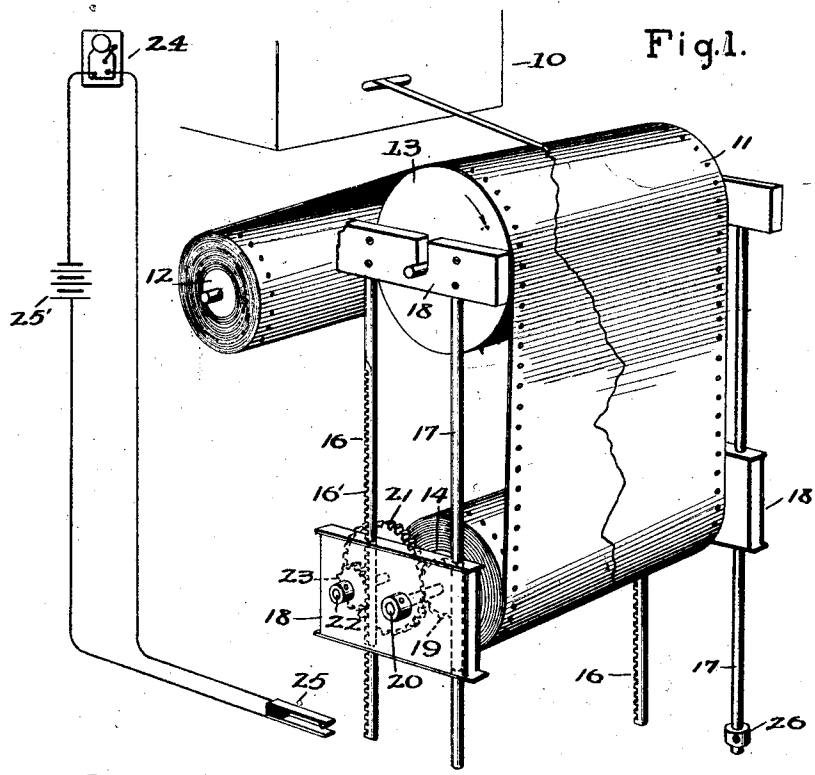
Aug. 25, 1925. 1,551,415

F. S. MARCELLUS

REROLL MECHANISM

Filed Feb. 16, 1924 2 Sheets-Sheet 1

Fig.1.



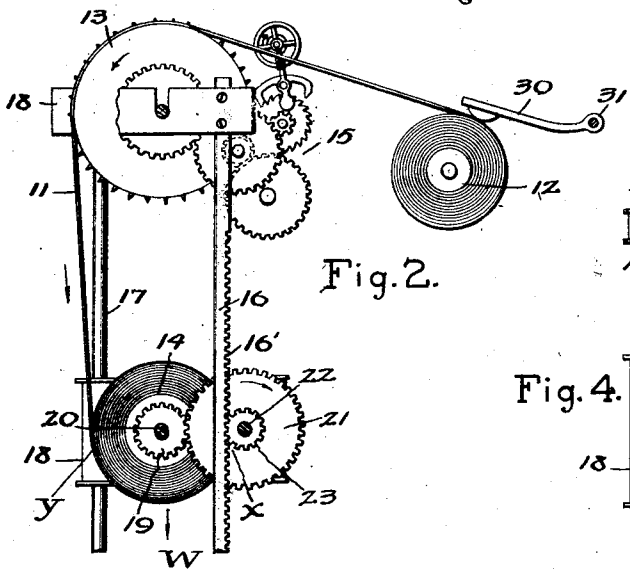


Fig.2.

Fig.3.

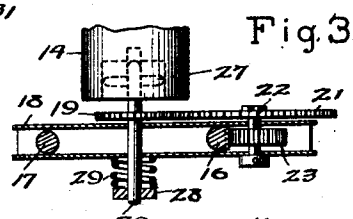
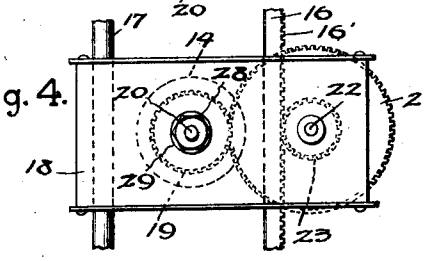


Fig.4.



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REROLL MECHANISM

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Fig. 5.

