Dec. 20, 1960 G. K. HALL 2,965,325

MAGAZINE FOR STORAGE OF STRIP MATERIAL

Filed March 21, 1958 2 Sheets-Sheet 1

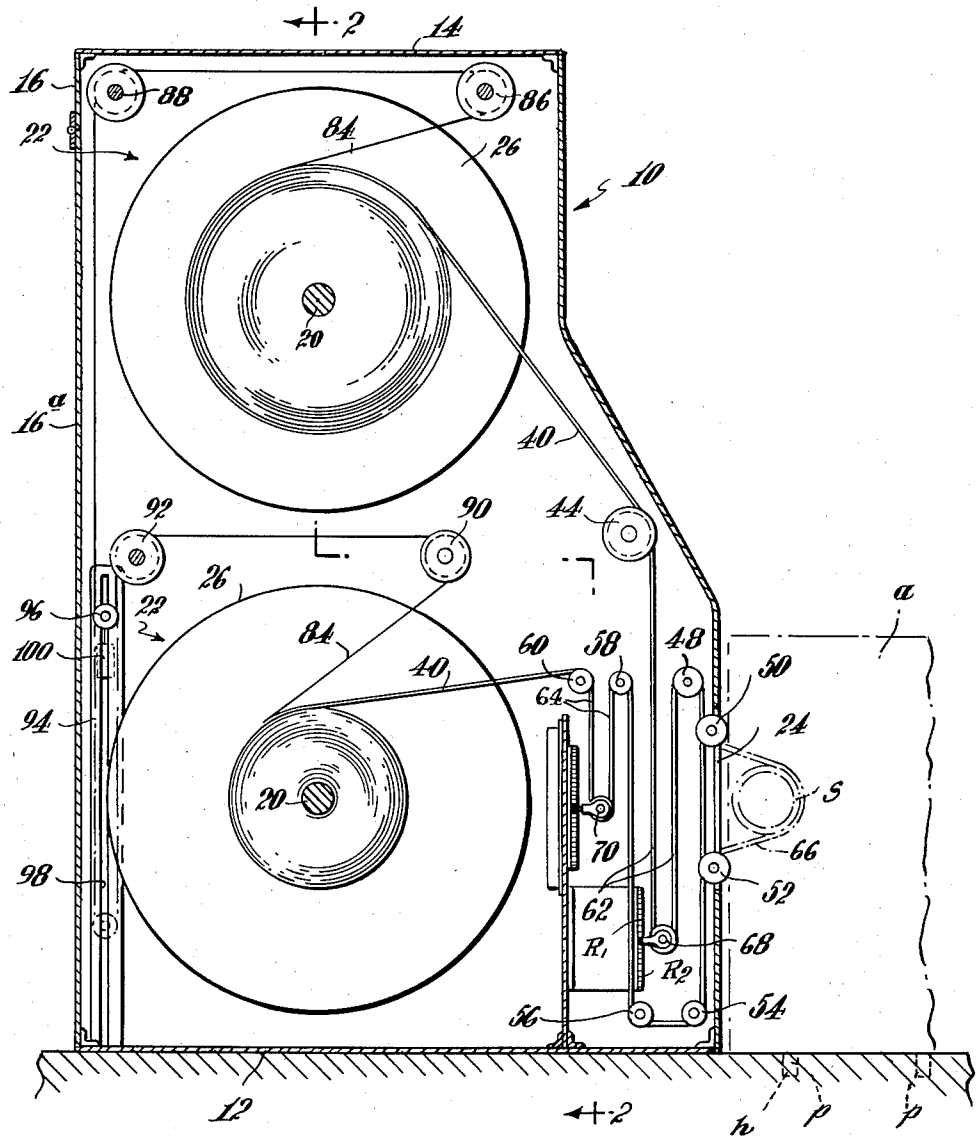


Fig. 1

Inventor
Garrison K. Hall
by Roberts, Cushman & Grover
Attys

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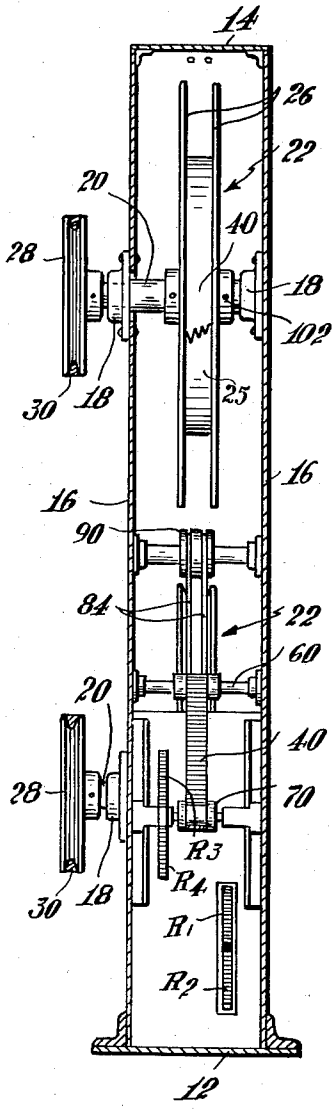


Fig. 2

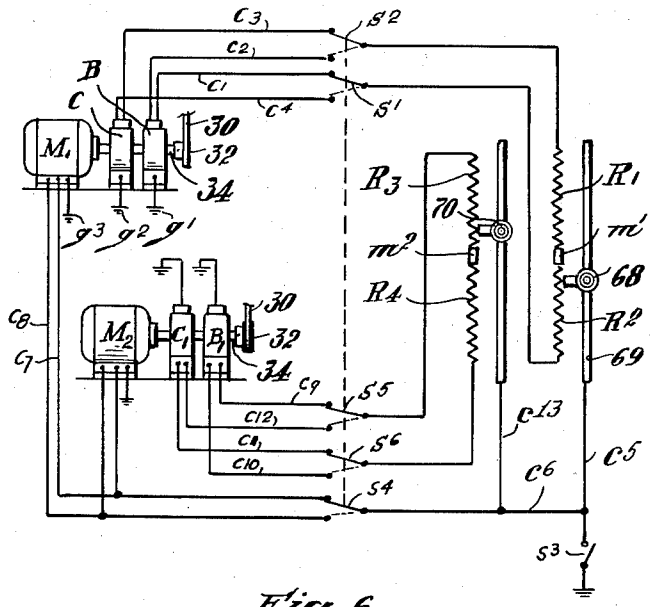


