(12) UK Patent (19) GB (11) 2 208 030 (13) B

(54) Title of Invention

Automatic stopping device for a tape feeding apparatus

(51) INT CL[5]; **G11B 15/22**

(21) Application No
8801800.7

(22) Date of filing
27.01.1988

(30) Priority Data

(31) **62124346**

(32) **14.08.1987**

(33) **JP**

(43) Application published
15.02.1989

(45) Patent published
21.08.1991

(72) Inventor(s)
Tadao Arata

(73) Proprietor(s)
Tanashin Denki Co Ltd

(Incorporated in Japan)

2-19-3 Shinmachi
Setagaya-ku
Tokyo 154
Japan

(74) Agent and/or
Address for Service
Graham Watt & Company
Riverhead
Sevenoaks
Kent
TN13 2BN
United Kingdom

(52) Domestic classification
(Edition K)
G5R RNF

(56) Documents cited
None

(58) Field of search

As for published application
2208030 A *viz:*
UK CL **G5R**
INT CL **G11B**
updated as appropriate

FIG. 1

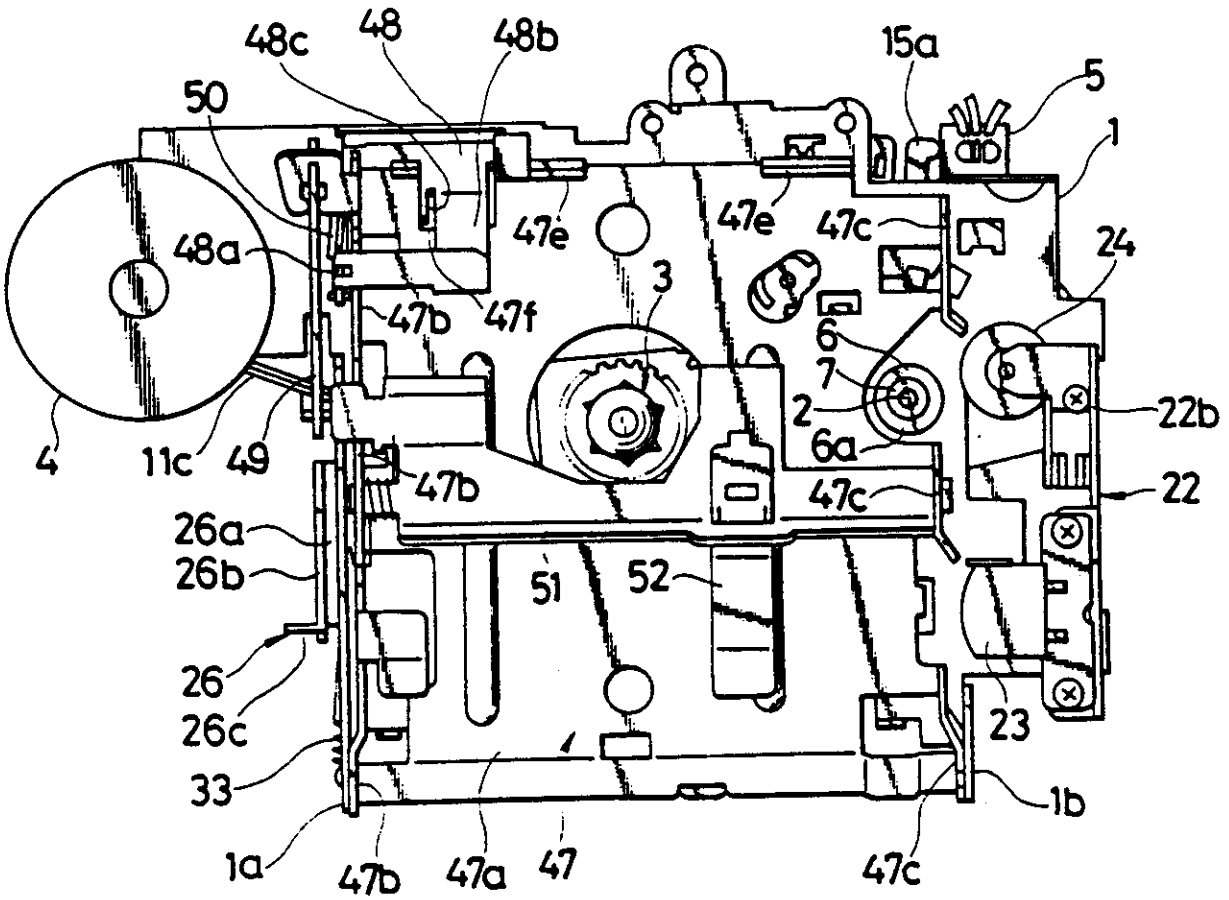

48c
48
48b
15a
5
50
1
47e
47e
47c
24
48a
3
47b
47f
6
7
2
22b
4
11c
49
6a
47b
47c
22
26a
26b
51
52
26
26c
23
33
1b
1a
47b
47a
47
47c

FIG. 2

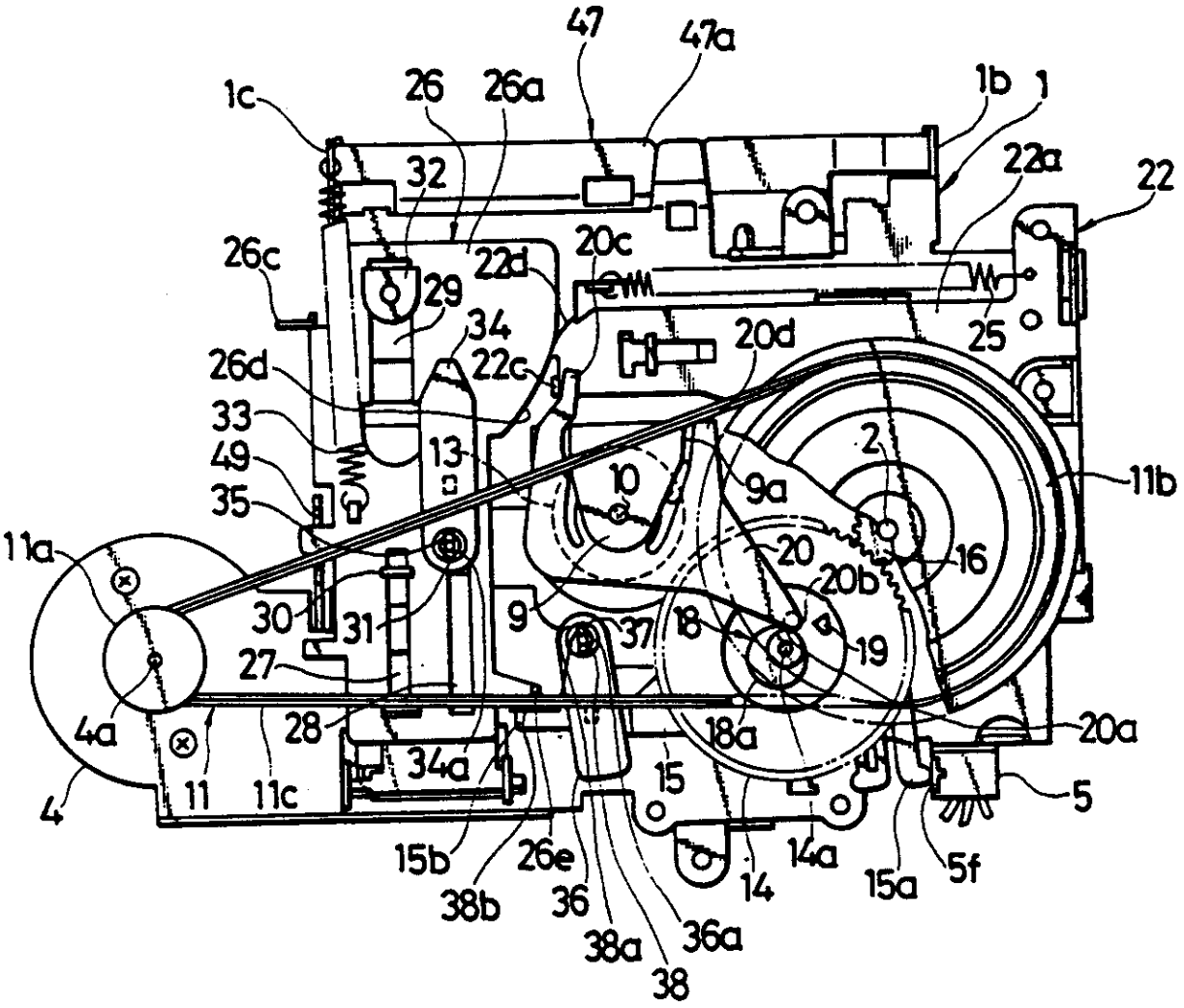

47
47a
1c
26
26a
1b
1
22a
22
32
26c
22d
20c
29
34
20d
25
26d
22c
33
13
2
49
10
9a
11b
35
11a
20
16
20b
30
31
9
37
18
19
27
4a
28
18a
20a
34a
15
5
4
11
11c
15b
26e
14a
15a
5f
38b
36
14
38a
36a
38

