June 15, 1948. J. J. M. L. MARCHAND 2,443,470

BUNDLE TYING MACHINE

Filed Dec. 15, 1942 2 Sheets-Sheet 1

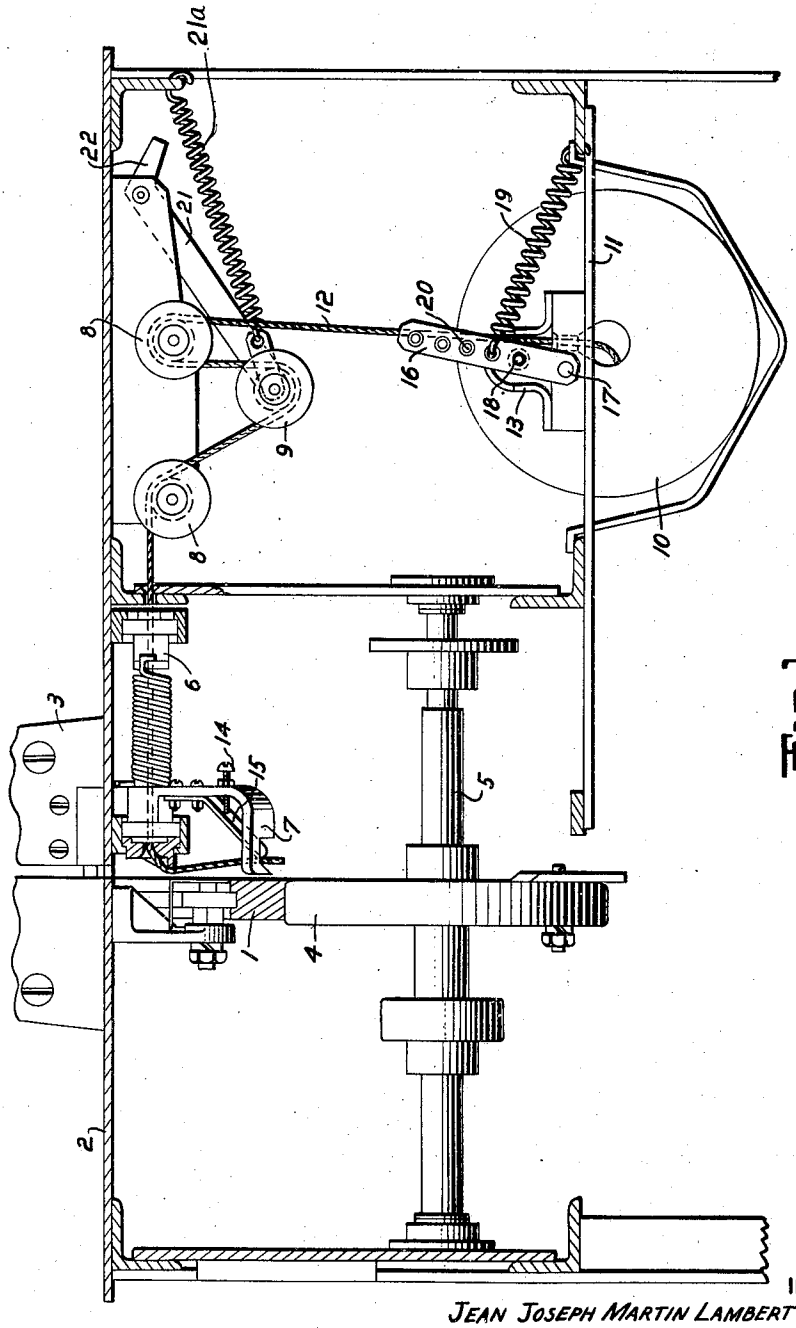


Fig. 1.

