Oct. 31, 1950 J. J. M. L. MARCHAND 2,527,641

BUNDLE TYING MACHINE

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FIG. 1

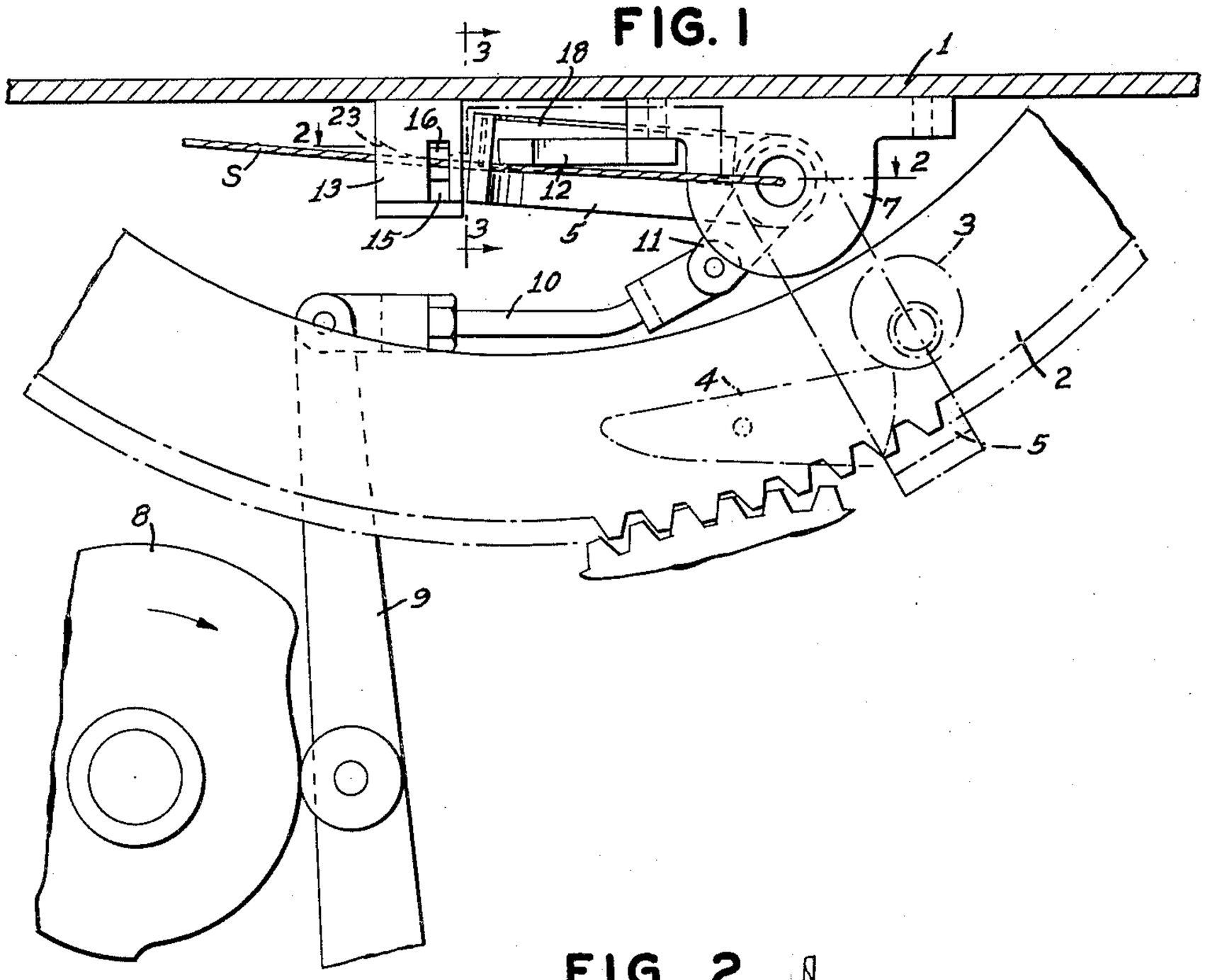



FIG. 2

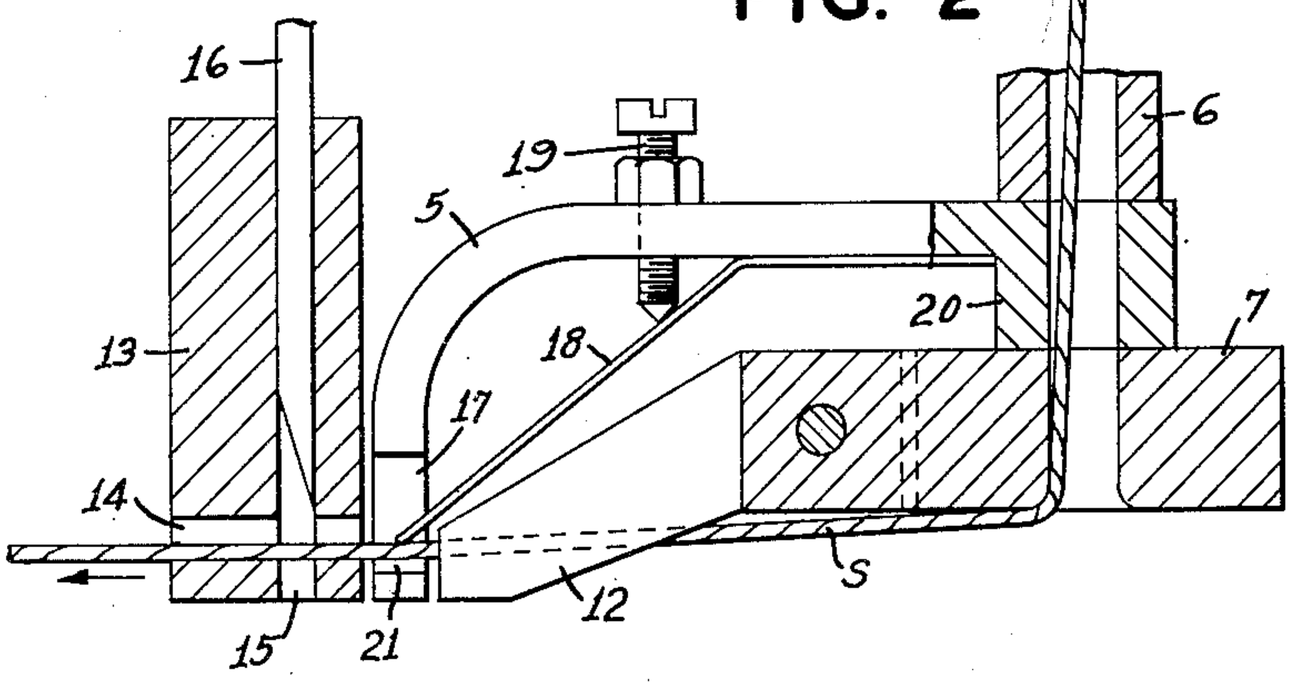
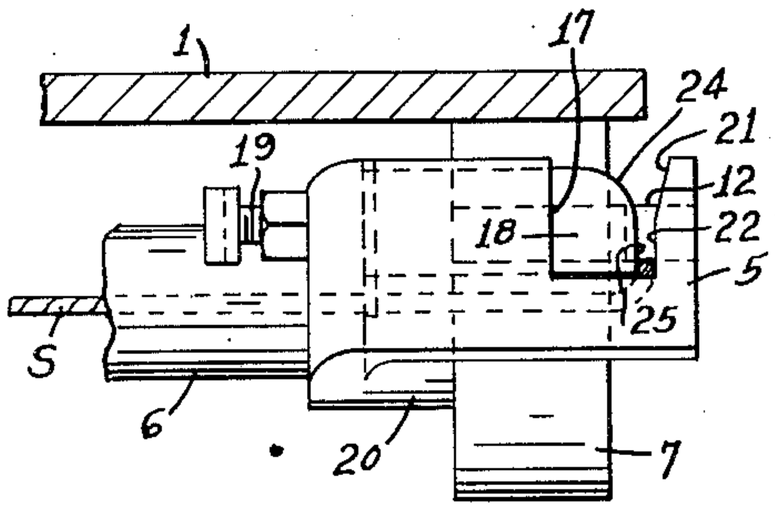



FIG. 3

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## BUNDLE TYING MACHINE

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4 Claims. (Cl. 100—31)

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This invention relates to machines for tying bundles of letters, books, or like documents, or for binding with a string, or the like, one or more other objects.

More specifically, the invention constitutes an improvement over the bundle-tying machine described and claimed in my prior U. S. Letters Patent No. 2,198,440, granted April 23, 1940. The improvements introduced by the present invention render the machine self-threading, as in the event that the string breaks during the tying operation, thus eliminating the manual threading necessitated by the machine covered by my mentioned patent. The improved construction also provides more reliable operation of the machine especially in the event that the string is of non-uniform diameter.

The nature of the improvement of this invention, and the manner in which the construction differs from that of the tying machine of my prior patent above mentioned, will be clear from the following description considered together with the drawings of a practical embodiment, in which:

Fig. 1 is a side view in elevation of a part of the machine to which the present invention relates, but in order to show the features of the present invention the view is taken from the side opposite to that represented in Fig. 5*a* of my mentioned patent;

Fig. 2 is a sectional view taken along line **2—2** of Fig. 1; and

Fig. 3 is a sectional view taken along line **3—3** of Fig. 1.