FIG. 3

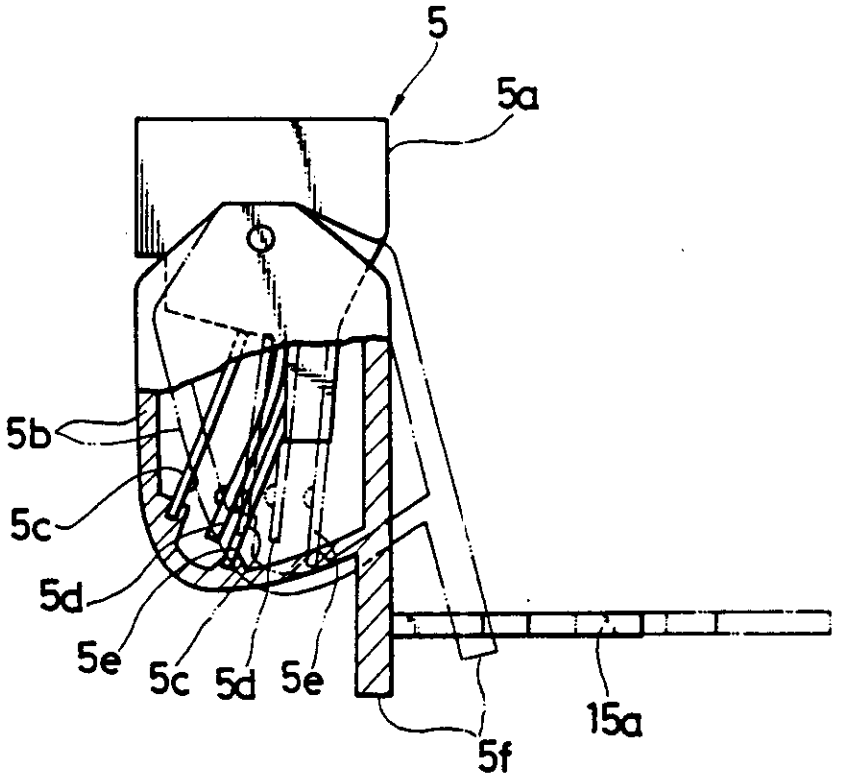


FIG. 4

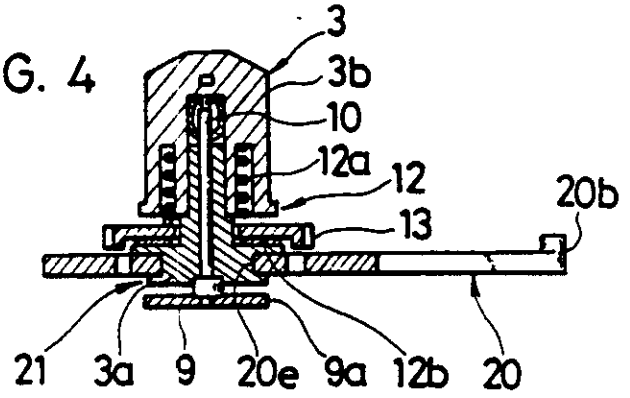


FIG. 5

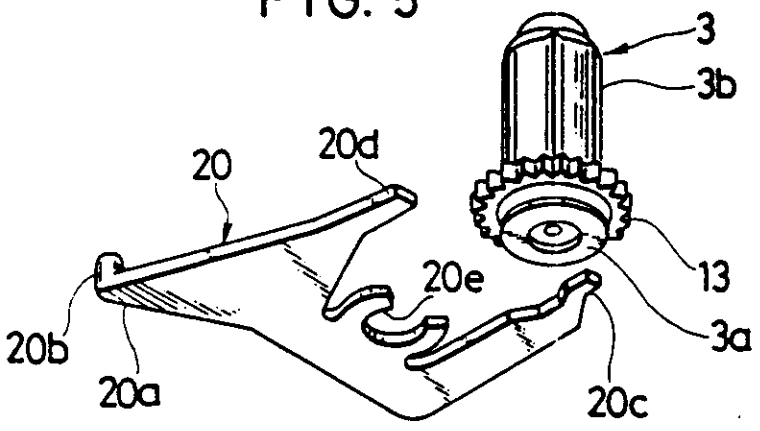


FIG. 6

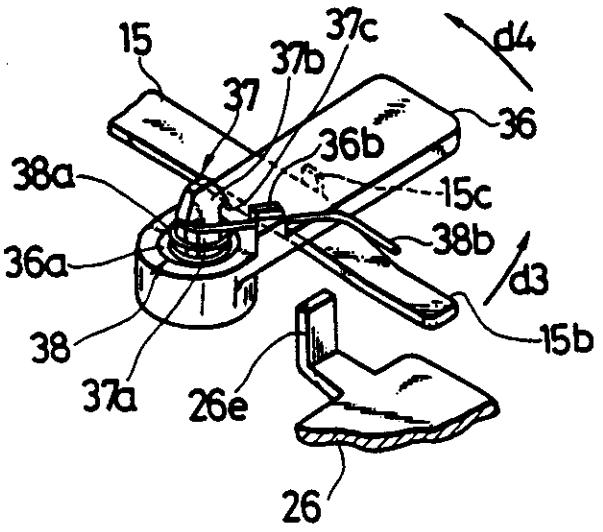

15
37c
37b
d4
37
36
36b
38a
15c
38b
36a
d3
15b
38
37a
26e
26

FIG. 17

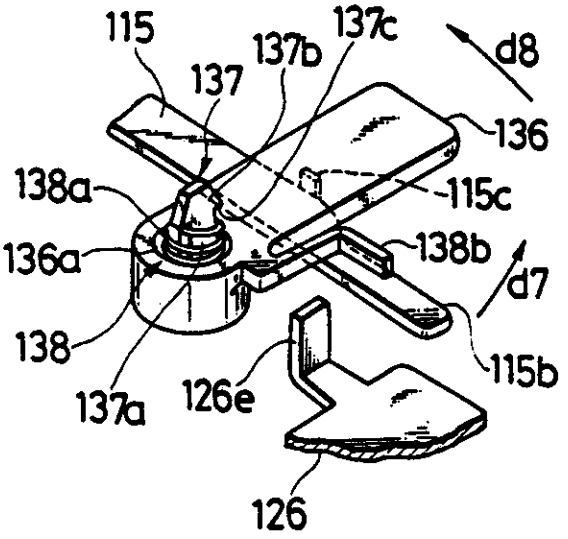

115
137c
137b
d8
137
136
138a
115c
138b
136a
d7
138
115b
137a
126e
126

FIG. 7

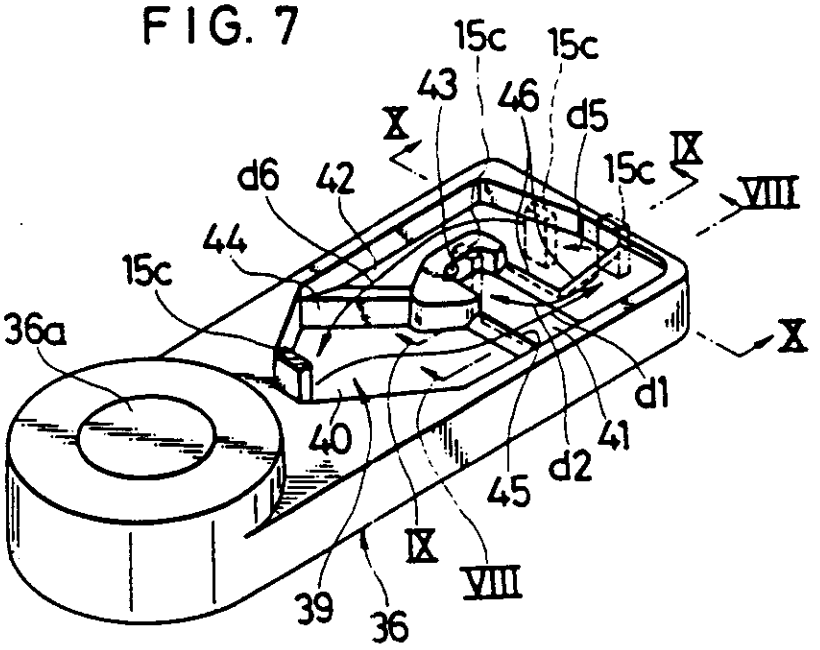


FIG. 8

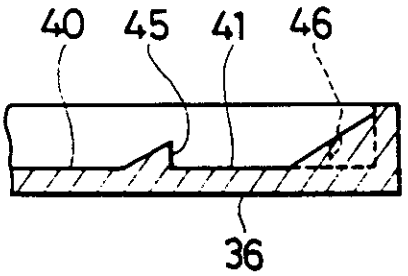


FIG. 9

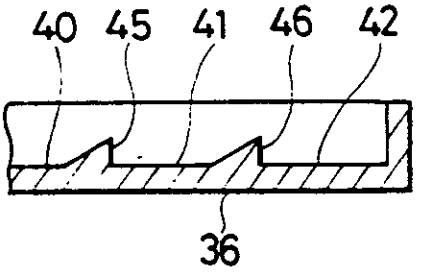


FIG. 10

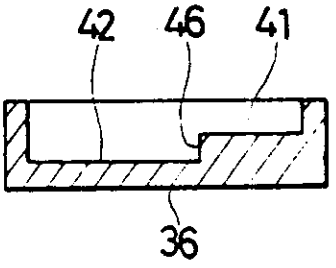


FIG. 11

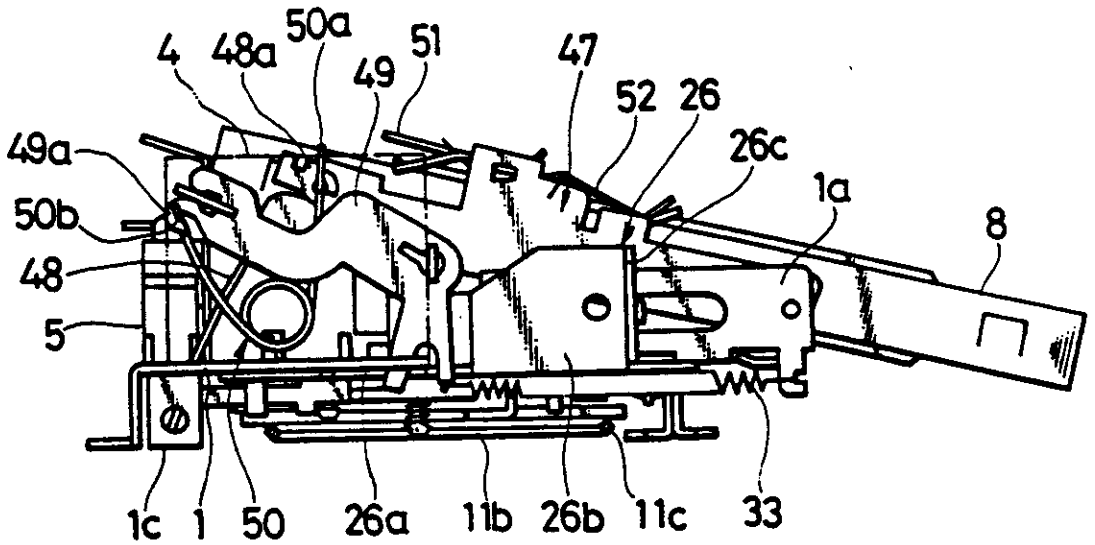

4
48a
50a
49
51
47
52
26
26c
1a
8
49a
50b
48
5
1c
1
50
26a
11b
26b
11c
33

FIG. 12

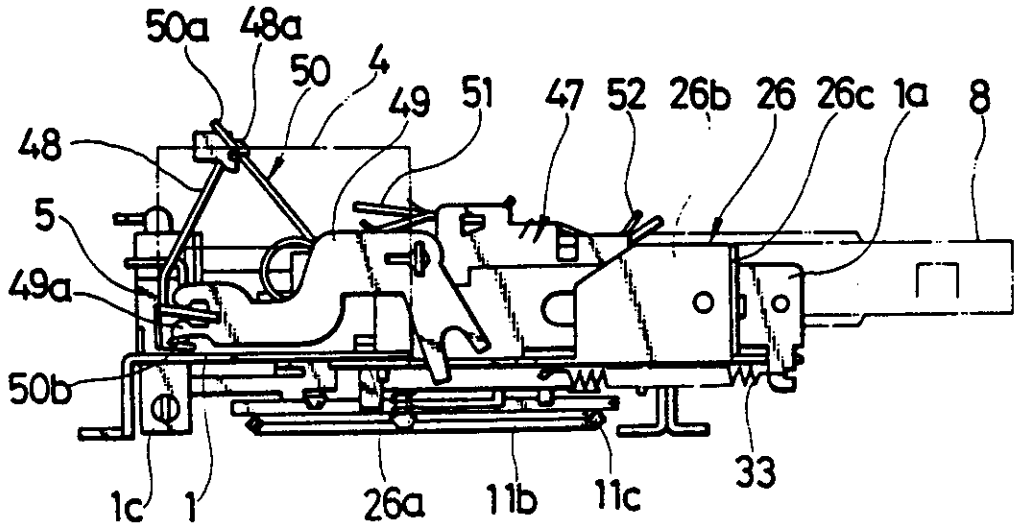

50a
48a
50
4
49
51
47
52
26b
26
26c
1a
8
48
5
49a
50b
1c
1
26a
11b
11c
33

FIG. 13

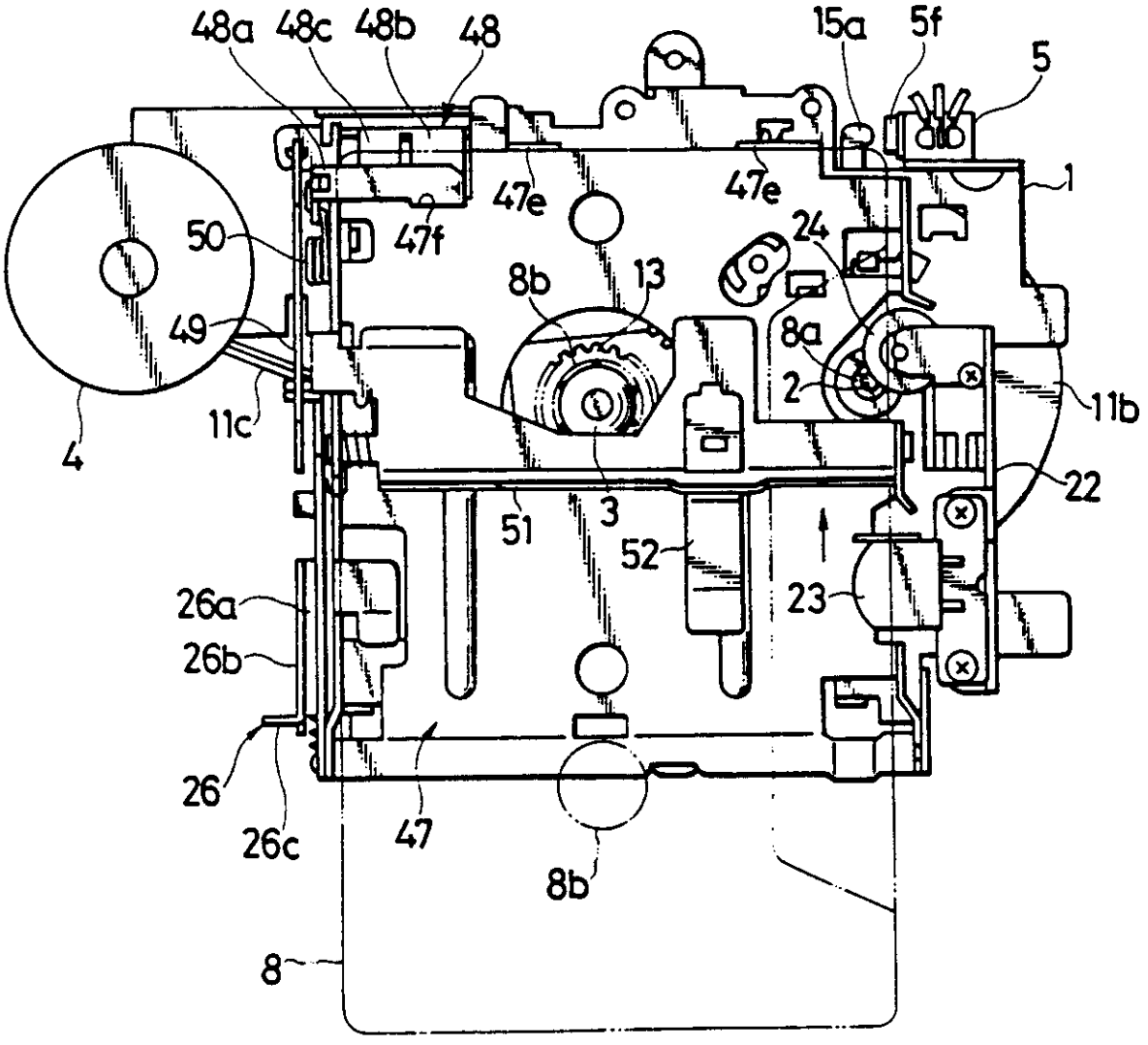

48a
48c
48b
48
15a
5f
5
1
47e
47e
47f
50
24
8b
13
49
8a
2
11b
4
11c
22
51
3
52
23
26a
26b
26
26c
47
8b
8