Fig. 6

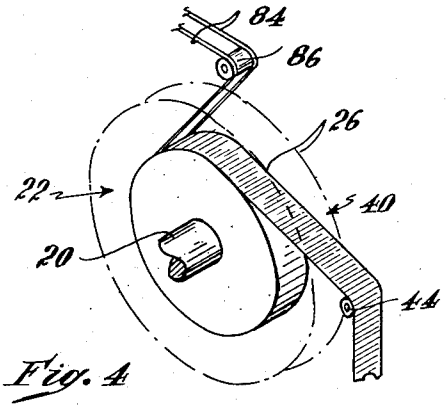


Fig. 4

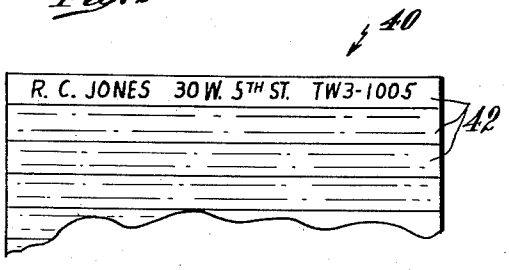


Fig. 3

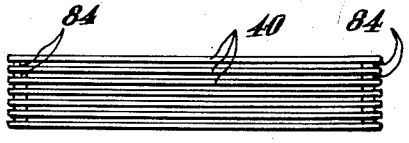


Fig. 5

Inventor
Garrison K. Hall
by Roberts, Cushman & Grover
Attys

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MAGAZINE FOR STORAGE OF STRIP MATERIAL

Garrison K. Hall, 621 Country Way, North Scituate, Mass.

