March 18, 1958 E. F. KLEINSCHMIDT ET AL 2,827,245

VARIABLE TAPE DRIVE

Filed May 14, 1953 3 Sheets-Sheet 1

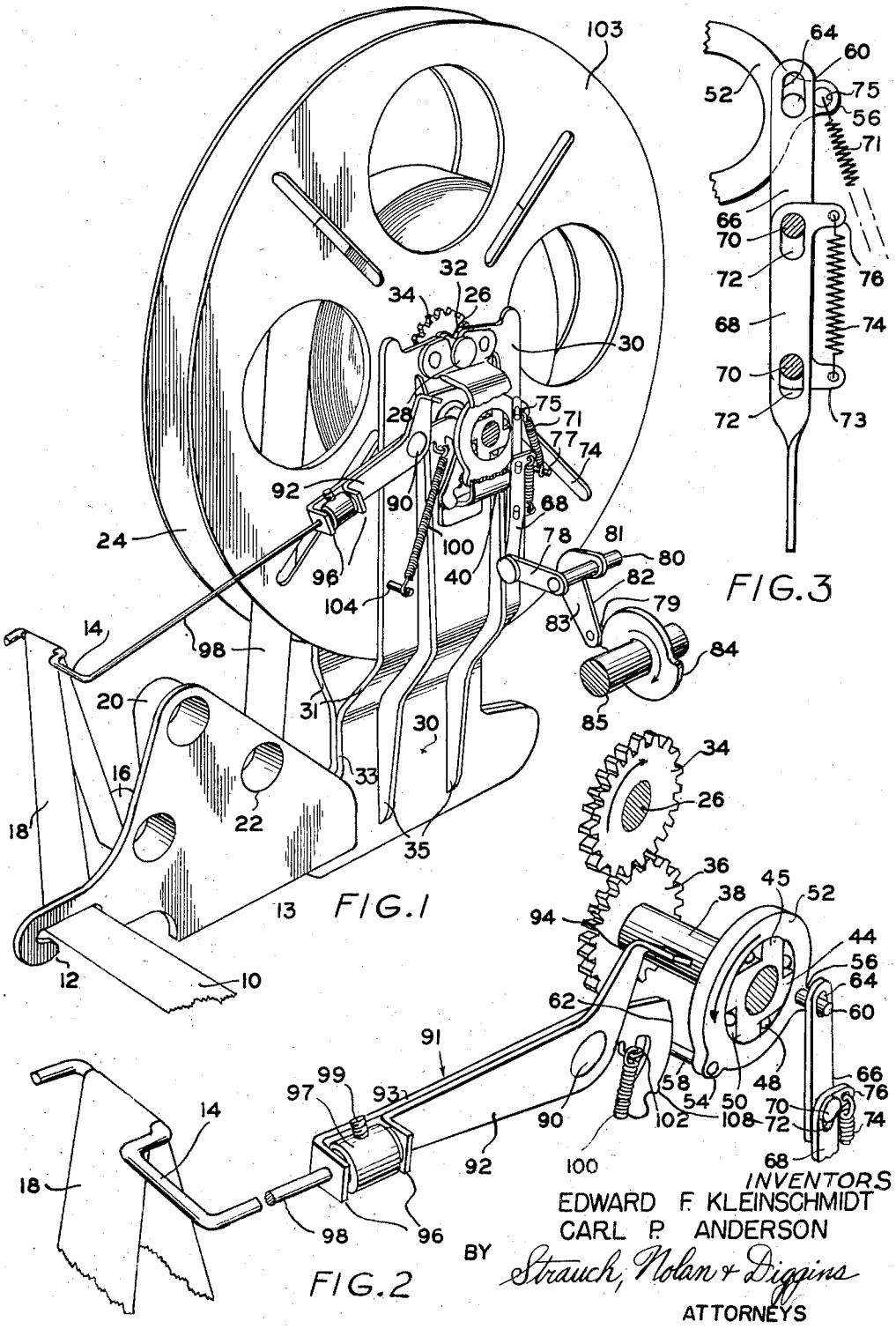

FIG. 1

FIG. 3

FIG. 2

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VARIABLE TAPE DRIVE

Filed May 14, 1953 3 Sheets-Sheet 2

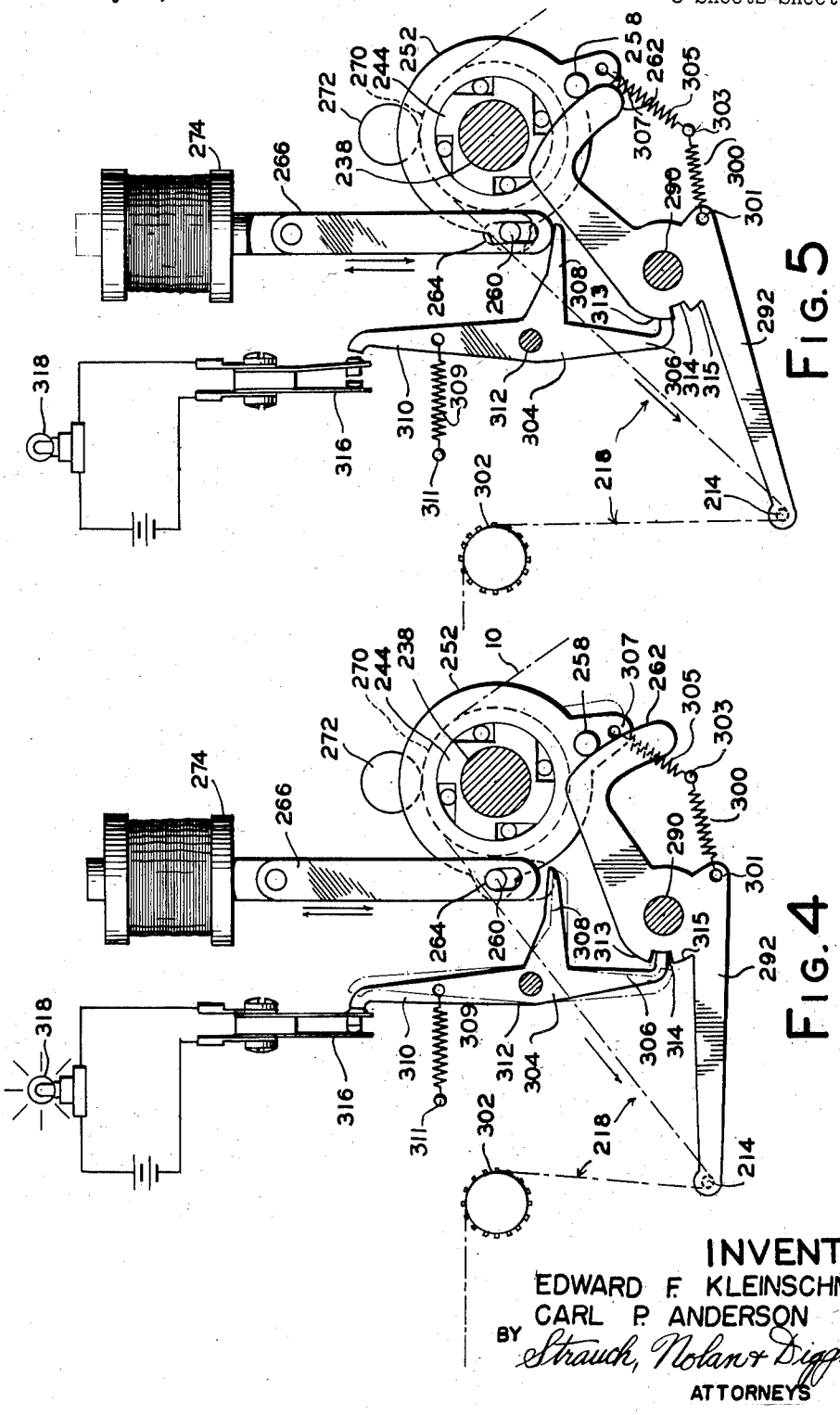

FIG. 5

FIG. 4

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VARIABLE TAPE DRIVE

Filed May 14, 1953 3 Sheets-Sheet 3

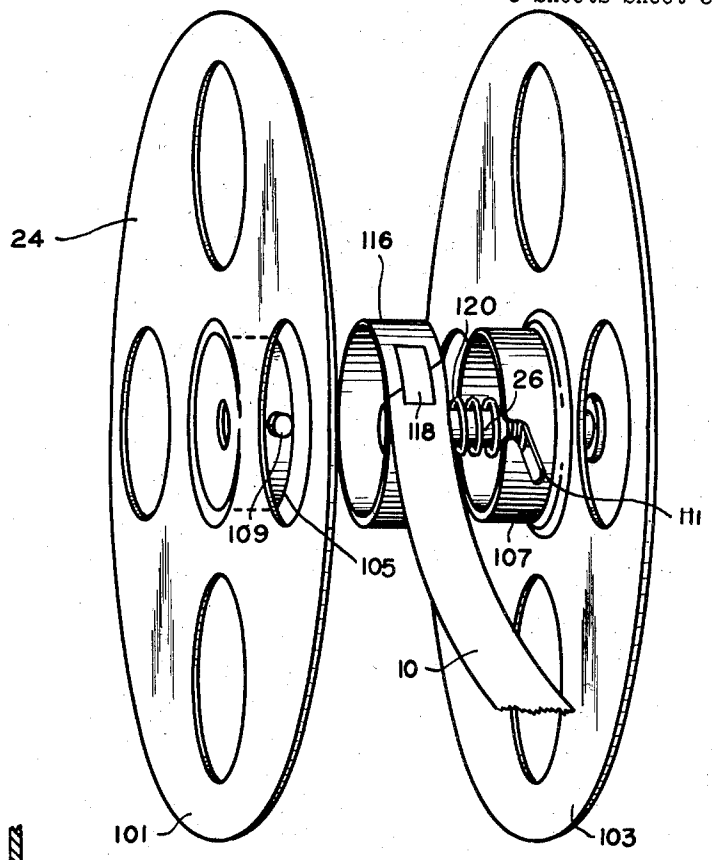

FIG. 6

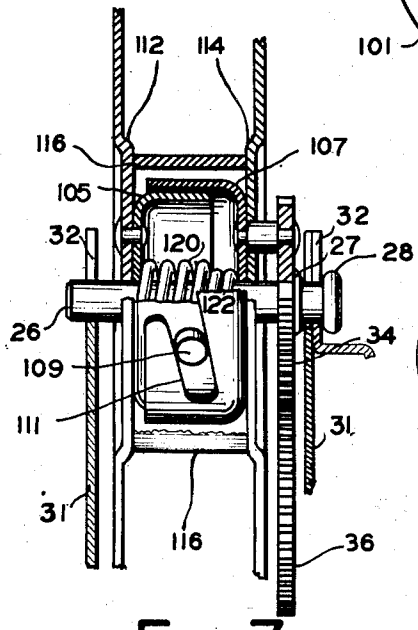

FIG. 7

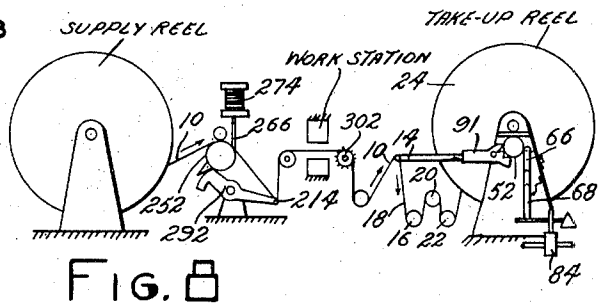

FIG. 8

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2,827,245

VARIABLE TAPE DRIVE

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Application May 14, 1953, Serial No. 355,002
12 Claims. (Cl. 242—55)

This invention relates to web feeding mechanisms and is more particularly applicable to variable tape drive mechanisms for feeding a record tape through a work station operating mechanism such as a recording, sensing or printing station in a printing telegraph and like machines utilizing record tapes.

