UNITED STATES PATENT OFFICE

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AUTOMATIC STOP FOR MAGNETIC
RECORDERS

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8 Claims. (Cl. 242—54)

1. This invention relates to an automatic stop
for magnetic recording and reproducing devices,
as well as for other winding and reeling appar-
atus which handles relatively fine thread-like
material, and which is equipped with a suitable
leader at its end.

One of the problems which is met with in
handling relatively fine thread-like media in any
winding and reeling mechanism is the problem of automatically stopping
the winding and reeling apparatus at the end of a winding and reeling operation. Any automatic stop mechanism should be positive, di-
rect acting, and yet, at the same time, be rela-
tively economical to manufacture. This prob-
lem is particularly important in magnetic rec-
cording and reproducing devices using an elon-
gated record medium, since it is extremely im-
portant that the cost of the record itself be kept
at a minimum.

It is one of the principal features and objects
of the present invention to provide a novel automatic stop for any winding and reeling mecha-
nism arranged to handle an elongated member.

It is a further object of the present invention to
provide a novel automatic stop mechanism which is positive and direct in its action, which
is substantially foolproof, which is relatively in-
expensive, and which is rugged and reliable in use.

Another object of the present invention is to
provide a novel automatic stop for magnetic re-
cording and reproducing devices of the type em-
ploying a wire or other thread-like medium hav-
ing a leader with either one or both of its edges
notched or otherwise provided with a series of tongues.

Still another object of the present invention is to
provide an automatic stop for winding and reeling mechanisms which will act irrespective of the
direction of movement of the elongated medium through the device.

Still another and further object of the present
invention is to provide automatic stop mecha-

nism and means for magnetic recording and re-
producing devices which includes means for readily and quickly resetting the stop mecha-
nism after it has been actuated.

The novel features which I believe to be char-
acteristic of my invention are set forth with
particularity in the appended claims. My inven-
tion itself, however, both as to its organization,
manner of construction and method of operation,
along with further objects and advantages
thereof, may best be understood by reference to
the following description, taken in connection
with the accompanying drawings, in which:

Figure 1 is a plan view of a magnetic record-
ing and reproducing device which is equipped
with automatic stop mechanism embodying the
novel features and characteristics of the present
invention;

Figure 2 is an enlarged plan view of the stop
mechanism employed in the recording and re-
producing device of Figure 1 with the top plate
removed;

Figure 3 is a sectional view through the stop
mechanism which shows parts in elevation, as
taken along the line III—III of Figure 1;

Figure 4 is a view similar to Figure 2 but with
the stop mechanism in its tripped position;

Figure 5 is a view similar to Figures 2 and 4
illustrating the resetting operation;

Figure 6 is a greatly enlarged fragmentary view
of the resetting arm in a position about to re-
turn the trip finger to its normal position;

Figure 7 is a view similar to Figure 8 showing
the position of the resetting mechanism imme-
diately following the movement of the trip finger
of the stop mechanism to its normal position;

Figure 8 is a fragmentary view of a portion of
the leader on the end of the wire or other thread-
like medium which is being handled by the wind-
ing and reeling mechanism;

Figure 9 is a schematic wiring diagram of the
stop mechanism switch in the energizing circuit
of the motor which drives the winding and reeling
mechanism.

Referring first to Figure 1 of the drawings there
is illustrated therein the top panel 11 of a re-
cording and reproducing device 10 upon which
the winding and reeling mechanism is mounted.
The takeoff spool 12, upon which the wire 13
is normally stored, is mounted for rotation with
the hub 14 carried by the shaft 15. On the op-
posite side of the device 10 is located a relatively
large takeup spool 16 which is mounted for rota-
tion on the shaft 17. The particular means for
rotating the shafts 15 and 17 forms no part of
the present invention, and for that reason has
not been illustrated. It will simply be necessary
to understand that when the wire 13 is being
transferred from the spool 12 to the spool 16,
the shaft 17 is driven in a clockwise direction
and some suitable drag is placed on the shaft
15 so as to maintain a certain amount of tension
in the wire 13 at all times. It will also be under-
stood that when the wire 13 is to be returned
from the takeup spool 16 to the storage spool 12
the shaft 15 is driven in a counterclockwise direc-
tion and a suitable drag is placed upon the shaft
17 to maintain tension in the wire 13.