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5 Claims. (Cl. 242—67.4)

This invention relates to a magazine for the storage of strip material and has for its principal objects to provide a storage chamber in which a master strip bearing a large amount of catalogued information may be supported for storage and for use, or a whole or a part thereof, without at anytime removing the entire amount. Another object is to provide a storage chamber for supporting the strip in such fashion that predetermined lengths of the strip may be exhibited in succession and at various constant or intermittent speeds. Another object is to provide means for supporting the strip in the storage chamber so that it can be exhibited throughout its entire length from either end and may at anytime in the course of its movement in one direction be reversed so as to be moved in the opposite direction. Another object is to provide spools for supporting the strip for movement from one to the other and for compensating for the change in effective diameter of the spools as the strip is wound from one to the other to afford uniform speed of the strip without slack or tension.

As herein illustrated, the storage magazine comprises a housing, means mounting a pair of spools therein in spaced relation upon which strip material wound on one may be wholly or partially transferred to the other, a port in a wall of the housing parallel to the plane of the axes of the spools, through which a loop of the strip passing from the one spool to the other may be drawn, means for turning the spools to transfer the strip from one spool to the other, and means for maintaining a loop of constant length exteriorly of the port. The spools are rotated by individual motors connected to their shafts and there is means controlling the motors to compensate for an excess or insufficient amount in the projecting loop due to the change in diameters of the coils on the spools as the strip is transferred from one spool to the other. The aforesaid means includes secondary loops within the housing, each being connected at one end to a spool and at the other end to an end of the projecting loop. These internal loops change length with the speed of pay-off or take-up of the strip on the spools and there is means operable by the change in length of these loops to increase or decrease the speed of the spools. The housing also contains tapes connected to the spools which lie between the interfaces of successive coils of the strip for winding and unwinding with the strip to hold the interfaces out of contact with each other. Portions of the tapes between spools are supported on guides to form loops and there is means yieldably engaged with the loops to maintain them under tension.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

Fig. 1 is a vertical section from front to back of the magazine;

Fig. 2 is a vertical section taken from side to side, taken on the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the strip;

Fig. 4 is a perspective of one of the spools removed from the magazine showing the strip and spacer tapes;

Fig. 5 is a greatly enlarged section of a fragmentary portion of a roll broken away between its ends showing the strip and spacers between adjacent rolls; and

Fig. 6 shows the wiring diagram for the apparatus.

As herein shown, the storage magazine **10** is substantially rectangular in horizontal section, having a base **12**, a top **14** and walls **16**. Part way down the front wall slopes forwardly and then downwardly and the side walls and bottom walls extend forwardly to meet its edges and to form with the front wall a base of larger cross-section than the top part of the magazine. In the lower part of the front wall there is a horizontal substantially rectangular port or opening **24**.

The magazine may be comprised of any suitable structural material such as wood, metal or plastic and preferably is fabricated so as to be substantially light and moisture-tight.

Within the upper and lower halves of the magazine there are journaled on suitable bearings **18**, fastened to the walls **16**, spaced parallel shafts **20**, on which are mounted for rotation spools or reels **22**, each of which has a barrel **25** and end flanges **26** rigidly fixed thereto. The shafts **20** extend through their bearings at one side to the exterior of the magazine and have fastened thereto pulleys **28**, over each of which there is entrained one end of an endless belt **30**, the opposite end being entrained about a pulley **32** (Fig. 6), fastened to a motor shaft **34** extending from an electric motor. There are two motors M^1 and M^2 at the base of the magazine on brackets fastened to the wall, one for each pulley. The motors are reversible so that the spools may be turned in opposite directions and are provided with means for controlling their speed of rotation or the effective speed of rotation of their extended shafts, independently of each other.