In the art of printing telegraph devices one of the long recognized and heretofore unsuccessfully solved problems has been the method of properly and efficiently feeding record tape through the machines and the winding and storing of the tape after it leaves the machine. This problem is particularly difficult when applied to telegraph machines used in automatic switching exchanges where the devices automatically operate unattended for extended periods and are only periodically checked for servicing purposes. In the case of automatically operating installations, it is naturally necessary to provide a sufficient supply of tape to assure operation of the machine while it is unattended. The supply tape which is customarily mounted on supply rolls is usually perforated by a suitable mechanism to provide the tape with a continuous row of feed holes just before the tape reaches a work station in order to facilitate control of the tape during its advancement through the work station. The provision of sufficient tape for extended periods of operation of the machine results in a supply roll of considerable weight and inertia. As a result, when the tape is fed from the supply roll through the machine work station to the take-up or storing roll it has been common experience with prior art methods of tape feeding that the tape is frequently torn in the vicinity of the feed holes in the tape, the portion of the tape intermediate adjacent holes not being strong enough to resist the pulling force exerted upon the tape in unwinding the tape from the heavy supply roll.

Additionally, it is necessary to wind the processed tape on a roll which can be easily removed from the reeling mechanism and conveniently stored. The formation of such rolls, after the tape has been processed presents further problems. Since the diameter of the receiving roll is constantly changing as it is being wound, in order to maintain the linear speed of the tape substantially constant it is necessary to compensate for the constantly changing diameter by providing some method of variably driving the take-up reel. In prior art devices such as United States Letters Patent 2,353,408 to Einer W. Larsen a relatively satisfactory solution to the problem of linear speed control of the take-up reel is disclosed wherein a separate electric motor to drive the take-up reel is provided in conjunction with electrical and mechanical means for controlling the input to the motor to constantly reduce the motor speed as the size of the reel increases. Such a system requires, as heretofore noted, both a mechanical and electrical control system so that the conditions of the reel are mechanically transmitted to an electrical control unit such as an auto-transformer which converts the mechanical signals into electrical control of the input of the reel driving motor.

It is the purpose of this invention to provide novel variable tape driving and reeling or winding means for printing telegraph mechanism which overcome the aforementioned difficulties encountered in prior art devices, by means of a simple improved construction which assures a more positive maximum efficient operation and which

utilizes minimum number of inexpensively manufactured, easily serviced elements. The variable tape feeding and coiling mechanism of our invention is so constructed to be immediately and automatically responsive to the supply needs of a printing telegraph machine and also immediately and automatically sensitive to the rate of ejection of the tape from the telegraph machine to assure efficient withdrawing of tape from the supply reel and reeling of tape on a take-up reel with no damage to the tape, and which readily permits adaptation of printing telegraph machines to extend unattended automatic service installations.

It is, therefore, the fundamental object of the present invention to provide, in a machine utilizing a record tape, means of such improved construction that the tape is automatically withdrawn from a supply, moved through a work station and wound on a take-up reel at an optimum rate to avoid both excessive looseness and tautness of the tape.

It is a primary object of this invention to provide, in a machine utilizing a record tape, improved means for intermittently driving a tape take-up reel whereby the rate of rotation of the reel automatically progressively decreases as the diameter of the coil of tape on the reel increases, thus preventing excessive tautness on the tape as it is fed to the take-up reel at a constant rate of speed from an associated telegraph apparatus.

Another object of this invention is the provision of improved tape reeling apparatus having means automatically operative to quickly wind up any slack occurring in a recording tape after a period of operation when the take-up reel is stopped for some reason while the tape continues to be ejected from an associated telegraph apparatus.

A further object of this invention is the provision of novel stopping means for a take-up reel to prevent rupture of a recording tape or damage to an associated telegraph machine or the tape mechanism should there be an unauthorized stoppage of tape supply while the take-up reel is still revolving.

Another object of this invention is the provision of a novel safety device in a take-up reel driving mechanism whereby the driving mechanism is allowed to continue to operate while the tape reel is held from turning thus minimizing danger of damage to the tape or to the tape mechanism.

A still further object of this invention is the provision of a novel take-up reel having removable sides and gripping means to prevent a tape coil from turning upon the reel during rotation of the reel, and associated novel driving means for the reel.

Another object of this invention is the provision of a novel tape feeding mechanism which will furnish tape to a telegraph machine at a speed consistent with the demands of said machine.

A still further object of this invention is the provision of a novel tape feeding device which will stop supplying tape to a telegraph machine when the telegraph machine stops even though the driving mechanism for the tape continues to operate.

A further object of this invention is the provision of a novel alarm system associated with the tape feeding mechanism to indicate its various operating conditions.

A still further object of this invention is the provision of a novel, relatively simple, and inexpensive automatic tape feeding and reeling mechanism for association with printing telegraph mechanisms.

These and other objects will become apparent from the following description and appended claims when read in connection with the attached drawing, wherein:

Figure 1 is a perspective view of the novel drive means for the take-up reel forming a part of this invention.

Figure 2 is an enlarged fragmentary perspective view of the regulating and driving mechanism shown in Figure 1;

Figure 3 is an enlarged fragmentary elevational view of the novel safety drive means for the take-up reel;

Figures 4 and 5 are enlarged schematic views showing two conditions of operation of the improved tape feeding mechanism and alarm system forming a part of this invention;

Figure 6 is an exploded view of the improved take-up reel;

Figure 7 is a partial sectional view of the assembled take-up reel of Figure 6; and

Figure 8 is a diagrammatic view illustrating a combination device in which a variable tape feed device is incorporated on the supply side and on the take up side of a work station.

Take-up reel drive

Referring now to Figures 1 and 2 there is shown the details of the novel drive mechanism for the tape or take-up reel wherein message tape 10, or other recording medium, passes through guide 12 of support 13 up over sensing wire 14 and then down under guide or snubbing post 16, rigidly mounted in support 13, to form a loop in the tape indicated at 18. After tape 10 leaves guide post 16 it passes over guide post 20 and under guide post 22, both also rigidly mounted on support 13, which serve to properly guide the tape and impart sufficient frictional resistance to the relative sliding movement of the tape to assure proper functioning of the mechanism to be hereinafter described. The end of the tape is suitably secured to reel 24 to permit winding, as will be hereinafter described.