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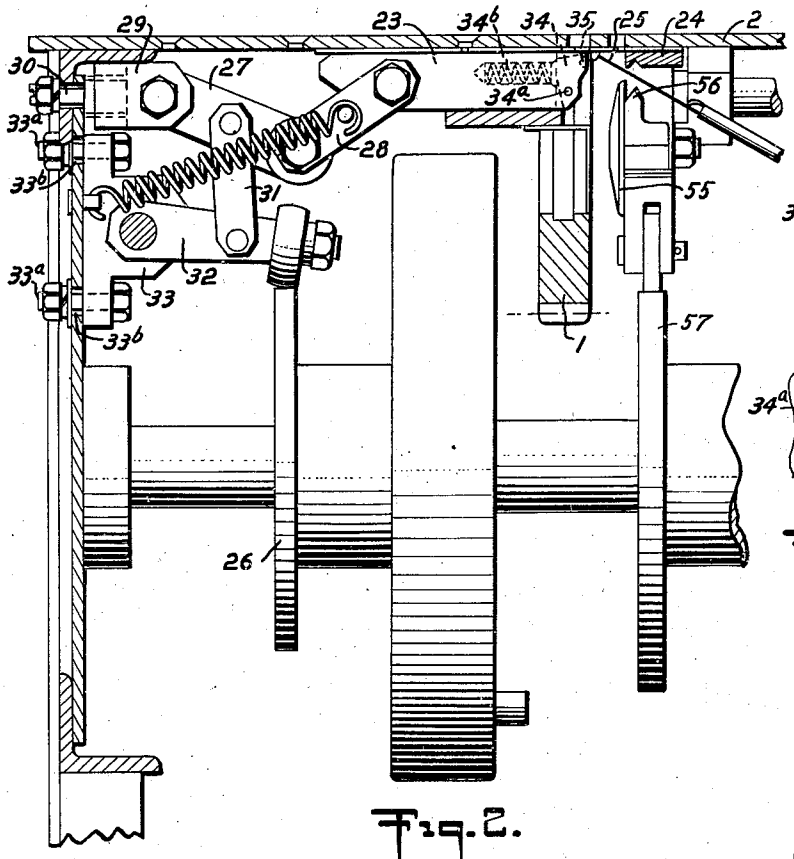


Fig. 2.

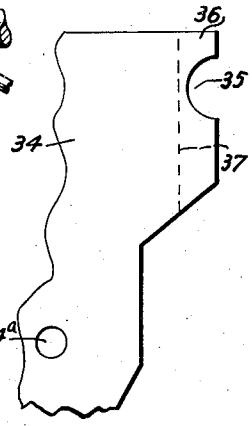


Fig. 3.

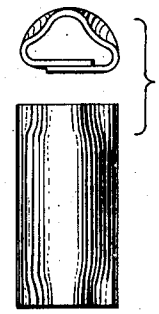


Fig. 5.

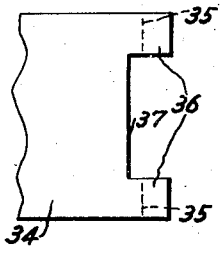


Fig. 4.

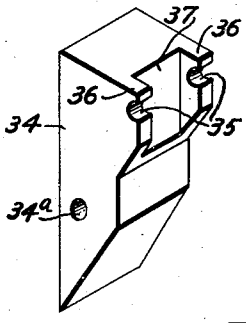


Fig. 4A.

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2,443,470

BUNDLE TYING MACHINE

Jean Joseph Martin Lambert Marchand, The Hague, Netherlands; vested in the Attorney General of the United States

Application December 15, 1942, Serial No. 469,105
In Germany May 16, 1941

Section 1, Public Law 690, August 8, 1946
Patent expires May 16, 1961

4 Claims. (Cl. 153—1)

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The invention relates to an improved machine for tying a bundle of letters, books or like documents or for binding one or more other objects, of the kind as described in the prior U. S. A. Patent No. 2,198,440. This prior machine comprises a member in the form of a tying ring, intermittently rotatable always in one and the same direction during a tying operation and a clamping device mounted on said ring, which seizes the primary end of a tying-medium from a revolving support and pulls it around the articles to be tied. Furthermore means are provided for firmly connecting the adjacent parts of the tying-medium by means of a metal clip, which parts are laid together in overlapping position after the wrapping.

