Jan. 10, 1956 J. S. BAER 2,730,309

REELING SYSTEM

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Fig. 1.

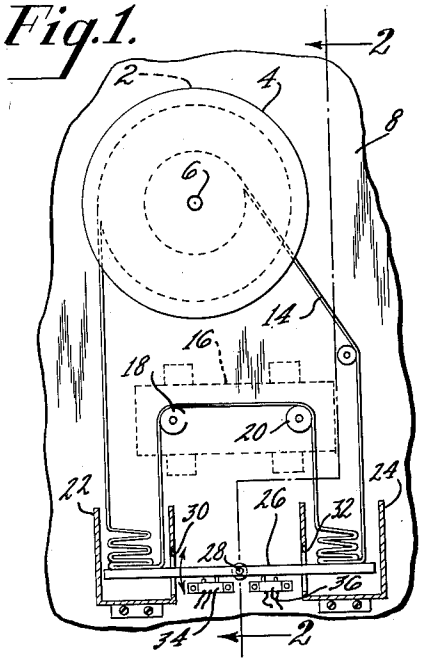


Fig. 2.

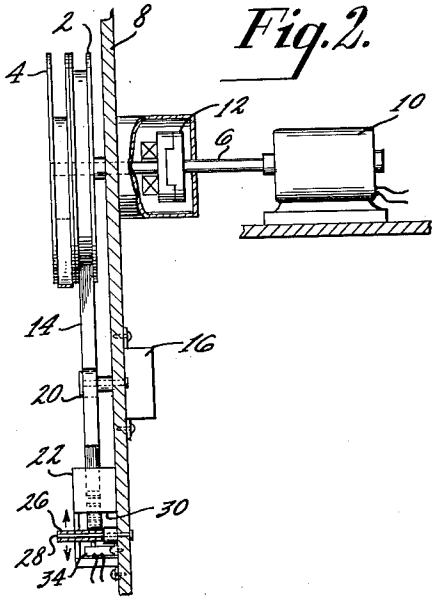
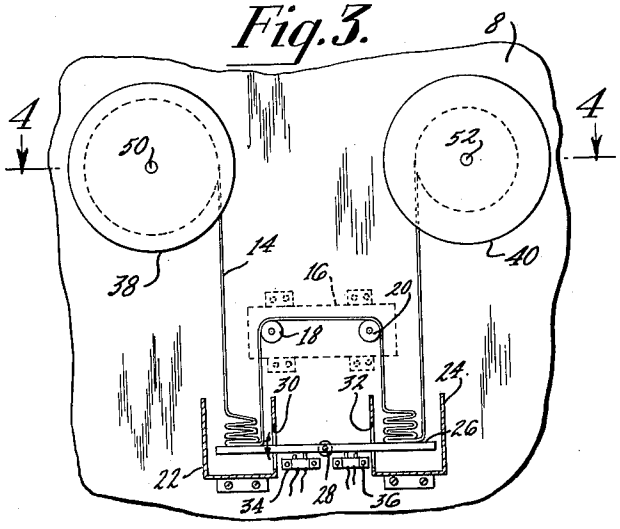


Fig. 3.



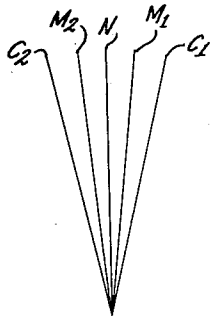
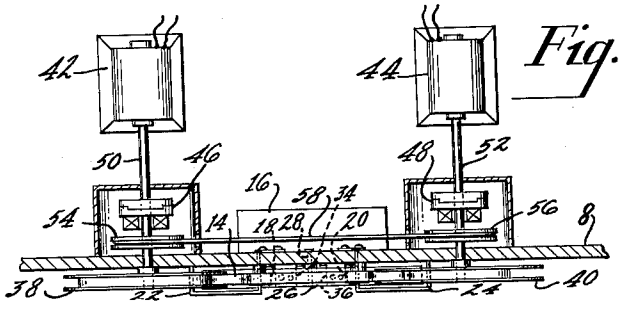


Fig. 5.

