1. This invention relates to a machine for making wire straps useful in the securing of packages, bales, stacks or groups of articles, and the like, for shipment. The straps produced by the machine are similar to those shown in U. S. patent to W. N. Lurcott, No. 1,474,372, dated November 20, 1923; and the machine itself is of the type, and resembles in general construction and operation, that shown in U. S. patent to W. N. Lurcott No. 1,427,962, dated September 5, 1922. The wire for forming the said straps is supplied to the machine from a spool, drum, or other suitable source, while the machine forms the straps therefrom, and severs and delivers the same as finished units.

An object of the invention is to provide a number of innovations and improvements in a machine of this character which, severally and/or in combination, serve to enhance the versatility, efficiency, precision, and speed at which the operation takes place and the straps are formed and delivered.

Another object is to provide a machine of this character which embodies means for varying the spacing of the coils formed at one end of the strap.

Another object is to provide a machine of this character which embodies means for varying the angularity of the coils formed at one end of the strap with respect to the portion of the strap to which the coils surround.

Another object is to provide a machine of this character which embodies means for accurately controlling the loop formed by the bending of the wire at the initiation of the coiling operation.

Another object is to provide a machine of this character which embodies means for feeding the wire during the step of forming the coils at one end thereof, which means may be varied so as correspondingly to vary the spacing of the said coils and/or their angularity with respect to the portion of the strap around which they are coiled.

Another object is to provide a machine of this character in which the means for varying the spacing and/or angularity of the said coils includes a set of elements that are removable and may be substituted for each other.

Another object is to provide a machine of this character in which the last named elements may be removed and replaced without dislocating, moving or affecting in any respect any other part of the machine.

Another object is to provide a machine of this character in which the removable and replaceable elements just named cooperate with a fixed element in the machine, which latter is so formed or constructed as efficiently to cooperate with any one of said removable and replaceable elements regardless of variations in form or construction of the latter.

Another object is to provide a machine of this character which embodies an improved mounting for the steady rest that supports the wire while the strap coils are being formed.

Another object is to provide a machine of this character that embodies positively actuated means for moving the steady rest to inoperative position.

Another object is to provide a machine of this character which embodies improved and adjustable means for feeding the steady rest during the operation of forming the coils of the strap and returning the same to starting position preliminary to another coil forming operation.

Another object is to provide a machine of this character which embodies improved and adjustable means for mounting and actuating the cutting head and blades which sever from the continuous wire supply each strap as it is finished.

Another object is to provide a machine of this character which embodies improved means for supporting the wire and its co-operative mandrel during the feeding of the wire and the forming of the strap coils therefrom.

Another object is to provide a machine of this character which embodies improved means for periodic rapid feeding of the wire as each strap is formed.

A further object is to provide certain improvements in the form, construction, arrangement, and operation of the several parts of a machine of this character, whereby the above named and other objects may be effectively attained.

A practical embodiment of the invention is represented in the accompanying drawings, in which

Fig. 1 represents a top plan view of the machine;
Fig. 2 represents a side elevation of the parts shown in Fig. 1;
Fig. 3 represents a rear end view of the parts shown in Fig. 1;
Fig. 4 represents a transverse vertical section taken in the plane of the line IV—IV of Fig. 1, looking in the direction of the arrows;
Fig. 5 represents a detail longitudinal hori-
horizontal section, showing part of the means for supporting and feeding the wire and its co-operative mandrel, together with the mounting and drive of the twister hook for forming the strap coils;

Fig. 7 represents an enlarged, detail longitudinal section of the means for mounting the mandrel;

Fig. 7 represents a section taken in the plane of the line VII—VIII of Fig. 6, looking in the direction of the arrows;

Fig. 8 represents a longitudinal vertical detail section, partly in elevation, taken in the plane of the line VIII—VIII of Fig. 1, looking in the direction of the arrows;

Fig. 9 represents a detail end elevation, partly in section, of the parts shown in Fig. 8;

Fig. 10 represents a transverse section taken in the plane of the line X—X of Fig. 2, looking in the direction of the arrows;

Fig. 11 represents a detail elevation, partly in section, of the wire screen, diaphragm;

Fig. 12 represents a detail section taken in the plane of the line XII—XII of Fig. 11, looking in the direction of the arrows;

Fig. 13 represents a detail plan view showing the operative relationship of the mandrel, steady rest, and twister hook which cooperate in forming the strap coils;

