H. W. DOUGHTY.

SIGNAL RECORDER.

APPLICATION FILED APR. 3, 1917.

1,345,355. **Patented July 6, 1920.**

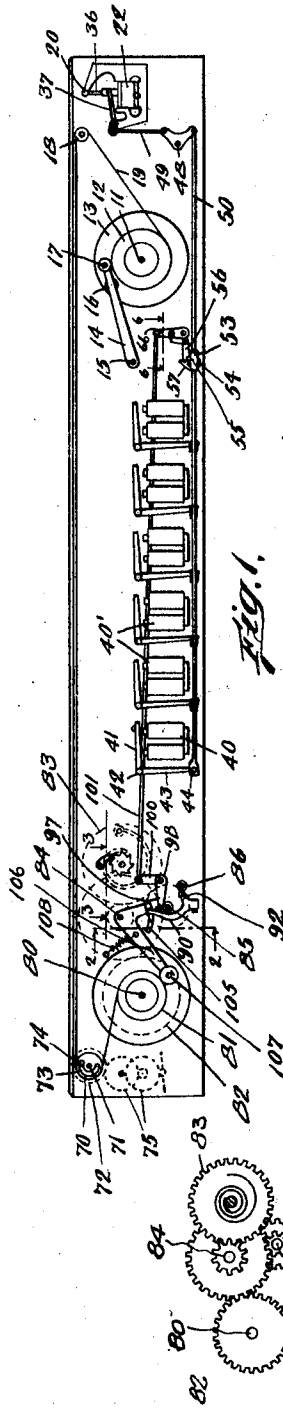

Fig. 1.

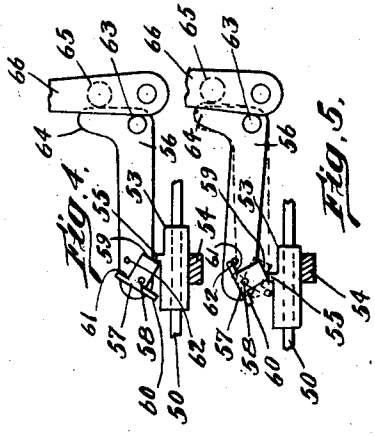

Fig. 4.

Fig. 5.

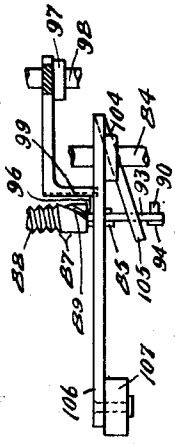

Fig. 3.

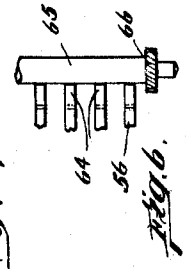

Fig. 6.

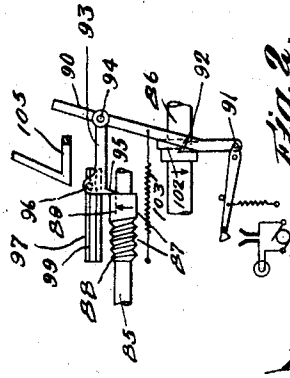

Fig. 2.

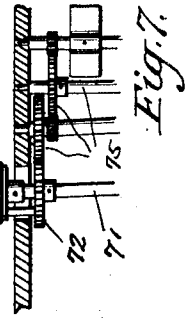

Fig. 7.

Fig. 8

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UNITED STATES PATENT OFFICE.

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SIGNAL-RECORDER.

1,345,355. Specification of Letters Patent. Patented July 6, 1920.

Original application filed November 30, 1914. Serial No. 874,732. Divided and this application filed April 3, 1917. Serial No. 159,407.

To all whom it may concern:

Be it known that I, HERMAN W. DOUGHTY, a citizen of the United States, residing at Binghamton, in the county of Broome and State of New York, have invented an Improvement in Signal-Recorders, of which the following is a specification.

This application is a division of my application Serial No. 874,732, filed November 30, 1914.

My invention relates to that class of signal recorders, frequently referred to as "multiple pen registers," in which a plurality of markers are provided, each having independent electromagnetic operating or controlling mechanism, and has specific reference to propelling-mechanism for feeding the tape or strip of material upon which the record is to be made, and self-starting and self-stopping mechanism for the propelling-mechanism, subject to the joint control of said propelling-mechanism and of the magnetic controlling or operating mechanism associated with the various markers.

The objects of this invention are as follows:—

To provide such an improved self-starting and self-stopping mechanism for the propelling-mechanism of a recorder, that said propelling-mechanism will be permitted to start, and said starting and stopping mechanism will be adjusted to adapt it to act to stop said propelling-mechanism upon a predetermined tape travel, upon the movement of a marker from its normal to its operated position.