Axle 26 rigidly secured to reel 24, to impart rotation thereto, extends a short distance beyond the outer faces of the reel and terminates at the right hand as viewed in Figure 7 in enlarged integral end or head 28. Bracket 30 consists of a pair of sheet metal members 31 suitably joined at one end, as at 33 as by welding, and extending therefrom in spaced parallel relation. Reinforcing ribs 35 secured to the outer faces of members 31 impart sufficient rigidity to the members to maintain them in their desired spaced relation. Axle 26 mounted in rotating bearing relation in slots 32 in the upper end of members 31 is prevented from axial shifting by the bearing contact of end 28 and portion 27 engaging opposite surfaces of the right hand member 31, as viewed in Figure 7, thus maintaining reel 24 axially centered between the members. The use of slots 32 in the upper end of members 31 permits easy and ready removal of reel 24 to remove a roll of tape therefrom or connect a new tape thereto, as will hereinafter become apparent. Spur gear 34 rigidly mounted on axle 26, to impart rotation to the axle, meshes with another spur gear 36 (Figure 2) rigidly secured to the left hand or inner end of drive shaft 38 which is rotatably journaled at opposite ends respectively in bracket 30 and a bracket extension 40 secured to bracket 31 and shown cut away in Figure 1.

On the outer or right hand end of shaft 38, as viewed in Figures 1 and 2, is a unidirectional clutch, of the well known wedging roller type, consisting of a central driven member 44 rigidly mounted on shaft 38 having spaced substantially radially outwardly extending arms 45 which rotatably support outer driving member 52 on their peripheries and define with the inner periphery of member 52 a plurality of wedge shaped slots 50 for carrying spring pressed rollers 48.

When outer driving member 52 is rotated in a counterclockwise direction, by means to be hereinafter described rollers 48, which are spring-pressed against the inner surface of driving ring 52, are caused to roll into the narrow end of notches 50 and are jammed there thus locking arms 45 of inner member 44 to the outer driving ring 52 so that the rotation of ring 52 is imparted to shaft 38 causing the associated gear 36 to also be turned in a counterclockwise direction.

The outer driving ring 52 has two ears 54 and 56 extending radially outwardly from its outer periphery which fixedly mount posts 58 and 60, respectively. Post 58 extends inwardly towards spur gear 36 and acts as a cam follower coacting with cam surface 62 for a purpose to be explained, and post 60 extends in an opposite direction and slidably fits into slot 64 in one end of link 66, of a driving arm.

The driving arm (Figure 3) consists of two links, an upper link 66, and a lower link 68, operatively fastened together by posts 70 rigidly mounted in the upper link 66, and slidably engaging slots 72 in lower link 68. The lower end of link 66 has a lateral projection 73 for affixing one end of a tension spring 74 and the upper end of the member 68 has a similar lateral projection 75 for affixing the other end of spring 74. When spring 74 is in place, projections 73 and 76 of links 66 and 68, respectively, are drawn toward each other so that pins 70 engage the top of slots 72. Spring 74 is strong enough to overcome all the other spring forces in the device plus all other normal operating resistances of the mechanism so that the two links 66 and 68 effectively act as a unitary driving arm unless the mechanism is over taxed, in which case the two members 66 and 68 will act as a safety device and will move relative to one another rather than driving the clutch and perhaps damaging the mechanism, as will be hereinafter more fully explained. The lower end of link 68 is pivotally connected to one end of arm 78 which has its other end rigidly fixed to the shaft 80 so that movement of the shaft is imparted to link 68 through arm 78. Dual arm cam follower 82 has one arm 81 rigidly mounted on shaft 80 and the other downwardly depending arm 83, mounting a roller 79 slightly, shown in Figure 1, in bearing contact with cam 84, rigidly mounted for rotation with cam shaft 85. Cam shaft 85 derives its rotation from any suitable power source such as an electric motor (not shown). Rotation of cam shaft 85 imparts a right and left hand oscillatory motion to follower 82 through cam 84, as viewed in Figure 1, which is transmitted through shaft 80 and arm 78 to impart an up and down or reciprocal movement to the members 66 and 68. Thus it can be seen, by referring to Figure 3, that as the member 66 makes its up-stroke the bottom of the slot 64 strikes pin 60 and turns the clutch driving member 52 a short distance in a counterclockwise direction. As previously explained inner driven member 44 of the clutch will be turned in the same direction by the wedging engagement of rollers 48 with arms 45 and member 52 which will turn take-up reel 24, by means of spur gears 36 and 34, in a clockwise direction.

The means by which the amount of clockwise turning of the tape reel is controlled will now be described. Rigidly fixed to bracket 30 is pivot post 90 upon which is pivotally mounted an arm, generally indicated at 91 comprising a pair of flat strips 92 and 93 fastened together, as by welding. Strip 93 extends to the right of the pivot post 90, as viewed in Figures 1 and 2, and has cam section 62 formed on the end for coaction with post 58. The other strip, 92, also extends to the right of pivot 90 and extends upwardly terminating in right angularly bent end 94 which forms a stop for selective coacting engagement with the rim of clutch drive member 52 preventing clockwise rotation of cam 62 to an extent where it will be out of engagement with post 58. Extending leftwardly, Figures 1 and 2, from pivot post 90 the two strips are laterally bent to form spaced bracket arms 96 for holding the tape loop sensing wire 98. Wire 98 is bent at one end, in the manner illustrated at 14 of Figures 1 and 2, and engages tape loop 18, as hereinbefore described, the other end of the wire fits in suitable apertures in arms 96 and mounts a cylinder 97

between the arms. Set screw 99 threadedly mounted in cylinder 97 tightly engages wire 98 and prevents the wire from sliding out of brackets 96. The whole arm 91 carrying wire 98 is biased in a clockwise direction by the pull of spring 100 attached at one end of the integral bent ear 102 on cam section 62 and to post 104 rigidly secured on mounting bracket 30.