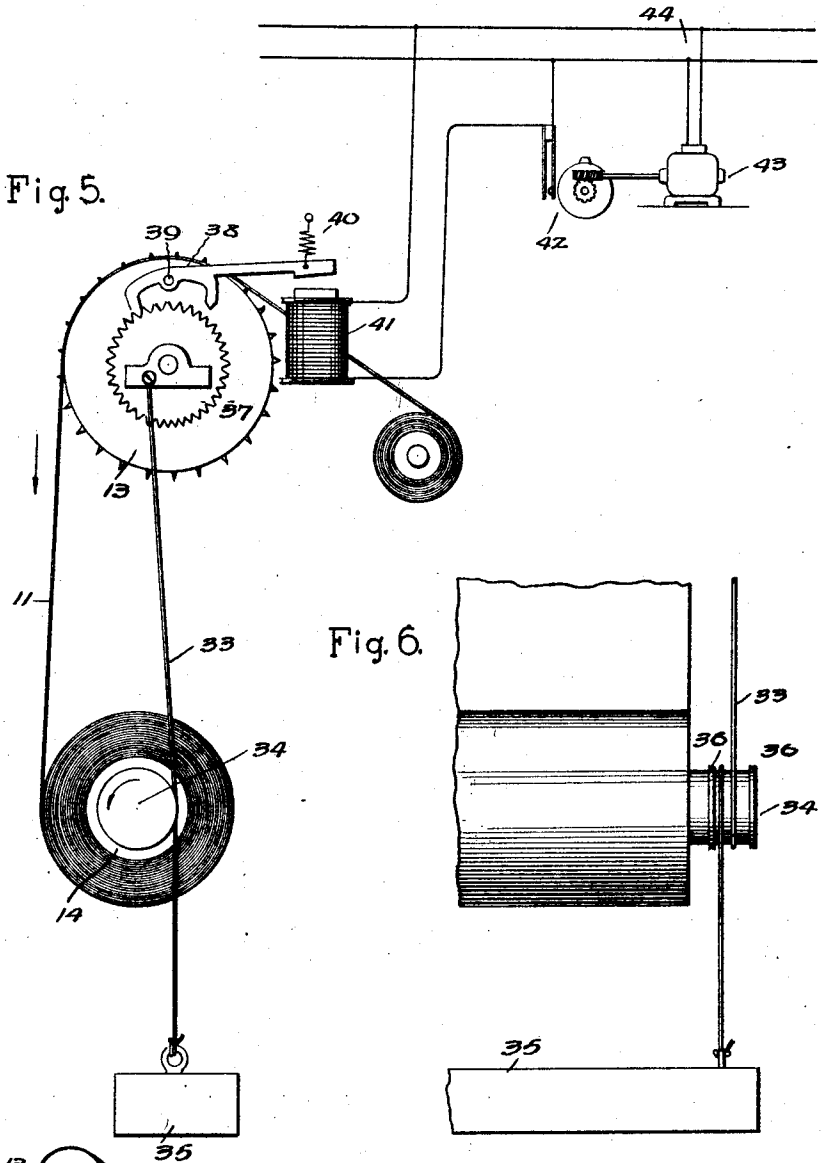


Fig. 6.

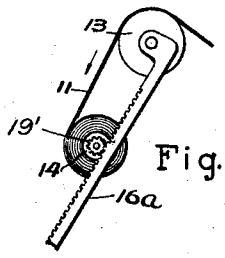


Fig. 7.

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Patented Aug. 25, 1925. 1,551,415

UNITED STATES PATENT OFFICE.

FREDRICK S. MARCELLUS, OF AMSTERDAM, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REROLL MECHANISM.

Application filed February 16, 1924. Serial No. 693,222.

To all whom it may concern:

Be it known that I, FREDRICK S. MARCELLUS, a citizen of the United States, residing at Amsterdam, in the county of Montgomery, State of New York, have invented certain new and useful Improvements in Reroll Mechanisms, of which the following is a specification.

My invention relates to a reroll mechanism and although not limited thereto it is particularly adapted for rolling up the record sheets of recording instruments as they are delivered from the recording instrument.