To so apply a self-starting and self-stopping mechanism to the take-up reel of a recorder that said mechanism is adapted to act to stop said reel after a predetermined travel of the exposed tape, regardless of the size of the tape roll upon such take-up reel.

To provide a recorder arranged to operate at high speed and to expose a comparatively great length of tape between the pay-out reel and take-up reel, in which the tape may be almost instantaneously brought to full speed without leaving slack tape between the pay-out reel and take-up reel.

To provide a recorder having a pay-out and a take-up reel for the record tape, said take-up reel being supplied with suitable propelling-mechanism and starting and stopping mechanism whereby its movement may be suddenly arrested, and said pay-out reel being supplied with a frictional retard sufficiently to instantly absorb the momentum of said pay-out reel and any tape roll thereon,—in which a uniform operating torque for said propelling-mechanism may be utilized regardless of changes in diameter of the tape rolls on the take-up and pay-out reels.

To provide a recorder having a take-up reel and propelling-mechanism for the record tape applied to said take-up reel, together with governor mechanism adapted to regulate the speed of linear movement of said tape regardless of the size of tape roll upon said take-up reel.

To provide a recorder having tape propelled by a take-up reel, from a frictionally retarded pay-out reel, in which the speed of tape movement will be practically constant under all operating conditions.

In attaining the feature of this invention whereby a self-starting and self-stopping mechanism is so applied to the take-up reel of a recorder that said mechanism is adapted to act to stop said reel upon a predetermined travel of the exposed tape, regardless of the size of the tape roll upon such take-up reel,—starting and stopping mechanism is provided which is adapted to be operated by the running of the take-up reel to stop said reel, and a member is provided, the movement of which is governed by the diameter of the tape roll, said member being adapted to so control the self-starting and self-stopping mechanism that, as the rate of tape travel increases in relation to the rotation of the take-up reel, due to the increase in diameter of the tape roll, the permitted rotation of the take-up reel, after any release thereof, will be so decreased that said self-starting and self-stopping mechanism will be adjusted to act to stop said take-up reel when said reel has acted to wind up a predetermined length of said tape.

In attaining the feature of this invention whereby,—in a recorder which is arranged to operate at high speed and to expose a comparatively great length of tape between the pay-out reel and take-up reel, such tape may be almost instantaneously brought to full speed, without leaving slack between the

pay-out reel and take-up reel,—a frictional retard is provided for the pay-out reel, propelling-mechanism is suitably applied to the tape and governor mechanism is provided which is adapted to be driven by the tape so as to suitably regulate the speed of movement thereof, said governor mechanism being so constructed and arranged that the stored energy therein, when said mechanism is running at normal speed and the movement of the tape is suddenly arrested, will cause portions of said mechanism to continue to run until there has been such relative movement between said portions and the tape that, when the tape is again started, said tape and the parts moving therewith will be permitted to reach at least full speed, before said governor mechanism becomes effective in checking and regulating the speed of said tape.

In attaining the feature of this invention whereby a uniform operating torque may be utilized regardless of changes in diameter of the tape rolls on the take-up and pay-out reels in a recorder having a pay-out and a take-up reel for the record tape, said take-up reel being supplied with suitable propelling-mechanism and starting and stopping mechanism whereby its movement may be suddenly arrested, and said pay-out reel being supplied with a frictional retard sufficient to instantly absorb the momentum of said pay-out reel and any tape roll thereon, a member is provided, the movement of which is governed by the diameter of the tape roll upon the pay-out reel, and which so governs the application of the frictional retard to the pay-out reel that, when the tape roll upon the take-up reel is at its maximum diameter and the tape roll upon the pay-out reel is at its minimum diameter sufficient frictional retard will be applied to the pay-out reel to instantly absorb the momentum of said pay-out reel and any tape roll which may be placed thereon, and that when the tape roll upon the take-up reel is at its minimum diameter and the tape roll upon the pay-out reel is at its maximum diameter, (the torque of the propelling-mechanism being then applied in rotating the pay-out reel at much greater advantage than when the conditions of said tape rolls are reversed) sufficient frictional retard will be applied to said pay-out reel so that the torque of the propelling-mechanism necessary to overcome said frictional retard will be substantially the same as when the conditions of said tape rolls were reversed, and that, as the diameter of the tape roll upon the take-up reel increases, and the diameter of the tape roll upon the pay-out reel decreases, said frictional retard will be applied to said pay-out reel at an advantage which decreases correspondingly to the decrease in advantage at which the torque of said propelling-mechanism acts upon the pay-out reel due to such change in the diameter of said rolls.