Tension spring 71 connected at one end to opening 75 of drive member 52 and at the other end to stationary pin 77 mounted on bracket 30, biases drive member 52 in a clockwise direction upon a downward or non-actuating stroke of link 66 to position member 52 for a succeeding driving stroke.

Post 58 of driving member 52 of the clutch acts as a cam follower in bearing contact against cam 62 so that as arm 91 is lowered or rotated counterclockwise, as viewed in Figure 1, due to a shortening of the tape loop 18 which occurs for example; when the peripheral speed of the take-up reel gets ahead of the speed of the supply reel due to an increase in the diameter of the take-up reel, cam 62 pushes the post 58 to the right as viewed in Figures 1 and 2 which raises the post 60 a like amount. Due to this raising of the post 60 the bottom of the slot 64 of driving arm 66 will strike the post 60 later in its operating cycle as it makes its upstroke and thus will rotate driving member 52 through a shorter distance. As the arm 92 is pulled down farther, cam 62 continues to push the post 58 farther to the right until it has raised post 60 high enough so that it will not be struck at all by the bottom of slot 64, as the member 66 makes its up-stroke, at this point no rotational movement will be imparted to the tape reel 24 and it will not wind any tape. There is provided on the cam surface 62 a radially outwardly extending detent 108 over which post 58 will ride if a manual counterclockwise force, as observed in Figures 1 and 2, is exerted on the wire 98, which for example, would be done by an attendant when a stoppage of the tape supply was noted by the attendant. When the post 58 is forced or rides over detent 108 clutch drive member 52 will be held in its extreme counterclockwise position, and there will be no rotational movement transmitted to the tape reel until the wire 98 is manually lifted to carry post 58 out of the detent 108 and back on to cam surface 62.

In operation, sensing lever 98 of arm assembly 91 having wire extension 14 for engaging loop 18 of the recording tape is caused to be gradually turned counterclockwise, as viewed in Figure 1 against the pull of spring 100 by the decreasing diameter of the loop as the quantity of tape builds up on take-up reel 24. This decreasing of the loop diameter is characteristic of all coiling devices where the speed of the take-up reel and the speed of supply to the reel are constant. As the diameter of the coil of tape on the reel 24 increases, its peripheral speed gets ahead of the supply speed and the loop between the supply and take-up reel will be gradually diminished in length. Sensing arm 91 is affected by this variation of loop size and rotates cam 62, which engages follower 58 on the clutch driving member, in a counterclockwise direction to change the position of driving pin 60 in slot 64 of the reciprocating driving arm. As the driving arm makes an upward stroke the bottom of the slot strikes the driving pin and forces clutch driving member 52 to follow to the end of the up-stroke in a counterclockwise direction. The clutch is so designed, as hereinbefore described, to drive shaft 38 in a counterclockwise direction only and rotate the take-up reel through the spur gear train in a clockwise direction to wind tape 10. When the driving arm returns to its lower position, the clutch driving member 52 is spring returned in a clockwise direction by spring 71 until its follower 58 strikes cam 62 on the loop sensing lever 91. The clutch driving member will be returned a shorter distance each time due to the constantly decreasing loop size which rotates cam 62 and limits the degree of return travel of follower 58 before it contacts the cam. As the driving arm makes each succeeding up stroke it will strike clutch driving pin 60 later in the cycle each time and will carry it a shorter distance thus turning the associated shaft and take-up reel through a shorter arc.

It is to be understood that the tape loop will not diminish in size as fast as it would without the above disclosed mechanism as the cam on the end of the sensing lever is designed to allow the peripheral speed of the coil to be just slightly in excess of the supply speed at all times thus maintaining a loop throughout the entire winding procedure.

Tape reel

In tape reels of this nature it is desirable to be able to easily remove the tape from the reel for storage or disposal and insert another tape to be wound; the following description applies to the device for performing this function. Reel 24 shown in exploded view in Figure 6, consists of two discs 101 and 103 each with a hollow hub 105 and 107. Hub 105 slidably fits within the hub 107 and is provided on its outer surface with radially outwardly extending post 109 which engages slot 111 extending diagonally inwardly across the surface of hub 107. Post 109 and slot 111 form a bayonet type lock when the two hubs are assembled together and turned in opposite directions to position post 109 at the bottom of slot 111. The surfaces of the discs 101 and 103 have their center sections die formed or embossed toward each other to form inwardly extending cylindrical hubs having shoulders 112 and 114, respectively (Figure 7). The distance between these shoulders when the reel is assembled, is slightly less than the width of the cardboard ring or core 116 upon which the tape is coiled, so that when core 116 is placed upon hub 107 and the two halves 101 and 103 are twisted and locked together, shoulders 112 and 114 will clampingly engage core 116 therebetween and prevent it from turning. Tape 10 can be attached to this core 116 by any suitable means, for example, adhesive cellophane tape 118, as illustrated in Figure 6. Coil spring 120 is mounted within hub 105 in surrounding relation to axle 26 and has an end 122 of the spring attached to the axle as seen in Figure 7. Spring 120 is compressed when discs 101 and 103 are assembled and exerts a force to the left, as viewed in Figure 7, against the inside surface of disc 101, which serves to facilitate separating discs 101 and 103 when the reel is being unloaded, and also exerts sufficient frictional engaging force between post 109 and slot 111 to prevent any inadvertent separation of the discs.

Tape puller mechanism

As heretofore noted, in mechanisms which require a continuous supply of intermittently fed tape, it is advantageous to use as large a supply roll as possible. As the size of the supply roll is increased the consequent increase in weight naturally causes considerable resistance to the intermittent unwinding required by the telegraph machine or other associated mechanism. We have invented novel means which relieves the receiving mechanism of the burden of pulling or jerking this weight, with the possible result of tearing the tape, and which assures supplying the tape to the receiving mechanism under its control and consistent with its demands, which novel means will now be fully described.