Fig. 14 represents a detail elevation showing the mandrel and twister hook;

Fig. 15 represents a detail horizontal section, partly in elevation, taken in the plane of the line XV—XV of Fig. 4, looking in the direction of the arrows, showing the mounting and part of the adjustable feed for the steady rest;

Fig. 16 represents a plan view, partly in section, taken in the plane of the line XVI—XVI of Fig. 4, looking in the direction of the arrows, showing the cam, and mounting therefor, which moves the steady rest into operative position;

Fig. 17 represents a detail section, partly in elevation, taken in the plane of the line XVII—XVII of Fig. 3, looking in the direction of the arrows, and showing the adjustable feature of the means for rapid feeding of the wire to determine the length of the strap following the shape of the bow.

Fig. 18 represents a detail broken side elevation of the strap formed by the machine.

In the functioning of the machine, the wire which is to form the straps comes to the machine in continuous length from a suitable source of supply; a predetermined amount of its leading end is bent by a device into an angular relationship with respect to the body of the wire; the said end is then bent backwardly upon the body of the wire and coiled therearound by another device, which the wire is fed forwardly at a predetermined speed in order to regulate the spacing and regularity of the coils; the wire is then fed forwardly at a relatively high rate of speed for a period which is predetermined according to the length of strap required; the complete strap is then severed from the wire, and the operation is repeated.

Turning now to a description of the embodiment of the invention shown in the drawings, the machine has a base 1 which supports the various parts. A main shaft 2 driven from a source of power not shown, is mounted in journals 3, 4, formed in the upper portions of uprights 10, 11. A gear 12 is also fixed to shaft 2 and meshes with a bevel gear 6 that is fixed to a shaft 7 which is mounted in bearings 6, 8 formed in uprights 10, 11 suitably secured on the base 1.

The shaft 1 has a pinion 13 fixed thereon which meshes with a spur gear 14 that is fastened to a shaft 14 which is mounted in bearings 15, 16 formed in the upper portions of uprights 10, 11. A gear 17 is also fixed to shaft 7 and meshes with a gear 18 which is mounted for rotation on a sleeve 19 that is mounted in a Journal 20 formed in upright 11.

As a result of the shaft and gearing arrangement just described, the power shaft 2 serves to actuate shaft 14 and gear 18 so that the functional elements connected thereto cooperate in proper timed relationship as will be hereinafter described.

A wire guiding tube 21 (see Fig. 5) is mounted in a pair of eccentric bearing linlers 22, 23, the former of which is fitted in a bearing 24 that is mounted in a journal 25 in upright 16, while liner 23 is fitted in a bearing 26 that is mounted in sleeve 19. The tube 21 is longitudinally slidable in liner 22, and the tube and liner 23 are longitudinally slidable in bearing 26; while the eccentricity of liners 22, 23 permits accurate centering of tube 21 in its mounting by suitable rotation in the proper direction of either or both said liners.

A mandrel 27 is fixed to tube 21 by having its inner end 28 (see Fig. 6) threaded into a correspondingly threaded socket in a plug 29 which is set into tube 21 and secured therein by a screw 30. This threaded connection permits mandrels of varying diameter and length to be used; and plug 29 is also fitted with a removable section 31 (see Fig. 7) which provides access to the threaded end 28 of mandrel 27 for removal thereof in case of breakage. Plug 29 has a central bore 32 in line with the bore of tube 21 to permit the passage through the tube and plug of the wire W from which the straps are formed.

A twister hook 33 is threaded into a central aperture formed in a cap 34 which is secured by a number of set screws 35 (only one being shown) to the hub of gear 18. This permits the twister hook to be rotatably adjusted with respect to said gear to insure accuracy in the formative action of the bow. The wire, as it passes through said hub of gear 18 and is fitted around bearing 26. A set screw 37 carried by band 38 pieces bearing 26 and impinges upon a collar 39 which is fitted within bearing 26 and mounts a guide piece 35 that is provided with a pair of bores through which mandrel 27 and wire W pass with a sliding fit to guide their movement and by which they are held and braced, in part, during the strap coil forming operation.