An important object of my invention particularly consists in the perfection of a machine of the kind as mentioned in such way as to enable the machine to satisfy all requirements of ordinary practice, particularly with regard to the tying-medium.

One feature of the present invention resides in the provision of an adjustable braking arrangement by means of which the tension of the tying-medium, gripped by the clamping device on the tying ring, can be accommodated to the strength, stiffness or to other properties of the material of said tying-medium, and in the provision of doubly adjustable means to accommodate also the extent of deformation of the metal connecting clip to the properties of the tying medium.

According to the present invention the tying-medium, coming from a bobbin, before it is led further to the revolving support, passes along a stationary abutment, against which abutment it is pressed by means of a spring-pressed brake-lever, pivoted on a fixed point. The braking action of said lever can be varied by connecting the spring to the lever at various distances from the fixed point of rotation. In this way the tension of the tying-medium may be accommodated to the flexibility of the material used for said medium.

According to another feature of the invention means are provided to equalize the deformation and the size of the connecting clip to the thickness of the tying-medium. For that purpose, the sliding matrix, which effects the deformation of the clip in co-operation with a stationary abutment, is moved by means of a lever system actuated from a cam shaft. The system comprises a toggle lever, one arm of which is pivotally connected to the sliding matrix, whereas the other is pivoted in a fork, which is adjustable in the direction of the sliding movement of the matrix. Furthermore a lever, directly moved by the cam shaft and acting

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on the toggle lever through a connecting bar, is pivotally mounted in a bearing, adapted to be slidably adjusted in a direction transverse to the sliding movement of the matrix.

A further feature of the invention relates to means for increasing the solidity or strength of the clip-connection and thereby adjust the same to any relatively stiff material of the tying medium. For that purpose the end face of the sliding matrix, situated opposite to the stationary abutment is provided with a semi-circular groove, said groove being interrupted over a given length in the middle by a recess of greater depth transversely of the groove. A matrix so constructed provides projecting teeth at both sides of said recess, and each tooth has a portion of said semi-circular groove extending transversely thereof. The walls of this semi-circular groove, at the pressing of the metal connecting clip, will squeeze the ends of the clip more than its middle part.

By providing a machine of the described character, it is possible to guide the tying-medium or to hold the same fast throughout the complete operation of the machine with such tension as may be required by the kind of material used for the tying-medium and at the same time to make the connection of the ends by the tying-medium by the metal clip more or less tight, according to the material of tying medium. In consequence, various materials may be used for the tying-medium, that is, the medium may be thin or thick, and for relatively stiff or relatively flexible material. Thus ordinary paper, rolled or twined in the form of a string, may be used and tied around the bundle with the same effect and in exactly the same manner as other string.

Other advantages and features of invention will be apparent in the following description of a preferred embodiment of the invention illustrated in the accompanying drawings, in which similar reference characters represent corresponding parts in all the views.

Fig. 1 is a vertical sectional view showing the braking arrangement for the passing tying-medium.

Fig. 2 is a fragmentary vertical sectional view showing the adjustable mechanism for the sliding movement of the matrix, when forming the metal connecting clip. For the sake of clearness some of the principal parts of the machine are shown in both figures, although they do not relate directly to the invention.

Fig. 3 is a fragmentary view of the matrix head 34 of Fig. 2.

Fig. 4 is a top plan view of Fig. 3.

Fig. 4A is an isometric view of said matrix head.

Fig. 5 illustrates a side and an end view of a compressed clip.

Referring to the drawings, 1 indicates that part of the tying ring, that is located beneath the table 2, which ring rotates above said table in the guard casing 3. The driving toothed wheel 4 is mounted on the shaft 5 and engages with the toothed rim on the outer peripheral edge of the tying ring. On the hollow shaft 6, the revolving support 7 is secured. The pulleys 8 and 9 are provided for the purpose of guiding the tying-medium. In Figure 1 the path of said tying-medium from the bobbin 10 up to the ring 1 is clearly illustrated.

