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[54] **MACHINE FOR BINDING AND TYING UP PACKAGES OR BUNDLES**
 1 Claim, 12 Drawing Figs.

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 [50] Field of Search 289/2, 15, 16, 18

ABSTRACT: The present invention machine is for binding and tying up packages or bundles, and comprises a table provided with an opening for the passage therethrough of a string guiding arm which performs one reciprocating during each tying operation, and below said table a knoter and a retaining means for the string which in cooperation with said string guiding arm form the knot, as well as cutter means for cutting the strand of string between the formed knot and the string supply at a point near the freshly formed knot.

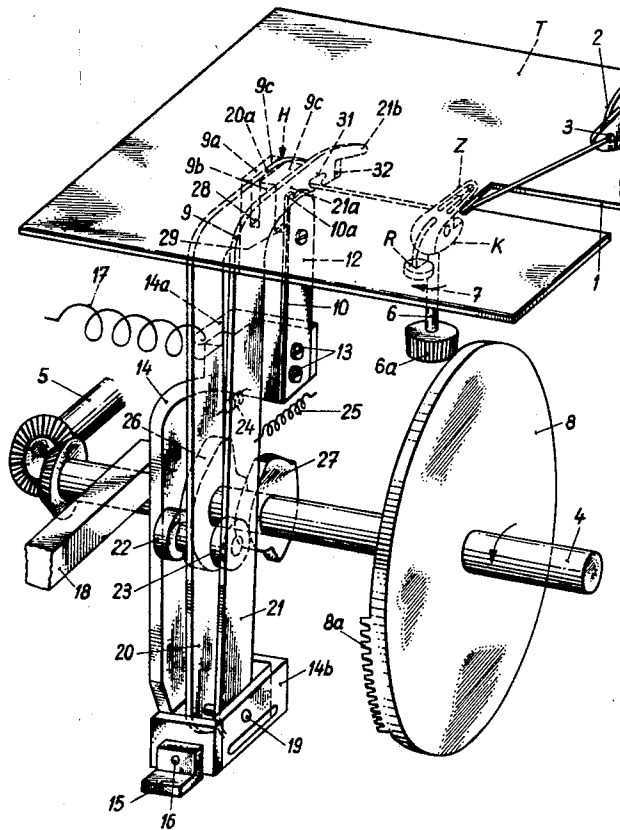
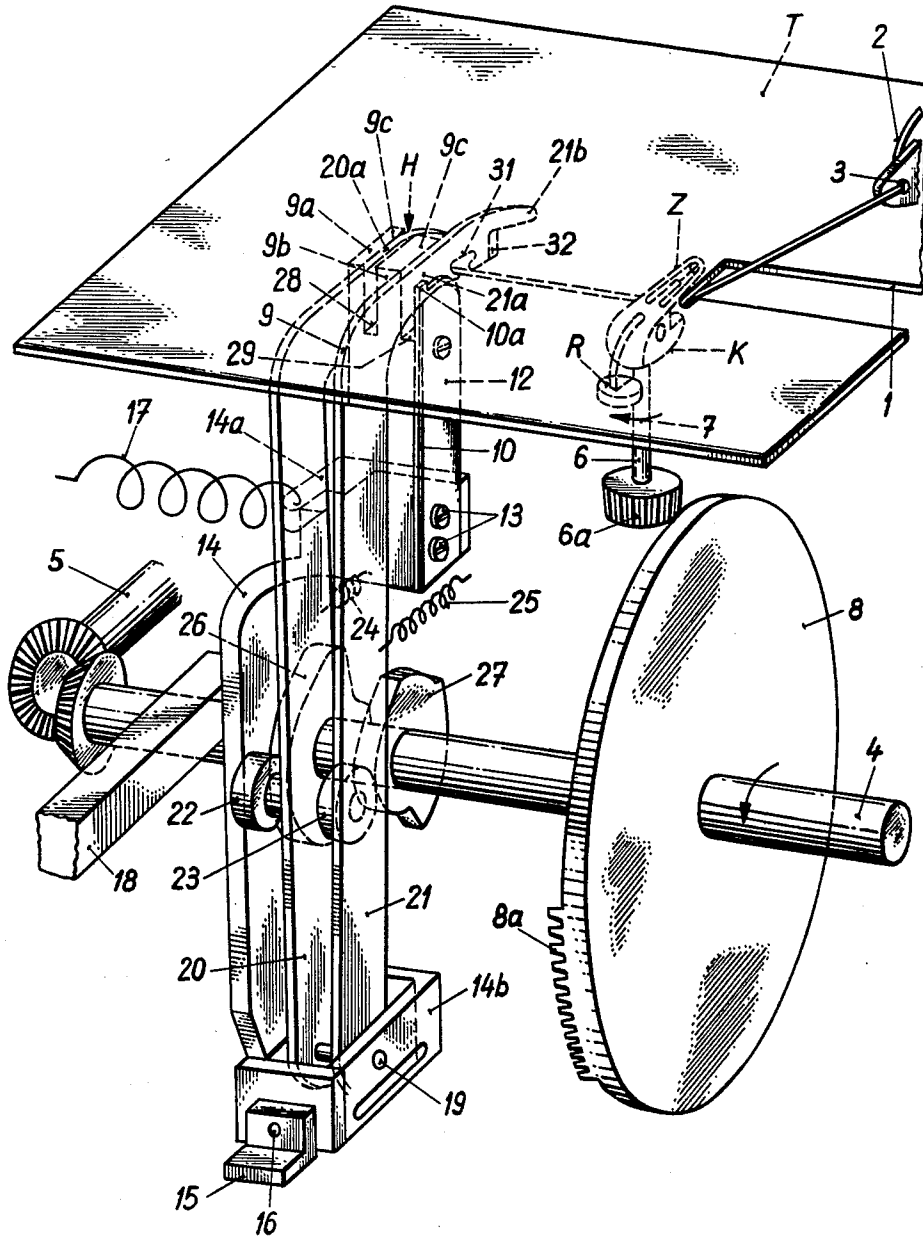
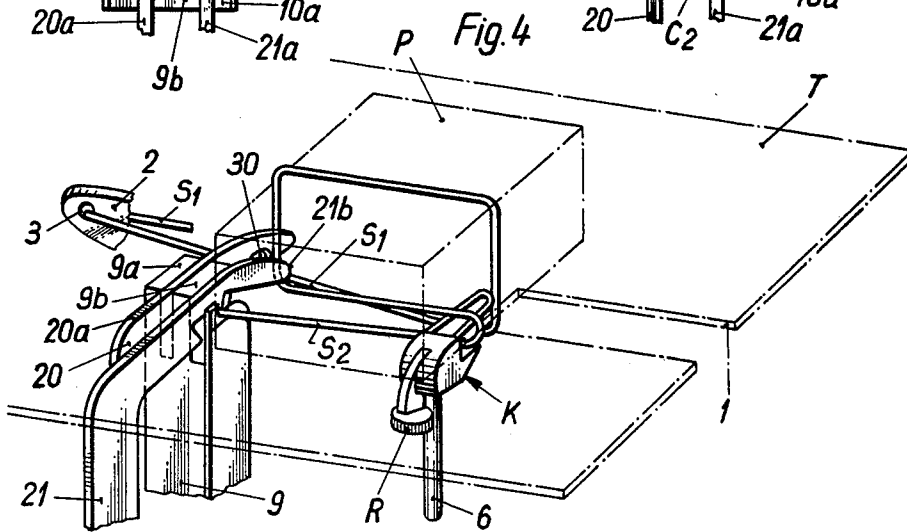
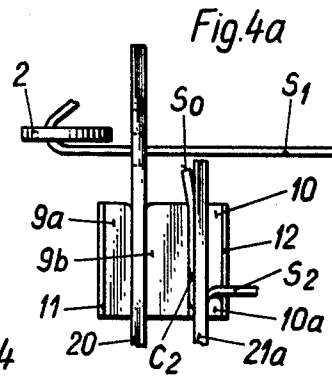
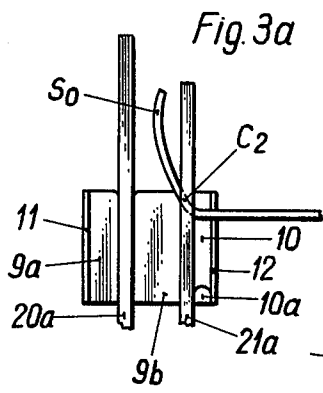
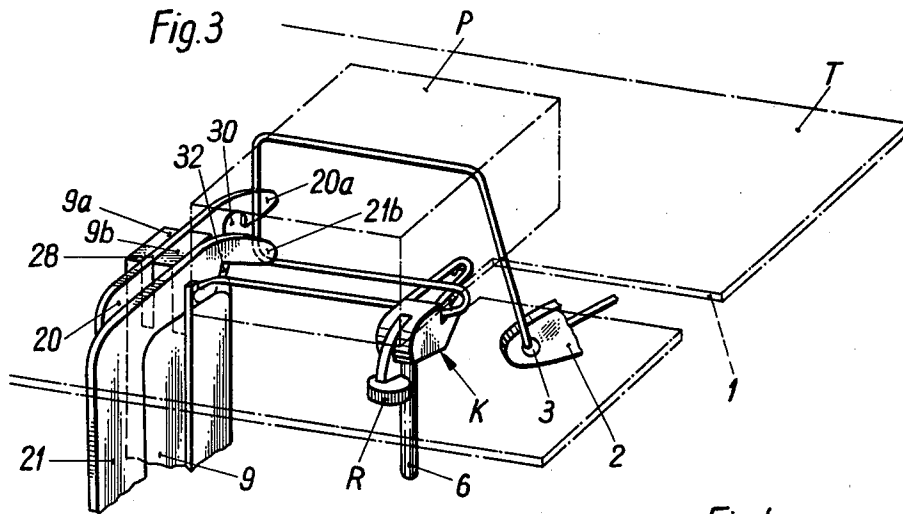