Means is provided for sliding the tube 21 forwardly to feed mandrel 27 during the formation of the strap coils, and for returning tube 21 and mandrel 27 to their initial position preparatory to the fabrication of each subsequent strap. This means includes a clamp 40 (see Figs. 1 and 5) which is secured to tube 21 by set screws 41, 41. The said clamp has a stud 42 threaded therein which stud carries a cam roller 43 that is fitted to ride in and be actuated by grooves 44, 45 (see also Figs. 2 and 10) formed in semicircular cams 46, 41 respectively. Cam 46 is secured by a pair of socket headed screw bolts 48, 48 to a hub 49 formed integrally with gear 18; and cam 41 is similarly secured by screw bolts 50, 50. The direction of rotation of these parts is indicated by the arrow on Fig. 1, from which it will be
seen that groove 44 in cam 46 serves to retract or move rearwardly tube 21 and mandrel 27, while groove 45 in cam 47 serves to advance the tube and mandrel during the operation of forming the coils of the strap.

In use, these straps are placed around the package, or the like, which they are to secure; the tail end of the strap is passed through the coils formed at the other end of the strap; and a wire strapping tool is employed to crush or flatten the coils and simultaneously corrugate the portion of the wire passing through the coils, to form the knot and secure the wire around its package or the like. This is well known to the art and is set forth in numerous patents on wire strapping tools, such, for instance, as U. S. patent to Mark H. Stratton No. 1,776,866, dated September 30, 1930. Furthermore, in manufacturing these straps, various gauges or sizes of wires are used in accordance with the demands to be made upon the straps in service, and we have discovered that, to obtain the best results, the spacing and angularity of the coils formed on the strap should vary when the gauge of the wire varies. This is particularly so because a coarser or larger gauge wire requires that the coils of the strap be spaced more widely and that their angularity with respect to the wire be reduced to insure avoidance of breakage of the wire during the crushing or knot forming operation of the strap fastening tool, and likewise to insure a knot or fastening that will be sufficiently resistant to the strains imposed upon the strap in service.

In order to provide for and govern the variations in the spacing and angularity of the strap coils to which reference has just been made, we provide a set of cams to be used as substitutes for cam 47 which performs the function of advancing the tube 21 and mandrel 27 during the coil forming step. These substitute cams are identical with cam 47 except that their grooves which correspond to groove 45 are varied slightly in contour so as to accelerate or decelerate the movement imparted to roller 43, and hence to tube 21 and mandrel 27, during the rotative motion of the cam. As the making of these slight changes in the contour of the cam grooves performing the function of groove 45 is well within the skill of this art upon the mere recital of the purpose thereof, it is deemed unnecessary to illustrate these slight variations in identity between cam 47 and the substitutes therefor. The number of these substitute cams may vary in accordance with the requirements of the strap manufacturer. It is quite common for a single manufacturer to produce straps from three different gauges of wire, but is equally feasible, with this invention, for the manufacturer to increase or decrease the number of different sizes or gauges of wire used.

It will be observed that the grooves 44, 45 in the cams 46, 47 are so arranged as to, in effect, constitute a circumferential groove, but it may be pointed out that these grooves line up in dotted lines in Fig. 2, and indicated at 51, the leading end of groove 44 in cam 46 is wider than the tail end of groove 45 in cam 47. This feature is of importance in that it provides for the free entry of cam roller 43 into groove 44 and the corresponding groove in cam 47 or of the corresponding groove in the cam which may be substituted for cam 47. In other words, the leading end of groove 44 in cam 46 is made to resemble a funnel to a certain extent in order surely to receive the cam roller 43 and guide it into groove 44 without any resistance, bumping or possibility of failure. The salient feature of the machine for precisely accurate formation of the coils on the strap according to their predetermined spaced spacing and angularity by varying the contour of the cam groove which advances the tube 21 and mandrel 27, is rendered practical and simple by the provision of two semicircular cams 46, 47, each of which is separately secured to the hub 48 of gear 13. If a single circular cam were used, it would be necessary largely to dismantle the machine each time an occasion arose for substituting a cam with a groove of slightly different conformation and, as this need, in practice, may arise several times during a single day, such dismantling of the machine would border on the prohibitive. However, with the cam structure constituting part of this invention, it is only necessary to unscrew bolts 50, 50 and make the necessary substitution. This is a matter of only a few minutes’ work, and the flaring or funnel-shaped formation of the leading end of the groove in cam 46 cooperates in this regard so as to render cam 47 and any one of its substitutes equally efficient and insure just as satisfactory results as if various circular cams were provided, with continuous grooves therein, and substituted one for another by dismantling the machine.

