minute limit.

Of course, if the machine is run forwardly for a recording of only a small time, say five minutes, and then the wire is rewound upon the reel 3, nevertheless the machine will stop ten or fifteen seconds before the pointer 57 reaches zero.

Now, let us assume that it is desired to make a recording for a short length of time only. Further, the assumption will be that at the start all indicating pointers are as closely as possible to zero. It is a simple expedient to press in upon the knob 70 to insure that the pin 67 is not engaged with the gear 52, and then turn the knob 70 counterclockwise or clockwise, as the case may be, depending upon the desired time interval. Suppose that time interval is ten minutes, the knob 70 will then be turned counter-clockwise until the pointer 71 coincides with the mark 10 upon the dial 58. This results in a shifting of the setting gear 66 together with its pin 67 to a position in advance of the driven gear 52, so that the pin will be approximately ten tooth widths from the aperture 59. Upon starting of the machine in a forward direction, the machine will operate for ten minutes, and then the aperture 59 will appear underneath the pin 67, the plate 61 having been held to one side, and there will be an automatic stopping of the machine at the end of the ten-minute interval. In similar manner, any desired time interval of operation may be established, and such interval may be established for either direction of travel of the wire 7.

A further distinct advantage of the time mechanism is apparent from the above disclosure. For example, assume that a series of recordings are being made upon the wire 7. Assume that one recording has been for five minutes, another recording for seven minutes, and a third recording for five minutes and thirty seconds. At the end of these three recordings the pointer 57 will be at the seventeen-minute mark, and the second pointer 48 will be upon the thirty-second mark. A note may be taken of the time at the start of the fourth recording, and in the event this recording lasts five minutes, the pointer 57 will then be upon the twenty-two-minute mark, and the pointer 48 will coincide again with the thirty-second mark. If it is desired to reproduce that last or fourth recording, the wire may be run in reverse direction until the fourth recording has been rewound upon the reel 3, then the machine may be operated in the forward direction and the recording reproduced. Rather than waste the time of a watcher during the rewinding operation, it is a simple expedient to turn the knob 70 and set the finder 71 at the seventeen-minute mark, and start the machine in the reverse direction. After five minutes of wire has been rewound in reverse direction, the machine will automatically stop. The knob 70 may then be pressed inwardly to lodge the plate 61 in front of the pin 67, the machine started in the forward direction, and the last and fourth recording made has been reproduced. It makes no difference if the machine operates faster in the reverse direction than in the forward direction to save time. The travel of the wire and the indications of the various pointers will all be directly proportional so that exactly five minutes of wire will be rewound regardless of the speed.

It should also be noted that if it is desired to remove a reel from the machine, the automatic stopping of the machine ten or fifteen seconds before the wire is entirely off a reel permits the

operator to press in the knob 70 and watch the finish of the rewinding operation. When the wire is all off one reel all pointers will be at zero position and no adjustment is necessary when a new reel of wire is mounted.

Numerous other variations in timing may be had, as will be obvious to one skilled in the art.

From the foregoing, it is apparent that I have provided novel timing and safety mechanism, highly desirable for use in connection with a magnetic recording device. When used with such a device, it will be noted that the timing mechanism automatically prevents unintentional complete removal of the wire or other recording medium from either of the reels, any particular recording may be timed exactly as to its duration, and the machine may be set to stop by a simple adjustment at the end of any desired time interval of operation, regardless of which direction the machine is operating. Further, the time intervals for operation of the machine in either direction may be established whenever desired, and whether or not the machine is stationary or in motion at the time. It is also to be noted that the total amount of the wire or other recording medium on either spool may be determined with quite a high degree of accuracy merely by noting the position of the minute and second indicating pointers. Another feature resides in the fact that with the timing mechanism, it is possible to make adequate corrections in advance of a scheduled reproduction. For example, a recording desired to run precisely fifteen minutes may be tried out upon the machine, and if it falls short of the fifteen minutes or extends over the fifteen minutes, it is a simple expedient to reverse the machine and rewind the wire for that recording on the first reel, then again operate the machine forward and make a new recording, slowing it down or speeding it up as may be desired to reach the exact fifteen-minute interval. Thus, the exact time of any particular reproduction may be determined to a very fine degree in advance.