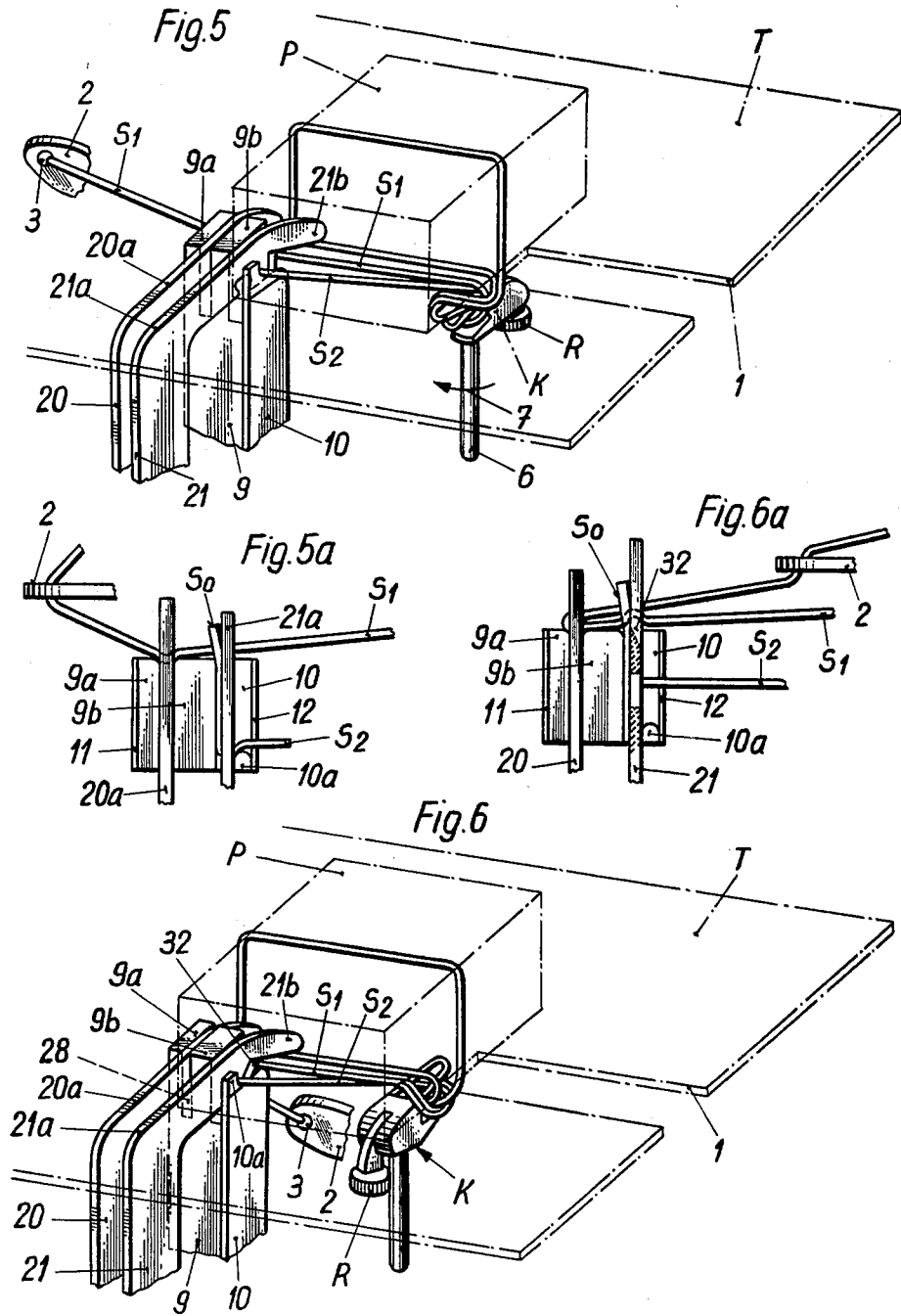
Fig. 1



Peter Werner Born



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MACHINE FOR BINDING AND TYING UP PACKAGES OR BUNDLES

The present invention is concerned with a machine for binding and tying up packages or bundles.

In a machine of this kind known in the art the retaining means are so devised that after the completion of each knot the strand between the package or bundle and the string guiding arm as well as the strand of string from the package to the end of the string are both gripped by the retaining means and cut. A length of string is therefore cut off this latter strand and drops into the machine as waste. These surplus pieces of string often cause trouble.

It is therefore an object of the present invention to provide retaining means such that no waste ends of string are formed.

Another important object of the invention is to simplify the mechanism by eliminating the need for a special cutter, the carrier arm for such a cutter and the cam for operating the arm. A further object of the invention is to effect a saving in the consumption of string when tying up packages and bundles of given diameter.

According to the invention these objects are achieved in that the retaining means includes a support having rounded string guiding faces and is movable from a position of rest against the resistance of a spring towards the knotter, and two cam-operated retaining arms each formed with a hook-shaped recess for forming two string gripping points, namely a rear gripping point and a front gripping point closer to the knotter, with operation of said retaining arms by the cams being so controlled that at the beginning of a working cycle the end of the string held at the rear is first also wedged in the front gripping point and then released at the rear gripping point, that during the knotting operation the entire retaining means are pulled towards the knotted against the resistance of the spring, and that the cutter means consist of a knife edge which on that