Fig. 4.



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REELING SYSTEM

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9 Claims. (Cl. 242—55)

This invention relates to reeling systems, and more particularly to a control means for such a system.

In automatic accounting apparatus, it has been found convenient to store data to be used by the apparatus in the form of magnetic pulses on a magnetizable record member such as iron-oxide coated plastic tape. In certain phases of the handling of such tape, it is necessary that the record member be started and/or stopped in very short time intervals, on the order of a very few milliseconds. Tapes of the type mentioned are most conveniently handled on storage reels. However, because of the mass and accompanying inertia of such reels together with similar characteristics of their associated driving apparatus, difficulty has been experienced in achieving the required rapidity in the starting and stopping thereof.

To obviate the necessity of utilizing the high-inertia reels, it has been proposed that the tape be stored loosely in bins on either side of a suitable tape driving unit. But it is anticipated that the tape used in such a system will be quite long, on the order of 2400 feet. Consequently, each bin must be of sufficient size to accommodate substantially the full length of tape, and, therefore, would be quite large. Since, in an anticipated record storage installation, a large number of such tapes will be used, and since the data stored thereon must be readily accessible, a correspondingly large number of reeling systems will be required. In such an installation, the space requirements of the system would present a problem.

It is accordingly, an object of the present invention to provide an improved reeling system for tapes characterized in that a minimum space is required while maximum convenience is achieved.

It is another object to provide an improved control system for reeling systems of the type set forth.

In accomplishing these and other objects, there has been provided, in accordance with the present invention, a reeling system wherein the tape is stored on a pair of reels. Motor means are provided for driving the reels. Separate driving means responsive to any desired control signals is provided for the tape. Means in accordance with the invention responsive to the demand of the tape driving means is provided which controls the reel driving means to maintain preferred tape storage conditions and thereby to permit free feed of tape without inertia effects of associated mechanism.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawing in which:

Fig. 1 is a schematic representation showing, in elevation, one form of reeling system embodying the present invention;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1 and looking in the direction of the arrows;

Fig. 3 is a schematic representation showing, in elevation, another form of reeling system embodying the present invention;

Fig. 4 is a sectional plan view taken along the line 4—4 of Fig. 3 and looking in the direction of the arrows; and

Fig. 5 is a chart showing a relationship between the lack of balance of the tape in a pair of receptacles and the energization of a reel driving means.

Referring now to the drawings in more detail, there is shown in Figs. 1 and 2 a reeling system embodying the present invention. A first and second tape storage reel 2 and 4 respectively are mounted coaxially on a common driving shaft 6 which extends through a mounting panel 8. The two reels 2 and 4 are driven simultaneously by a motor 10 through an electrically operated clutch 12 such, for example, as a magnetic clutch. A tape member 14, which may be a magnetic record tape, passes from one of the storage reels to the other. The motor 10 is to be of any known reversible type having external connections facilitating reversal. Simple and known switching arrangements or relay control may be operated by the switching means hereinafter referred to as being a part of the illustrative embodiments for reversing the motor.

In its path between the two reels, the tape passes a separate tape driving unit 16 of a known kind and employed for any desired purpose. The tape driving unit 16 usually drives the tape in response to signals which may be some function of the data recorded on the tape. Suitable function means (not shown) may be included between the rollers 18 and 20 of the tape driving means. The function means may, for example, comprise a set of signal translating heads or any other signal sensing means.

Between the first reel 2 and the tape driving unit 16, the tape forms a slack loop. Another slack loop in the tape is formed between the second reel 4 and the tape driving unit 16. Since the two reels are always driven at the same rotational velocity, the combined length of the two slack loops will be variable from a minimum when substantially all of the tape is on one reel to a maximum when the two reels contain substantially equal amounts of tape. The slack loops on both sides of the tape drive unit 16 permits the tape to be rapidly started and stopped without the necessity of overcoming the high inertia of the reels. The minimum length of the loops should be such that the reels 2 and 4 can be brought into motion before either of the loops have been completely taken up.