The wire 13, in passing from the spool 12 to
the spool 16, passes through the stop mecha-
nism 18 and then through a recorder head 19. The problem which is here solved involves the automatic stopping of the drive mechanism for the shaft 16 and 17 when the end of the wire 13 passes through the stop mechanism 18, irrespective of which direction the wire is traveling.

Referring now particularly to Figures 2 and 3 of the drawings, the stop mechanism 18 is illustrated in detail therein. This stop mechanism 18 includes a relatively thick base plate 20 which has a large V-shaped recess 21 therein in which a pair of trip fingers 22 are mounted for angular movement about a pin 23 which is journaled in the base 20 at 24, as well as in a cover plate 25, as at 26.

The base member 20 is also recessed as at 27 for mounting of the switch mechanism 28, presently to be described. The base 20 is still further recessed as at 28 to receive a small helical spring 29 and a portion of the recessed arm 30.

The base 20 may conveniently be in the form of a casting, and in addition to the recesses just described, preferably includes a plurality of channels 31, 32, 33 and 34 which are parallel disposed and extend from one side of the base 20 to the other substantially at right angles to the trip fingers 22 when they are disposed in a central position in the V-shaped recess 21. The cover plate 25 is provided with a similar set of grooves 35, 36, 37 and 38, which are disposed directly opposite grooves 31, 32, 33 and 34 respectively. The grooves 31 to 38 are for the purpose of confining the leader 39 within the upper portion of the stop mechanism as it passes between the fingers 22. This leader 39 (see Figure 8) is in the form of an elongated strip having a plurality of notches 40 cut therein along the two longitudinal edges thereof, and is provided with a tapered end 41 adjacent the end of the wire. The end of the wire 13 is bent through first hole 42 and then back through another hole 43 in this tapered end portion 41 of the leader 39.

The end of the wire 13 may be conveniently held in place by a piece of tape 44 having a pressure-sensitive adhesive thereon. The leader 39 is slightly wider than the spacing between the two outer walls of the spool 12 or the spool 16 and it will therefore be understood that the tongues 45 formed by the notches 40 make a resilient frictional engagement with the side walls to hold the leader securely in place. It has been found that no other securing means is required.

This particular method and means of securing the end of a wire to a spool is described and claimed in my copending application entitled "Leader for Magnetic Recorder Medium, and Method of Making Same," U. S. Serial No. 638,497, filed December 29, 1945, and assigned to the same assignee as the present invention.

It is to be understood that a leader such as the leader 39 is secured to the inner end of the wire 13 as well as the outer end of the wire 13. It will thus be apparent that when the end of the wire 13 is reached in the winding and reeling operation one of these leaders will pass between the pair of fingers 22, irrespective of which direction the wire is traveling (since there is a leader at both ends).

The grooves 33 and 37 are arranged to normally confine the leader as it passes through the automatic stop mechanism 18. The additional grooves are provided in case different size spools are used for the takeoff spool 12 and as additional safety means in case the leader should slip out of the normal pair of guide grooves.

As will now be described, the pair of fingers 22 of the leader 39 between the pair of fingers 22 causes a rocking movement of these fingers about their pivot points 34 and 38 and this rocking movement is utilized to cause deenergization of the motor or other driving means which operates the winding and reeling mechanism.