According to the invention, the tying-medium, such as a string 12, is drawn off from the bobbin 10 and passes through an opening in the frame member 11, and through a slot in a brace 13, fixed to the frame, from whence the string passes over the pulleys 8, 9, 8 and through the hollow shaft 6 up to the recess of the support 7, in which the end of the string is clamped between the blade spring 15 and the end of support 7. The blade spring is adjustable by means of a set-screw 14. In the brace 13, the string is frictionally pressed against the flat inner side of the brace by means of a brake-lever 16, pivotable at 17 on a fixed point and provided with a pressing-pin 18, located at one side of the string 12. A helical spring 19 is connected at one end to the lever 16 and at its other end to a fixed point on the frame member. Under the action of the spring 19 the lever with its pin 18 continuously presses the string against the sidewall of the brace, in such way that it frictionally brakes said string during the wrapping. The free portion of the lever 16 is provided with a number of holes 20, equally spaced along its length. When the end of the spring 19 is connected to one of the upper holes, the effective part of the lever is increased for the braking action. In this way it is possible to adjust the braking force and thereby the resulting tension of the string beyond the brace according to the thickness, strength or other properties of the tying medium used.

The guiding pulley 9 is mounted at the end of a lever 21, which lever is pivoted on the machine frame and is tensioned by a spring 21*a* in a direction to take up slack in the string when tying bundles or objects of very small dimensions. In this case the pulley 9, being normally held in its uppermost position through the tension of the string 12, is moved downwardly by the action of the spring. In the embodiment of the invention illustrated in the drawing, the lever 21 is provided with a heel 22, which bears against the framework at a given lower-most position of the pulley 9, thereby preventing further downward movement of said pulley. This prevents jamming of the string between the sliding matrix 23 and the lower side of the table 2, when no bundle to be tied is present in the machine.

As shown in Figure 2, the matrix 23 is slidably mounted underneath the table 2 and is adapted to roll up and press together a small strip of metal, in co-operation with a stationary abutment 24. The strips are cut intermittently from a metallic band 25, which is advanced step by step and fed to the matrix where it is formed into a connecting clip. The lever-system provided for operating the matrix is driven by the cam-shaft 26, and is adjustable in the direction

of movement of the matrix as well as transversely to this direction. For this purpose the system is provided with a toggle-lever 27, 28, one arm 28 of which is pivotally connected to the matrix 23, and the other arm 27 is pivotally connected to a fork 29. Said fork is internally threaded for the reception of a threaded portion on one end of a set bolt 30. The other end of bolt 30 projects through the frame and has a lock nut mounted thereon. By turning the bolt 30, the fork 29 can be adjusted over a given distance in a horizontal direction. When the fork is adjusted toward the right or left in Figure 2, the matrix 23 is moved in the corresponding direction. An adjustment of the fork 29 to the left increases the distance between the matrix 23 and the abutment 24.

The lever 32, which is connected to the toggle lever 27, 28 by means of the bar 31, is provided at one end with a roller, rolling against the cam-disc 26 and the other end of the lever 32 is pivotably mounted in a bearing 33. Said bearing is connected to the frame of the machine by means of bolts 33*a* which are adjustable upwardly or downwardly in slots 33*b* in the frame. Upon lowering the bearing and thereby the point of rotation of the lever 32, the matrix 23 is adjusted in such a way that a greater length clip is cut off from the metallic band as the band is moved between the matrix 23 and the abutment 24. Thus it is possible to exactly accommodate the connection of the ends of the string by a metal clip to the thickness as well as to the strength and other properties of the material of the tying-medium, and by adjusting the distance between the matrix and the stationary abutment by means of the fork 29, the amount of deformation of the metal clip also may be varied.