In order to prevent the loops in the tape 14 from falling free, with the accompanying danger of becoming fouled or tangled, a pair of receptacles 22 and 24 are provided for receiving, respectively, the two loops. Since, as previously pointed out, the space requirements should be held to a minimum, the receptacles should, accordingly, be kept as small as practicable.

The necessary size of the receptacles may be kept to a minimum if the quantity of tape in one of the receptacles is substantially the same as the quantity of tape in the other. In other words, approximately one-half of the tape that is extending between the reels is in each receptacle. This is achieved by using a balancing member or arm 26 which extends in opposite directions from a central pivot 28. The ends of the arm 26 extend through openings 30 and 32 into the receptacles, respectively.

The slack length of tape in each of the receptacles rests on the end of the balance arm 26 associated with the respective receptacles. If one receptacle contains a greater quantity of tape than the other, the end of the balance arm associated therewith will be depressed.

In a position to be actuated by movement of the balancing arm 26, is a suitable electric circuit controlling means, represented in the drawing by a set of suitable switches such as micro-switches 34 and 36. It will, of course, be apparent to anyone skilled in the art that suitably selected potentiometers or other known devices may be substituted for the switches. These switches are ar-

ranged to control the energization of the reel motor **10** and the associated clutch. In one arrangement, the order of operation of the clutch **12** and the motor **10** is illustrated in Fig. 5. In the normal position of the balance arm **26** as represented by the line N, neither the motor nor the clutch is energized. Each of the switches 34 and 36 comprises two switching units and may be a double pole switch which is characterized in that one unit or member of the switch closes before the other. One of the units may of itself be a double pole switch to facilitate motor reversal. As the balance arm **26** tips either way from the normal position to a position represented by the line M_1, or M_2, the first member of the appropriate one of the switches closes to energize the motor, the direction of the tilt of the arm **26** will determine the direction in the which the motor will be energized to be driven. Further tilting of the balance arm **26** to a position represented by the line C_1 or C_2 causes the second portion of the microswitch to close, engaging the clutch. The time lag between the starting of the motor and the engagement of the clutch permits the motor to come up to speed before a load is applied to it. Thus, if there is an excess of tape in the receptacle **22**, the tilting of the balance arm will close the switch **34** energizing the motor and the clutch to drive the reels in a clockwise direction. Of course, if there is an excess of tape in the receptacle **24** the motor will be energized to drive the reels in a counterclockwise direction. Thus the system described above will function by repeated operations to maintain a substantial equality of the amount of tape in the two receptacles.

The form of reeling system embodying the invention which is illustrated in Figs. 3 and 4 is substantially the same as that shown in Figs. 1 and 2 with the exception that the reels **38** and **40** are mounted in spaced, parallel axes instead of being mounted coaxially as previously described. There is the further distinction in that each reel is provided with a separate drive motor **42** and **44**, respectively. These motors operate in opposite directions with normal excitation. For the sake of convenience of description, the same reference characters will be used in Figs. 3 and 4 as was used in Figs. 1 and 2 for parts which are substantially the same. Each motor is coupled to its associated reel by means of an electrically operable clutch **46** and **48** respectively. As shown in Fig. 4, the first reel **38** is mounted on a shaft **50** which is connected to the motor **42** through the clutch **46** and the second reel **40** is mounted on a second shaft **52** which is connected to the motor **44** through the second clutch **48**. Mounted on the first shaft **50**, between the reel and the clutch, is a pulley **54**. A second pulley **56** is similarly mounted on the second shaft **52**. These pulleys are coupled together by a coupling belt **58** in such a manner that there will be no relative slip between the two pulleys. This may be accomplished by using a notched belt and toothed pulleys. With this sort of an arrangement, the motors need not be of a reversible type. Only one motor and the associated clutch need be energized at any one time. Due to the coupling of the belt **58**, when one of the motors and the associate dclutch is energized, both reels will be driven at the same speed and in the direction determined by the motor and clutch that is energized. When the balance arm **26** tilts in the opposite direction the motor that was energized is disconnected, and the other motor is energized and connected to drive both reels in the opposite direction.