As is diagrammatically illustrated in Figure 9 of the drawings, the energizing circuit of the winding and reeling motor 50 includes a pair of power supply conductors 67 and 68. The power supply conductor 67 is connected to a field winding 56 of the motor 50 and the power supply conductor 68 is connected through a pair of leaf-spring contact arms 60 and 61 to the other field winding 52 of the motor 48. The leaf-spring contact arms 60 and 61 include contact buttons 33 and 36. Merely by way of diagrammatic illustration, other control mechanism, such, for example, as a solenoid operated brake, might also be controlled through this same energization circuit. Such a solenoid operated brake is diagrammatically illustrated by the coil 55 which is connected in shunt across the motor 46.

The field coils 56 and 52 of the motor 46 are shown as being connected in series with the armature 50. It is to be clearly understood that the electrical control circuit per se forms no part of the present invention, for the invention is confined to the automatic stop mechanism, which includes means for opening or otherwise changing the condition of energization of any control circuit through the opening and closing of the contacts 53 and 56.

The contact arms 60 and 61 of the switch 28 are mounted on insulating blocks 57 and 59 within the recess 27 of the base 20. It will be noted that the leaf-spring contact arm 54 has a curled end 55 which extends around in substantially a closed circle. The top of this curled portion 58 has a depressed portion 60 therein which normally extends into engagement with a small depending pin 61 of insulating material rigidly secured to the shaft 22. The leaf-spring arm 54 normally tries to lift up away from the lower arm 56, and for that reason it will be apparent that the depressed portion 60 on the arm 54, with the pin 61 on the shaft 22, normally holds the trip fingers 22 in their central position as shown in Figure 2 of the drawings.

As the wire 13 moves from left to right, as viewed in Figure 2 of the drawings, it finally reaches the position where the leader 39 strikes the trip fingers 22. Since the tongues 40 on the leader 39 are farther apart than the spacing between the trip fingers 22, the trip fingers 22 will be grasped by the projections 45 (see Figure 8) and the fingers will be rocked to the side of the recess 21 and against the action of the resilient biasing force produced by the arm 51. This is shown in Figure 4 of the drawings by the full line position of the trip fingers 22. In moving to the position shown as by the full line in Figure 4, it will be observed that the contact arm 51 is released upwardly, thus separating the contacts 53 and 56. This, in turn, opens the energizing circuit to the motor driving the winding and reeling mechanism and automatically stops the operation thereof.

Usually enough momentum is involved in the drive mechanism of the winding and reeling device so that the leader be carried by the rotation of take-up spool 16 beyond the mechanism 18 and will be wrapped about the take-up spool 16.
However, it may be desirable to stop the mechanism before the leader comes off the winding spool. This may be accomplished by making the leader sufficiently longer, or by employing a cast iron brake which may be operated by suitable control mechanism such as mechanism 55 in Figure 9.

The reset mechanism includes the reset arm 30 which is slidable mounted in the recess 28 of the base 20. This reset arm 30 includes a finger 62 which extends up into a position just short of the shaft 23 upon which the trip fingers 22 are mounted. The trip finger is confined to limited movement toward and away from the shaft 23 by a guide pin 63 which extends through a slot 64 in the finger 62, as well as by the walls of the recess 28. The finger 62 of the recessed arm 30 is normally biased to its lower position by the coil spring 29. The upper end of the finger 62 has a curved or V-shaped cut out portion 65 therein which is located under a small protuberance 66 on the shaft 23. In the normal position of operation of the device (as shown in Figure 1) the lower position of the arm shaft is projected by the spring 29 and the curved cut out tip 65 is spaced from the protuberance 66. After the leader 39 has tripped the fingers 22 and moved them to one side of the V-shaped recess 21 the protuberance 66 is still within the confines of the notched out tip 65 but over to one side thereof. If the recessed arm 30 is now pushed upwardly against the action of the spring 29, the curved tip 65 of the finger 62 engages the protuberance 66 and causes the same to ride down to the bottom of the groove (as may be seen in Figures 6 and 7, the latter being the position of the protuberance 66 after the recessed arm 30 has been moved up as far as it will go).