In attaining the feature of this invention whereby, in a recorder having a take-up reel and propelling-mechanism for the record tape applied to said take-up reel, together with governor mechanism adapted to regulate the speed of linear movement of said tape regardless of the size of the tape roll upon said take-up reel,—a suitable governor mechanism is provided which is so connected to said tape as to be moved exclusively by said tape and to control the speed of movement of said tape.

In attaining the feature of this invention whereby, in a recorder having record tape propelled by a take-up reel, from a frictionally retarded pay-out reel, in which the speed of movement of the exposed portion of such tape will be practically constant under all operating conditions,—a governor mechanism is provided which is driven directly by the tape, said governor mechanism being arranged to absorb so large a proportion of the propelling force of the take-up reel that the speed of tape movement will be practically constant under all operating conditions.

Like characters of reference denote similar parts throughout the accompanying drawings, in which:

Figure 1 is a side elevation of a multiple pen register embodying this invention.

Fig. 2 is an enlarged diagrammatic partial section of the starting and stopping mechanism, taken through the line 2—2 of Fig. 1.

Fig. 3 is an enlarged diagrammatic partial section of the starting and stopping mechanism, taken through the line 3—3 of Fig. 1.

Fig. 4 is an enlarged view of the controlling means for the stopping mechanism, shown in normal position.

Fig. 5 is a view of the parts shown in Fig. 4, shown in actuated position.

Fig. 6 is an enlarged plan view of a portion of parts of the mechanism shown in Fig. 4, taken on the line 6—6 of Fig. 1.

Fig. 7 is an enlarged detail of the speed-governor train. Fig. 8 is an enlarged detail of the driving gears of the tape-propelling mechanism.

Referring to Fig. 1, 11 is the pay-out reel shaft, to which the tape roll 12 is attached, and upon which the friction disk 13 is fixed.

The friction arm 14, pivoted at 15, carries the friction pad 16, and is mounted in such position, with relation to the friction disk 13, that the movement of said arm will cause said pad to bear against said disk at differing distances from the center of said disk, and that the movement imparted to said disk by the rotation of the tape roll

in paying out the record tape will, through the engagement of the pad 16 with said disk, tend to so move said arm as to bring said pad toward the center of said disk. The retardant effect to said pad 16 must at all times be sufficient to instantly absorb the momentum of the pay-out reel shaft 11, any tape 12 thereon, and the disk 13.

The roller 17 is mounted near the free end of the friction arm 14 in such relation to the tape roll 12 that said roller is adapted to act as a follower, to ride upon the periphery of said tape roll, and thereby regulate the movement of the friction arm toward the center of the friction disk, for a purpose to be hereinafter more fully explained.

Said parts therefore form a pay-out reel and a compensatingly variable frictional retard mechanism therefor.

The roller 18 is mounted adjacent to the tape roll 12 and is adapted to form a guide for the tape 19, said roller being formed of, or covered by, suitable elastically yielding material so as to be adapted to form a platen for suitable markers.

The location of the platen roller 18 is somewhat above and to one side of the tape roll 12, and the tape 19 is drawn around said roller 18 and is drawn away from the upper face of said roller in such direction as pass above the pay-out reel.

Suitably disposed with relation to the platen roller 18 is a marker 36, slidably supported in the pivoted fulcrum block 20, and moved into contact with tape 19 on roller 18 by operating-lever 37. In normal position, marker 36 rests on an inking pad 22. A rod 49 connects operating-lever 37 with one arm of a bell crank pivoted at 48, the other arm of which is connected to rod 50. Rod 50 is pivotally connected, at 44, to an actuating arm 43 secured to armature 41 of electromagnet 40. Armature 41 is pivoted at 42.

The magnet 40, its armature 41, and the structure connecting same to marker 36, form magnetically-controlled operating-mechanism, adapted, upon energization of electromagnet 40, to move marker 36 into contact with the tape on platen roller 18.

It is evident that one or more markers of the type here shown and described, may be used in the same recorder as indicated by the additional magnet 40', etc., and as the parts corresponding to those already described are alike for all of said markers and their associated controlling mechanism, but one marker and magnetic controlling or operating mechanism therefor have been described.

The block 53 is attached to the connecting rod 50 and is adapted to slide over the support 54.

The actuating pin or projection 55 is carried by the block 53, and extends a suitable distance therefrom.

In a multiple pen recorder, it is evident that there will be a corresponding block carrying a similar projection associated with each of the markers. In suitable relation with each of such projections, an individual lever 56 is mounted, having one arm extending in a direction substantially parallel to the line of travel of its associated projection 55.

Near the free end of each of such arms, a latch dog 57 is pivoted at 58, each of said dogs having a face 59 adapted to be engaged by its associated projection 55, and also having a projection 60, so located as to be adapted to be brought into contact with the block 53 by the movement of the lever 56 toward said block for the purpose of swinging said latch dog to a position which will bring the face 59 in the path of the projection 55.