As above indicated, the tying machine of the present invention is fundamentally the same as that of my mentioned prior patent, and therefore only such parts of the machine are herein specifically described and illustrated as are required for an understanding of the present invention. Consequently, the following general description of the tying machine and its operation will first be given.

The bundle tying machine of the invention includes a tying member in the form of a ring which rotates intermittently in one direction. This member holds the end of the string, cord, wire or other tying medium (hereafter referred to as "string") by means of a clamping device mounted on the ring which pulls the string around the object to be tied, and by which the string is first placed around the bundle with a preliminary tension. Continued rotation of the ring causes the string to be tightly stretched. Prior to the wrapping action just described, the

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end of the string is held by a movable carrier which is so timed in its movement as to present the string where it may be gripped by the mentioned clamping device which then carries the string around the bundle as the ring rotates, as stated. At the finish of the wrapping, the ring is arrested and holds the string under tension with the starting portion of the string close to the finishing portion thereof in overlapping relation. At this point in the operation, the string carrier, but which now carries no string, automatically swings upwardly where it grips the finishing portion of the string in a clutch-like manner, thus assuring adequate tension of the string around the bundle. Then the overlapping portions of string are firmly attached together by a clip, preferably of metal, which binds them securely and which is automatically severed from a roll of metal tape. The finishing portion of the string is then automatically cut behind the clip, which leaves the severed end of the string still in the grip of the string carrier. The release of tension on the string frees it from the clamp so that the tied bundle can be removed from the machine, which will then be in condition to repeat the described operation.

From the foregoing description of operation which applies to the machine of the present invention, as well as to that of my mentioned patent, it will be seen that unless the string is gripped and held by the string carrier member, it will not be picked up by the clamping device and carried around the bundle. Formerly, it was necessary manually to thread the machine by inserting the string in the clutch members of the string carrier, both initially and in the event that the string broke during the tying operation. The improved construction of the present invention provides means by which the broken or free end of the string is automatically forced into the clutch members of the string carrier, with a resulting improvement in convenience in and speed of operation of the machine. This same improvement also provides adequate gripping of the string even though it be of non-uniform diameter; which again results in improved operation of the machine.

The nature of the improvement in accordance with the invention will be better understood by reference to Fig. 1 which shows a portion of a tying ring **2** where it extends below the horizontal table **1** on which the bundle to be tied is supported. This ring **2** is large enough to extend well above the table through suitable slots therein so as to encircle the bundle. Near the

periphery of ring 2 a plurality of clamping devices 3, 4 (only one being illustrated), are positioned. These clamps are arranged so that one of them will clamp on to the string and hold it firmly when the string is presented to the clamp in the proper position. To this end, a string carrier 5 is arranged to rotate on a hollow shaft 6. The movement of string carrier 5 is determined by the link system 9, 10, 11 attached at one end to the carrier and actuated at the other end by cam disc 8. Mechanism controlling the motion of cam 8 in timed relation to the other parts of the machine is described in my prior patent and is not here shown.

Through hollow shaft 6 the string, or other tying medium, S, is supplied from a bobbin (not illustrated) and is gripped by the clutch members at the free end of carrier 5 when the carrier is in the position illustrated by solid lines in Fig. 1. Adjacent the end of carrier 5, when in the mentioned position, is a guide member 13 which is secured beneath the table 1. A groove 14 in guide member 13 (Fig. 2) preferably is formed with a curved bottom 23 (Fig. 1) against which string S presses when it rests in the groove. Attached to the bearing block 7 is an abutment plate 12, the shape of which is shown in Fig. 2. This abutment plate is so shaped and positioned that the end of it lies close to guide member 13, being spaced therefrom only slightly more than the width of the end of the string carrier 5 which, when in the position shown, lies between the members 12 and 13. From Fig. 1 it will be clear that the lower edge of plate 12 is positioned so that the string S presses against it when the elements of the machine are in the positions shown, at which time the string also presses against the surface 23 of groove 14. It is preferred that the clearance between the end of carrier 5, constituting the clutch portion, and the adjacent surfaces of guide 13 and abutment plate 12 be as small as possible.