FIG. 14

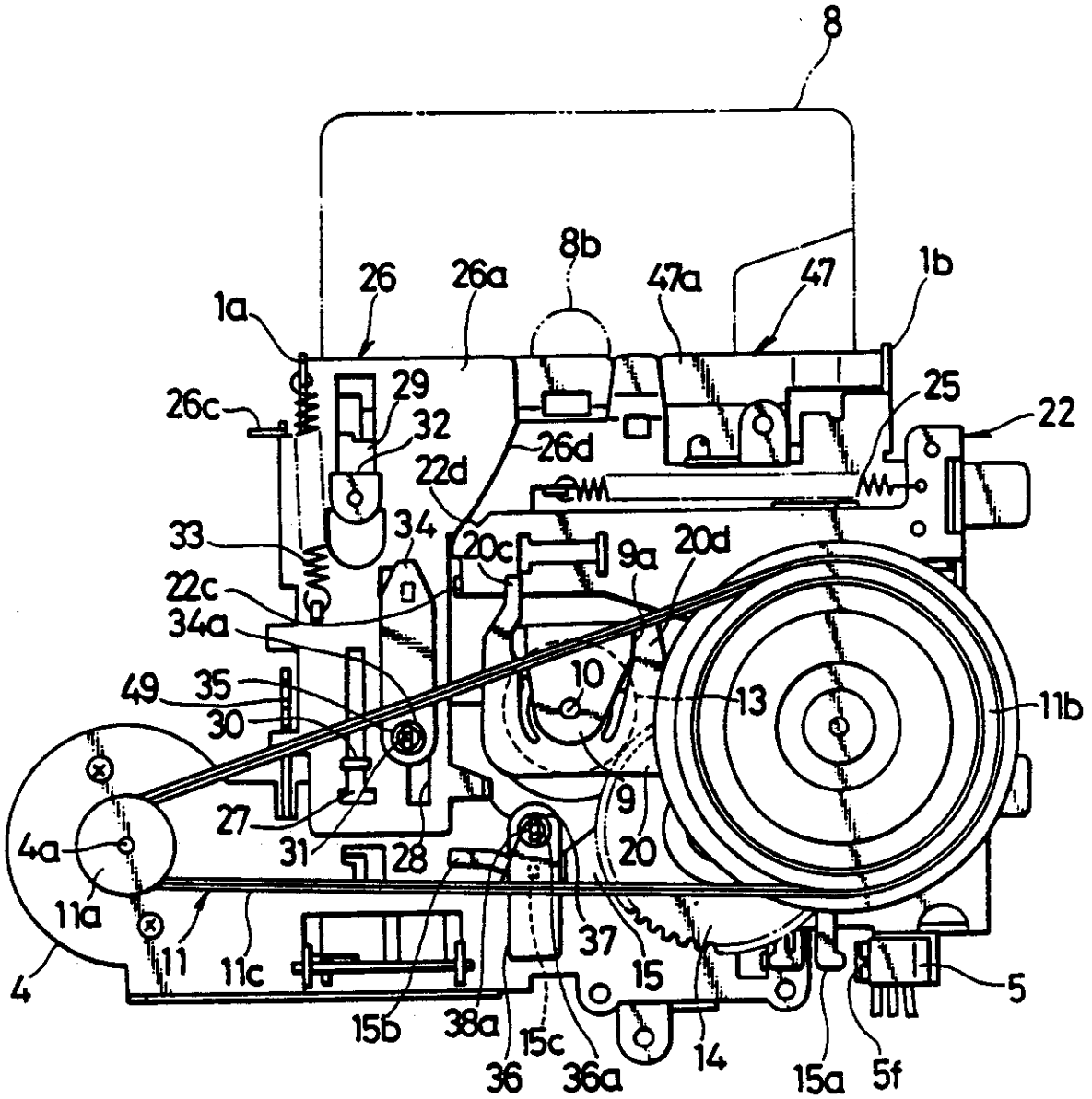

8
8b
26
26a
47a
47
1b
1a
25
22
26c
29
32
26d
22d
33
34
20c
9a
20d
22c
34a
49
35
10
13
11b
30
27
9
4a
31
28
20
11a
37
11
11c
15
5
4
15b
38a
15c
14
36
36a
15a
5f

FIG. 15

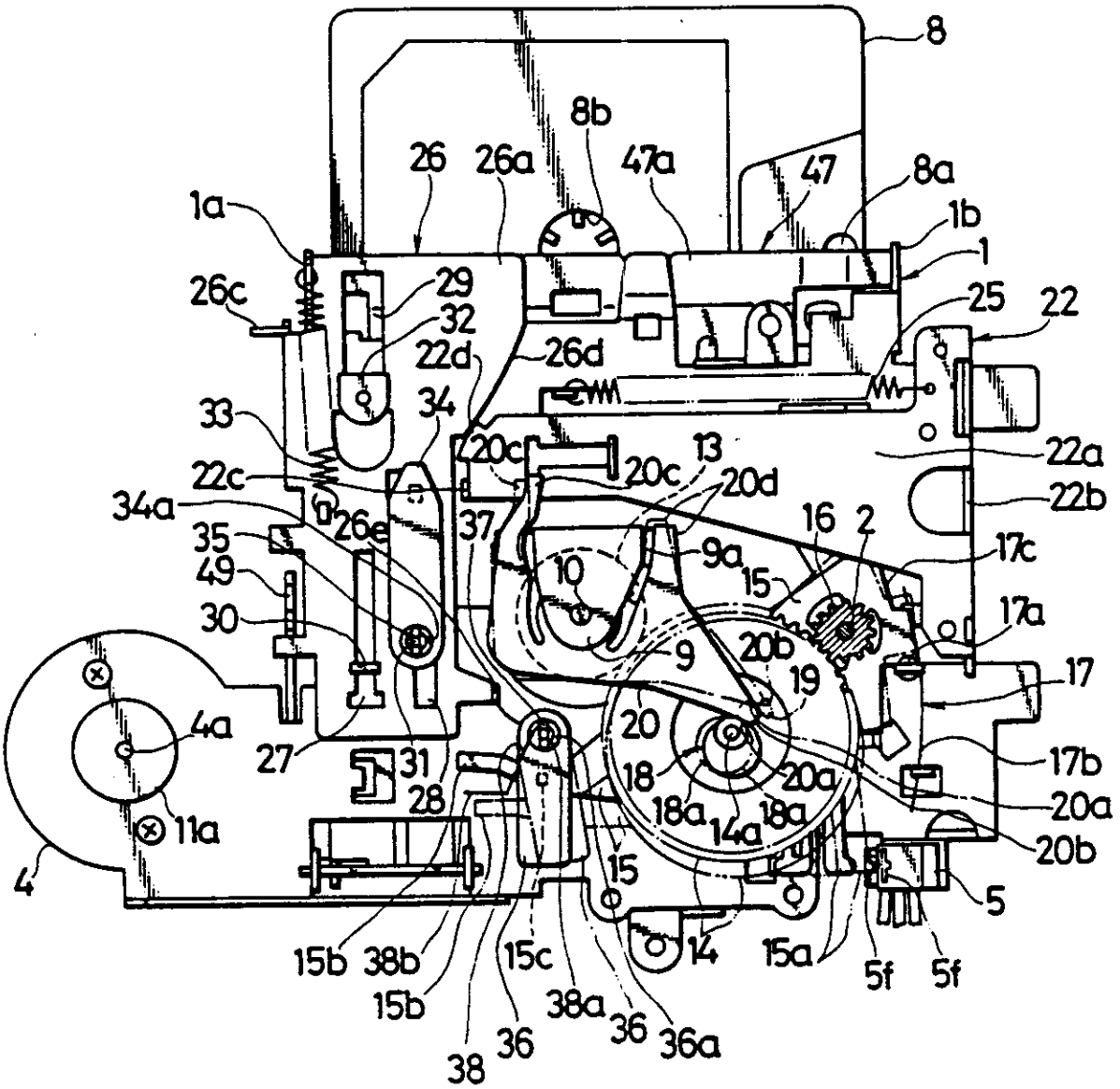

8
8b
26
26a
47a
47
8a
1a
1b
1
26c
29
32
25
22
22d
26d
34
33
20c
13
22a
22c
20c
20d
22b
34a
26e
37
16
2
35
9a
17c
49
10
15
30
17a
9
20b
19
17
4a
20
27
31
18
20a
17b
28
18a
14a
18a
20a
11a
20b
4
15
5
15b
38b
15c
14
15a
5f
5f
15b
38a
36
36a
38
36

FIG. 16

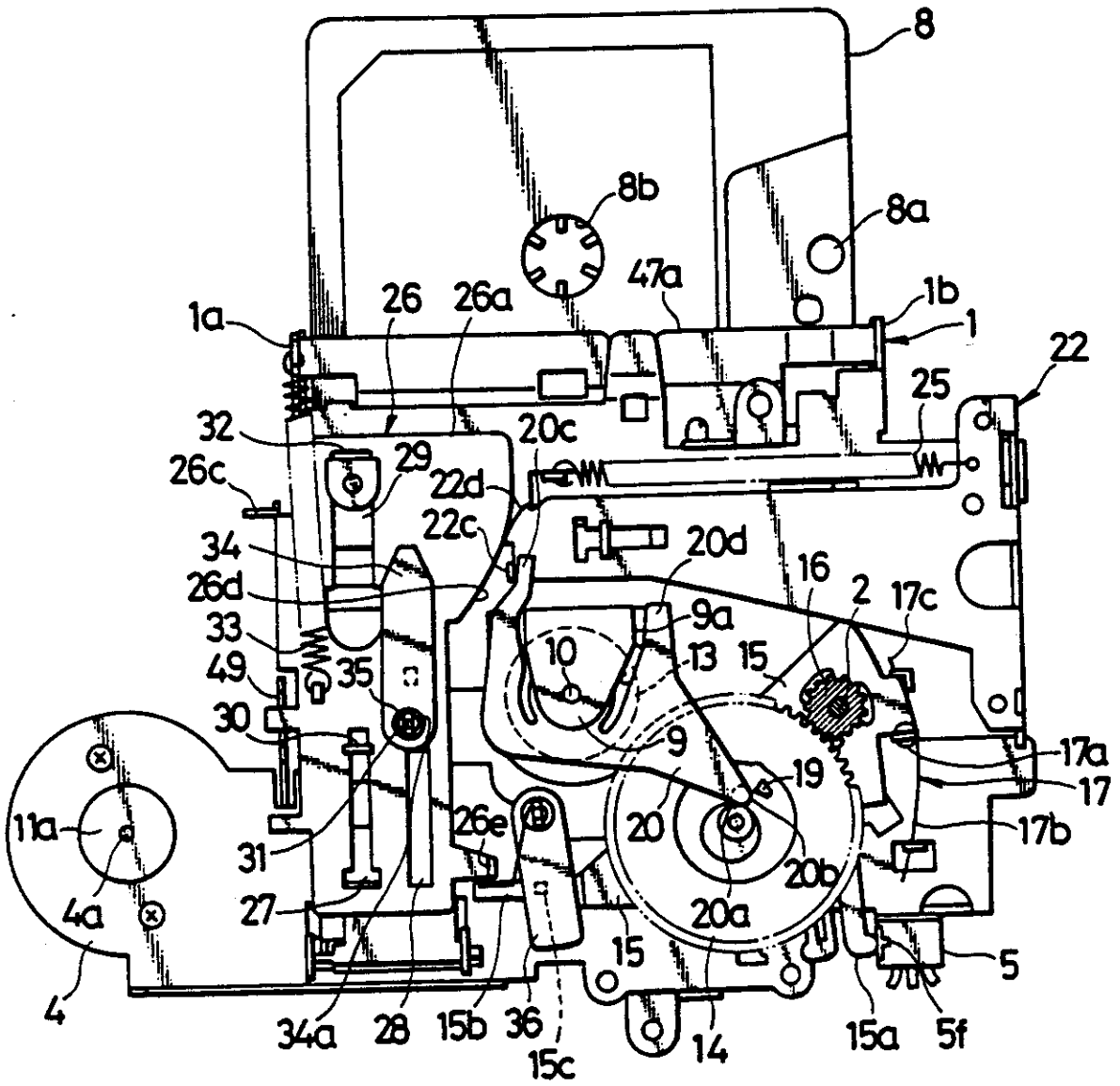

8
8b
8a
47a
1b
1
22
1a
26
26a
25
32
20c
29
22d
26c
22c
20d
34
16
26d
2
17c
9a
33
10
13
15
49
35
9
17a
30
19
17
11a
20
17b
26e
31
20b
4a
27
20a
15
5
4
34a
28
15b
36
15c
14
15a
5f