retaining arm which together with the support forms the front gripping point is formed in front of the hook-shaped recess, said knife edge taking effect after the knotting operation, during the first part of the movement of said retaining arm in the direction of releasing the end of the string from the front gripping point, and after the strand of string that is to be cut has been wedged at the rear gripping point.

The accompanying drawings schematically illustrate an embodiment of the invention with the omission of some of the parts of the machine which are already well known in conventional machines, and which do not further contribute to an understanding of the invention.

FIG. 1 is a perspective view of the machine showing the movable parts in the positions they occupy when the machine is stopped,

FIG. 1a is a view of the string retaining mechanism seen from above,

FIGS. 2, 3, 4, 5 and 6 are perspective views similar to FIG. 1, but illustrating consecutive stages in a working cycle of the machine, and

FIGS. 2a, 3a, 4a, 5a and 6a are views from above corresponding to FIG. 1a of the retaining mechanism in positions corresponding to those shown in FIGS. 2, 3 and 6, respectively.

The machine for binding packages or bundles according to the invention, of which only a part is shown in the drawing, comprises a frame, not included in the drawing, which carries a table T provided with an opening 1 for a string withdrawing and guide arm 2. In exactly the same way as in conventional machines this arm can swing about a fixed pivot in part of the machine frame. The string which is withdrawn from a reel via tensioning means runs over deflecting rollers mounted on the arm and then through a hole 3 in the free end of the arm.

In conventional manner a mainshaft 4 is rotatably mounted under the table T in the machine frame. This shaft performs one revolution for forming a loop around a package or bundle and for simultaneously tying a knot. The shaft is driven by an electric motor, likewise not shown, and a transmission shaft 5.