As hereinbefore stated, the first step in the formation of the strap is the angular bending of its forward end. This is accomplished by a striker 82 (see Figs. 1 and 4) which is circular in cross section and flanged at its extremity, as shown in the drawings. This striker is secured by a bolt 53 to a bracket 54 which extends laterally from an arm 55 which is fixed by a clamp 56 on shaft 14. A spacing collar 57 serves to determine the projection of the striker from the bracket 54 in order to insure its correct contact with the wire W, which collar may be varied in length to vary the distance of the striker from the bracket; and screws 58, 59 which serve to secure clamp 56 to shaft 14 provide for rotative adjustment of the bracket on the shaft for precise control of the stroke of the striker 82 with respect to the action of the other functional parts of the machine.

It will be clear that rotation of shaft 14 will cause striker 82 to contact the extremity of wire W which projects beyond mandrel 27 and bend the said extremity substantially at right angles to the body of the wire. Fig. 4 shows the striker as it is about to hit the wire, and it may be added that the flange on the striker prevents the latter from slipping by the wire without performing its bending function.

In order to brace the wire for this bending step, the machine includes a device known as a steady rest, which is well shown in Fig. 4 and consists of an upwardly projecting arm 59, which is provided at its top with a cross piece 60 that has two fingers 61, 82 projecting laterally therefrom. The said fingers, as shown in Fig. 13, are slightly staggered in the direction of the length of mandrel 27 and are spaced on a circular circumference so as to readily, but not too loosely, receive therebetween the said mandrel and that portion of the wire W which lies alongside the mandrel. Reference to Fig. 4 will illustrate how the fingers 61 and 62 serve to brace the wire against the action of striker 82 while the latter is bending the extremity of the wire.

The steady rest 59 is pivoted to swing into and out of operative relation with respect to the wire and mandrel 27, by providing it with a transverse
bore 63, the ends of which are fitted to receive the tapered points of cap screws 64, 64 which are threaded in a bracket 65 which is properly mounted in the machine as will hereinafter be described. This form of pivot construction permits a certain amount of lateral adjustment of the steady rest 59 and also provides accurate take-up for wear so as to obviate lost motion.

The steady rest 59 has its lower end 66 projecting from the face of its pivotal mounting, which end is designed for contact with the edge of a fixed cam 87 (see Fig. 16) that is secured to the base 1 of the machine by cap screws 68, 68. The holes 68, 69 formed in the cam 87 for the passage of the cap screws 68 are elongated in the direction of swinging movement of the steady rest 59 in order to permit adjustment of the cam in that direction with respect to the lower end 66 of the steady rest.

The steady rest 59 not only acts to brace the wire and mandrel 21 while the former is being bent by the striker 52, but it also continues to brace the wire and mandrel, and serves to feed the wire forwardly at the same speed as the mandrel, while the coils of the strap are being formed. As the tube 21 and mandrel 21 are fed forwardly by the means hereinafore described, the steady rest 59 is correspondingly fed in order to feed the wire and maintain its bracing contact with the wire and mandrel at all points to which the wire was bent by the striker 52. This movement of the steady rest 59 is caused by securing its bracket 65 to a rod 70 (see Figs. 2, 4 and 13) which is slidable mounted in the lower part of uprights 10, 11 and also in a boss 71 carried on the base 1 of the machine. The fastening of the rod 70 to bracket 65 is accomplished by providing an enlarged threaded portion 72 on the rod 70 which mates with a threaded bore in bracket 65, as clearly shown in Figs. 2, 4, 13 and 15. The edge of the bracket 65 adjacent the said bore is slant, as shown in Figs. 2 and 4, and screws 73, 74 are threaded in the bracket across the said slant. As the result of this arrangement, it will be clear that the rod 70 can be longitudinally adjusted with respect to the bracket 65 by turning the rod in one direction or the other so that the engagement of its threads with the threads in the bracket will move the rod to the right or left as shown in Fig. 2. Flattened surfaces may be formed at the ends of the rod to facilitate its rotary adjustment. Following such adjustment to the desired position, the parts may be locked therein by tightening the screws 73.

Sliding longitudinal movement is imparted to the rod 70 by the mechanism which reciprocates the blade 21 and mandrel 21 as hereinafore described, because there is integrally formed with the clamp 40 that embraces tube 21 another clamp 74 (see Figs. 1, 2 and 5) which embraces rod 70 and is fixed thereto by set screws 75, 15.