In accordance with the invention there is wound on the spools a strip **40**, a fragmentary portion of which is shown in Fig. 3. The strip is made up of a plurality of narrow bars **42**, hingedly joined edge to edge and each bar has transversely thereof indicia, for example telephone listings or alphabetically or numerically arranged catalogue information. As herein illustrated, the strip has arranged transversely of it telephone listings which are taken from a telephone directory and is kept up to date daily or weekly, as will appear in my copending application Serial No. 676,807, filed August 7, 1957, for Finder for Quickly Locating a Desired Item in a Long List of Items, by adding and/or removing bars **42** to the strip **40**.

The information stored on this master strip constitutes a source for making copy of the same size, larger size or reduced size, as for example on microfilm, and it is the purpose of this invention to make the master strip available for such copying by exposing as little or as much thereof as desired at any given time for copying without removing the entire strip from its protective magazine. This is accomplished herein, as shown in Fig. 1, by drawing the strip **40**, wound on the upper spool **22** downwardly over a transversely disposed roller guide **44**, into the lower part of the magazine, into a space in front of the lower spool **22** which was made available by enlarging the lower part of the magazine. Within this frontal space there are transversely extending guide rollers **48**, **50**, **52**, **54**, **56**, **58** and **60**. The guide rollers **50** and **52** parallel the edges of the opening **24** while the remaining rollers are either above or below the opening. As shown, the strip **40**, coming off of the upper spool, passes over the guide roller **44** downwardly therefrom and then reverses itself and passes upwardly over the roller **48**. Between the rollers **44** and **48** there is a loop **62**. After passing over the roller **48** the strip extends down to the roller **54**, hence rearwardly to the roller **56**, hence upwardly over the roller **58**, and hence downwardly and reverses itself over the roller **60**, so as to form a second loop **64** which hangs between the

rollers **58** and **60**. From the roller **60** the strip runs onto the lower spool **22**.

When the magazine is employed solely as a storage chamber the length of the strip between the rollers **48** and **54** passes directly from one to the other, wholly within the housing, as shown in full lines. When it is desirable to use or obtain from the strip information, the strip is drawn outwardly through the opening **24**, as shown in dot and dash lines, to form a transversely extending loop **66**, the latter being guided adjacent the edges of the opening about the rollers **50** and **52** which prevent damage to the strip and assist in guiding it. The loop **66** is supported by a suitable spool *s* which may be part of a copying apparatus *a* placed adjacent the magazine and located in a proper relation thereto by positioning pins *p—p*, at its base which are adapted to engage holes *h—h* in the base on which the apparatus rests.

The different machines which are used in conjunction with the magazine will have means in the form of a spool *s* (Fig. 1), for engaging the loop **66** which will drive it at various constant or intermittent speeds. To prevent variation of the length of the loop **66** extending externally of the magazine due to change in the effective diameters of the spools **22** as the strip is unwound from one and wound onto the other, means is provided for varying the speeds of the spools, as will now be described with reference in particular to Fig. 6.

On the shaft **34** of the motor M^1 there is mounted a clutch C and a brake B. The brake B is connected by lead wires c^1 and c^2, through switch s^1 and s^2, to resistances R^1 and R^2, the latter being separated by a block of insulation m^1. The clutch C is connected by lead lines c^3 and c^4 to the same switches s^1 and s^2 to the resistances R^1 and R^2. The brush **68** is supported by the loop **62** (Fig. 1) and guided by slots **69**, so as to move along the resistances R^1 and R^2 as the length of the loop changes and is connected by a lead c^5 to a conductor c^6, which in turn is connected to an outside source of power by way of a switch s^3. The motor M^1 is grounded at g^3 and connected through either of two lines c^7 and c^8 and a switch s^4 to the conductor c^6.

As thus wired, as the strip **40** is unwound from the upper spool and wound onto the lower spool an increase in the length of the loop **62** results in the brush **68** moving downwardly along the resistance R^2, thereby decreasing the resistance in the circuit (Fig. 6), so that more current is supplied to the brake B by way of switch s^1 and line c^1. Increasing the current, increases the magnetic flux so that the braking action increases and hence slows down the rotation of the upper pulley **22**, so that slack in the loop is taken up. If, however, the loop **62** is decreasing in length the brush **68** moves up along the resistance R^1, which decreases the resistance and increases the current through switch s^2 and line c^3, to the clutch C, thereby increasing the flux in the clutch, which in turn increases the rotation of the spool. Increasing the rotation of the spool delivers the strip at a faster rate.