A notch 61 is formed in each of the dogs 57, and each lever 56 carries a limit pin 62, positioned within the walls of this notch to thereby prevent such movement of the dog 57 as would carry the face 59 out of proper working relation with the projection 55.

The individual levers 56, associated with the various recording-mechanisms, are loosely pivoted upon the shaft 63, so as to be capable of independent movement thereon, and each of said levers is provided with an upwardly extending arm 64.

A bar 65 is mounted in the path of all of the arms 64, said bar being supported between two arms 66 (as shown more clearly in Fig. 6), said arms 66 being adapted to be connected to suitable controlling mechanism for such feeding mechanism as is provided for propelling the record tape, so that when any of the markers of the recording-mechanism are actuated from normal position, the latch dog 57 will swing on its pivot 58 from the position shown in Fig. 4, as the projection 55 moves beneath said pivot, and thereby transmit movement to the associated individual lever 56, which will, in turn, through the engagement of its arm 64 with the bar 65, swing the arms 66 on their shaft.

As shown, the arms 66 are not mounted on the same shaft as the individual levers 56, this construction being illustrated in the interest of clearness, but it is evident that the shaft 63 may be employed for supporting both the arms 66 and the levers 56.

As the block 53 is moved from right to left and its projection 55 swings the latch dog 57 from the position shown in Fig. 4 to the position shown in Fig. 5, a side of the notch 61 in said latch dog 57 is brought against the limit pin 62 so as to prevent further swinging of said dog, whereupon the further movement of said block 53 toward the left, will bring the projection 55 to the left of the face 59, and thus permit

the associated individual arm 56 to drop to its normal position.

When the block 53 thereafter moves from the left to right, it will swing the latch dog 57, so as to permit the projection 55 to pass to the right of the face 59, without materially moving its associated individual lever 56 (see dotted lines Fig. 5). The further movement of said block 53 toward the right will permit the latch dog 57 to drop to the left of the projection 55, and the weight of the arm of the lever 56 will cause it to fall to the position where the engagement of the projection 60 with the surface of the block 53 will swing the face 59 into the path of the projection 55, as shown in Fig. 4.

The bar 65, arms 66, levers 56, dogs 57, and projections 55 therefore form controlling-means, operated by the recording-mechanism, and adapted to move a member of a starting and stopping mechanism to disengaged position during the actuation of any marker from its normal position to its operated position, and adapted to permit such member to move to engaged position before the completion of such actuation of said marker, and further adapted to enable any marker to be moved from its operated or marking position to its normal position without causing said member to be moved to disengaged position.

The roller 70 is mounted in suitable relation to the platen roller 18, so as to be adapted to form a guide for the tape delivered from said platen roller; the distance between the rollers 18 and 70 being such as to permit a desired length of tape bearing the signal record to be exposed between said rollers.

Said roller 70 is mounted upon a shaft 71, and is connected to the gear 72 (the pitch line of which is indicated by a dotted line in Fig. 1), by a slack connection, consisting of a slot 73 and a pin 74 adapted to work therein, said slot being formed in the gear 72, and said pin being carried by the roller 70, or vice versa, as may be desired, so as to permit considerable relative movement between said gear and roller.

A governor train, indicated generally at 75, is located below the roller 70, and is driven by gear 72, and is so constructed and arranged that the stored energy therein, when said train is running at normal speed and the movement of the roller 70 is suddenly arrested, will cause said train to continue to run until there has been relative movement between the gear 72 and the roller 70 for a distance less than the permitted travel of the pin 74 in the slot 73. Said relative movement should be such that, when the roller is again started, the tape and parts moving therewith will be permitted to reach at least full speed before said governor train is set in motion by the engagement of the end of the slot 73 with the pin 74.

In the interests of clearness of illustration, the governor train 75 is diagrammatically shown as being controlled by a typical fly or fan, but in practice it will, in many instances, be found preferable to employ a friction governor, so arranged that the friction will not become effective until substantially the normal speed of the train has been attained, and in any event said governor train should be arranged to absorb so large a proportion of the propelling force of the take-up reel that the speed of tape movement will be practically constant under all operative conditions.

The shaft 80 carries the tape roll 81 and the gear 82, driven by the main gear 83, acting by means of a suitable system of gearing, through the intermediate shaft 84, the pitch lines of the gears being shown by dotted lines. A suitable motor spring, or other desired prime mover adapted to exert a substantially uniform torque, is so applied to the gear 83 as to tend to turn said gear clockwise. The torque exerted upon the gear 83 must be sufficient to cause the tape 19, and the governor train 75, to be moved at the desired speed, when the tape roll 81 is of maximum diameter and the tape roll 12 is of minimum diameter, against the application of such frictional retard to the pay-out reel as will instantly absorb the momentum of the pay-out reel and any tape roll thereon.