Thus it will be clear that there is precise coincidence of movement between tube 21 and mandrel 21 on the one hand and rod 70 with steady rest 59 and associated parts on the other hand, with the result that the mandrel, wire, and steady rest are fed forwardly in unison.

Bracket 66 in which steady rest 59 is pivoted has a lateral extension 76 (see Figs. 1, 4 and 13) that carries an eye 77 to which is fastened one end of a retractile coil spring 78, the other end of which is secured to an eye 79 fixed in the upper part of the steady rest, whereby the tension of spring 78 constantly urges the steady rest toward inoperative position and simultaneously urges the lower projecting end 66 of the steady rest into contact with fixed cam 87. Movement of the steady rest to operative position, shown in Fig. 4, is accomplished by cam 87 which forces the lower end 66 of the steady rest to the left as the parts are exhibited in Fig. 4 when the said lower end 66 is slid along the face of the cam by the sliding movement of rod 70 toward the left. As the operation of forming the coils on the strap proceeds, the lower end 66 of steady rest 59 moves along the high part of the face of cam 87 and, when the coil forming operation is completed, the said end 66 comes opposite the low part of the said cam face so that the steady rest may be drawn to inoperative position by spring 78. There is, however, a tendency for the steady rest 59 to remain in operative position, against the pull of spring 78, because of the engagement of the fingers 61, 62 of the steady rest with the wire W and mandrel 27. To overcome this tendency and insure prompt return of the steady rest to inoperative position, the machine includes a kickoff 80 (see Figs. 1 and 4) which has its hub fixed to shaft 14 by a set screw 81; the circumferential adjustment of the kickoff on the shaft being such as to cause the former to be brought into contact with a lug 82 carried by steady rest 59 at the moment the operation of forming the coils on the strap is completed. The direction of rotation of the shaft 14 is indicated by the arrow on Fig. 4, from which it will be seen that the kickoff 80 swings downwardly and then to the left in the said figure so as to hit the rounded underside of lug 82 in performing the function just described. Once the steady rest 59 has been thus positively thrown to inoperative position by kickoff 80, it is retained in said position by spring 78 until the sliding movement of the steady rest during the reciprocation of rod 70 causes the high part of the face of cam 81 again to swing the steady rest to operative position against the tension of spring 78.

The machine also embodies means for severing each completed strap from the continuous wire W, which means includes a pair of cooperating cutting blades 83, 84, see Figs. 1, 2, 11 and 12. Blade 83 is fixed by screw 85 to one end of a stem 86 that is shouldercd and threaded in an upright 87 carried on the base 1 of the machine. The other end of stem 86 is provided with a kerf 88 by which it may be adjusted in upright 87, and a nut 89 is threaded on the said end of the stem for locking it in adjusted position. As the result of this arrangement, the fixed blade 83 can be slightly adjusted in either a rotary or axial direction. Blade 84 is fixed by a screw 90 to one end of a reciprocating arm 91, the other end of which arm is provided with a split bearing 92, 93 that is held together by screws 94, 94 and embraces an eccentric 95, which has a hub 96 that is fastened to shaft 14 by a set screw 97. The arm 91 is held in substantially horizontal position by bifurcations 98, 98 which slidable engage the top and bottom of stem 86. It will be clear that this construction will cause the arm 91 to protrude as shaft 14 is rotated, so that blade 84 will have slidable cooperative contact with fixed blade 83 and thereby, after each strap is formed, sever the wire W which passes between the said blades. It will be observed from Fig. 11 that the blade 84 is so shaped as to have four cutting edges, any one of which may be brought into operative relationship with blade 83 by the simple expedient of loosening the screw 90, turning the blade 84, and tightening the said screw. A funnel-shaped
guide 99 for leading the wire between the said blades is carried by a bracket 100 that is suitably fixed to upright 87.

During the strap forming operation, the wire \( W \), and operative parts associated therewith, are fed forwardly by the action of cam 47 on roller 43 carried by clamps 40 and 74, as heretofore described, the engagement of fingers 61, 62 of steady rest 99 being sufficient to draw the wire along as the said tube and rod 70 are advanced. When, however, the operation of forming the coils on the strap has been completed, it is desirable to feed the wire rapidly forwardly into the position where it will be severed from the wire supply by the blades 83, 84. This rapid feed of the wire is accomplished by wheels 101, 102 (see Figs. 1, 2 and 3), the former of which is fixed to power shaft 2 by a set screw, and has a groove 104 formed in its periphery which serves to guide the wire from its source of supply upon entering the machine.