A third form of the apparatus can be arranged in view of the foregoing disclosure, similar to that shown in Figs. 3 and 4, wherein only one of the motors is used, if that motor is of a reversible type, the two reels being simultaneously driven by the coupling belt. Regardless of the form of apparatus employed, the principles involved are substantially the same.

Thus it may be seen that there has been provided a reeling system which provides the convenience of reel storage for the tape, the rapidity of start-stop operation of receptacle storage of the tape, and economy of space construction cost.

I claim:

1. In a reeling system for a tape member the system including separate tape driving means, in combination, a first and second movable tape storage means, means for imparting movement to said tape storage means, a first and second tape accumulating means associated respectively with said first and second tape storage means for receiving a slack length of tape between each of said tape storage means and said tape driving means, means positioned in cooperative association with each of said tape accumulating means for determining the relative amount of tape in said two tape accumulating means, and means responsive to said determining means for controlling said means for imparting movement to said tape storage means.

2. In a reeling system for a tape member and including a signal responsive tape driving means, in combination, a first and second tape storage reel, driving means for said reels, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of tape in each of said receptacles with respect to each other, and means responsive to said balancing means for controlling said driving means for said reels.

3. In a reeling system for a tape member and including a signal responsive tape driving means, in combination, a first and second tape storage reel, said reels being mounted coaxially, driving means common to both of said reels, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of film in each of said receptacles with respect to each other, and means responsive to movements of said balancing means for controlling said driving means for said reels.

4. In a reeling system for a tape member and including a signal responsive tape driving means, in combination, a first and second tape storage reel, said reels being mounted on spaced, parallel axes, driving means for said reels, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of tape in each of said receptacles with respect to each other, and means responsive to movements of said balancing means for controlling said driving means for said reels.

5. In a reeling system for a tape member and including a signal responsive tape driving member, in combination, a first and second tape storage reel, driving means for said reels, said driving means including an electric motor and an electrically operable clutch, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of tape in each of said receptacles with respect to each other, and means responsive to said balancing means for controlling the energization of said clutch and said motor.

6. In a reeling system for a tape member and including a signal responsive tape driving means, in combination, a first and second tape storage reel, said reels being mounted

on spaced, parallel axes, driving means for each of said reels, each of said driving means including a motor and an electrically operable clutch, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of tape in each of said receptacles with respect to each other, and means responsive to said balancing means selectively controlling the energization of said clutches and said motors.

7. In a reeling system for a tape member, in combination, a tape driving means, a first and second tape storage reel, driving means for said reels, a first and second receptacle associated respectively with said first and second reels for receiving a slack length of tape between each of said reels and said tape driving means, means positioned in cooperative association with each of said receptacles for determining the relative amount of tape in each of said two receptacles with respect to each other, and means responsive to said determining means for controlling said reel driving means.

8. In a reeling system for a tape member, in combination, a tape driving means, a first and second tape storage reel, driving means for said reels, said driving means including an electric motor and an electrically operable clutch, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity of tape in each of said receptacles with respect to each other, and electric circuit controlling means responsive to said balancing means for controlling the energization of said clutch and said motor.

9. In a reeling system for a tape member, in combination, a tape driving means, a first and second tape storage reel, said reels being mounted on spaced, parallel axes, driving means for each of said reels, each of said driving means including an electric motor and an electrically operable clutch, a first receptacle positioned to receive a slack length of tape between said first reel and said tape driving means, a second receptacle positioned to receive a slack length of tape between said second reel and said tape driving means, balancing means positioned in cooperative association with said receptacles for determining the relative quantity in each of said reels with respect to each other, and electric circuit controlling means responsive to said balancing means for selectively controlling the energization of said clutches and said motors.

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