It is evident that, when a full new roll of tape is placed upon the pay-out reel shaft 11, the advantage at which the propelling-mechanism acts, to unwind the tape therefrom, will be increased on account of the increased diameter of said roll, and the pad 16 should therefore be so positioned, with relation to the pivot 15 of the arm 14 and the follower 17 carried thereby, that said follower 17, being held at an increased distance from the center of rotation of said shaft 11 by such larger tape roll, will carry said pad 16 to a position, with relation to the disk 13, where the retardant effect of said pad will be increased to an extent which will offset the increased advantage at which said propelling-mechanism will then act.

In practice, whenever a new roll of tape is placed on the pay-out reel shaft 11, the full roll of used tape would be removed from the take-up reel shaft 80, and it is evident that the propelling-mechanism would thereupon act at a further increased advantage on account of the smaller radius of the tape roll on said take-up reel, and the pad 16 should therefore be so positioned that the follower 17 will hold said pad at such an increased distance from the center of rotation of the shaft 11, when there is a full roll of tape thereon, that the retardant

effect of said pad 16 will be increased to an extent which will offset the increased advantage at which said propelling-mechanism will act due both to the increased diameter of the roll 12 and to the decreased diameter of the roll 81.

Then, as the tape passes from roll 12 to roll 81, the follower should permit such movement of the pad 16 that the advantage at which the frictional retard of said pad is applied will so decrease as to offset the decrease in the advantage at which said propelling-mechanism acts.

Said shaft 80 and the gearing associated therewith therefore constitute a take-up reel and propelling-mechanism therefor located below the exposed portion of the record tape.

A comparatively slow moving worm shaft 85 is geared to the intermediate shaft 84, and a comparatively fast moving shaft 86 is geared to the worm shaft 85. The worm 87 is fixed upon the shaft 85, and has a screw thread 88 of comparatively fine pitch terminating at one end in a slot 89 formed at an extremely coarse pitch (see Fig. 3), so that a tracer point riding through the fine pitch thread 88 will be moved very slowly in a line parallel with the shaft 85 for any given rotation of said shaft until said tracer reaches the slot 89, whereupon the rotation of such shaft 85 to a very slight degree will move such tracer point a comparatively great distance in a line parallel to said shaft.

A detent lever 90 is pivoted at 91, and has the projection 92 formed therein, and carries the tracer 93 which is pivoted to said lever at 94, (see Fig. 2).

The tracer 93 is provided with a point 95, which is adapted to engage with the threads of the worm 87, and the actuating pin 96 projects from one side of said tracer 93, near the free end thereof.

The guide lever 97 is pivoted at 98 in suitable relation to the actuating pin 96, so that the guide slot 99 may engage said pin and thereby control the engagement of the point 95 with the threads of the worm 87.

An arm 100, of the guide lever 97, is connected with one of the arms 66 by means of the rod 101, so that the movement of said arms 66 will cause corresponding movement of the guide slot 99.

A detent arm 102 is carried by the detent shaft 86 in such position as to be adapted to engage the projection 92 formed in the detent lever 90 when said lever is in a certain position, and the retractile spring 103 is so applied to said detent lever 90 as to be adapted to move said lever out of engagement with the detent arm 102 and a suitable distance therefrom, the engaging faces of the projection 92 and detent arm 102 being preferably slanted so that the pressure of the arm 102 against said projection 92 will tend to suitably assist said spring 103 in moving said projection out of engagement with the arm 102.

The relative positions of the worm 87, detent lever 90 and arm 102 are such that the movement of the detent lever 90 in response to the tension of its retractile spring 103 causes the tracer point 95 to move away from the end of the worm 87 in which the slot 89 is formed, and toward the opposite end of said worm, and the threads of the worm 87 are so formed that the movement of the shaft 85, incident to the rotation of the shaft 80 to wind up the tape 19, will be such that, when the tracer point 95 is engaging the threads of said worm, the detent lever 90 will be moved against the tension of the spring 103.

The fine pitch threads 88 are so located as to cause the detent lever 90 to be moved to a point where the projection 92 is adjacent to, but not in the path of the arm 102, and the arm 102 is not in the path of said projection, whereupon, the movement of said point 95 through the slot 89, will so move said lever 90, as to bring a comparatively great area of the projection 92 into the path of said detent arm 102, during the movement of said arm 102 from the point where the tracer point 95 is first engaged by the slot 89 until said arm 102 is brought into contact with said projection 92.