It will be noted that the short lengths which later are formed into clips are severed from the end of band 25 by a knife 55, which knife is intermittently raised and lowered by cam 57. During each severing operation, the leading edge of the band is curved downwardly by a forming tool 56 which moves with knife 55.

The sliding matrix 23 preferably is provided, as illustrated in the drawing, at its end facing the abutment 24 with a head 34, oscillably mounted on a fixed fin 34*a* under the action of a spring 34*b*, and the free curved end of the metallic band 25 abuts against the end face of said head 34. In the end face a semi-circular groove 35 is provided (Figs. 3, 4 and 4A), which does not extend to the full width. The intermediate portion of groove 35 is interrupted by a recess 37 of greater depth. In this way, at both sides of the recess 37, projecting hollow teeth 36 are formed. Now when the matrix 23 is pressed against the abutment 24, the clip, cut from the metallic band 25 and situated between the matrix and the abutment, is rolled up, thus forming a sleeve around the overlapping ends of the string, the sleeve being pressed and deformed by means of the projecting hollow teeth so as to have a shape as indicated on an enlarged scale in Figure 5. The middle part of the clip corresponding to the recess 37 in the matrix is bulged outwardly to a small extent, whereas both the ends of the clip are firmly squeezed round the ends of the string by the mentioned teeth 36 and thus assure an effective tightening.

Exact adjustments of the fork 29 and of the bearing 33 of the lever system for the matrix 23 respectively not only permits variation of the distance between the matrix and the stationary

abutment according to the thickness of the ends of the string to be connected, but also varies the tightness and the deformation of the ends of the metal clip by the teeth 36, according to the nature of the material of the tying medium.

It will be evident that the provision of a separate head 34 for the matrix will not always be required. Instead the end face of the matrix 23 itself, facing the abutment, may be shaped as described for the separate head.

Now having described the nature of my invention and the manner in which it is to be performed, I declare that what I claim is:

1. The combination of a support, a stationary abutment thereon having a working face, a matrix having a working face comprising a pair of longitudinally spaced and longitudinally grooved teeth means reciprocally mounting said matrix on said support for movement toward and away from the working face of the abutment, feeding means for intermittently feeding the free end portion of a metallic strip past said working face of the abutment and across the space between said matrix and the abutment and placing the terminal end of the strip in engagement with the working face of the matrix, cutting means cooperating with said abutment and intermittently operable to cut off the said free end portion from the strip as the matrix moves toward the abutment, so as to produce a clip blank, the spacing of the matrix and the abutment determining the length of the clip, said matrix being arranged to continue toward the abutment after cutting off the clip blank so as to compress longitudinally spaced portions of the clip blank between the teeth of the matrix and the abutment in a manner to wrap longitudinally spaced portions of the clip blank around an object positioned in the space between the matrix and the working face of the abutment in alignment with the grooved portions of the teeth of the matrix, and coordinated driving means including means for operating said feeding means, means for operating said cutting means, and means for reciprocating said matrix.

2. The combination of a support, a stationary abutment thereon having a working face, a matrix having a working face comprising a pair of longitudinally spaced and longitudinally grooved teeth means reciprocally mounting said matrix on said support for movement toward and away from the working face of the abutment, feeding means for intermittently feeding the free end portion of a metallic strip past said working face of the abutment and across the space between said matrix and the abutment and placing the terminal end of the strip in engagement with the working face of the matrix, cutting means cooperating with said abutment and intermittently operable to cut off the said free end portion from the strip as the matrix moves toward the abutment, so as to produce a clip blank, the spacing of the matrix and the abutment determining the length of the clip, said matrix being arranged to continue toward the abutment after cutting off the clip blank so as to compress longitudinally spaced portions of the clip blank between the teeth of the matrix and the abutment in a manner to wrap longitudinally spaced portions of the clip blank around an object positioned in the space between the matrix and the working face of the abutment in alignment with the grooved portions of the teeth of the matrix, and coordinated driving means including means for operating said feeding means, means for operating said cutting means, and means for reciprocating said matrix, said reciprocating means comprising toggle linkage pivotally connected at one end to said matrix, a first bearing on said support to which the opposite end of the toggle linkage is pivotally connected, said first bearing being adjustable in a direction parallel to the direction of movement of said matrix in a manner to determine the degree to which the clip is compressed around said object.