FIG. 18

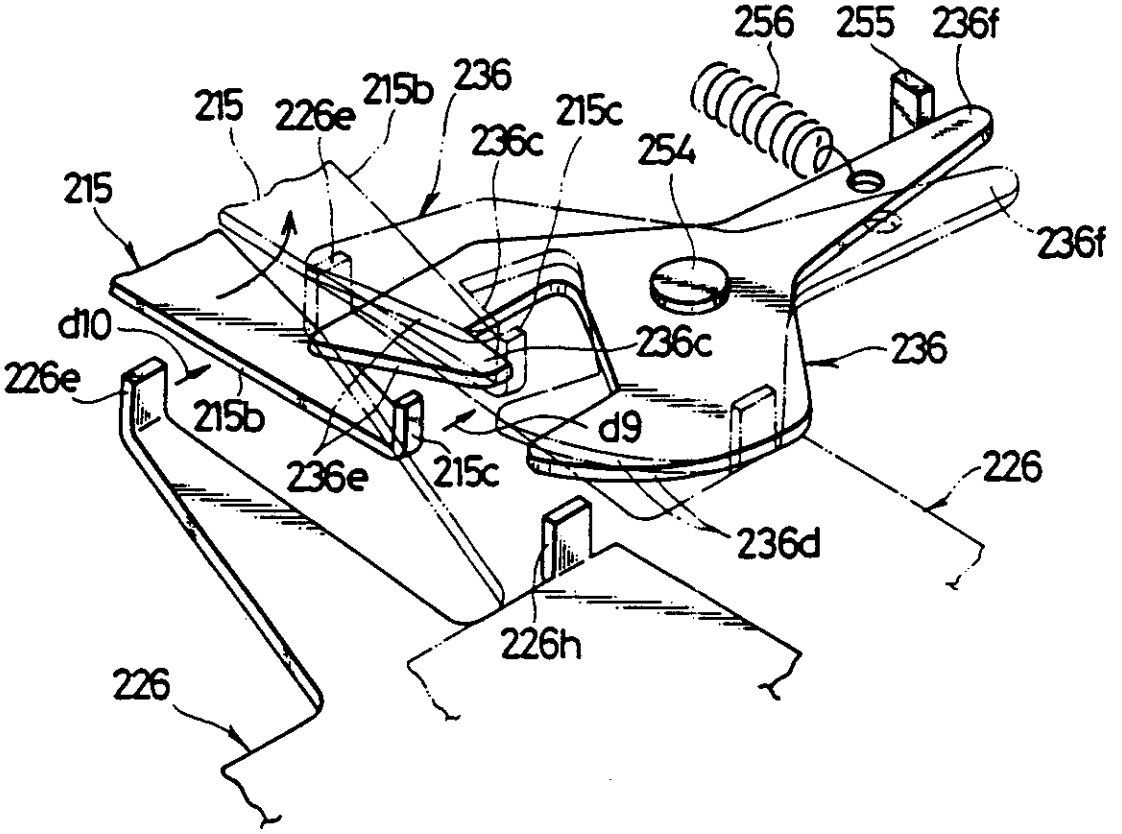
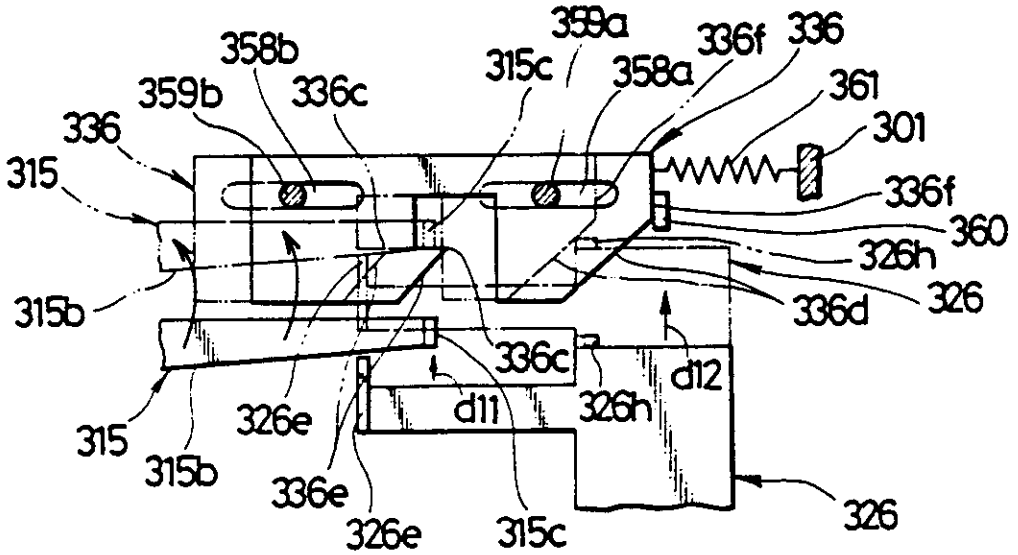

256
255
236f
215
226e
215b
236
215c
236c
254
215
236f
d10
236c
236
226e
215b
d9
236e
215c
226
236d
226h
226

FIG. 19


359a
358b
336f
336
315c
358a
359b
336c
361
336
301
315
336f
360
326h
315b
336d
326
336c
d12
315
326e
d11
326h
315b
336e
326
326e
315c

2208030

AUTOMATIC STOPPING DEVICE FOR A TAPE FEEDING APPARATUS

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to an automatic stopping device for a tape feeding apparatus for use with a tape recorder and the like, and more particularly to improvements in or relating to an automatic stopping device for a tape feeding apparatus which can stop feeding of a tape in response to an end of the tape whether the tape feeding apparatus is in a reproduction or recording mode or in a fast feeding mode.

2) Description of the Prior Art

Automatic stopping devices for a tape recorder are already known which operate to automatically stop feeding of a tape when the tape is wound to its final end and a reel shaft is compulsorily stopped by the tape.

In one of such conventional automatic stopping devices, a tape end detecting element is mounted, for example, for pivotal motion on a head mounting plate on which a magnetic head is mounted, and when the head mounting plate is advanced to cause a pinch roller to

contact with a capstan shaft and cause the magnetic head to contact with a magnetic tape, the tape is pushed in deeply by the tape end detecting element in order to effect a reproducing operation of the tape while the tape is compulsorily fed along a bent or curved path at a constant speed by rotation of the capstan shaft.

Thus, when the tape is wound to its last end, the tensile force of the tape between the capstan shaft and the supply side reel shaft increases suddenly because the tape is held between the capstan shaft and the pinch roller and the last end of the tape is fastened to a supply side reel. Consequently, the detecting element is pushed back by the tape, and in response to such movement of the detecting element, a motor switch is turned off to stop rotation of a tape feeding motor.

However, the automatic stopping device of the type mentioned has a drawback that, because the tape end detecting element is mounted on the head mounting plate, when the head mounting plate is not at its fully advanced position as in the fast feeding mode of the tape feeding apparatus, the tape is not pushed in to its fully pushed-in position and consequently an automatic stopping action will not occur even if the tape is wound to its last end.

An automatic stopping device of another type is

already known wherein a tape end detecting element is mounted not on a head mounting plate but on a chassis in order that a tape may be positioned at a fully pushed-in position by the tape end detecting element irrespective of a position of the head mounting plate.

With such a construction described just above, even when the tape feeding apparatus is in the fast feeding mode, the tape is held at its fully pushed-in position by the tape end detecting element. Accordingly, when the tape is wound to its last end in the fast feeding mode of the tape feeding apparatus, the tensile force of the tape between the take-up side reel shaft and the supply side reel shaft increases suddenly so that the detecting element is pushed back by the tape. Such movement of the detecting element is used to turn a motor switch off to stop rotation of a tape feeding motor.

However, the torque of the take-up side reel shaft to wind the tape is considerably low. Accordingly, the tensile force of the tape when the tape is wound to its last end in the fast feeding mode of the tape feeding apparatus is much lower than that when the tape is wound to its last end in the reproduction mode of the tape feeding apparatus so that, even when the tape is wound to its last end in the fast feeding mode

of the tape feeding apparatus, the tape cannot push back the tape end detecting element with a sufficiently strong force to assure operation of the tape end detecting element. Accordingly, the automatic stopping device of the second type has a drawback that the tape feeding motor cannot be stopped with certainty when the tape is wound to its last end while the tape feeding apparatus is in the fast feeding mode.

It is to be noted that the reason why the tensile force of the tape when the tape is wound to its last end in the fast feeding mode of the tape feeding apparatus cannot be set to a similar level to the tensile force of the tape when the tape is wound to its last end in the reproduction mode is that, in order to apply a suitable tensile force to a portion of the tape between the capstan shaft and the take-up side reel shaft to allow the tape to be wound on a reel with a suitable degree of rigidity, commonly a turning force of the tape feeding motor is transmitted not positively but by way of an interposed slip mechanism to the take-up side reel shaft which is rotated to wind the tape at a speed a little higher than the speed of the tape being fed by the capstan shaft so that an excessive tape feeding speed of the take-up side reel shaft may be absorbed by the slip mechanism when the tape feeding apparatus is in the

reproduction mode. However, if the torque to be transmitted to the take-up side reel shaft by way of the slip mechanism is set to a very high level, an excessive tensile force will be applied to the tape between the capstan shaft and the take-up side reel shaft in the reproduction mode of the tape feeding apparatus, resulting in promotion of damage to the tape.

By the way, the conventional tape recorders of both the two types further have following drawbacks.

In particular, as described above, the tape end detecting element is pushed back by a tensile force of a portion of the tape between the supply side reel shaft and the capstan shaft when the tape is wound to its last end in the reproduction mode of the tape feeding apparatus. Accordingly, if the tape is not held firmly between the capstan shaft and the pinch roller, or in other words, if the pressing force of the pinch roller against the capstan shaft is not sufficiently high, a sufficiently high tensile force cannot be provided to the tape. However, since the pinch roller is contacted with the capstan shaft as the head mounting plate is advanced, if the pressing force of the pinch roller against the capstan shaft is increased, a corresponding high operating force will be required to advance the head mounting plate. Thus, the operability of the tape

feeding apparatus is deteriorated particularly for a reproducing operation. Besides, if the pressing force is increased, the force which acts transversely on the capstan shaft will increase accordingly, and consequently the capstan shaft must be supported by a bearing having an increased strength.

Further, if lubricant for a bearing for the capstan shaft should enter between the capstan shaft and the pinch roller, a slip will readily appear between them, and accordingly there is the possibility that a insufficient tensile force of the tape may not be provided.

In addition, the automatic stopping devices of the two types have a drawback that, since the tape end detecting element is pressed against the magnetic tape, damage to the tape will be accelerated. Further, if the contacting pressure between the tape end detecting element and the magnetic tape does not act uniformly over the overall width of the tape, the tape may be displaced in a widthwise direction to the higher contacting pressure side, which will cause crosstalk or separation.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present

invention to provide an automatic stopping device for a tape feeding apparatus which can automatically stop feeding of a tape by the tape feeding apparatus when the tape is wound to its last end whether the tape feeding apparatus is in the reproduction mode or in the fast feeding mode and which can prevent occurrence of crosstalk and separation as well as deterioration of the operability for a reproducing operation of the tape feeding apparatus.

With the automatic stopping device for a tape feeding apparatus, several effects can be anticipated. In particular, whether the tape feeding apparatus is in a reproduction mode or in a fast feeding mode, when a tape is wound to its last end, feeding of the tape is automatically stopped with certainty. Further, occurrence of crosstalk or separation can be prevented. Besides, deterioration of the operability for a reproducing operation can be prevented.

A specific embodiment of the present invention will now be described in detail by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a mechanism of a cassette tape recorder in which an automatic stopping

device for a tape feeding apparatus according to the present invention is incorporated;

FIG. 2 is a bottom plan view of the cassette tape recorder mechanism of FIG. 1;

FIG. 3 is an enlarged view, partly broken, of a switch of the cassette tape recorder mechanism of FIG. 1;

FIG. 4 is a cross sectional view of a reel shaft of the cassette tape recorder mechanism of FIG. 1;

FIG. 5 is a fragmentary perspective view of the reel shaft of FIG. 4;

FIG. 6 is a perspective view showing relative positions of a pivotal member, a stopping operating member and an arresting member of the cassette tape recorder mechanism of FIG. 1;

FIG. 7 is a perspective view of the arresting member of FIG. 6;

FIG. 8 is a cross sectional view taken along line VIII-VIII of FIG. 7;

FIG. 9 is a cross sectional view taken along line IX-IX of FIG. 7;

FIG. 10 is a cross sectional view taken along line X-X of FIG. 7;

FIG. 11 is a side elevational view showing a tape cassette mounted in position on a cassette holder in a

reset position;

FIG. 12 is a left-hand side elevational view of the cassette tape recorder mechanism of FIG. 1 in a reproducing mode;

FIG. 13 is a top plan view of the cassette tape recorder mechanism of FIG. 1 in the reproducing mode;

FIG. 14 is a bottom plan view of the cassette tape recorder mechanism of FIG. 1 in the reproducing mode;

FIG. 15 is a bottom plan view, partly broken, of the cassette tape recorder mechanism of FIG. 1 when feeding of a tape is to be automatically stopped;

FIG. 16 is a bottom plan view, partly broken, of the cassette tape recorder mechanism of FIG. 1 when a tape cassette is ejected;

FIG. 17, which is shown in the same drawing sheet as FIG. 6, is a perspective view showing a modified form of arresting member;

FIG. 18 is a perspective view showing another modified form of arresting member; and

FIG. 19 is a plan view showing a further modified form of arresting member.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring first to FIGS. 1 and 2, there is shown a mechanism of a cassette tape recorder in which an

automatic stopping device for a tape feeding apparatus is incorporated. The cassette tape recorder mechanism shown includes a capstan shaft 2, a reel shaft 3, a motor 4 for driving the capstan shaft 2 and the reel shaft 3 to rotate, and a switch 5 for interrupting energization of the motor 4, all located on a chassis 1.