The construction of the carrier 5 is shown more especially in Figs. 2 and 3. This carrier has a boss 20 at one end through which hollow shaft 6 passes, permitting the carrier to rotate around the shaft. It is bent, as shown, in a right angle, and at the free end includes a cut-out portion or recess 17. A leaf spring 18 is secured at one end to the inside of the bent arm of carrier 5 and the free end thereof extends at an angle just within the recess 17. The upper portion 24 of this free end of spring 18 is rounded, as shown in Fig. 3, so as to form one side of a tapered slot between itself and the inside tapered surface 21 of the end of the carrier arm. A screw 19 (Fig. 2) passing through the carrier 5 can be adjusted to bend spring 18 more or less so as to adjust with considerable accuracy the position of the free end of spring 18 in the recess 17, thereby to adjust the force with which the string is gripped between the end of spring 18 and the adjacent inside surface 22 of recess 17. Thus it will be seen that the surface 22 in cooperation with the end of spring 18 comprises a clutch which can grip the string when it is interposed therebetween. It will also be seen, especially from Fig. 2, that the string may be drawn in the direction of the arrow, toward the left in the figure, but not in the reverse direction because of the clutching effect of the spring 18. Within guide member 13, a knife 16 is arranged to slide in a channel 15 so as to sever the string beyond the point where it is gripped by the clutch means on carrier 5. The operation of the machine in accordance with the present invention will be understood from the following: Assuming that a short piece of string S is hanging loose downwardly from hollow shaft 6, either in the initial operation of the machine or because the string has broken during operation thereof, it will hang in the path of the end of carrier 5. Therefore, when carrier 5 swings from its lower position (as shown in dash-dot lines, Fig. 1) toward its upper position (shown in solid lines), the string will pass into the tapered opening of the clutch members between surface 21 and the rounded edge 24 of spring 18 opposite thereto, as seen in Fig. 3. The carrier will then carry the string upwardly until the carrier reaches the position shown in Fig. 1, at which point the string will be pressed by abutment plate 12 into the slot between the two surfaces 22 and 25, and will be retained there by the gripping action of the spring. Such gripping of the string will occur even though one end of it is free, because of the facts that the string inherently has a certain stiffness and the motion of carrier 5 is sufficiently rapid. Therefore, as a result of striking against the lower edge of plate 12 and the adjacent surface 23 of groove 14 the end portion of the string will, before it has had time to bend appreciably, be pressed sufficiently far into recess 17 to be gripped by the spring. Having been gripped by carrier 5, the string will then be carried down to the first or lower position (dot and dash lines of Fig. 1) from which it may be seized by clamping device 3, 4 as above explained.



It will be evident that in order that the gripping action just described be satisfactorily effected, the spacing between the surface 22 of recess 17 and the end of spring 18 (Fig. 3) should be accurately adjusted to accommodate the diameter of the string employed. However, because of the resiliency of spring 18 there is considerable latitude in the clutch action, so that if the adjustment be adequate to grip a string of certain minimum diameter, the same adjustment will be satisfactory for string of somewhat greater diameter. Thus, even though the diameter of the string on a given bobbin is not uniform, the string will be satisfactorily gripped by the carrier provided spring 18 be adjusted to the minimum diameter of the string on that bobbin.

I claim:

1. In a machine for tying a bundle, or for binding a plurality of objects, with string or the like, comprising a tying ring rotatable in only one direction during a tying operation, clamping means carried by said ring for holding the end portion of the string, and adapted, as the ring rotates, to pull the string around the bundle to be tied, a string carrier rotatable around a fixed point at one end, clutch means at the other end of said carrier adapted to grip the string, and means rotating said carrier to a first position at which said clamping means seizes the string from said carrier and wraps it around the bundle and to a second position at which said clutch means grips the string again behind the portion of string which has wrapped the bundle, the improvement which comprises two fixed abutment members between which said clutch means is interposed at said second position, said abutment members being spaced very close, respectively, to opposite sides of said clutch means and having edges across which said string is stretched at the finish of each tying operation.

2. A bundle-tying machine according to claim 1

wherein said fixed point around which said string carrier rotates comprises a hollow shaft through which the string feeds, the opening in said shaft being so located above said first position that the string when loose falls into said clutch means as said carrier moves toward said second position, said clutch means comprising elements formed in a taper having a wide entrance adapted to receive the string, said abutment members being located above the normal course of said string at the finish of the tying operation so that said string is pressed thereagainst when said clutch means arrives at said second position whereby said string is engaged by said clutch means.

3. In a bundle-tying machine substantially as described, a hollow shaft through which a tying string feeds, a string carrier which at one end is pivoted to rotate on said shaft and at the other end is fitted with string-gripping means, and a pair of abutment members disposed above the course of said string which is adjacent said shaft at the finish of the tying operation, said members being spaced apart a distance only sufficient to



accommodate said gripping means therebetween and having surfaces adapted to support said string, whereby said string is caused to be gripped by said gripping means when said carrier rotates on said shaft towards said course of the string.

4. A bundle-tying machine according to claim 3 wherein one of said abutment members is more remote from said shaft than is the other, the more remote member being grooved, the bottom of said groove forming one of said surfaces, and the less remote member comprising a fixed plate having a free end, a portion of which forms the other of said surfaces.

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