3. The combination of a support, a stationary abutment thereon having a working face, a matrix having a working face comprising a pair of longitudinally spaced and longitudinally grooved teeth means reciprocally mounting said matrix on said support for movement toward and away from the working face of the abutment, feeding means for intermittently feeding the free end portion of a metallic strip past said working face of the abutment and across the space between said matrix and the abutment and placing the terminal end of the strip in engagement with the working face of the matrix, cutting means cooperating with said abutment and intermittently operable to cut off the said free end portion from the strip as the matrix moves toward the abutment, so as to produce a clip blank, the spacing of the matrix and the abutment determining the length of the clip, said matrix being arranged to continue toward the abutment after cutting off the clip blank so as to compress longitudinally spaced portions of the clip blank between the teeth of the matrix and the abutment in a manner to wrap longitudinally spaced portions of the clip blank around an object positioned in the space between the matrix and the working face of the abutment in alignment with the grooved portions of the teeth of the matrix, and coordinated driving means including means for operating said feeding means, means for operating said cutting means, and means for reciprocating said matrix, said reciprocating means comprising toggle linkage pivotally connected at one end to said matrix, a first bearing on said support to which the opposite end of said toggle linkage is pivotally connected, a second bearing on said support, a lever pivoted at one end on said second bearing, a link pivotally connected to and between intermediate portions of said lever and of one of the links of said toggle linkage, and adjusting means for adjusting said second bearing to move the pivotal point of said lever in a direction transverse with respect to the direction of reciprocation of said matrix in a manner to determine the spacing of the working face of the matrix from the working face of said abutment when the matrix is in initial or retracted position.

4. The combination of a support, a stationary abutment thereon having a working face, a matrix having a working face comprising a pair of longitudinally spaced and longitudinally grooved teeth means reciprocally mounting said matrix on said support for movement toward and away from the working face of the abutment, feeding means for intermittently feeding the free end portion of a metallic strip past said working face of the abutment and across the space between said matrix and the abutment and placing the terminal end of the strip in engagement with the working face of the matrix, cutting means cooperating with said abutment and intermittently operable to cut off the said free end portion from the strip as the matrix moves toward the abutment, so as to produce a clip blank, the spacing of the matrix and the abutment determining the

length of the clip, said matrix being arranged to continue toward the abutment after cutting off the clip blank so as to compress longitudinally spaced portions of the clip blank between the teeth of the matrix and the abutment in a manner to wrap longitudinally spaced portions of the clip blank around an object positioned in the space between the matrix and the working face of the abutment in alignment with the grooved portions of the teeth of the matrix, and coordinated driving means including means for operating said feeding means, means for operating said cutting means, and means for reciprocating said matrix, said reciprocating means comprising toggle linkage pivotally connected at one end to said matrix, a first bearing on said support to which the opposite end of the toggle linkage is pivotally connected, said first bearing being adjustable in a direction parallel to the direction of movement of said matrix in a manner to change the amount of approach of the working face of said matrix toward the working face of said abutment so as to predetermine the degree to which the longitudinally spaced portions of the clip are compressed around said object, said reciprocating means further comprising a second bearing on said support, a lever pivoted at one end on said second bearing, a link pivotably connected to and between intermediate portions of said lever and one of the links of said toggle linkage, and adjusting means for adjusting said second bearing to move the pivotal point of said lever in a direction transverse with respect to the direction of reciprocation of said matrix in a manner to determine the spacing of the working face of the matrix from the working face of said abutment when the matrix is in initial or retracted position, the two adjusting means being capable of simultaneous adjustment to accommodate the length of clip and the degree of compression thereof to objects of different diameters and degrees of compressibility.

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