The capstan shaft 2 is fitted from the lower face side of the chassis 1 into and supported for relative rotation on a hub member 6 secured to a predetermined location of the chassis 1 and extends upwardly above an upper face of the chassis 1. A snap ring 7 such as an E-snap ring is snapped into an annular groove not shown formed around an outer periphery of the capstan shaft 2 and is located for engagement with an upper end face of the hub member 6 to prevent the capstan shaft 2 from being inadvertently pulled downwardly off the hub member 6.

The hub member 6 has a guide portion 6a of a truncated right circular conical shape adjacent an upper end thereof. Thus, when a tape cassette 8 is moved to a loaded position as seen in FIG. 13, the guide portion 6a of the hub member 6 is fitted into one of a pair of capstan shaft fitting holes 8a (only one is shown in FIG. 13) formed in the tape cassette 8, and thereupon it provides an automatic aligning action to the tape

cassette 8. Consequently, a guide pin which is conventionally provided specially for providing an automatic aligning action can be eliminated.

Referring now to FIGS. 4 and 5, the reel shaft 3 includes a first member 3a supported for rotation on a support shaft 10 secured to and extending upwardly from a support plate 9 formed by slitting of the chassis 1, and a second member 3b fitted for integral rotation on an outer periphery of the first member 3a.

Referring back to FIGS. 1 and 2, the motor 4 is electrically connected to a suitable power source not shown via the switch 5. Turning power of the motor 4 is transmitted to the capstan shaft 2 by way of a power transmitting mechanism 11.

The power transmitting mechanism 11 includes a first pulley 11a securely mounted on an output power shaft 4a of the motor 4, a second pulley 11b of a greater diameter securely mounted at a lower end of the capstan shaft 2, and an endless belt 11c made of a rubber material or the like and extending between and around the first and second pulleys 11a, 11b.

Referring to FIG. 3, the switch 5 is of the normally closed type and includes a base member 5a and a cover member 5b supported at an upper end portion thereof for pivotal motion on the base member 5a.

First, second and third contact springs 5c, 5d and 5e are secured at upper ends thereof to the base member 5a of the switch 5 such that they may be brought into or out of contact with each other. The first to third contact springs 5c to 5e are located inside the cover member 5b. The first contact spring 5c is located in an opposing relationship to the third contact spring 5e with the second contact spring 5d interposed therebetween, and lower ends of the oppositely located first and third contact springs 5c and 5e are secured to respective predetermined locations of an inner face of the cover member 5b. A tongue 5f is formed at and extends downwardly from a lower end of a side of the cover member 5b. The cover member 5b of the switch 5 is normally biased in a counterclockwise direction in FIG. 3 by spring forces of the first and third contact springs 5c and 5e so that the switch 5 is biased to and normally assumes a position as shown in phantom in FIG. 3 in which the first and second contact springs 5c and 5d contact with each other while the third contact spring 5e is spaced away from the second contact spring 5d, that is, an on position or motor energizing position thereof in which the motor 4 is allowed to continue energization thereof. To the contrary, if the cover member 5b is pivoted in a clockwise direction in FIG. 3

against the spring forces of the first and third contact springs 5c and 5e from the motor energizing position of the switch 5, the switch 5 is brought into another position in which the first and second contact springs 5c and 5d are spaced away from each other while the second and third contact springs 5d and 5e contact with each other as shown in solid lines in FIG. 3, that is, an off position or motor deenergizing position thereof in which it interrupts energization of the motor 4.

Referring again to FIGS. 4 and 5, a first small diameter gear 13 is mounted in a concentrical relationship at a lower end portion of the reel shaft 3 and for integral rotation with the reel shaft 3 via a first frictional coupling means 12.

The first frictional coupling means 12 includes a coil spring 12a interposed between the second member 3b of the reel shaft 3 and the first small diameter gear 13, and a friction plate 12b interposed between the first member 3a of the reel shaft 3 and the first small diameter gear 13. During normal feeding of a tape not shown within a tape cassette 8, rotation of the first small diameter gear 13 is transmitted to the reel shaft 3 via the friction plate 12b under the spring force of the coil spring 12a. To the contrary, when the tape within the tape cassette 8 is wound up to its last end,

the reel shaft 3 is stopped by the tape while the first small diameter gear 13 continues its rotation yielding a slip at the friction plate 12b.

Referring back to FIGS. 1 and 2, a turning force transmitting member 14 in the form of a gear is mounted for meshing engagement with the first small diameter gear 13. In particular, the turning force transmitting member 14 is supported for rotation by means of a shaft 14a on a lower face of a pivotal member 15 which is in turn mounted for pivotal motion within a predetermined angular range around the capstan shaft 2 on the lower face of the chassis 1 as shown in FIG. 15. Referring also to FIG. 15, the turning force transmitting member 14 is normally held in meshing engagement with a second small diameter gear 16 which is mounted in an integral relationship on an upper face of the second pulley 11b at the lower end of the capstan shaft 2. The pivotal member 15 has a switch operating arm 15a located for engagement with the tongue 5f of the switch 5, an engaging arm 15b located for contacting with a bent pressing lug 26e of a stopping operating member 26 serving as a movable member which will be hereinafter described, and an engaging projection 15c for slidably engaging with a cam groove 39 (FIG. 7) of an arresting member 36 which will also be hereinafter described.

When the pivotal member 15 is pivoted in a clockwise direction in FIG. 2, the turning force transmitting member 14 is brought into meshing engagement with the first small diameter gear 13 of the reel shaft 3 as shown in FIG. 14 to allow the turning force of the capstan shaft 2 to be transmitted to the reel shaft 3 via the second small diameter gear 16, turning force transmitting member 14, first small diameter gear 13 and first frictional coupling means 12 while the switch operating arm 15a of the pivotal member 15 is brought out of engagement with the tongue 5f of the switch 5 to turn the switch 5 on as shown in solid lines in FIG. 14. On the contrary, when the pivotal member 15 is pivoted in a counterclockwise direction in FIG. 14, the turning force transmitting member 14 is brought out of meshing engagement with the first small diameter gear 13 of the reel shaft 3 as shown in phantom in FIG. 15 thereby to interrupt the transmission of the turning force from the capstan shaft 2 to the reel shaft 3 while the switch operating arm 15a of the pivotal member 15 is brought into engagement with the tongue 5f of the switch 5 to push and pivot the cover member 5b of the switch 5 in a clockwise direction in FIG. 3 against the spring forces of the first and third contact springs 5c and 5e thereby to turn the switch 5 off. The pivotal member 15 is

normally biased by a torsion coil spring 17 in a clockwise direction in FIG. 15 to an operative home position in which the turning force transmitting member 14 is engaged with the first small diameter gear 13 of the reel shaft 3 and the switch operating arm 15a of the pivotal member 15 is disengaged from the tongue 5f of the switch 5 to cause the switch 5 to assume the motor energizing position at which the motor 4 is energized. The torsion coil spring 17 is secured at an intermediate coiled portion 17a and an end portion 17b thereof to predetermined locations of the chassis 1 and at the other end portion 17c thereof to a predetermined location of the pivotal member 15.

A circular cam 18 is formed on a lower face of the turning force transmitting member 14 in an eccentric relationship to and around the shaft 14a of the turning force transmitting member 14 as shown in FIG. 2. The circular cam 18 has a cam face 18a on an outer periphery thereof. A projection 19 is formed on the lower face of the turning force transmitting member 14 in a spaced relationship from the outer periphery or cam face 18a of the circular cam 18. The circular cam 18 on the turning force transmitting member 14 is located for engagement with a cam engaging portion 20a at an end of a cam follower or detecting member 20 while the operating

projection 19 on the turning force transmitting member 14 is located for engagement by an engaging projection 20b formed at the same end of the cam follower 20.

Referring again to FIGS. 4 and 5, the cam follower 20 is formed from an elastic synthetic resin plate and has, in addition to the cam engaging portion 20a and the engaging projection 20b at the end thereof, an elastically deformable engaging arm 20c remote from the cam engaging portion 20a, an abutting arm 20d between the cam engaging projection 20a and the engaging arm 20c, and a pair of fingers located between the abutting arm 20d and the engaging arm 20c and defining a substantially C-shaped fitting recess 20e therein. A second frictional coupling means 21 is formed by the fitting recess 20e of the cam follower 20 which is resiliently fitted around an outer periphery of a lower end portion of the first member 3a of the reel shaft 3. Thus, a turning force of the reel shaft 3 is transmitted to the cam follower 20 via the second frictional coupling means 21 so that the cam follower 20 is urged in a clockwise direction in FIG. 2, that is, in a direction to slidably contact the cam engaging portion 20a of the cam follower 20 with the circular cam 18 and keep the engaging projection 20b spaced away from the operating projection 19 of the turning force

transmitting member 14. To the contrary, if rotation of the reel shaft 3 is stopped, the urging force to pivot the cam follower 20 in the clockwise direction in FIG. 2 is removed. Consequently, as the turning force transmitting member 14 continues its counterclockwise rotation, the cam follower 20 is first pivoted in the counterclockwise direction in FIG. 2 by a maximum diameter portion of the circular cam 18 to a predetermined angular position in which the abutting arm 20d thereof is positioned near a stopper means 9a provided by an end face of the support plate 9 of the chassis 1 and the engaging projection 20b thereof is positioned on a locus of the operating projection 19 of the turning force transmitting member 14. After then, the cam follower 20 remains at the angular position so that as the turning force transmitting member 14 is further rotated, the engaging projection 20b of the cam follower 20 is engaged with the operating projection 19 of the turning force transmitting member 14 and stops further rotation of the turning force transmitting member 14 in the counterclockwise direction in FIG. 2. However, since the turning force transmitting member 14 tends to rotate further in the same direction, now the pivotal member 15 on which the turning force transmitting member 14 is supported for rotation is

pivoted itself in the counterclockwise direction in FIG. 2 against the biasing force of the torsion coil spring 17.

The engaging arm 20c of the cam follower 20 is engaged by a head mounting plate 22 when the latter is moved from an operative mode position to a rest mode position thereof.

Referring to FIGS. 1 and 2, the head mounting plate 22 is mounted for movement within a predetermined range on the lower face of the chassis 1. The head mounting plate 22 has a main plate portion 22a having a substantially triangular or trapezoidal shape in plan with a wide side located at one longitudinal end and a narrow side located at other other longitudinal end thereof, a side wall 22b extending perpendicularly upwardly from the wide side of the main plate portion 22a, a bent abutting lug 22c extending perpendicularly downwardly from a corner of the narrow side of the main plate portion 22a, and a bent engaging lug 22d extending perpendicularly upwardly from the other corner of the narrow side of the main plate portion 22a and having an arcuate shape in plan.

A reproducing magnetic head 23 and a pinch roller 24 are mounted on an upper face adjacent the wide side of the head mounting plate 22. The magnetic head 23 is

designed such that a front face thereof is contacted with a tape within a tape cassette 8 while the pinch roller 24 is designed so as to be pressed against and spaced away from the capstan shaft 2 with the tape interposed therebetween.

The head mounting plate 22 is normally biased by a coil spring 25 in the leftward direction in FIG. 2 toward its operative mode position, that is, to a position in which the pinch roller 24 is pressed against the capstan shaft 2. The coil spring 25 is secured at an end thereof to the main plate portion 22a of the head mounting plate 22 and at the other end thereof to the chassis 1.

Thus, the pinch roller 24 is pressed against the capstan shaft 2 by the biasing force of the coil spring 25 thereby to set a reproduction mode position of the magnetic head 23.

As the head mounting plate 22 is moved from the operation mode position to the rest mode position, the abutting lug 22c of the head mounting plate 22 is engaged with the engaging arm 20c of the cam follower 20 to pivot the cam follower 20 in the clockwise direction in FIG. 2 until the cam engaging portion 20a of the cam follower 20 is engaged with the cam face 18a of the circular cam 18.

As the stopping operating member or movable member 26 which is also used for ejecting operation is moved from its operation mode position to its rest mode position, the head mounting plate 22 is pushed to move in the rightward direction in FIG. 2 toward its rest mode position against the biasing force of the coil spring 25.