Referring to Figure 4 of the drawing, shaft 238 suitably journalled in supports (not shown) is capable of rotating only in a counterclockwise direction through its connection with drive or reaction member 244 of a unidirectional clutch similar to unidirectional clutch assembly 44 and 52. Fixed to shaft 238, and rotating with it, is axially extending circumferentially serrated drum 270 over which tape 10 passes after leaving a supply roll or reel (not shown). Roller 272 is spring pressed toward drum 270 and serves to hold tape 10 against the

serrated circumference of the drum 270 to cause enough resistance between the drum 270 and the tape to allow the tape to be pulled from the supply reel as drum 270 is rotated. Driving member 252 of the unidirectional clutch, similar to driving member 52 (Figure 2), is intermittently turned by reciprocating arm 266 which receives its motion from any suitable source; for example, intermittently energized solenoid 274. A sensing lever 292 pivoted at 290, and having cam surface 262, corresponding to sensing lever 91 of Figure 2, carries laterally extending post 214 for engaging loop 218 of tape 10. Arm 292 and its associated cam surface 262 are biased in a counterclockwise direction by the biasing force of tension spring 300, connected at one end to offset projection 301 of arm 292 and at the other end to stationary pin 303. Tension spring 305 is similarly connected at one end to pin 303 and is secured at the other end to projection 307 of drive member 252, and serves to bias the drive member in a clockwise direction forcing pin 258 against cam surface 262. Sprocket 302 is used in this illustration to schematically indicate the receiving mechanism utilizing the supplied tape, and which revolves intermittently at the same rate of speed as drum 270. The receiving mechanism symbolized by sprocket 302 may be any device for performing a function upon the tape as for example, a sensing or recording station.

The above described mechanism operates in the following manner: Sensing arm 292 is shown in Figure 4 in its normal operating position during regular operation of the mechanism; in this position tape 10 will be pulled from the supply reel by the rotation of drum 270 an amount exactly equal to the amount that the tape is moved leftwardly as viewed in Figure 4 by sprocket 302, each time the arm 266 makes a down stroke which rotates drive member 252 and consequently drum 270 in a counterclockwise direction. In actual application of this mechanism, the amount that the tape 10 will be pulled by revolving drum 270 is not constant, since a slight slippage of tape 10 on drum 270 can occur when the tape is being pulled from a full supply reel. When slipping occurs the correct amount of tape is not being supplied to the receiving sprocket and in consequence loop 218 will become smaller. The decreasing of loop 218 will draw laterally extending post 214 upwardly, as viewed in Figure 4, causing arm 292 to rotate in a clockwise direction rotating cam 262 to a low point which effectively decreases the distance between pivot 290 and the contact point of the cam. Spring 305 maintains follower 258 in contact with cam surface 262 and will consequently rotate drive member 252 clockwise to raise driving post 260 within slot 264, which will cause post 260 to be struck sooner during the downward operating stroke of arm 266. Thus driving ring 252, driven member 244 of the clutch, and drum 270 will be tuned slightly more than the normal amount to keep the supply of tape 10 equal to the demand of the sprocket, and the loop 218 will increase in size to allow the sensing arm 292 to reapproach its normal position. It can be readily seen that small variations of speed at either the pulling mechanism or the receiving mechanism will be compensated for by this device. If the receiving mechanism should stop, the tape will continue to be supplied until the sensing arm 292 drops to its lowest position as shown in Figure 5 which will cause ring 252 to be turned to its extreme counterclockwise position moving post 260 to its lowest position. In this position arm 266 will continue to reciprocate freely without driving the ring 252 and associated tape pulling drum 270, and no tape will be drawn from the supply reel.

Alarm mechanism

A signal for keeping an attendant informed of the condition of movement of tape 10 may be associated with the above described device in the following manner: As clearly seen in Figures 4 and 5 contact lever 304, having three legs 306, 308 and 310, is mounted for free pivotal movement at 312. The lower leg 306 loosely engages notch 314 in the hub of the sensing arm 292, this notch 314 is wide enough to allow sensing arm 292 to rotate in either direction a predetermined amount without interfering with the leg 306. Tension spring 309 connected at one end to stationary post 311 and at the other end to arm 310 of lever 304 normally biases leg 306 into notch 314. The rightwardly extending leg 308 as viewed in Figure 4 projects into the path of the lower end of driving arm 266 and is struck by the bottom of the driving arm upon each downward stroke. Upwardly extending arm 310 is associated with a pair of spring type electrical contacts 316 which are normally biased apart to open the associated circuit. In this particular embodiment, arm 310 under the biasing force of spring 309, normally engages and closes contacts 316. Each time the driving arm 266 makes a downward stroke, arm 310 is rotated clockwise away from the contacts to permit them to separate to their normal separated position as is clearly seen in Figure 5. Thus, during normal operations of the mechanism a signal light 318 will be flashed for each stroke of reciprocating arm 266.

Each such pivotal movement of lever 304 momentarily disengages arm 306 from notch 314. If for some reason a stoppage of the sprocket 302 should occur, sensing arm 292 will be dropped due to a lengthening of loop 218 and its hub 313 rotated in a counterclockwise direction as viewed in Figure 5. This rotation will cause notch 314 to be rotated out of the path of the leg 306 and the surface of hub 313 will prevent the leg 306 from oscillating by holding leg 306 in its extreme leftward position as illustrated in Figure 5. This will in turn hold the member 308 in its lowermost position to prevent it from being struck by reciprocating driving arm 266. Upper arm 310 will also be held away from contacts 316 so that the circuit will be opened and signal light 318 will cease to flash. The above described signal will also be given when tape loop 218 becomes smaller than normal due to insufficient tape being supplied to the receiving sprocket. In this case sensing arm 292 will be raised or rotated about pivot 290 in a clockwise direction, and the leg 306 of lever 310 will be retained in its extreme leftward position by hub portion 315 below notch 314 and upper arm 310 will again be out of contact with contacts 316 so that the circuit will be open and flashing of light 318 will cease.

Considering Figures 1, 4, 5 and 8 a brief resume of the complete operation of our novel tape feeding and reeling device will now be described.