Below the left hand end of the opening 1 in the table is a knotter K of conventional construction. The knotter is rotata-

ble about a shaft 6 in a swing mount, not shown, mounted on the control shaft 4. The swing mount and the knotter swing out of the plane of the drawing towards the viewer when the tying of the knot is about to be completed. For forming the knot the knotter performs a complete revolution in the direction indicated by an arrow 7. This movement is imparted thereto by a coned pinion 6a which is fast on the shaft 6 engaging a gear segment 8a on a circular plate 8 affixed to the mainshaft 4. The knotter has a knotter bill Z which can be hingeably raised and lowered and which forms part of a cranked lever mounted on the knotter. In the same way as in conventional machines the knotter bill is raised only during the last part of a knotter revolution, i.e. during the completion of the knot, a small roller R on the other arm of the lever during this phase bearing against a stop which is provided on the above mentioned swing mount, and which is deflectable against the resistance of a spring by the traversing roller R. For keeping the knotter bill Z in lowered position the roller R rides on a surface of the swing mount which is coaxial with the shaft 6.

A certain distance away from the knotter K on the left is a retaining mechanism generally indicated by H. This retaining mechanism comprises a support 9 and a retaining plate 10 bearing against that side of the support which faces the knotter, support and plate both preferably consisting of nylon. The support 9, the retaining plate 10 and two leaf springs 11, 12, of which one bears against the other side of the support and the other against the outside of the retaining plate 10, are attached by screws 13 to the upper end 14a of a carrier arm 14. The carrier arm has a framelike lower end portion 14b which is deflectable on pivot pins 16 in fixed bearing members 15 towards the knotter K. A powerful spring 17 seeks to keep the arm in position of rest in contact with a fixed abutment 18.

The ends of a pivot pin 19 are fitted into the sides of part 14b said pin being parallel to the mainshaft 4 when the carrier arm 14 is in position of rest. Deflectably mounted on this pin are two retaining arms 20, 21 of which each carries a follower roller 22 and 23 respectively maintained in contact with a cam 26 respectively 27 by a spring 24 respectively 25. The cams are fixed on the mainshaft 4 and thus control the deflections in relation to the support 9 of the retaining arms 20, 21 about the pivot pin 19. The upper arched shanks 20a and 21a of the retaining arms move in a slot 28 respectively in a recess 29 laterally adjacent the retaining plate 10 at the upper end of the support 9. This end of the support thus forms fins 9a, 9b with rounded ends adjacent the slot and the recess, as indicated at 9c.

Each of the shanks 20a, 21a of the retaining arms contains a hook-shaped recess 30 respectively 31 for the reception of parts of the string which, as will be later described, are wedged during the rearward deflection of the relative retaining arm. As will be understood by reference to FIG. 1a a "rear" gripping point C1 is formed by the cooperation of the edge of the hooked recess 30 in the retaining arm 20 with the adjacent rounds 9c, and as will be understood from FIGS. 4, 4a, 5 and 5a a "front" gripping point C2 closer to the knotter K is formed by the cooperation of the edge of the hook-shaped recess 31 in retaining arm 21 with the side of the fin 9b facing the recess 29. The gripping point C2 extends to a rounded edge 10b on the front of an upward projection 10a at the back of the clamping plate 10. The part of the string which is gripped at this point is the end of the string. It comes to lie between the fin 9b of the support and the shank 21a of the retaining arm 21, the latter together with the clamping plate 10 and the leaf spring 12 laterally yielding. A headed screw 33 which passes through this leaf spring 12, the clamping plate 10, the support 9 and the leaf spring 11 carries a nut 34 and a lock nut 35 which limit the lateral deflection of the parts 21a, 10 and 12.

In front of the hooked recess 31 in the shank 21a of the retaining arm which participates in the creating of the front gripping point C2, the shank forms a knife edge 32 which substantially coincides with a radius extending from the pivot axis

of the retaining arm, and which cuts when the retaining arm 21 pivots forwards, i.e. in the direction of opening the gripping point at C2. In order to ensure a reliable engagement of the part of the string that is to be cut, an extension 21b of the shank 21a projects beyond the knife edge 31.

The described machine functions as follows:

In position of rest all the movable parts will be in the positions shown in FIG. 1, the end of the guide arm 2 containing the hole 3 being located far enough above the table T to permit a package or bundle to be pushed across the table to the left under the arm. The string S from the reel runs through the hole 1 and then on the left hand end of the opening 1 descends under the table, passing underneath the bill Z of the knotter K, and through the open hook-shaped recess 31 in the retaining arm 21 around the forward end of the retaining arm 20. The end S_o of the string is wedged at the rear gripping point C1.