Referring to FIGS. 1, 2 and 11, the stopping operating member 26 has a main body portion 26a, a side wall portion 26b extending vertically upwardly from a side edge of the main body portion 26a, and a front wall portion 26c extending perpendicularly outwardly from a forward end of the side wall portion 26b. The stopping operating member 26 is mounted for movement within a predetermined range with the main body portion 26a thereof located on the lower face of the chassis 1 and with the side wall portion 27b thereof located on an outer face of a side wall 1a of the chassis 1. The main body portion 26a of the stopping operating member 26 has first, second and third elongated engaging holes 27, 28, 29 perforated therein. First, second and third bent engaging projections 30, 31, 32 are formed on and extend downwardly from the chassis 1. The first to third bent engaging projections 30 to 32 are engaged for sliding movement in the first to third engaging holes 27 to 29,

respectively. The main body portion 26a of the stopping operating member 26 has a guide face 26d in the form of an inclined curved face formed on the other edge thereof for sliding contact with the bent engaging lug 22d of the head mounting plate 22. Thus, if the stopping operating member 26 is manually pushed to move from its operation mode position to its first actuated position or fast feeding mode position, the head mounting plate 22 is moved, through sliding engagement between the guide face 26d of the stopping operating member 26 and the bent engaging lug 22d of the head mounting plate 22, from its reproduction mode position against the biasing force of the coil spring 25 to its fast feeding mode position in which the pinch roller 24 is spaced by a little distance from the capstan shaft 2. If the stopping operating member 26 is further pushed to move from the first actuated position to a second actuated position or ejection/rest mode position, the head mounting plate 22 is further moved, through sliding contact between the guide face 26d and the bent engaging lug 22d, against the biasing force of the coil spring 25 to a rest mode position or ejecting position in which the pinch roller 24 is spaced by a maximum distance from the capstan shaft 2. The stopping operating member 26 is normally biased toward the reproduction mode position

in an upward direction in FIG. 2 by a coil spring 33. The coil spring 33 is secured at one end thereof to the lower face of the chassis 1 and at the other end thereof to a lower face of the main body portion 26a of the stopping operating member 26.

After the stopping operating member 26 is moved from the reproduction mode position to the first actuated position, it is arrested at the first actuated position by a hook 34.

Referring to FIG. 2, the hook 34 is formed as an elongated plate and is located on the lower face of the main body portion 26a of the stopping operating member 26. The hook 34 has a fitting hole 34a formed at one end portion thereof and loosely fitted on the second engaging projection 31 on the lower face of the chassis 1 so as to allow the hook 34 to be pivoted around the second engaging projection 31 and also in a plane containing the second engaging projection 31 but by a limited angle. The hook 34 is normally biased by a coil spring 35 in a direction to closely contact with the lower face of the main body portion 26a of the stopping operating member 26.

Thus, if the stopping operating member 26 in its reproduction mode position is pushed in by a relatively small distance to its first actuated or fast feeding

mode position, the stopping operating member 26 is thereafter arrested at the first actuated position, that is, the fast feeding mode position by the hook 34. If the stopping operating member 26 in the fast feeding mode position is pushed in by a little distance toward the ejecting position and then the pushing in force to the stopping operating member 26 is removed, the arrested condition of the stopping operating member 26 by the hook 34 is canceled so that the stopping operating member 26 is returned to its reproduction mode position. To the contrary, if the stopping operating member 26 in the fast feeding mode position is pushed in by a long distance toward the ejecting position, the arrested condition thereof by the hook 34 is canceled and then the stopping operating member 26 assumes its ejecting position. On the other hand, if the stopping operating member 26 in the reproduction mode position is pushed in to the second actuated position or ejecting position farther than the first actuated position, it now assumes its ejecting position.

As the stopping operating member 26 approaches the ejecting position, it releases the pivotal member 15 from a counterclockwise (in FIG. 2) pivoted position or inoperative position at which the pivotal member 15 has been arrested by the arresting member 36 and in which

the pivotal member 15 causes the switch 5 to assume the motor deenergizing position, and then it arrests the pivotal member 15 at the pivoted position.

Referring now to FIGS. 2, 6 and 7, the arresting member 36 is formed as an elongated plate and is located on the lower face of the pivotal member 15. The arresting member 36 has a fitting hole 36a formed at an end portion thereof and fitted on a bent arresting projection 37 formed on and extending downwardly from the chassis 1 so that the arresting member 36 can be pivoted around the arresting projection 37 and also in a plane containing the arresting projection 37 but by a limited angle. The arresting member 36 is normally biased by a torsion coil spring 38 in a direction to closely contact with the lower face of the pivotal member 15. The arresting member 36 is also biased in a counterclockwise direction in FIG. 2 by the torsion coil spring 38 when the stopping operating member 26 is moved to the ejecting position.

In order to assemble the arresting member 36, it is first placed from below onto the bottom face of the chassis 1 with the fitting hole 36a thereof fitted on the arresting projection 37, and then a coiled portion 38a of the torsion coil spring 38 is fitted on the arresting projection 37 until a base end portion of the

coiled portion 38a is seated on a spring seat not shown formed at an inner end of the fitting hole 36a and a smaller diameter portion of the coiled portion 38a passes a step 37c at a boundary between a body portion 37a and a trapezoidal head portion 37b of the arresting projection 37. The torsion coil spring 38 has adjacent the smaller diameter portion of the coiled portion 38a thereof an extension 38b which is received in an arresting groove 36b formed at an end of a lower projection of the arresting member 36 and extends laterally outwardly from the arresting member 36. The extension 38b of the torsion coil spring 38 is located for contacting with the bent pressing lug 26e formed at an end of the stopping operating member 26. When the pressing lug 26e of the stopping operating member 26 is engaged with and pushes the extension 38b of the torsion coil spring 38, the torsion coil spring 38 exerts a biasing force to bias the arresting member 36 in the counterclockwise direction in FIG. 2.

The engaging arm 15b of the pivotal member 15 is also located for engagement by the pressing lug 26e of the stopping operating member 26, and when it is engaged by the latter, the pivotal member 15 is pushed to pivot in the counterclockwise direction in FIG. 2, that is, in a direction to turn the switch 5 off.

Referring to FIGS. 7 to 10, the arresting member 36 has a cam groove 39 formed on an upper face thereof, and the engaging projection 15c of the pivotal member 15 is slidably engaged in the cam groove 39. The cam groove 39 has a returning allowing portion 40, a forward path portion 41, a return path portion 42, an arresting portion 43, and first, second and third steps or guide portions 44, 45 and 46.

The returning allowing portion 40 is provided so as to allow pivotal returning motion of the pivotal member 15 in the clockwise direction in FIG. 2 to the operative home position in which the the pivotal member 15 causes the switch 5 to assume the motor energizing position. The returning allowing portion 40 is located adjacent one end of the arresting member 36 on a line of a longitudinal axis of the arresting member 36, and one ends of the forward path portion 41 and the return path portion 42 are connected to the returning allowing portion 40.

The forward path portion 41 and the return path portion 42 are formed in a spaced relationship on opposite locations of the arresting member 36 with respect to the longitudinal axial line of the arresting member 36. The other ends of the forward path portion 41 and the return path portion 42 are located adjacent

the other end of the arresting member 36 and are connected to each other.

The arresting portion 43 is formed at a substantially central location of the arresting member 36, and when the pivotal member 15 is pivoted in the counterclockwise direction in FIG. 2 to turn the switch 5 off after stopping of rotation of the reel shaft 3, the engaging projection 15c thereon is introduced via part of the forward path portion 41 into and thereafter arrested by the arresting portion 43 of the arresting member 36 to arrest the pivotal member 15 to its pivoted inoperative position.

The first guide portion 44 is formed so as to prevent the engaging projection 15c from advancing from the returning allowing portion 40 into the return path portion 42.

The second guide portion 45 is formed so as to prevent the engaging projection 15c from advancing from the forward path portion 41 into the returning allowing portion 40 as seen from FIGS. 8 and 9.

The third guide portion 46 is formed so as to prevent the engaging projection 15c from advancing from the return path portion 42 into the forward path portion 41 as seen from FIGS. 9 and 10.

Thus, when the reel shaft 3 is rotating, the

pivotal member 15 is in its pivoted inoperative position to which it has been pivoted in the clockwise direction in FIG. 2 by the biasing force of the torsion coil spring 17, and in this position, the engaging projection 15c of the pivotal member 15 is positioned at a position as shown in solid lines in FIG. 7. In this condition, if rotation of the reel shaft 3 is stopped and consequently the pivotal member 15 is pivoted in the counterclockwise direction in FIG. 2 against the biasing force of the torsion coil spring 17, the engaging projection 15c thereon moves toward the other end of the forward path portion 41 as indicated by an arrow mark d1 in FIG. 7 until it reaches a position shown in two dot chain lines in FIG. 7. Then, upon subsequent stopping of the motor 5, the pivotal member 15 is pivoted back in the clockwise direction in FIG. 2 by the biasing force of the torsion coil spring 17 but by a small distance because thereupon the engaging projection 15c thereon moves in a direction indicated by an arrow mark d2 in FIG. 7 along the forward path portion 41 only until it is engaged with and stopped by the second guide portion 45 and then the arresting portion 43 as shown in long and short dash lines in FIG. 7 to arrest the pivotal member 15 to its pivoted inoperative position.

If the stopping operating member 26 is moved to

its ejecting position while the pivotal member 15 is arrested at the pivoted inoperative position, the engaging arm 15b of the pivotal member 15 is pushed in a direction indicated by an arrow mark d3 in FIG. 6 by the pressing lug 26e of the stopping operating member 26 so that the pivotal member 15 is pivoted in the counterclockwise direction in FIG. 2 whereupon the engaging projection 15c thereon is released from the arresting portion 43 and moves in a direction opposite to the direction of the arrow mark d2 in FIG. 7 to the position shown in two dot chain lines in FIG. 7 at the other end of the forward path portion 41. Meanwhile, when the stopping operating member 26 is moved to its ejecting position, the extension 38b of the torsion coil spring 38 is pressed in the same direction with the engaging arm 15b of the pivotal member 15 by the pressing lug 26e of the stopping operating member 26 so that the torsion coil spring 38 exerts a biasing force in a direction to pivot the arresting member 36 in the counterclockwise direction in FIG. 2. By the biasing force of the torsion coil spring 38, the arresting member 36 is pivoted in the counterclockwise direction in FIG. 2, that is, in a direction indicated by an arrow mark d4 in FIG. 6 whereupon the engaging projection 15c of the pivotal member 15 moves toward the other end of the

return path portion 42 as indicated by an arrow mark d5 in FIG. 7 until it comes to a position shown in a broken lines in FIG. 7.

In this manner, the stopping operating member 26 has dual functions, when it is moved to its ejecting position, on one hand to cancel an arrested condition by the arresting member 36 of the pivotal member 15 at the pivoted inoperative position in which the pivotal member 15 causes the switch 5 to assume the motor deenergizing position and on the other hand to arrest the pivotal member 15 to the pivoted inoperative position in which the pivotal member 15 causes the switch 5 to assume the motor deenergizing position.

If the stopping operating member 26 is moved to its reproduction mode position from such an arresting condition at the ejecting position, the pivotal member 15 is pivoted in the clockwise direction in FIG. 2 by the biasing force of the torsion coil spring 17 to turn the switch 5 on whereupon the engaging projection 15c thereon passes the return path portion 42 as indicated by an arrow mark d6 in FIG. 7 until it comes back to the position at the returning allowing portion 40 as shown in solid lines in FIG. 7.

By moving the stopping operating member 26 to its ejecting position, a cassette holder 47 is pivoted from

a set position to a reset position. To the contrary, by putting a tape cassette 8 into the cassette holder 47 and pushing the tape cassette 8 in to a predetermined position, the cassette holder 47 is pivoted from the reset position to the set position.

Referring to FIGS. 1 and 2 and 11 to 13, the cassette holder 47 has a pair of side walls 47b, 47c extending vertically upwardly from opposite side edges of a bottom wall 47a thereof. The side walls 47b, 47c are mounted at one end portions thereof for pivotal motion within a predetermined angular range around a horizontal axis on inner faces of one end portions of a pair of opposite side walls 1a, 1b of the chassis 1. The cassette holder 47 is supported for pivotal motion between the ejecting or reset position in which it is inclined obliquely upwardly and spaced at its free end thereof away from the chassis 1 and the other reproduction mode or set position in which it lies on the chassis 1.

Referring to FIG. 13, as the cassette holder 47 is pivoted from the reset position to the set position, one of the capstan shaft fitting holes 8a (only one is shown in FIG. 13) and one of a pair of reel shaft fitting holes 8b of the tape cassette 8 inserted in the cassette holder 47 are fitted on the capstan shaft 2 and

the reel shaft 3, respectively, while the magnetic head 23 and the pinch roller 24 are moved into the tape cassette 8 through openings not shown formed in the tape cassette 8 until they are contacted with a tape within the tape cassette 8. In order to allow the magnetic head 23 and the pinch roller 24 to move into and out of the tape cassette 8, the side wall 47c of the cassette holder 47 is divided into three sections as shown in FIG. 1 which define therebetween a pair of openings opposing to the openings of the tape cassette 8.

Then, as the cassette holder 47 is pivoted from the set position to the reset position, the capstan shaft 2 and the reel shaft 3 are removed from the capstan shaft fitting hole 8a and the reel shaft fitting hole 8b of the tape cassette 8, respectively, while the magnetic head 23 and the pinch roller 24 are also removed from within the tape cassette 8 and from the tape.

Referring to FIGS. 1, 2, 11 and 12, the cassette holder 47 can be arrested at its reset position by a latching member 48. The latching member 48 has a short latching piece 48c and a tall cassette ejecting piece 48b formed in a juxtaposed relationship at left and right locations thereof. The cassette ejecting piece 48b has a bent spring anchor 48a formed at an upper end

thereof and extending in a horizontally leftward direction in FIG. 1.