In the usual type of recording instrument the record tape or sheet is advanced at a predetermined rate by some kind of a clock mechanism. Sometimes the advance of the tape is continuous and sometimes intermittent. The winding up of the sheet is usually accomplished by a winding roll driven by the same clock mechanism that determines the rate of advance of the sheet. This has certain disadvantages in that it requires a greater amount of work from the clock and, what is more detrimental, it requires a variable amount of work from the clock. The variation in work required from the clock for the rewinding operation is due to the fact that the rewinding roll increases in diameter as it is wound up. If the sheet is to be advanced at a uniform rate the speed of rotation of the rewinding roll must continuously decrease as the roll becomes larger. This means that there cannot be a fixed ratio driving connection between the sheet advancing mechanism and the rewinding roll. The usual arrangement is to provide a slip friction clutch between the two mechanisms so that as the rewinding roll becomes larger in diameter the clutch will slip at a faster rate. It will thus be evident that as the winding roll increases in diameter the clock must do more work to supply the increased friction losses in the clutch. This constitutes a serious source of error in the time keeping qualities of the clock.

One object of my invention is to eliminate this source of error. Another object of my invention is to provide a reroll mechanism which operates by gravity and has no connection with the escapement that determines the rate of advance of the record sheet and, if desirable, this gravity reroll device may constitute the sole source of power for moving the record sheet. Another object of my invention is to provide a gravity operated mechanism which maintains a constant tension on the sheet irrespective of changes in diameter of the rewinding roll.

In carrying my invention into effect I arrange the rewinding roll in vertical, or substantially vertical, guides and permit the rewinding roll to descend therein. The rewinding roll is geared or otherwise connected in driving relation to the guides in such a way that in descending, its weight together with the weight of the paper thereon, causes the paper or record sheet to be wound up. As the roll increases in diameter and in weight, that portion of the total weight of the reroll mechanism sustained by the sheet is gradually decreased so that the tension on the paper is maintained substantially constant. If desired the gravity device may constitute the clock driving force, or the advance of the sheet may be accomplished by the gravity device and be controlled by a magnetic escapement from a clock located at a distant point.

The features of my invention in which I believe to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of my invention reference is made in the following description to the accompanying drawings, in which Fig. 1 shows a perspective view of my improved reroll mechanism as applied to a recording meter; Fig. 2 shows a diagrammatic end view of the recording drum of Fig. 1 together with the mechanism which determines the rate of advance of the record sheet and the rewinding mechanism; Fig. 3 shows a detail top sectional view of a preferred type of rewinding mechanism; Fig. 4 a side view of the same; Fig. 5 a front view of another arrangement of the gravity reroll mechanism; Fig. 6 an end view of the same and Fig. 7 shows an end view of another modification of the invention.

Referring now to Figs. 1 and 2, the arrangement shows, at 10, any type of meter or other instrument, the indications of which it is desired to record on the record sheet 11. The record sheet is fed from a supply spool 12 to the recording drum 13 and passes thence to the rerolling spool 14. For the sake of clearness only that portion of the supporting framework necessary for

an understanding of my invention is illustrated. The drum 13 is either driven by a clock mechanism or controlled by some form of escapement so that it moves either continuously or intermittently at the desired rate, although this feature is not essential to certain broad aspects of my invention. For the present we will assume that the drum 13 is driven through suitable gearing at a constant speed by means of a clockwork indicated at 15 in Fig. 2, the direction of rotation being indicated by the arrow. The sheet 11 is rerolled on the spool 14 by the mechanism now to be described. Spaced parallel guides 16 and 17 are fixed to the framework 18 and extend downward from either end of the drum 13. These guides carry the rewinding spool and winding up mechanism. The spool 14 is journaled in members 18 parallel to the drum 13. The members 18 are slidably mounted on the guides 16 and 17 as illustrated. One or both members 18 carry a gear train which consists of a pinion 19 secured to the shaft 20 of the spool 14, a larger gear 21 meshing with pinion 19 and secured on a shaft 22 and a pinion 23 also secured on shaft 22 which meshes with a rack 16′ contained in the rear side of guide 16. The members 18 may each consist of small framework made up of 4 flat stampings riveted together in the manner illustrated in Figs. 3 and 4, with the guides passing between the side plates and through suitable openings in the top and bottom plates, although any other suitable arrangement may be used and the gear train may be otherwise assembled.