When a package such as that shown at P is pushed across the table roughly into the position shown in FIG. 2, this parcel will in conventional manner operate an electric switch for starting the motor driving the mainshaft 4 which therefore begins a single revolution. At the same time the arm 2 is operated in a manner not shown. Approximately at the same time as the free end of the arm descends through the table opening 1 (FIG. 2) the cam 27 deflects the retaining arm 21 in the forward direction out of the plane of the drawing towards the viewer, causing the hook-shaped recess 31 to enter the gap between the fin 9b and the clamping plate 10 (FIG. 2a) thus wedging the string a second time ("front" gripping point C2). Shortly afterwards the cam 26 permits the spring 24 to deflect the retaining arm 20 and to uncover the hook-shaped recess 30 thereby to open the rear gripping point C1 and releasing the end S_o of the string (FIG. 3).

Meanwhile the arm 2 continues its deflection and its free end passes underneath the knotter K and the retaining arm 20 to insert the strand of string S₁ extending from the package P to the hole 3 in the arm into the hook-shaped recess 30 (FIG. 4) Shortly before the arm 2 reaches its end position the cam 26 operates the retaining arm 20 and wedges the strand S₁ of the string at the rear gripping point C1.

Meanwhile, the cam 27 has further deflected the retaining arm 21 forward out of the plane of the drawing towards the viewer carrying the end S_o of the string towards the projection 10a without releasing the same from the gripping point C2 whilst the end is additionally gripped by the projection (FIG. 4).

Immediately afterwards the knotter K begins to rotate about its shaft 6 in the direction of the arrow 7. consequently it forms a loop each in strand S₁ of the string and in the strand S₂ of the string which adjoins the end S_o that is wedged in the front gripping point C2, these loops embracing the upper part of the knotter and the knotter bill Z, as shown in FIG. 5. A certain length of string is required for forming these loops and since the strand S₁ of the string is firmly held by the front gripping point C2, the latter must yield by moving towards the knotter K. For this reason the assembly 9, 14, 20, 21 is pivotably deflectable about the pivot pin 16. The spring 17 can yield to this deflection.

When the knotter K has completed about three-fourths of a

revolution and the arm 2 has already traversed part of its return path, the upper part of the knotter K and the knotter bill Z will have engaged the strands S₁ and S₂ of the string, as in conventional machines. Directly afterwards the knotter bill Z swings upwards, as already described, and the projection at its face end thus retains the two strands S₁ and S₂ of the string which it has engaged. When the knotter has completed a full revolution, the retaining arm 21 begins to swing back into the plane of the paper urged by the spring 25 as far as the contour of the cam 27 permits. When this motion begins the knife edge on this retaining arm 21 already cuts the strand S₁ of the string (FIG. 6), whereas at the end of this deflection the strand S₂ is released by the front gripping point C2. This strand S₂ together with the short adjoining end S_o projects from the knot that has been formed in the manner of a short stump. The spring pulls the supporting arm 14 and the retaining arms 20, 21 back into their positions of rest determined by the abutment 18.

The formation of the knot is completed in conventional manner by the return of the swivel mount carrying the knotter, permitting the two loops which embrace the upper part of the knotter and the knotter bill to slide off over the strands of the string which had been retained between the top of the knotter and the knotter bill, and which are now withdrawn from the knotter by the return deflection of the swivel mount. The tied and bound package can now be removed from the table T. The position shown in FIG. 1 is thus reestablished and the next working cycle can be begun by pushing another package that is to be tied onto the table.

I claim:

1. A machine for binding and tying up packages or bundles, comprising a table provided with an opening, a driven string guiding arm capable of performing one reciprocation during each tying operation, through said table opening, a knotter mounted below said table and a retaining means for the string which cooperates with said string guiding arm to form the knot, and includes cutting means for cutting the strand of string between the finished knot and the string supply at a point near the freshly formed knot, said retaining means including a support having rounded string guiding faces and being movable from a position of rest towards said knotter, a spring tending to retain said support in its rest position and two retaining arms each formed with a hook-shaped recess for forming two string gripping points, namely a rear gripping point and a front gripping point closer to said knotter, driven cams capable of operating said retaining arms so that at the beginning of a working cycle the end of the string held at the rear gripping point is first also wedged in the front gripping point and then released at the rear gripping point, and said cutter means consist of a knife edge on that retaining arm which together with said support forms the front gripping point and is provided in front of the hook-shaped recess of said retaining arm with said knife edge operating after the knotting operation, during the first part of the movement of said retaining arm in the direction of releasing the end of the string from the front gripping point, and after the strand of string that is to be cut has been wedged at the rear gripping point.

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