Tape 10 extends from a supply reel (Fig. 8) located to the right of Figures 4 and 5, over drum 270, under post 214 to the receiving mechanism schematically indicated as sprocket 302. From the receiving mechanism, tape 10 passes under guide 12 over wire 14 and alternately under and over guide posts 16, 20 and 22 to take-up reel 24. Tape 10 is fed to the receiving mechanism commensurate with its demands which demands are relayed to the feed mechanism by the size of tape loop 218. That is, if the demand of the receiving mechanism is greater than the feed, loop 218 will decrease rotating arm 292 clockwise to position post 260 nearer the top of slot 264 which will result in arm 266 moving post 260 and consequently feed drum 270 a greater counterclockwise distance to pull more tape from the supply reel. If for some operational reason the supply of tape is wholly inadequate, loop 218 will decrease sufficiently to rotate arm 292 clockwise a sufficient distance so that leg 306 is held in its leftmost position by hub 315. In this position light 318 will cease to flash giving the operator a warning of malfunction. Conversely should the feed exceed the demands of the receiving mechanism 302 or should the mechanism stop altogether loop 218 will increase in size permitting spring 300 to lower or rotate arm 292 in a counterclockwise direction which will have the effect of

moving post 260 farther away from the top of slot 264 and result in less feed rotation of drum 270. If the receiving mechanism is completely stopped loop 218 will increase to such a size to permit spring 300 to rotate arm 292 to a point where leg 306 is held against hub 313. In this position pin 260 will not be struck at all by arm 266 and no tape will be fed. Additionally, as hereinbefore described, in this condition of leg 306, contacts 316 will be separated and light 318 will cease to flash thus warning the operator of malfunction.

As the tape is ejected from the receiving mechanism it passes to take-up reel 24 which like the feed mechanism is similarly sensitive and responsive to operating conditions. The size of loop 18 controls sensing lever 91 to give the proper setting to the take-up reel drive mechanism. If tape is being ejected at a greater rate than it is being wound on the take-up reel, lever 91 rotates clockwise due to the increase in loop size and biasing force of spring 100 to position post 60 nearer the bottom of slot 64 which results in a greater rotation of clutch 44—52 and consequently reel 24. Conversely if the reel is winding too rapidly loop 18 decreases rotating arm 91 counterclockwise to move post 60 away from the bottom of slot 64 and consequently decrease the amount of rotation of reel 24. Should tape fail to be ejected from the receiving mechanism altogether arm 91 will be rotated counterclockwise sufficiently to pass detent 108 over follower 58 which will hold post 60 in a position where it can never be struck by the bottom of slot 64, so that even though the electric drive motor (not shown) continues to actuate shaft 85 and the associated mechanism to move driving links 66 and 68 the reel will not turn.

In this type of coiling or reeling device the peripheral speed of reel 24 will increase as the tape accumulates thereon and increases the diameter. This increase in speed will have a tendency to decrease loop 18 and sensing lever 91 will be incrementally moved counterclockwise to limit the return or clockwise rotation of drive member 52 under the biasing force of spring 74. As a result reel 24 will be progressively rotated a lesser amount thus compensating for the increasing diametric size and linear speed of the reel. The aforementioned sensing mechanism, however, is so constructed to allow the peripheral speed of reel 24 to be just slightly in excess of the supply speed so that a loop will be maintained throughout the winding procedure; whereas, without the novel sensing mechanism the peripheral speed of the reel would greatly exceed the supply to a point where there would be no loop and the tape would be put under severe tension with consequent tearing of the tape or damage to the mechanism.

Tape can be easily connected to or removed after winding by the provision of the novel separable reel illustrated in Figure 6 and hereinbefore described.

From the foregoing description it will be readily seen that we have invented novel automatic feeding and reeling means for recording tape for association with automatic printing telegraphs that is completely sensitive to all operating conditions and variations in operating conditions to assure efficient feeding and winding with no damage to the tape, tape mechanism or associated telegraph mechanisms and which is relatively simple and inexpensively manufactured.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired by United States Letters Patent is:

1. In tape feeding apparatus; a member for moving a tape; motive means for said tape moving member including a unidirectional driven means drive connected to said tape moving member, a bidirectional driving means and a unidirectional clutch device operatively connecting said driving and driven means, said bidirectional driving means including an adjustable linkage enabling the range of bidirectional movement of the portion of said bidirectional means operatively connected to said unidirectional clutch device to be varied; and sensing means operatively engageable with said portion of said bidirectional driving means and responsive to tautness in the tape being moved to adjust said adjustable linkage whereby said tape moving member is variably driven in accordance with tautness in the tape.

2. In a tape coiling apparatus, tape guide structure, a tape take-up reel for winding tape passing from said guide structure; a unidirectional clutch having a driven member operatively connected to said reel and a driving member; actuating means, including an automatically variable linkage, for imparting intermittent drive movement to the driving member of said clutch; a cam operatively coacting with said clutch driving member; and a pivotally mounted arm connected with said cam, operatively engaging the tape and responsive to tautness in the tape to selectively vary the position of said cam whereby selective positioning of the cam causes a variation, resulting from variation in said variable linkage, in the degree of movement which can be imparted to said clutch driving member from the actuating means thus causing an effective variation of the movement of said reel to keep the winding action of the reel in step with the speed of supply of the tape.

3. In combination, a rotatable shaft, a unidirectional clutch having a driven member, operatively connected with said shaft, and a driving member; a projection on said driving member; a driving means with an arm having an automatically variable range of movement and with a longitudinal slot slidably containing said projection on said driving member; means for reciprocating said driving arm to cause an edge of said slot to strike the projection of the clutch driving member to impart movement to said clutch driving member and rotate said shaft, and means to adjust said projection with respect to said arm to selectively increase or decrease the range of movement of said arm and the resultant turning of said driving member and thereby control the rotation of said shaft.