The principle of operation is best seen from Fig. 2 where the guiding framework has been omitted from the end view for the sake of clearness. It will be noted that the mechanism is free to move up and down on the guides but in so doing the rack will cause the various gears and the spool 14 to revolve. The weight of the device will naturally carry it downward so that if the record sheet is wound about the spool in the direction shown in Fig. 2 and suitably secured thereto the sheet will be wound up as the roll descends, the direction of rotation of the various parts being indicated by the arrows. The vertical length of the guides and the gear ratio may be anything desired. The values of these factors and their relation to each other will be selected to produce the best results in any given case, and will depend upon the speed of travel of the record sheet, the length of record sheets available, the length of time between which it is desired to remove a used record sheet and put on a new roll and the tension which it is desired to have on the record sheet. When a new roll is placed on spool 12, the spool 14 will presumably be replaced by an empty spool. The reroll mechanism will be slid to the top of the rack and the new sheet fed over the record drum and secured to an empty spool 14. No further attention is required until a record sheet replacement is necessary. Gravity causes the reroll mechanism to descend as fast as the record sheet 11 is advanced and in so doing the record sheet is wound up. If desired an electric signal 24 may be actuated when the reroll mechanism reaches any predetermined point such as the bottom of the rack by means of electrical contacts 25 placed in the path of movement of one of the end members 18 and connected in series with a source 25′ and the signal 24. This signal will also function when the paper runs out because this will permit the reroll mechanism to drop and close the contacts 25. If the record sheet is of considerable width it will be desirable to have the gearing and rack connected at both ends of the spool. If the record sheet is quite narrow it will only be necessary to provide this device at one end while the other end is simply guided in any suitable manner such as by the members 18 without the gearing.

To change the spool, the device may be slipped off the lower end of the guides. Preferably the guides on one end will be a few inches longer than the guides on the other end and provided with a removable stop such as shown at 26, to facilitate changing spools. In this way only the member 18 at the opposite end of the spool need be disturbed.

To facilitate adjustment of the spool when on the racks I prefer to arrange the gears 19 and 21 so that they can be slipped out of mesh. This feature is shown in Fig. 3 where the short shaft 20 carries on its inner end the usual pin 27 fitting into a slot in the spool and provided on its opposite end a nut 28 which secures a spring 29 between the nut and the outer side of member 18. By pressing this shaft in a short distance the gears 19 and 21 may be slid out of mesh and any desired rotative adjustment of the spool made.

The manner in which the tension of the paper is maintained constant, irrespective of the increase in weight of the paper carried by the reroll mechanism will now be explained. The reroll mechanism and the weight thereof may be considered as being supported at two points on both ends of the roll. One of these points of suspension X is at the intersection of the rack 16 and pinion 23 while the other point Y is by means of the record sheet where it is tangent to the roll. The center of gravity of the reroll mechanism falls just to the right of the shaft 20 and may be represented by the arrow W. This center of gravity moves slightly to the left as the empty spool becomes full; but only to a very small extent

The point of suspension X remains fixed and approximately fixed with respect to the center of gravity W; but the point of suspension Y moves away from the center of gravity as the spool becomes full somewhat more rapidly so that although the weight W increases, the proportion of that weight carried by the record sheet decreases, and by properly proportioning the parts, the tension on the paper may be maintained constant or substantially so as the roll becomes larger and heavier. No fixed values for the different factors involved should be specified because it will be evident that they will vary with the thickness and weight of the paper, also the width of the record sheet and the tension which it is desired to maintain on the paper. This feature is of considerable importance because it produces no error in the time keeping qualities of the clock 15. In fact, the usual clock spring may be omitted from the escapement and the reroll mechanism may constitute the clock weight as well as the sole source of power for moving the record sheet, while the only function of the escapement is to control the rate of advance of the record sheet. Of course, the usual clock spring may be used if desired and the tension on the record sheet 11 decreased proportionately. However, the use of the reroll mechanism as a clock weight is advantageous in that it makes the time for changing the spool the same as that for rewinding the clock, which then merely consists of replacing a full spool at the bottom of the rack by an empty spool at the top of the rack.

The work required to unwind the sheet from the supply spool 12 is so very slight that any change therein due to a change in diameter of the roll on spool 12 may be neglected. However, if desired this work may be made substantially constant by arranging a light weight 30 freely pivoted at 31 to rub against the periphery of the roll as indicated in Fig. 2.

In Figs. 5 and 6 I have represented a somewhat more simplified modification of my invention. Here the guides consist of a pair of flexible cords 33 which are merely given one turn about the enlarged shaft 34 of the winding up roll 14 as represented. The cords are fixed at the top to the framework and at the bottom to a stationary base or to a suspended weight 35 as represented. Collars 36 are provided to keep the cords in their proper place.

The rate at which the reroll mechanism travels downward in winding up a given length of paper is somewhat faster than with the geared arrangement of Fig. 3. Otherwise, the operation is in general similar and the same general principles previously explained apply.