If the strip is to be unwound from the lower spool onto the upper spool **22** the switches s^1 and s^2 and s^4 are thrown over to the dotted line positions. This reverses the direction of rotation of the motors M^1 and M^2. Now when the loop **62** increases in length, indicating that the spool is not taking up the strip **40** fast enough, the brush **68** travels downwardly along resistance R^2 which reduces the resistance and increases the current through switch s^1 and line c^4 to the clutch, thereby increasing the speed of rotation of the spool so as to take up the excess. If the loop is growing shorter the brush **68** travels upwardly, decreasing the resistance and increasing the current through switch s^2 and line c^2 to the brake B, increasing the braking action to slow down rotation of the spool.

The lower spool **22** is driven by the motor M^2 and is controlled in like manner by a brake B^1, and clutch C^1, connected by lines c^9, c^{10}, c^{11} and c^{12} through switches s^5 and s^6 to resistances R^3 and R^4. The brush **70** is supported by the loop **64** and guided by a groove **69** so as to move along the resistances R^3 and R^4 and is connected by a line c^{13} to the conductor c^6.

As heretofore stated, the strip **40** is made up of a plurality of narrow, parallel metal bars **42** (Fig. 3), which are hingedly joined edge to edge. The strip is quite long and sometimes weighs as much as 1500 pounds. Constant use of the master strip for making copies, if precautions were not taken, would scratch the contacting surfaces so that good reprint could not be made. Accordingly, spacer tapes **84** (Fig. 2) are disposed between the coils and are arranged to be wound and unwound together with the strip. The ends of the spacer tapes **84**, of which two are shown, near the opposite ends of the spool, although a larger number may be employed, are fastened to the barrel of the spool together with the ends of the strip **40** and as the strip is wound on and off the tapes are simultaneously wound on and off so as to be disposed at all times between adjacent coils and to hold them radially spaced, as shown in Fig. 5. To keep the tapes taut and to avoid movement thereof in the region where the strip is being reproduced they are led off the upper spool near the top thereof over transversely disposed roller guides **86** and **88** and back onto the lower spool near the top over correspondingly located, transversely extending roller guides **90** and **92**. Tension is maintained in the tape by entraining loops **94—94** between the roller guides **88** and **92**, about a movable guide **96** which is supported for vertical movement on a guide **98** and is operated upon by spring means **100** or a weight which constantly urges it downwardly to hold the tapes under tension.

As previously stated, when in storage the entire strip is concealed within the magazine and if desired a cover may be placed over the transversely extending front opening of the magazine to exclude dust and the like. When in use the strip is drawn forwardly through the opening **24** to form the loop **66** of suitable size to accommodate reproducing means which is placed adjacent the magazine. Having engaged the spool of the copying means with the loop **66** the motors M^1 and M^2 are started and the strip travels from one spool to the other at a constant rate by reason of the aforesaid control. By manipulation of the switch s^4 and the connected switches s^1, s^2, s^5 and s^6, the strip may be wound in either direction and by manipulation of the switch s^3 the apparatus may be stopped and started when desired.

The spools **40** may be interchangeably mounted on the shafts **20**, for example by set screws **102**, so that the spools may be lowered and the shafts withdrawn. To permit removal and replacement of the spools the wall **16** may have a hinged section 16^a.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A storage magazine comprising a housing, means mounting a pair of spools therein in spaced relation, upon which strip material wound on one may be wholly or partially transferred to the other, a port in a wall of the housing parallel to the plane of the axes of the spools through which a loop of the strip passing from one spool to the other is drawn for cooperation externally of the housing with copying means when it is desirable to copy information from the strip, motivating means, variable means connecting the motivating means to the spools for turning the spools to transfer the strip from one spool to the other, and means for maintaining a constant length of the loop externally of the port, comprising sec-

ondary loops within the housing, each being connected at one end to a spool and at the other end to one end of the external loop, said secondary loops changing length with the speed of pay-off and take-up of the strip upon the spools, and means operable by the change of length of the secondary loops to vary the variable means to cause said spools to supply to and take-up from the external loops the same number of increments of length.