Wheel 102 has a hub 105 which turns on an eccentric 106 that is fixed to a cross rod 107 which is carried in stanchions 108, 109 mounted on base 1 of the machine. An arm 110 is fixed to rod 107. Arm 110 is connected to wheel 111 which is secured to a pin 112 at the upper end of a retractive coil spring 113 which has its lower end fastened to a lug 114 which is fixed by a cap screw 115 to a cross head 116 which is mounted on the top of upright 87. The tension of spring 113 normally urges the extremity of arm 110 downwardly so as to bring wheel 102 into contact with wheel 101 by virtue of the eccentric mounting of the former. Wheel 102 has a peripheral groove 117 which matches grooves 114 in wheel 101 and, when the two wheels are pressed together by spring 113, the said grooves will grip the wire \( W \) and the latter will be rapidly fed forwardly into the machine at the rotary surface speed of wheel 101 which is fixed to and driven by power shaft 2.

As the said rapid feeding of the wire is intended to take place intermittently at the completion of each strap forming operation, the machine includes means for controlling the action of spring 113, which means comprise a finger 118 provided with a clamp type bearing that embraces rod 107 and is fixed in position thereon by a cap screw 119 which traverses the finger. (See Fig. 17.) A bifurcated arm 120 is loosely mounted on rod 107 with its bifurcations located at each side of finger 118, and said arm carries at its extremity a cam roller 121 which is fastened in position by a cap screw 122. The said roller 121 rests on the periphery of a cam which is composed of two plates 123, 124. One of said plates is provided with a stud bolt 125 which rides in an arcuate groove 126 formed in the other plate, whereby said plates may be rotatably adjusted with respect to each other and secured in the desired adjusted position. The peripheral contour of the said plates is such as to increase decrease the duration of the effect of the cam upon roller 121; and a thumb screw 127 threaded in finger 118 bears upon the bifurcated arm 120 so as to adjustably force the cam roller 121 into contact with the adjustable cam 123, 124. As a result of the construction just described, it will be seen that, when the roller 121 is riding on the high part of the periphery of cam 123, 124, spring 113 is extended and wheel 102 is held in an elevated position out of contact with wheel 101. When, however, roller 121 rides on the low part of the periphery of cam 123, 124, spring 113 is permitted to bring wheel 102 into contact with wheel 101 and force wire \( W \) tightly into frictional contact with the groove in wheel 101; whereupon the rotation of the latter will rapidly feed the wire forwardly into the machine as heretofore described. The adjustability of cam 123, 124 permits the duration of this rapid feed to be varied, which correspondingly controls the amount of wire fed during this periodic operation and therefore the tension of the wire in the machine.

This functioning of wheels 101 and 102 for the intermittent or periodic rapid feeding of the wire \( W \) is initiated at the instant of completion of the operation of forming the coils on a strap, and terminates at the moment the desired amount of wire has thus been rapidly fed; at the instant of which termination the cutting blades 83, 84 sever the completed strap from the continuous wire supply, and the strap is ejected or delivered at the right hand end of the machine as illustrated in Figs. 1 and 2.

It will be clear that the leading end of the wire, following the severing operation of a strap just described, is the part that is bent and twisted to form the coil ends of each succeeding strap. Consequently, the length of wire extending from the end of mandrel 27 to cutting blades 83, 84 establishes the length of wire used in the formation of the bend and coils. This length will naturally depend upon the distance separating the end of the mandrel from the cutting blades and, as it is a matter of importance to predetermine and precisely fix this distance when making straps from different gauges or thicknesses of wire, the machine includes means for readily and precisely sliding the support for the cutting blades 83, 84 toward and away from the mandrel 27.