In Fig. 5 I have shown a magnetic escapement controlled from a distant clock. The drum 13 is provided with a scape wheel 37 and an escapement lever 38 pivoted at 39. The escapement lever 38 is urged in one direction by a spring 40 and is adapted to be moved in the opposite direction about the pivot 39 by an electromagnet 41 when the latter is energized.

The electromagnet is intermittently energized by the time controlled contact device 42 which may be actuated in any suitable manner as by a meter or a clock here shown as a synchronous motor 43 which is fed from a constant frequency source of alternating current 44.

Normally the escapement locks the drum from rotation as indicated. When the electromagnet 41 is energized the left-hand pawl is raised and the right-hand pawl lowered allowing the drum to advance the distance corresponding to one-half the distance between teeth on the scape wheel 37. The drum is locked only momentarily by the right-hand pawl which is raised as soon as the electromagnet 41 is deenergized. This allows the drum to advance another half tooth distance and brings the left-hand pawl in the next consecutive depression in the scape wheel. The record sheet is thus advanced intermittently instead of continuously as in Fig. 2. Here it is unnecessary to take any precautions about having the tension of the record sheet constant, because a variation therein cannot affect the rate of the clock 43, although the parts may be proportioned for this purpose if desired without any complications.

In Fig. 7 I have shown another modification of my invention where a single guiding rack 16^a is used for each end of the spool 14 which rack is inclined at an angle to the vertical in such a manner that no other supporting means is required for the spool 14. The pinion 19′ causes the spool to wind up the sheet 11 as the spool descends as will be clearly evident from the illustration.

The invention has been described in connection with recording instruments but I consider the invention applicable for various other purposes where a winding up operation of any kind is required.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown and described is only illustrative and that the invention may be carried out by other arrangements.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. A reroll mechanism comprising a substantially horizontally disposed spool, means for guiding said spool for movement in sub-

stantially a vertical direction to perform a rerolling operation and a driving connection between said guide and spool for turning the spool when it is so moved.

2. A reroll mechanism comprising a substantially horizontally disposed spool, guides at either end of said spool for guiding the same for movement in substantially a vertical direction to perform a rerolling operation, and a driving connection between at least one of said guides and said spool for turning the spool when it is so moved.

3. A reroll mechanism comprising a shaft, a spool mounted on said shaft, guiding means for holding said shaft in substantially a horizontal axis while permitting its movement in substantially a vertical direction, and a driving connection between said guiding means and said shaft for turing said shaft when the latter is moved in a vertical direction to perform a rerolling operation.

4. A reroll mechanism comprising a spool, guiding means for maintaining said spool on substantially a horizontal axis while permitting its movement in substantially a vertical direction, and a gear driving connection between said guiding means and said spool for rotating said spool on its axis when the spool is moved in a vertical direction.

5. A reroll mechanism comprising a spool, vertically positioned guides for maintaining said spool on substantially a horizontal axis while permitting its movement in substantially a vertical direction, and a reduction gear driving connection between said spool and at least one of said guides for rotating said spool on its axis when the spool is moved vertically.

6. A reroll mechanism comprising a spool, vertically positioned guides for maintaining said spool on substantially a horizontal axis while permiting its movement in substantially a vertical direction, a rack on at least one of said guides, and a gear drive between said spool and said rack for rotating said spool on its axis when the spool is moved vertically.

7. A reroll mechanism comprising a horizontally disposed spool, trunnions for said spool, a pair of vertical guides at either end of said spool, slidable guiding frames on said guides into which the trunnions of said spool are journaled, a rack on one of said guides, a pinion on one of said trunnions, and gearing supported by one of said frames forming a driving connection between said rack and said pinion.

8. A reroll mechanism comprising a horizontally disposed spool, trunnions for said spool, a pair of vertical guides at either end of said spool, a slider on each pair of said guides into which the trunnions of said spool are respectively journaled, racks cut into one of the guides at each pair, pinions on each trunnion, and reduction gear trains supported by said sliders between said pinions and said racks forming a driving connection therebetween.

9. In combination a record sheet or the like, a drum over which said sheet is supplied, and means for winding up said sheet as it comes from said drum comprising a spool to which said sheet is secured, guiding means for said spool positioned in fixed relation to said drum and arranged to guide said spool in a downward direction while maintaining it on a horizontal axis, and a driving connection between said guiding means and said spool for rotating said spool in a direction to wind up said sheet when the spool moves downward, said spool being of sufficient weight to move downward by gravity and to thereby supply the energy for winding up said sheet.