2. A storage magazine comprising a housing, means mounting a pair of spools therein in spaced relation, upon which strip material wound on one may be wholly or partially transferred to the other, a port in the wall of the housing parallel to the plane of the axes of the spools through which a loop of the strip passing from one spool to the other is drawn for cooperation externally of the housing with copying means when it is desirable to copy information from the strip, motivating means, variable means drivably connecting the motivating means to the spools for turning the spools at different rates, to transfer the strip from one spool to the other, and means for maintaining an unchanging length of loop externally of the port, comprising secondary loops within the housing, each being connected at one end to one spool and at the other end to one end of the external loop, said secondary loops changing length with the speed of pay-off and take-up of the strip on the spools, and means controlled by the change of length of the secondary loops to vary the variable means to increase or decrease the speed of the spools.

3. A storage magazine comprising a housing, means mounting a pair of spools therein in spaced relation, upon which strip material wound on one may be wholly or partially transferred to the other, a port in a wall of the housing parallel to the plane of the axes of the spools through which a loop of the strip passing from one spool to the other is drawn for cooperation externally of the housing with copying means when it is desirable to copy information from the strip, motivating means, variable means drivably connecting the motivating means to the spools for turning the spools at different rates for transferring the strip from one spool to the other, and means for maintaining a constant length of loop externally of the port, comprising secondary loops within the housing, each being connected at one end to one of the spools and at the other end to an end of the external loop, each secondary loop supporting a control member which is movable as said secondary loops change in length to vary said variable means in directions to increase the speed of rotation of the spools from which the strip is being payed off when a secondary loop commences to decrease in length and to decrease the speed of rotation of the spool from which the strip is being payed off when a secondary loop commences to increase in length and vice versa as to the spool upon which the strip is being taken up.

4. A storage magazine comprising a housing, means mounting a pair of spools therein in spaced relation, upon which strip material wound on one may be wholly or partially transferred to the other, a port in a wall of the housing parallel to the plane of the axes of the spools through which a loop of the strip material passing from one spool to the other is drawn for cooperation externally of the housing with copying means when it is desirable to copy information from the strip, motivating means, a slip clutch and brake drivably connecting the motivating means to the spools for turning the spools at different rates for transferring the strip from one spool to the other, and means for maintaining a constant length of loop externally of the port, comprising secondary loops within the housing, each being connected at one end to one of the spools and at the other end to an end of the external loop, each secondary loop supporting a control member which is movable as the secondary loops increase in length to decrease the effectiveness of the clutch and increase the effectiveness of the brake and is operable by a decrease in the length of the secondary loops to increase the effectiveness of the clutch and decrease the effectiveness of the brake.

5. A storage magazine comprising a housing, means mounting a pair of spools therein in spaced relation, upon which strip material wound on one may be wholly or partially transferred to the other, a port in a wall of the housing parallel to the plane of the axes of the spools through which a loop of the strip passing from one spool to the other is drawn for cooperation externally of the housing with copying means when it is desirable to copy informaton from the strip, motivating means, magnetically operable clutch and brake units operably connecting the motivating means to the spools for turning the spools at different rates for transferring the strip from one spool to the other, and means for maintaining a constant length of loop externally of the port, comprising secondary loops within the housing, each being connected at one end to one of the spools and at the other end to an end of the external loop, each secondary loop supporting a variable resistance operative by an increase in the length of the secondary loop to decrease the effectiveness of the clutch and increase the effectiveness of the brake and by a decrease in the length of the secondary loop to increase the effectiveness of the clutch and decrease the effectiveness of the brake.

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