It will also be noted that the timing mechanism is extremely durable, simple in construction, very easy to operate, and that it may be economically manufactured and used.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a timing mechanism, a driven member having an opening therein, an adjustable member, a pin on said adjustable member in line with said opening, and resilient means urging said members together, said pin bearing against the driven member until said opening is reached when the pin enters the opening and locks the driven member to the adjustable member and a spring held shield carried by said driven member and normally overlying said opening, said shield being held back against movement of said driven member by said pin until the pin engages in the opening.

2. In a timing mechanism, a driven member having an opening therein, a shield carried by said driven member and resiliently held over said opening, an adjustable member stationary in respect to said driven member, a pin on said adjustable member in line with said opening, resilient

means urging said adjustable member toward said driven member to cause said pin to bear against the surface of the driven member and hold back the shield sufficiently to reach and enter said opening to lock the driven member, and means associated with said adjustable member to move it against the action of said resilient means and withdraw the pin from the opening permitting said shield to snap back over the opening in front of the pin for resumption of operation.

3. In a timing mechanism, driving means, a shaft geared to said driving means to rotate at substantially one revolution per minute, a dial marked in second increments in a visible location, a pointer on said shaft to travel over said dial, another dial adjacent the first said dial marked in minute increments, a shaft associated with the minute dial, a pointer on said shaft to travel over the minute dial, and means associated with both said shafts, whereby the first said shaft intermittently actuates the second said shaft a one-minute increment per revolution of the first shaft, said pointers denoting the actual time in minutes and seconds of a particular operation, and a pre-set arrangement associated with the second said shaft to automatically lock the second said shaft against normal and individual operation at the expiration of a predetermined time interval.

4. In a timing mechanism, driving means, a shaft geared to said driving means to rotate at a predetermined speed, a dial adjacent said shaft, a pointer on the shaft to travel over the face of the dial to indicate time, a second shaft carrying a gear, a dial disposed adjacent the second shaft, a pointer on the second shaft to travel over the second dial, said second dial being divided in larger increments of time, means on the first shaft to actuate the second shaft the equivalent of one increment on the second dial per revolution of the first shaft, a third shaft fixed in respect to the second shaft, a pointer on said third shaft adjustable to a desired position in respect to the second dial, and means on the third shaft for engagement with said gear to lock the gear against normal and individual operation when the pointer on the second shaft coincides with the position of the pointer on the first shaft.

5. In a timing mechanism, an adjustable shaft, a gear on said shaft, a dial adjacent said shaft, a pointer on the shaft for pre-selective movement over the face of the dial, said gear corresponding in the number of teeth to the division of time increments on said dial, a sleeve floating on said shaft, a driven gear similar to the first gear on said sleeve, said driven gear having an aperture therein, a pin on the first said gear in line with said aperture, resilient means pressing said first gear toward the second gear so said pin will bear against the face of the driven gear, a pointer on the sleeve of the driven gear for movement over the face of said dial, resilient means tending to hold both said gears in position of adjustment, and the arrangement being such that said pin will enter said aperture and lock the gears together whenever the pointers coincide in respect to said dial.

6. In a timing mechanism, an adjustable shaft, a gear on said shaft, a dial adjacent said shaft, a pointer on the shaft for pre-selective movement over the face of the dial, said gear corresponding in the number of teeth to the division of time increments on said dial, a sleeve floating on said shaft, a driven gear similar to the

first gear on said sleeve, said driven gear having an aperture therein, a pin on the first said gear in line with said aperture, resilient means pressing said first gear toward the second gear so said pin will bear against the face of the driven gear, a pointer on the sleeve of the driven gear for movement over the face of said dial, resilient means tending to hold both said gears in a position of adjustment, the arrangement being such that said pin will enter said aperture and lock the gears together whenever the pointers coincide in respect to said dial, said shaft moving

axially with its respective gear when the pin enters the aperture, means associated with the driven gear to normally cover the aperture but being held aside when the driven gear passes said pin, means associated with said shaft to move it in reverse direction to separate the pin from the aperture, and resilient means causing said cover means to snap back in position to cover the aperture upon a reverse movement of said shaft and hold the pin out of the aperture to permit further operation.

MARVIN CAMRAS.