The latching member 48 has a pair of horizontally extending tabs formed on opposite sides of a lower end thereof and received in round holes perforated in a pair of bent lugs 1c of the chassis 1 so as to allow pivotal motion of the latching member 48. When the latching member 48 is pivoted in a cassette removing direction, that is, in a clockwise direction in FIG. 11, the latching piece 48c thereof is engaged with a lower face of the cassette holder 47 to prevent pivotal motion of the cassette holder 47 toward its set position while the cassette ejecting piece 48b thereof pushes back the tape cassette 8 within the cassette holder 47 in the removing direction. To the contrary, if the tape cassette 8 is inserted into the cassette holder 47 to a predetermined position, the cassette ejecting piece 48b of the latching member 48 is pushed by the tape cassette 8 to pivot the latching member 48 in an inserting direction, that is, in a counterclockwise direction in FIG. 11 to disengage the latching piece 48c thereof from the lower face of the cassette holder 47 thereby to cancel the arresting condition of the latching member 48. It is to be noted that the cassette holder 47 has a recess 47f formed therein as shown in FIG. 1 for allowing the

cassette ejecting piece 48b of the latching member 48 to make such a pivotal motion therein.

The cassette holder 47 is operatively connected to the stopping operating member 26 by an interlocking member 49. In particular, when the stopping operating member 26 is moved forwardly from the reproduction mode position to the ejecting position, the interlocking member 49 is pivoted in a clockwise direction in FIG. 12 by the stopping operating member 26 to pivot the cassette holder 47 away from the chassis 1 to the reset position. After pivotal motion of the cassette holder 47 to the reset position, the stopping operating member 26 is arrested at its ejecting position against the biasing force of the coil spring 33. To the contrary, when the stopping operating member 26 is moved reversely from the ejecting position to the reproduction mode position, the interlocking member 49 is pivoted in the counterclockwise direction in FIG. 11 whereupon the cassette holder 47 is pivoted toward the chassis 1 to its set position.

A torsion coil spring 50 is anchored at opposite ends 50a, 50b thereof to the spring anchor 48a of the latching member 48 and a spring anchor 49a at an end of the interlocking member 49, respectively, and has a function to bias the cassette holder 47 toward its set

position.

In particular, when the tape cassette 8 is fully inserted to a position at which it contacts with and is stopped by a stopping wall 47e of the cassette holder 47, the upper end of the latching piece 48c of the latching member 48 is disengaged from the lower face of the cassette holder 47 so that the cassette holder 47 is pivoted strongly toward the set position by the accumulated spring force of the torsion coil spring 50 until the tape cassette 8 is brought into its loaded position as shown in FIG. 12.

Referring to FIGS. 1 and 2, a cassette holding member 51 is located on the cassette holder 47. The cassette holding member 51 is formed from an elongated plate and has a pair of laterally extending tabs formed on opposite ends thereof and received in a pair of sectoral openings formed in the opposite side walls 47b, 47c of the cassette holder 47 so as to allow pivotal motion of the cassette holding member 51 within a predetermined angular range. A cassette holding leaf spring 52 is secured at one end thereof to a location between a substantially central portion and one end or right-hand side end in FIG. 1 of the cassette holding member 51 and extends at the other end thereof in the cassette removing direction. The cassette holding leaf

spring 52 is bent into a substantially V-shape in side elevation at a portion adjacent the other end thereof, and a lower face of a bent corner of the cassette holding leaf spring 52 is located for engagement with an upper face of a tape cassette 8.

Now, operation of the automatic stopping device for a tape feeding apparatus according to the present invention having such a construction as described above will be described. In FIGS. 1 and 2, the tape feeding device is shown in its rest mode condition. In this condition, the cassette holder 47 is in its reset position, the stopping operating member 26 is in its rest mode position, and the head mounting plate 22 is held at its rest mode position in which the pinch roller 24 thereon is spaced farthest away from the capstan shaft 2 against the biasing force of the coil spring 25 and the engaging lug 22d thereof engages with the guide face 26d of the stopping operating member 26. Meanwhile, the pivotal member 15 is in its inoperative home position or limit position of pivotal motion in the counterclockwise direction in FIG. 2 in which the switch operating arm 15a thereof presses against the tongue 5f of the switch 5 to hold the switch 5 to an off or motor deenergizing position as shown in solid lines in FIG. 3.

In this condition, if a tape cassette 8 is

inserted into the cassette holder 47 as shown in FIG. 11 and then further pushed in strongly, the latching piece 48c of the latching member 48 is disengaged from the lower face of the cassette holder 47 to allow the cassette holder 47 to be pivoted to the set position in which the capstan shaft 2 and the reel shaft 3 are fitted in corresponding ones of the capstan shaft fitting holes 8a and the reel shaft fitting holes 8b of the tape cassette 8, respectively. Meanwhile, as the cassette holder 47 is pivoted to the set position, the interlocking member 49 is pivoted in the counterclockwise direction in FIG. 11 whereupon the stopping operating member 26 is released from its arrested condition at the rest mode position and thus moved to its operative mode position by the biasing force of the coil spring 33. Upon such movement of the stopping operating member 26, the pivotal member 15 is released from the arrested condition by the pressing lug 26e of the stopping operating member 26 in which the pivotal member 15 causes the switch 5 to assume the motor deenergizing position so that the pivotal member 15 is allowed to be pivoted in the clockwise direction in FIG. 2 by the biasing force of the torsion coil spring 17. Consequently, the turning force transmitting member 14 is brought into meshing engagement with the

first small diameter gear 13 of the reel shaft 3 while the switch operating arm 15a of the pivotal member 15 is spaced away from the tongue 5f of the switch 5 to allow the switch 5 to be turned on as shown in two dot chain lines in FIG. 3. Consequently, the motor 4 is energized and thus driven to rotate in the clockwise direction in FIG. 2.

Further, as the stopping operating member 26 is moved to its operative mode position, the head mounting plate 22 is released from its arrested condition at the rest mode position by the stopping operating member 26 so that it is moved in the leftward direction in FIG. 2 by the biasing force of the coil spring 25 to its operative mode position, that is, its reproduction mode position as shown in FIG. 13 in which the magnetic head 23 contacts with a tape within the tape cassette 8 and the pinch roller 24 is pressed against the capstan shaft 2 via the tape. Since the turning power of the motor 4 is transmitted to the capstan shaft 2 via the power transmitting mechanism 11, the capstan shaft 2 is rotated in the clockwise direction in FIG. 2. The turning power of the motor 4 is also transmitted to the reel shaft 3 via the power transmitting mechanism 11, second small diameter gear 16, turning force transmitting member 14 and first small diameter gear 13

to rotate the reel shaft 3 in the clockwise direction in FIG. 2. Accordingly, the tape of the tape cassette 8 is fed in a direction indicated by an arrow mark in FIG. 13 in order to effect operation for the reproduction mode in such a condition of the tape feeding apparatus as shown in FIGS. 13 and 14 and as shown in solid lines in FIG. 15.

In the reproduction condition described above, the cam follower 20 is normally urged in the clockwise direction in FIG. 2 by a turning force of the reel shaft 3 in the clockwise direction in FIG. 2 via the second frictional coupling means 21. Consequently, the cam follower 20 normally assumes a position in which the cam engaging portion 20a thereof is held in sliding contact with the cam face 18a of the circular cam 18 so that the cam follower 20 is repetitively rocked in the clockwise and counterclockwise directions around the reel shaft 3.

Operation of the reproduction mode is effected in this manner. Then, if the tape is completely wound up from one of a pair of reels not shown within the tape cassette 8 which is not fitted on the reel shaft 3 to the other reel fitted on the reel shaft 3, the reel shaft 3 is stopped while the first small diameter gear 13 continues its rotation, yielding a slip at the first frictional coupling means 12 between the reel shaft 3

and the first small diameter gear 13. As a result of stopping of rotation of the reel shaft 3, the urging force to pivot the cam follower 20 in the clockwise direction in FIG. 2 disappears. Consequently, after the cam follower 20 is pivoted by a maximum angle in the clockwise direction in FIG. 2 by a maximum diameter portion of the cam face 18a of the circular cam 18, the cam follower 20 will not be pivoted back in the clockwise direction in FIG. 2 but stay on a locus of the operating projection 19 on the turning force transmitting member 14. Accordingly, as the turning force transmitting member 14 is rotated further, the engaging projection 20b of the cam follower 20 is soon contacted with the operating projection 19 as shown in two dot chain lines in FIG. 15 and stops rotation of the turning force transmitting member 14 in the counterclockwise direction in FIG. 2. However, since the turning force transmitting member 14 tends to continue its rotation due to the turning power of the motor 4, the pivotal member 15 is after all pivoted in the counterclockwise direction in FIG. 2 around the capstan shaft 2 against the biasing force of the torsion coil spring 17 to move the turning force transmitting member 14 away from the gear 13 of the reel shaft 3, thereby interrupting transmission of the power between

the reel shaft 3 and the motor 4. Meanwhile, as the pivotal member 15 is pivoted in the counterclockwise direction in FIG. 2, the switch operating arm 15a thereof presses against the tongue 5f of the switch 5 to turn the switch 5 off as shown in two dot chain lines in FIG. 3. Consequently, energization of the motor 4 is stopped to stop rotation of the capstan shaft 2. Further, at a final stage of the pivotal motion of the pivotal member 15 in the counterclockwise direction in FIG. 2, it is arrested at the pivoted position by the arresting member 36 as shown in two dot chain lines in FIG. 15.

In this condition, if the stopping operating member 26 is pushed in in the downward direction in FIG. 15 to its rest mode position against the biasing force of the coil spring 33 in order to remove the tape cassette 8 from the cassette holder 47, the engaging lug 22d of the head mounting plate 22 is pressed by the guide face 26d of the stopping operating member 26 so that the head mounting plate 22 is moved in the rightward direction in FIG. 15 against the biasing force of the coil spring 25 until the pinch roller 24 comes to its rest mode position in which it is spaced farthest away from the capstan shaft 2 and the pinch roller 24 and the magnetic head 23 are spaced away from the tape

cassette 8. Meanwhile, as the stopping operating member 26 is moved to its rest mode position, the pressing lug 26e thereof presses against the engaging arm 15b of the pivotal member 15 and the extension 38b of the torsion coil spring 38 until the engaging projection 15c of the pivotal member 15 advances into the return path portion 42 of the cam groove 39 of the arresting member 36 to allow the arresting member 36 to be pivoted in the direction of the arrow mark d9 in FIG. 6 by the biasing force of the coil spring 38. In this manner, the stopping operating member 26 cancels the arrested condition of the pivotal member 15 by the arresting member 36 and in turn arrests the pivotal member 15 at its pivoted inoperative position in which the pivotal member 15 causes the switch 5 to assume the motor deenergizing position. Further, as the stopping operating member 26 is pivoted to the rest mode position, the interlocking member 49 is pivoted in the clockwise direction in FIG. 12 whereupon the cassette holder 47 is also pivoted to its reset position. Upon such pivotal motion of the cassette holder 47, the tape cassette 8 is pushed outwardly of the cassette holder 47 by the cassette ejecting piece 48b of the latching member 48 while the latching piece 48c of the latching member 48 is engaged with the lower face of the cassette

holder 47 to arrest the cassette holder 47 to its reset position.

While the preferred form of the present invention has been described, it is to be understood that many modifications and variations of the present invention are possible in the light of the above teachings. Here, exemplary modified forms of a mechanism for arresting a pivotal member having a turning force transmitting member supported thereon at a pivoted position will be specifically described.

Referring first to FIG. 17, a modification to the arresting member 36 of the embodiment described above is shown. A modified arresting member 136 is similar in construction to the arresting member 36 except that it has no such a formation as the arresting groove 36b of the arresting member 36 but has an angularly bent L-shaped elastic finger 138b formed thereon. The finger 138b is located for engagement by a bent pressing lug 126e of a stopping operating member 126. Meanwhile, a coil spring 138 fitted in a fitting hole 136a of the arresting member 136 for biasing the arresting member 136 toward a chassis not shown has no such an extension as the extension 38b of the coil spring 38 of the embodiment described above. The coil spring 138 is interposed in a compressed condition between a spring

seat not shown on an end face of the fitting hole 136a of the arresting member 136 and a step 137c between a body portion 137a and a head portion 137b of an arresting projection 137 formed on and extending downwardly from the chassis. An end portion of the coil spring 138 adjacent the step 137c of the arresting projection 137 has a smaller inner diameter than the remaining portion of the coil spring 137 similarly as in the coil spring 38.

Thus, the elastic finger 138b of the arresting member 136 serves as an equivalent to the extension 36b of the coil spring 38. Accordingly, as the stopping operating member 126 moves from its operative mode position to its ejecting position to pivot a pivotal member 115 in a direction indicated by an arrow mark d7 either from an inoperative home position or from a pivoted inoperative position arrested by the arresting member 136 to another pivoted inoperative position through engagement of the pressing lug 126e thereof with an engaging arm 115b of the pivotal member 115, the pressing lug 126e is also engaged with the elastic finger 138b of the arresting member 136 so that the arresting member 136 is biased to pivot in a direction indicated by an arrow mark d19. Consequently, an arrested condition of the pivotal member 115 at the

pivoted position by the arresting member 136 through engagement of a cam groove not shown of the former with an engaging projection 115c of the latter is canceled, and the pivotal member 115 is thereafter arrested at the pivoted position by the pressing lug 126e of the stopping operating member 126.