An arm 105, forming part of a stop lever 104, projects in the path of the detent lever 90, said stop lever being loosely pivoted upon the intermediate shaft 84. Said arm 105 of said lever is formed at an angle to its line of motion so that as said arm is rotated around its pivot 84, the permitted movement of the detent lever 90 in response to its spring 103 will be varied.

An arm 106 of the lever 104 is provided with a roller 107, so positioned as to be adapted to ride upon the tape roll 81, a spring 108 being so applied to the lever 104 as to tend to hold said roller in engagement with the tape roll 81.

The direction and degree of slant of the arm 105 is such that, as the tape roll 81 increases in diameter, the movement imparted to lever 104 as a result of such increase, will carry the arm 105 in a direction causing it to decrease the permitted travel of the lever 90 in response to its spring 103, so that as the rate of tape travel increases, in relation to the rotation of the shaft 80, due to the increase in diameter of the tape roll 81, the permitted travel of the detent lever 90 will decrease at such a rate that the lever 90 will always be carried, from engagement with the arm 105, to the position where it is engaged by the detent arm 102 upon a constant predetermined travel of the record tape.

The worm 87, detent lever 90 and parts associated therewith, therefore form a starting and stopping mechanism for the take-up or propelling-mechanism adapted to act upon a constant predetermined travel of the tape after it is released by the recording-mechanism, said starting and stopping-mechanism being located below the exposed portion of the record tape 19.

When the recorder is at rest in normal position, the various parts are in the position shown in Fig. 1.

The operation of this recorder is as follows:—

If the magnet 40 is suitably energized, the armature 41 will move against the poles of said magnet, and such movement of said armature will be transmitted to the marker 36 through connecting rod 50 and the associated mechanism.

The movement of the connecting rod 50, in transmitting the motion of the armature 41 to the marker 34, will first carry its associated projection 55 to the left, from the position shown in Fig. 4, so that the latch dog 57 will be rotated on its pivot 58 to the position shown in Fig. 5 and thus raise the horizontally extending arm of the lever 56 so as to cause the upper end of the arm 66 to swing toward the right.

The further movement of the projection 55 to the left, will bring said projection out from beneath the face 59 of said latch dog 57, and thus allow said lever 56 and arm 66 to move nearly but not quite to their normal position.

When the magnet 40 is deënergized, the armature 41 and marker 34 will return to normal position and the projection 55 will move to the right of the face 59, swinging the latch dog 57 out of the path of said projection, as indicated by dotted lines in Fig. 5, and when said projection 55 reaches the position shown in Fig. 4, the horizontal arm of the lever 56 will drop slightly, bringing the projection 60 against the top surface of the block 53, and thereby swinging the face 59 downwardly into the path of said projection 55.

The movement of the arm 66 hereinbefore described will be transmitted through the rod 101 to the guide lever 97, and, when said arm 66 is moved to the right, the guide slot 99 will be raised, thus disengaging the point 95 from the worm 97, whereupon the detent lever 90 will be moved by the spring 103 so as to carry the projection 92 out of the path of the detent arm 102, and to carry the tracer 93 toward the end of the worm 87 farthest from the slot 89 until said detent lever 90 strikes the arm 105 of the stop lever 104, and, when said arm 66 is moved nearly but not quite to its normal position, the tracer 93 will be dropped by the guide slot 99 so that point 95 will engage the fine thread 88 of the worm 87.

Upon disengagement of the projection 92 from the detent arm 102, the shaft 80 will commence to turn in response to the driving force of gear 83, and will thereby commence winding the tape 19 upon the roll 81.

The movement of the tape 19 will be imparted to the roller 70, and said roller will bring the pin 74 into engagement with the end of the slot 73 in gear 72, and thereafter the continued movement of the tape 19 will operate the governor train 75 and thereby regulate the speed of movement of the tape 19, but it is evident that the first movement of said tape will be free from the retardant effect of said governor train, and that said tape will therefore quickly attain full speed.

As the shaft 80 is rotated to wind the tape 19 thereon, the worm 87 will be correspondingly rotated and thus tend to move the point 95 in a direction which will carry the projection 92 toward the path of the detent arm 102, but it is evident that if the magnet 40 is repeatedly energized, the detent lever 90 will be permitted to move into engagement with the arm 105 upon each movement of the armature 41 to attracted position.

Whenever the arm 66 remains in its normal position for a sufficient time to permit such rotation of the worm 87 as will carry the point 95 into the slot 89, the detent lever 90 will be moved into the path of the detent arm 102, and the take-up reel shaft 80 and parts moving therewith will thereupon be brought to rest. However, the governor train 75 will continue to run, after the tape 19 has come to rest, until the momentum of said train has been absorbed in the friction of the parts thereof, such additional movement of said train being permitted by the slack connection between the slot 73 and the pin 74.