After the protuberance 66 has been advanced to the position as shown in Figure 7, the depending pin 61 on the tripped finger shaft 23 has again become engaged in the depressed portion 33 of the spring arm 31. The recessed arm may now be released and the trip fingers 22 will again be held in their normal central position as shown in Figure 2 of the drawings.

If the wire 18 is now to be rewound onto the spool 12 the leader is wrapped around the drum (the reversing drum) and the wire 18 is positioned in the head 10 and through the automatic stop mechanism 10. The shaft 10 is then rotated in a counter-clockwise direction to wind the wire 18 onto the spool 12. After the wire 18 has been wound onto the spool 12 the leader, which was originally wrapped around the drum of the spool 12, will pass between the trip fingers 22 and move into the position as shown by the dotted lines in Figure 4. This likewise releases the spring arm 61 and causes separation of the contacts 35 and 36 to open the energization circuit of the winding and reeling motor 35.

While the level-wind mechanism does not form a part of the present invention, it will be noted that the spacing of the trip fingers 22 is such as to in nowise interfere with any sort of a level winding operation. One particular manner in which the wire 18 may be level-wound is to cause movement of the head 18 toward and away from the panel 61.

From the above description, it will be apparent that I have described a particularly efficient and economical automatic stop mechanism for winding and reeling mechanisms handling wire or other thread-like media. It will, of course, be equally well understood that such trip mechanism may be used for winding and reeling tape or other elongated media by providing a leader, such as the leader 39, for effecting the tripping operation of the trip fingers 22. In this connection it is to be observed that the wire itself does not directly operate the automatic stop mechanism, but rather the leader secured to the end of the wire does, and hence the specific nature of the elongated medium which is to be handled by the winding and reeling mechanism may vary within wide limits without departing from the spirit and scope of the present invention. It will furthermore be observed that the medium may indeed be in the form of an elongated strip of material, such as the leader 39, provided that the edge of the elongated material is so dimensioned or arranged that when the end thereof passes between the trip fingers 22 it will rock the same to either of their two extreme positions.

While I have shown a particular embodiment of my invention, and have described a particular method of operation, it will, of course, be understood that I do not wish to be limited thereto, since many modifications may be made in the device, and therefore, contemplate by the appended claims, to cover such modifications as fall within the true spirit and scope of my invention.

I claim as my invention:

1. In winding and reeling apparatus for wire having a leader of resilient strip material secured to one end thereof, said strip having a plurality of projecting teeth along at least one of its longitudinal edges, automatic stop mechanism comprising a pair of spaced fingers through which the wire travels, said fingers being mounted for movement about an axis lying in a plane transverse to the path of travel of the wire between said fingers, the overall width of said leader, including said teeth, being slightly greater than the spacing between said fingers, means normally biasing said fingers to one position, whereby when said leader engages a finger as said leader tries to pass between said fingers, said fingers are rocked from said one position to a second position, and means responsive to rocking movement of said fingers for stopping said winding and reeling apparatus.

2. In winding and reeling apparatus for wire having a leader of resilient strip material substantially wider than the wire and secured to an end thereof, automatic stop mechanism comprising a pair of fingers spaced a distance greater than the thickness of the wire and between which the wire travels, the width of said leader being slightly greater than the spacing between said fingers, means engaging opposite sides of said leader and guiding said leader to said fingers, said fingers being mounted for movement about an axis lying in a plane transverse to the path of travel of the wire between said fingers, yieldable means normally biasing said fingers to a second position whereby when said leader is reached and tries to pass between said fingers said fingers are rocked from said one position to a second position, means responsive to said rocking movement of said fingers for stopping said winding and reeling apparatus, and means for resetting said fingers to said first position.