Referring now to FIG. 18, another modification is shown. A modified arresting member 236 shown has a substantially Y-shape in plan and is supported at a substantially central portion thereof for pivotal motion on a chassis not shown similar to the chassis 1 of the embodiment described above by means of a shaft 254. The arresting member 236 has an arresting hook 236c extending laterally from an end of one of three arms thereof. The arresting hook 236c of the arresting member 236 has a cam face 236e at an outer side thereof remote from the shaft 254 while a second one of the three arms of the arresting member 236 has a circular or curved cam face 236d also at an outer side thereof. The cam face 236e is located in an opposing relationship to a bent lug or engaging projection 215c on an extension 215b of a pivotal member 215 on which a turning force transmitting member not shown is supported for rotation while the cam face 236d is located in an opposing relationship to another bent lug or engaging projection

226h of a stopping operating member 226. The arresting member 236 further has an abutting portion 236f at one side of the third arm thereof, and the abutting portion 236f is located in an opposing relationship to a stop or bent lug 255 formed on the chassis. The arresting member 236 is normally biased in one direction, that is, in a counterclockwise direction in FIG. 18 by a coil spring 256 and normally engaged at the abutting portion 236f of the third arm thereof with the stop 255. The stop 255 thus defines a limit position of pivotal motion of the arresting member 236 in the one direction or counterclockwise direction in FIG. 18.

When the pivotal member 215 is pivoted in a direction indicated by an arrow mark d9 in FIG. 18 from an operative home position shown in solid lines in FIG. 18, the engaging projection 215c thereof is engaged with the cam face 236e of the arresting member 236 to pivot the arresting member 236 in the clockwise direction in FIG. 18 against the biasing force of the coil spring 256. Then, just after the engaging projection 215c of the pivotal member 215 passes an end of the cam face 236e of the arresting member 236, the arresting member 236 is pivoted back in the counterclockwise direction in FIG. 18 by the biasing force of the coil spring 256 to the operative home

position shown in solid lines in FIG. 18. Consequently, when the pivotal member 215 is allowed to pivot back in a direction opposite to the direction of the arrow mark d9, the arresting projection 215c thereof is engaged with an inner face of the arresting hook 236c of the arresting member 236 to thereafter arrest the pivotal member 215 at its pivoted inoperative position shown in two dot chain lines in FIG. 18 in which the pivotal member 215 causes a switch not shown for controlling a motor not shown to assume its motor deenergizing position.

In this condition, if the stopping operating member 226 is pushed to move from an operative mode position shown in sold lines in FIG. 18 in a direction indicated by an arrow mark d10 in FIG. 18 to an ejecting position shown in two dot chain lines in FIG. 18, another bent lug or pressing piece 226e thereof is engaged with the extension 215b of the pivotal member 215 to thereafter arrest the pivotal member 215 at the pivoted inoperative position in which the pivotal member 215 causes the switch to assume its motor deenergizing position. Meanwhile, the engaging projection 226h of the stopping operating member 226 is engaged with the cam face 236d of the second arm of the arresting member 236 to pivot the arresting member 236 in the clockwise

direction in FIG. 18 against the biasing force of the coil spring 256 to a position shown in two dot chain lines in FIG. 18 in which the arresting projection 215c of the pivotal member 215 is released from the arresting hook 236c of the arresting member 236. Thus, the arrested condition by the arresting member 236 of the pivotal member 215 at the pivoted inoperative position in which the pivotal member 215 causes the switch to assume its motor deenergizing position is canceled.

Referring now to FIG. 19, a further modification is shown. An arresting member 336 shown has a flattened U-shape in plan and is mounted on a chassis 301 for movement within a range of a longitudinal length of a pair of elongated holes 358a, 358b formed in the arresting member 336 and fitted on a pair of engaging pins 359a, 359b, respectively, secured to the chassis 301. The arresting member 336 has an arresting hook 336c extending laterally from an end of one of a pair of arms thereof. The arresting hook 336c of the arresting member 336 has an inclined cam face 336e at an outer side thereof while the other arm of the arresting member 336 has another inclined cam face 336d at an outer side thereof. The cam face 336e is located in an opposing relationship to a bent lug or engaging projection 315c on an extension 315b of a pivotal member 315

corresponding to the pivotal member 15 of the embodiment described above while the cam face 336d is located in an opposing relationship to a bent lug or engaging projection 326h of a stopping operating member 326. The arresting member 336 further has an abutting portion 336f at one side of the second arm thereof adjacent the cam face 336d, and the abutting portion 336f is located in an opposing relationship to a stop or bent lug 360 formed on the chassis 301. The arresting member 336 is normally biased in one direction, that is, in a rightward direction in FIG. 19 by a coil spring 361 extending between the arresting member 336 and the chassis 301 and is normally engaged at the abutting portion 336f of the second arm thereof with the stop 361. The stop 361 thus defines a limit position of rightward movement of the arresting member 336 in the one direction or rightward direction in FIG. 19.

When the pivotal member 315 is pivoted in a direction indicated by an arrow mark d11 in FIG. 19 from an operative home position shown in solid lines in FIG. 19, the engaging projection 315c thereof is engaged with the cam face 336e of the arresting member 336 to move the arresting member 336 in the leftward direction in FIG. 19 against the biasing force of the coil spring 361. Then, just after the engaging projection 315c of

the pivotal member 315 passes an end of the cam face 336e of the arresting member 336, the arresting member 336 is moved back in the rightward direction in FIG. 19 by the biasing force of the coil spring 361 to the home position shown in solid lines in FIG. 19. Consequently, when the pivotal member 315 is allowed to pivot back in a direction opposite to the direction of the arrow mark d11, the arresting projection 315c thereof is engaged with an inner face of the arresting hook 336c of the arresting member 336 to thereafter arrest the pivotal member 315 at its pivoted inoperative position shown in two dot chain lines in FIG. 19 in which the pivotal member 315 causes a switch not shown for controlling a motor not shown to assume its motor deenergizing position.

In this condition, if the stopping operating member 326 is pushed to move from an operative mode position shown in sold lines in FIG. 19 in a direction indicated by an arrow mark d12 in FIG. 19 to an ejecting position shown in two dot chain lines in FIG. 19, another bent lug or pressing piece 326e thereof is engaged with the extension 315b of the pivotal member 315 to thereafter arrest the pivotal member 315 at the pivoted inoperative position in which the pivotal member 315 causes the switch to assume its motor deenergizing

position. Meanwhile, the engaging projection 326h of the stopping operating member 326 is engaged with the cam face 336d of the second arm of the arresting member 336 to move the arresting member 336 again in the leftward direction in FIG. 19 against the biasing force of the coil spring 361 to a position shown in two dot chain lines in FIG. 19 in which the arresting projection 315c of the pivotal member 315 is released from the arresting hook 336c of the arresting member 336. Thus, the arrested condition by the arresting member 336 of the pivotal member 315 at the pivoted inoperative position in which the pivotal member 315 causes the switch to assume its motor deenergizing position is canceled.

Reference is made to our copending applications Nos. 8800679 (Serial No. 8800679 (Serial No. 2208745 A) and 8800680 (Serial No. 2208746 A), the claims of which relate to tape recorders as disclosed herein.

CLAIMS:

1. An automatic stopping device for a tape feeding apparatus which includes a capstan shaft, a reel shaft, a motor for normally rotating said capstan shaft and said reel shaft, and a switch for interrupting energization of said motor to stop rotation of said capstan shaft and said reel shaft, comprising a turning force transmitting member connected to said motor via said capstan shaft, a pivotal member supporting said turning force transmitting member for rotation thereon and mounted for pivotal motion between an operative position in which transmission of a turning force from said turning force transmitting member to said reel shaft via frictional coupling means is enabled and an inoperative position in which transmission of a turning force is disabled, said switch being located for operation by said pivotal member so as to deenergize said motor in response to the inoperative position of said pivotal member, said pivotal member being spring-biased toward the operative position, detecting means for detecting stopping of rotation of said reel shaft to pivot said pivotal member from the operative to the inoperative position, an arresting member operable upon pivotal motion of said pivotal member from the operative

to the inoperative position for arresting said pivotal member at the inoperative position, and a movable member capable of assuming a first position in an operative mode of the feeding apparatus and a second position while the feeding apparatus is in rest, said movable member being operable upon movement thereof from the first position to the second position for canceling an arrested condition of said pivotal member by said arresting member and in turn arresting said pivotal member at the inoperative position.

2. An automatic stopping device for a tape feeding apparatus as claimed in claim 1, wherein said arresting member is mounted for pivotal motion around a predetermined axis and having a cam groove formed therein, and a spring member is located for engagement by said movable member, said pivotal member having an engaging projection formed thereon for engaging with said cam groove of said arresting member, said spring member being engaged by said movable member to resiliently bias said arresting member only when said movable member is moved from the first position to the second position.

3. An automatic stopping device for a tape feeding apparatus as claimed in claim 2, wherein said spring member is a coil spring having a coiled portion

fitted around the predetermined axis of said arresting member and an extension contiguous to an end of said coiled portion and located for engagement by said movable member.

4. An automatic stopping device for a tape feeding apparatus as claimed in claim 2, wherein said spring member is a resilient finger formed laterally in an integral relationship on said arresting member and located for engagement by said movable member.

5. An automatic stopping device for a tape feeding apparatus as claimed in claim 1, wherein said arresting member is mounted for movement from and to a predetermined position and normally biased to the predetermined position by a spring member, said arresting member having a camming portion thereon which is engaged, when said pivotal member is pivoted from the operative to the inoperative position, by an engaging projection of said pivotal member to move said arresting member from the predetermined position against the biasing force of said spring member to allow said engaging projection of said pivotal member to be arrested by an arresting portion of said arresting member to arrest said pivotal member at the inoperative position.

6. An automatic stopping device for a tape

feeding apparatus as claimed in claim 5, wherein said arresting member has a second camming portion thereon, and said movable member has a first portion formed thereon and located for engagement with said pivotal member, and a second portion for engagement with said second camming portion of said arresting member to move said arresting member from the predetermined position against the biasing force of said spring member to allow said engaging projection of said pivotal member to be released from said arresting portion of said arresting member.

7. An automatic stopping device for a tape feeding apparatus as claimed in any one of the preceding claims, wherein said movable member is a stopping operating member manually operable for stopping operation of said tape feeding apparatus.

8. An automatic stopping device for a tape feeding apparatus as claimed in claim 7, wherein said stopping operating member is spring-biased from the second position to the first position and is associated with arresting means which is operable upon movement of said stopping operating member from the first position to the second position for arresting said stopping operating member at the second position.

9. An automatic stopping device for a tape

feeding apparatus as claimed in claim 8, wherein said stopping operating member is associated with a cassette holder such that when a tape cassette is inserted to a predetermined position into said cassette holder and said cassette holder is moved to a cassette loading position, said stopping operating member is released from said second arresting member and moved from the second position to the first position and when said stopping operating member is moved from the first position to the second position, said cassette holder is moved from the cassette loading position to a cassette ejecting position to eject the cassette.

10. An automatic stopping device for a tape feeding apparatus as claimed in claim 8 or 9, wherein the first position and the second position of said stopping operating member are a recording or reproducing position and an ejecting position, respectively, and said stopping operating member has a fast feeding mode position between the first position and the second position and is arrested, when said stopping operating member is moved from the first position to the fast feeding mode position, at the fast feeding mode position by another arresting member.

11. An automatic stopping device for a tape feeding apparatus as claimed in claim 1 and substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

REGISTER ENTRY FOR GB2208030

Form 1 Application No GB8801800.7 filing date 27.01.1988

Priority claimed:
14.08.1987 in Japan - doc: 62124346U

Title AUTOMATIC STOPPING DEVICE FOR A TAPE FEEDING APPARATUS

Applicant/Proprietor
TANASHIN DENKI CO LTD, Incorporated in Japan, 2-19-3 Shinmachi, Setagaya-ku, Tokyo 154, Japan [ADP No. 00759159002]

Inventor
TADAO ARATA, 174-14 Higashinaganuma, Inagi-shi, Tokyo 206, Japan [ADP No. 03940749001]

Classified to
G5R
G11B

Address for Service
GRAHAM WATT & COMPANY, Riverhead, Sevenoaks, Kent, TN13 2BN, United Kingdom [ADP No. 00001685001]

Publication No GB2208030 dated 15.02.1989

Examination requested 09.06.1988

Patent Granted with effect from 21.08.1991 (Section 25(1)) with title
AUTOMATIC STOPPING DEVICE FOR A TAPE FEEDING APPARATUS

**** END OF REGISTER ENTRY ****

RENEWAL DETAILS

PUBLICATION NUMBER GB2208030

PROPRIETOR(S)

Tanashin Denki Co Ltd, Incorporated in Japan, 2-19-3 Shinmachi, Setagaya-ku, Tokyo 154, Japan

DATE FILED 27.01.1988

DATE GRANTED 21.08.1991

DATE NEXT RENEWAL DUE 27.01.1992

DATE NOT IN FORCE

DATE OF LAST RENEWAL

YEAR OF LAST RENEWAL 00

STATUS PATENT IN FORCE