As the tape is wound upon the roll 81, it is evident that the amount of tape wound thereon for a given angular motion of the shaft 80 will be increased as said roll increases in diameter, and the engagement of the roller 107, with the periphery of said tape roll 81, will act to move the arm 105 toward the detent lever 90 and thereby decrease the permitted movement of the point 95 away from the end of the worm 87 having the slot 89, so that the permitted angular motion of the shaft 80, after any engagement of the point 95 with the worm 87, will be correspondingly decreased, so as to wind up a predetermined constant amount of tape.

The engagement of the friction pad 16 with the friction disk 13 applies such retardant effect to the tape roll 12 at all times that, when the tape movement is suddenly arrested by the detent arm 102 coming into engagement with the projection 92, the mo-

mentum of the tape roll 12 and parts rotating therewith will be instantly absorbed.

It is evident that when the tape roll 12 is at its minimum diameter, and the tape roll 81 is at its maximum diameter, the energy supplied by the main gear 83 will be applied to unwinding the tape from roll 12 at a maximum disadvantage, and the driving power of said gear 83 must then be sufficient to overcome said friction.

On the other hand, when the tape roll 12 is at its maximum diameter, and the tape roll 81 is at its minimum diameter, the energy of said gear 83 will be applied at much greater advantage, and the tape roll 12 will hold the roller 17 in such position as to bring the pad 16 to a point, with relation to the disk 13, where its retardant effect will be so increased as to compensate for the increased advantage at which the energy of the main gear is then applied. As the diameter of the tape roll 12 decreases, the friction arm 14 will be so moved, by the action of the disk 13 upon the pad 16, as to press the roller 17 against the periphery of said tape roll 12, and thereby to decrease the retardant effect of the friction pad 16 to correspond with the decrease in the advantage at which the energy of the main gear is applied.

I claim: —

1. In a strip winder for a signal recorder, the combination of a record tape, a pay-out reel and a take-up reel for the tape, propelling mechanism for the tape, an intermediate roller over which the tape is passed during its traverse between said reels and by which the roller is driven, and a speed-governing train for the tape associated with said roller.

2. In a strip winder for a signal recorder, the combination of a record tape, a pay-out reel and a take-up reel for the tape, propelling mechanism for the take-up reel, an intermediate roller over which the tape is passed during its traverse between said reels and by which the roller is driven, and a speed-governing train for the tape associated with said roller.

3. In a strip winder for a signal recorder, the combination of a record tape, a pay-out reel and a take-up reel for the tape, propelling mechanism for the tape, an intermediate roller over which the tape is passed during its traverse between said reels and by which the roller is driven, and an energy-absorbing, speed-governing device for the tape driven by said roller.

4. In a strip winder for a signal recorder, record tape, speed propelling mechanism for said tape, and tape governor mechanism, driven exclusively by said tape, and comprising a governor-train, a roller adapted to be rotated by said tape, and a slack connection between said roller and said governing-train whereby said governor-train is permitted a restricted movement independent of said roller.

5. In a strip winder for a signal recorder, record tape, a pay-out reel for said tape, compensatingly variable friction mechanism for said pay-out reel, propelling mechanism for said tape comprising a power-driven take-up reel, and speed-governor mechanism driven exclusively by said tape and comprising a speed-governing-train, a roller adapted to be rotated by said tape, and a slack connection between said roller and said governing train whereby said governing-train is permitted a restricted movement independent of said roller.

6. In a strip winder for a signal recorder, record tape, means for suitably propelling said tape, a pay-out reel for said tape, and compensatingly variable friction mechanism for said pay-out reel comprising,—a friction disk moving with said pay-out reel, a friction pad bearing against said disk, a friction arm carrying said pad, and a follower carried by said arm and adapted to ride upon the periphery of the tape roll upon the pay-out reel, to thereby move said arm and vary the friction in accordance with a variation of diameter of the tape roll.

7. In a strip winder for a signal recorder adapted for intermittent operation, the combination of a record tape, a pay-out reel and a take-up reel for said tape, and means for winding a predetermined length of tape on said take-up reel at each operation of the recorder comprising power-actuated driving mechanism for said take-up reel, starting and stopping means for said driving mechanism, and governing means for said starting and stopping means governed by variation in diameter of the tape-roll on the take-up reel.

8. In a strip winder for a signal recorder adapted for intermittent operation, the combination of a record tape, a pay-out reel and a take-up reel for said tape, and means for winding a predetermined length of tape on said take-up reel at each operation of the recorder comprising power-actuated driving mechanism for said take-up reel, starting and stopping means for the driving mechanism arranged to provide for a maximum period of driving of the take-up reel by the driving mechanism, and means actuated by the variation in diameter of the tape-roll on the take-up reel to govern the starting and stopping mechanism to provide for a lesser period of driving of the take-up reel.