4. In a tape coiling apparatus, a tape supply device; a take-up reel for winding a tape from said supply; a unidirectional and selectively movable clutch with driving means and driven means; a post operatively connected to the driving means of said clutch; means operatively connecting the driven means of said clutch to said take-up reel; a reciprocating driving arm connected to the driving means of said clutch for driving said clutch; a tape sensing arm operatively engaging tape from said supply and responsive to tautness in the tape; a cam connected to said arm coacting with said post on said unidirectional clutch to vary the range of movement of said driving means of said clutch in response to tautness in the tape; and means for engaging said post and retaining said clutch in an inoperable position to prevent excessive tautness from being imposed on the tape.

5. In a tape coiling apparatus, a tape supply device, a take-up reel for winding tape from said supply device; means for causing resistance to the passage of the tape from the supply to the reel; a rotatable unidirectional clutch having a reaction member; torque transmitting means between said take-up reel and said reaction member of said clutch; actuating means connected to a driving member of said clutch to intermittently actuate said clutch; a cam coacting with the clutch driving member to control its degree of rotation; a pivotally mounted arm connected to said cam operatively engaging and responsive to the tautness in the tape passing between said supply device and the take-up reel, said arm being variably

positioned in accordance with the tautness of the tape to move said cam and control the degree of rotation of said driving member whereby the degree of winding of the reel is controlled to prevent damage to the tape and coiling apparatus.

6. In tape winding apparatus, a support; a take-up reel rotatably mounted on said support for winding a tape; a rotatable shaft operatively connected to said reel for imparting rotation to said reel; a clutch comprising a driven member operatively connected to said shaft and a selectively positionable driving member; an actuator for moving said driving member to drive said driven member and reel; means defining a variable driving connection between said driving member and actuator for variably driving said driving member; motive means for imparting motion to said actuator; means defining an operative connection between said motive means and actuator for converting continuous motion of said motive means to intermittent motion of said actuator and intermittent rotation of said reel; and sensing means operatively engageable with said clutch and responsive to the tautness of a tape being wound for automatically selectively positioning said driving member and varying said driving connection between said actuator and driving member whereby the amount of movement of said reel is varied for varying operating conditions.

7. In tape winding apparatus, a support; a take-up reel rotatably mounted on said support for winding a tape; a rotatable shaft operatively connected to said reel for imparting rotation of said reel; a unidirectional rotatable clutch comprising a driven member operatively connected to said shaft and a selectively positionable driving member; a reciprocable arm for moving said driving member to drive said driven member and reel; means defining a variable driving connection between said driving member and reciprocable arm; motive means for imparting motion to said reciprocable arm; means defining an operative connection between said motive means and reciprocable arm for converting continuous motion of said motive means to intermittent reciprocable motion of said arm; and a pivotally mounted sensing lever operatively engageable with said clutch and responsive to the tautness of a tape being wound for automatically positioning said driving member and varying said driving connection between said reciprocable arm and driving member whereby the amount of movement of said reel is varied for varying operating conditions.

8. The device as set forth in claim 7 wherein said reciprocable arm comprises a pair of slidably connected links; and spring means operatively holding said links together for unitary reciprocable movement and defining safety means whereby normal force will cause said links to unitarily reciprocate and abnormal force transmitted to said reciprocable arm will cause said links to move relative to each other thereby preventing abnormal force from being transmitted to said clutch and reel mechanisms.

9. In tape feeding apparatus, a feeding member for moving a tape; a clutch comprising a driven member operatively connected to said feeding member and a selectively positionable driving member for driving said driven member; and actuator for intermittently actuating said driving member to intermittently move said feeding member; means defining a variable driving connection between said driving member and actuator for variably driving said driving member; sensing means operatively engageable with said clutch and responsive to the tautness of a tape being moved for automatically selectively positioning said driving member and varying said driving connection between said actuator and driving member to vary the amount of movement of said feeding member for varying operating conditions; signal means to indicate operating conditions of said feeding apparatus; and means operatively associated with and engageable by said actuator and sensing means for transmitting operating conditions to said signal means.

10. In tape feeding apparatus, a feeding member for moving a tape; a unidirectional rotatable clutch comprising a driven member operatively connected to said feeding member and a selectively positionable driving member for variably driving said driven member; a reciprocable arm for intermittently actuating said driving member to intermittently move said feeding member; means defining a variable driving connection between said driving member and reciprocable arm for variably driving said driving member; a pivotally mounted sensing lever operatively engageable with said clutch and responsive to the tautness of a tape being fed for automatically selectively positioning said driving member and varying said driving connection between said reciprocable arm and driving member to vary the amount of movement of said feeding member for varying operating conditions; signal means to indicate operating conditions of said feeding apparatus; and means operatively associated with and engageable by said reciprocable arm and sensing lever for transmitting operating conditions to said signal means.

11. In tape feeding apparatus, a feeding member for moving a tape; a unidirectional rotatable clutch comprising a driven member operatively connected to said feeding member and a selectively positionable driving member for variably driving said driven member, a reciprocable arm for intermittently actuating said driving member to intermittently move said feeding member; means defining a variable driving connection between said driving member and reciprocable arm for variably driving said driving member; a pivotally mounted sensing lever operatively engageable with said clutch and responsive to the tautness of a tape being fed to automatically selectively position said driving member and vary said driving connection to vary the amount of movement of said feeding means for varying operating conditions; electric signal means, having resiliently spaced contacts, to indicate operating conditions of said feeding apparatus; and means, engageable with said contacts resiliently biased to contact closing position, operatively associated with and engageable by said reciprocable arm and sensing lever, intermittently moved by said arm to permit opening of said contacts to produce intermittent signals of normal operation and moved by said sensing lever to inoperative positions to prevent transmission of a signal to indicate abnormal operation of said feeding apparatus.

12. The device as set forth in claim 11 wherein said movable means comprises a pivotally mounted actuating lever resiliently biased to contact closing position to permit transmission of a signal and intermittently moved away from said contacts during an actuating stroke of said arm permitting intermittent opening of said contacts to provide an intermittent signal during normal operation and moved by said sensing lever under abnormal conditions to hold said actuating lever away from said contacts to prevent a signal and thereby indicate abnormal operation of said feeding mechanism.

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