10. A gravity reroll for record sheets and the like comprising a spool mounted for rotation on a horizontal axis, means for guiding said spool in a vertical direction, and a driving connection between said spool and said guiding means such that the spool is permitted to descend by gravity and to rotate on its axis by reason of said driving connection.

11. In combination a drum, a record sheet or similar material supplied over said drum, a spool upon which said material is adapted to be wound, said spool being mounted for rotation on a horizontal axis below said drum, vertical guides for said spool, a driving connection between said guides and spool, said spool being suspended by said driving connection and by the material to be wound up in such a manner that the spool is permitted to descend by gravity and in so doing to be rotated by said driving connection to wind up said material and to maintain a substantially constant tension thereon.

12. In combination a record sheet or the like, a drum over which said sheet is passed for determining the rate of advance of said sheet, and a winding up device for said sheet comprising guides extending downward from said drum, a spool adapted to receive said sheet as it is delivered from the drum having its axis parallel to said drum and arranged to descend by gravity in said guides and to be rotated on its axis when descending by reason of a driving connection between it and said guides, the driving connection and the point at which the sheet is received by said spool being on opposite sides of the axis of rotation of said spool and arranged so that the tension maintained on the record sheet is substantially constant irrespective of the changes in diameter and weight of the record sheet roll carried by the spool.

13. In a recording device, a rotary drum for determining the rate of advance of a

record sheet, a record sheet supplied to said drum, a spool for rerolling said sheet as it is delivered from said drum, guides extending downward from said drum for retaining the spool with its axis parallel to the axis of the drum while permitting the spool to descend by gravity, a driving connection between said spool and guides for causing the spool to rotate on its axis in descending in the same direction as that of the drum, the record sheet being wound on said spool so as to be received thereby on the opposite side of said spool from the driving connection, said parts being so adjusted and arranged that the tension maintained on the sheet by the reroll mechanism is substantially constant irrespective of the amount of the record sheet carried by said spool.

14. In a recording device, a gravity reroll mechanism for receiving and rolling up a record sheet which operates to wind up the record sheet by the action of gravity acting on the weight of the reroll mechanism and causing the same to descend as the sheet is rolled up, and a signal arranged to be actuated when said reroll mechanism has descended to a predetermined point.

15. In a recording device, a record sheet, a gravity operated reroll mechanism for receiving and rolling up said record sheet, and a signal arranged to be operated by said reroll mechanism whenever the record sheet runs out or whenever the gravity device requires to be wound up.

16. In a recording device, a record sheet, a rotary drum over which said record sheet is advanced, an escapement for said drum for determining the rate of advance of said record sheet, and a gravity operated mechanism for rolling up said record sheet as it is delivered from the drum and for moving said record sheet and drum.

17. In a recording device, a record sheet, a rotary drum over which said record sheet is advanced, an escapement for said drum for determining the rate of advance of said record sheet, and a gravity operated mechanism for rolling up said record sheet as it is delivered from said drum and for moving said record sheet and drum, said mechanism being arranged to maintain a substantially constant tension on said record sheet as it is delivered from said drum.

18. In a recording device, a record sheet, a rotary drum over which said sheet is advanced, an escapement for said drum for determining the rate at which said record sheet shall be advanced, and a weight secured to the forward end of said record sheet for advancing the same and rotating the drum, said weight comprising a gravity operated mechanism for rolling up said sheet as it is delivered from the drum.

19. In a recording device, a record sheet, a rotary drum over which said sheet is advanced, an escapement for said drum for determining the rate at which said record sheet shall be advanced, and a variable weight secured to said record sheet after it has passed over the drum for moving the record sheet and drum, said weight constituting a reroll mechanism for the record sheet and the amount of record sheet which has been rerolled thereby, said mechanism being arranged to maintain a substantially constant tension on said record sheet as it is delivered from the drum irrespective of changes in weight caused by the variable amount of record sheet carried thereby.

20. In a recording device, a record sheet, a rotary drum over which said record sheet is advanced, and a gravity operated clock for moving said record sheet and drum at a uniform rate, said clock comprising a spring escapement geared to said drum and a weight constituting a mechanism for rolling up said sheet as it is delivered from said drum, said weight being secured to the forward end of said record sheet and arranged to maintain a substantially constant tension.

In witness whereof, I have hereunto set my hand this 13th day of February, 1924.

FREDRICK S. MARCELLUS.