9. In a strip winder for a signal recorder, record tape, propelling mechanism for said tape comprising a power driven take-up reel, detent-mechanism comprising a detent adapted, when in one position, to engage and stop said propelling mechanism, means for

moving said detent away from such position, and actuating-means, operated by the propelling mechanism, and adapted to move the detent toward engaging position, and variable stopping-means for limiting the extent of the movement of the detent away from engaging position whereby the actuating-means is enabled to return the detent mechanism to engaging position upon a predetermined travel of the record tape.

10. In a strip winder for a signal recorder, record tape, propelling mechanism for said tape comprising a power driven take-up reel, detent mechanism comprising a detent adapted, when in one position, to engage and stop said propelling mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling mechanism adapted to move the detent toward engaging position, and variable stopping means for limiting the extent of the movement of said detent away from engaging position whereby, as the diameter of said tape roll increases, the extent of the permitted movement of the detent, away from engaging position, will be correspondingly decreased.

11. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape comprising a power driven take-up reel, detent mechanism comprising a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling-mechanism adapted to move the detent toward engaging position, and variable stopping means for limiting the extent of the movement of said detent away from engaging position comprising a stop arm so mounted as to so move in relation to the periphery of the tape roll upon the take-up reel that, as the diameter of said tape roll increases, the extent of the permitted movement of said detent away from engaging position will be correspondingly decreased.

12. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape comprising a power driven take-up reel, detent mechanism comprising a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling mechanism adapted to move said detent toward engaging position, and variable stopping means for limiting the extent of the movement of said detent away from engaging position, so as to enable the actuating-means to move said detent into engaging position upon a predetermined travel of the record tape, comprising a stop arm so mounted as to so move in relation to the periphery of the tape roll upon the take-up reel that, as the diameter of said tape roll increases, the extent of the permitted movement of said detent away from engaging position will be correspondingly decreased.

13. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape comprising a power driven take-up reel, detent mechanism comprising a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling-mechanism adapted to move said detent toward engaging position, and variable stopping-means for limiting the extent of the movement of said detent away from engaging position,—comprising a stop arm so mounted that its movement will alter the extent of the permitted movement of said detent away from engaging position, and a follower, riding upon the periphery of the tape roll upon the take-up reel, and so moving said stop arm that, as the diameter of said tape roll increases, the extent of the permitted movement of the detent away from engaging position will be correspondingly decreased.

14. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape comprising a power driven take-up reel, detent mechanism comprising a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling-mechanism adapted to move said detent toward engaging position, and variable stopping means for limiting the extent of the movement of said detent away from engaging position, so as to enable the actuating-means to move the detent into engaging position upon a predetermined travel of the record tape, comprising a stop arm so mounted that its movement will alter the extent of the permitted movement of said detent away from engaging position, and a follower, riding upon the periphery of the tape roll upon the take-up reel, and so moving said stop arm that, as the diameter of said tape roll increases, the extent of the permitted movement of the detent away from engaging position will be correspondingly decreased.

15. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape, a detent for a comparatively fast moving part of said propelling-mechanism, means constantly tending to move said detent away from engaging position, actuating-means operated by a comparatively slow moving part of said propelling-mechanism and adapted to move said detent toward engaging position, means for disengaging said detent from the actuating-means therefor,

and variable stopping-means for limiting the extent of the movement of said detent away from engaging position.

16. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape, and detent mechanism comprising,—a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means, operated by the propelling mechanism, so arranged with relation to said detent as to slowly move said detent toward engaging position until said detent is moved to a position comparatively near to engagement and thereafter to quickly move said detent into full engaging position.

17. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape, a detent arm carried by a comparatively fast moving part of said propelling-mechanism, and detent mechanism comprising,—a detent lever adapted to be moved into or out of the path of said detent arm, means for moving said detent lever out of the path of the detent arm, and actuating-means, operated by the propelling-mechanism, adapted to move the detent lever, at a time when the detent arm is not in the path of said lever, to a point where said lever is near but not in the path of the detent arm, and thereupon to so move said lever as to bring a comparatively great area of said lever into the path of said detent arm before said arm is brought into engagement with said lever.

18. In a strip winder for a signal recorder, record tape, propelling-mechanism for said tape, and detent mechanism comprising,—a detent adapted, when in one position, to engage and stop said propelling-mechanism, means for moving said detent away from said position, and actuating-means operated by the propelling mechanism adapted to move said detent toward engaging position, comprising a worm having two connecting threads of different pitches.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

HERMAN W. DOUGHTY.

Witnesses:
HARRY E. REED,
MARION C. CASE.