3. In winding and reeling apparatus for wire having a leader of strip material secured to each end thereof, automatic stop mechanism for stopping said winding and reeling mechanism when either end of said wire is reached during a winding or rewinding operation comprising a pair of spaced fingers through which the wire travels,
the width of each of said leaders being slightly
greater than the spacing between said fingers,
said fingers being mounted for movement about
an axis lying in a plane transverse to the path
of travel of the wire between said fingers, means
normally biasing said fingers to an intermediate
position whereby when one of said leaders strikes
said fingers, said fingers are rocked in one direc-
tion to a second position, and when said fingers
are engaged by said other leader, said fingers are
rocked in the other direction to a third position,
and means responsive to rocking movement to
either of said second or third positions for stop-
ping said winding and reeling apparatus.
6. In winding and reeling apparatus for an
elongated member having an end portion there-
of of strip material, automatic stop mechanism
comprising a pair of spaced plate portions hav-
ing a confronting series of grooves therein dis-
posed parallel to the path of travel of said elon-
gated member to define a plurality of tracks to
receive said end portion of said member, a pair of
trip fingers mounted between said plate por-
tions, one finger being in close proximity to one
plate portion and the other finger being in close
proximity to the other plate portion and being
spaced apart a distance slightly less than the
overall width of said end portion of said elon-
gated member, said fingers being normally biased
to one position and then movable to a second posi-
tion to stop said winding and reeling apparatus
when said end portion of strip material of said
elongated member strikes said fingers.
7. In winding and reeling apparatus for an
elongated member having an end portion there-
of of strip material, automatic stop mechanism
comprising a pair of spaced plate portions hav-
ing a confronting series of grooves therein dis-
posed parallel to the path of travel of said elon-
gated member to define a plurality of tracks to
receive said end portion of said member, a pair of
trip fingers mounted between said plate por-
tions, one finger being in close proximity to one
plate portion and the other finger being in close
proximity to the other plate portion and being
spaced apart a distance slightly less than the
overall width of said end portion of said elon-
gated member, said fingers being normally biased
to one position and then movable to a second posi-
tion to stop said winding and reeling apparatus
when said end portion of strip material of said
elongated member strikes said fingers, means normally biasing
said trip fingers to said first position where they are
disposed generally transverse to the path of
movement of said elongated member, and means
for restoring said trip fingers from said second
position to said first position.
8. In winding and reeling apparatus for an
elongated member having an end portion thereof
of strip material, automatic stop mechanism com-
prising a trip finger in close proximity to which
said elongated member travels, said trip finger
being pivotally mounted at a point spaced lateral-
ly from the normal path of travel of said elon-
gated member and said finger extending toward
and past said elongated member, said finger hav-
ing a depending tooth on the opposite side of its
pivot point from the portion extending toward
said elongated member, a leaf-spring movable
contact member disposed substantially at right
angles to said finger and below said depending
tooth, the end of said leaf-spring being curved
toward said tooth through approximately three-
quarters of a circle and lying immediately under
said depending tooth, said portion lying imme-
diately adjacent to said trip finger and having a
dent therein in which said depending tooth is
normally seated, a second leaf-spring contact
member below said first leaf-spring and in elec-
trical contact therewith when said depending
tooth is seated in said detent, and cooperating
means between said end portion of said elongated
member and said trip finger for angularly mov-
ing said trip finger to rock said depending tooth
out of said detent, whereby said first leaf-spring
contact member is free to separate from said sec-
ond leaf-spring contact member.
9. In a winding and reeling apparatus for wire
having a leader of resilient strip material secured
to an end thereof, said strip having a finger
cooperating means along at least one of its lon-
gitudinal edges, an automatic stop mechanism
comprising at least one elongated finger past
which the wire travels in close proximity, said
finger being mounted for movement about an
axis lying in a plane transverse to the path of
travel of the wire along said finger, the over-all
width of said leader as compared to the spacing
of said wire from said finger, including said finger
cooperating means being sufficiently great to en-
gage said finger, means for directing said leader
in a direction substantially normal to the finger,
means normally retaining said finger in one posi-
tion, whereby when said finger cooperating means
engage said finger as said leader tries to pass said
finger, said finger is moved from said one posi-
tion to a second position, and means responsive
to the movement of said finger for stopping said
winding and reeling apparatus.

MARVIN CAMRAS.

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