To this end upright 87 which carries cutting blade 83, as heretofore described, is provided with a foot 128 (see Figs. 8 and 9) that has a longitudinal channel 129 formed in its underside which is slidable mounted on a rail 130 which is secured to the base 1 of the machine by screws 131, 131. One end of the rail is upturned, as indicated at 132, and bored to receive a thumbscrew 133 which has a shoulder 134 bearing thereagainst to prevent inward movement of the thread of the screw with respect to said upturned end 132. Thumbscrew 133 is threaded into upright 87 so that the latter may be slid inwardly and outwardly on rail 130 by turning screw 133 in one direction or the other. A pair of set screws 135, 136 are threaded through said foot 128 for the purpose of securing it and upright 87 in adjusted position. Additional and finer adjustment of the cutting blades 83, 84 may be accomplished by turning the screw threaded stem 86. This will positively move blade 83 and, as blade 84 is carried on arm 91, the bifurcated end of which is engaged with stem 86, the said turning of the stem will adjust blade 84 as well as blade 83 and the two blades will maintain their precise cooperative relationship.

In the operation of the machine, the wire is fed from a suitable source of supply between wheels 101 and 102, through tube 21 and guide piece 30; through funnel-shaped guide 99 and between blades 83, 84; and out at the right hand end of the machine in Figs. 1 and 2. It will be noted that tube 21 is shaped (see Fig. 2) so that its rear extremity extends well between wheels 101 and 102 so as to support the wire closely adjacent the support afforded by the groove 104 in wheel 101.

The first function of the machine when starting
to produce is to sever the wire by blades 83, 84 so as to provide an end of exactly the desired length for forming the bend and coils of the strap. Thereupon the steady rest 85 moves co-operatively with its fingers 81, 82 at each side of and bracing the wire and mandrel 27. Immediately thereafter striker 82 bends the free end of the wire upwardly into an angular position, whereupon said bent-up portion is caught by the twister hook 33, both by its rotation in combination with the forward feeding of the mandrel, wire and steady rest, forms the coils upon the strap, as clearly represented in Figs. 13 and 18. Immediately upon the completion of the coiling step, the wheels 10 and 12 are brought into co-operative engagement with the wire and feed it rapidly forward, at the end of which movement the completed strap is severed by the cutting blades 83, 84 and delivered from the machine. As the guide 89 is semi-circular in cross section and its bracket 100 is slit at the top, as shown in Figs. 1 and 2, it does not interfere with the initial upward bending of the wire by striker 82. Furthermore, the size of the guide, and the distance between blades 83, 84 when separated, permit the free passage therethrough of the coiled end of each completed strap.

The operation takes place very rapidly and straps which vary in the spacing and angularity of their coils, as well as in their length, can be produced as desired by simple adjustments and ready substitution of certain parts in the machine. This last is a matter of much importance in view of the fact that there is a commercial demand for straps composed of wire of varying thicknesses and gauges, and that there is a marked relationship of efficiency with respect to the size of the wire and the spacing and angularity of the coils formed in making the strap. Changes in contour of cam 67 by means of the substitutions hereinbefore described, will vary the speed at which the wire is fed forward with relation to the rotary speed of the twister hook 33, and correspondingly vary the spacing and angularity of the wire coils; while substitution of mandrels of greater or less diameter will vary the size and angularity of the coils without affecting their spacing.

Notable features of improvement in this machine include the ability to vary the spacing and angularity of the strap coils; the provision for quickly and easily changing the cam member which feeds the mandrel, steady rest and wire during the coil forming operation; the formation of the groove in the fixed cam member to insure proper reception of the cam roller regardless of changes in the changeable cam member; the precise adjustability of the cutting blades, involving both coarse and fine adjustment, whereby the length of wire used in forming the coils can be predetermined with exactness; the improved mounting and readjustable adjustability of the steady rest; the similar adjustability of the twister hook; the provision of a kickoff for the steady rest; the construction and adjustability of the striker for bending the wire; the construction and adjustability of mounting of the cutting blade arm; the supporting and guiding construction for the wire and mandrel; the adjustability of the means for rapid feeding of the wire whereby the length of the straps may be varied; and the general arrangement, inter-relationship and nicety in coaction of the various parts through which a high degree of perfection in timing and precision of the functions is attained and straps of substantially perfect uniformity may be produced in quantity and at a high rate of speed.

In the commercial exploitation of these straps it is important to be able to provide the customer with straps which in number to be applied to each package and strength of individual straps are fully adequate for the shipment at hand without involving the waste of substantially exceeding the requirements. In this connection the most important factor is probably the size and shape of the coiled portion that is used in the formation of and constitutes part of the knot or seal when the strap is applied to its package. The size of this coiled portion is of major consequence in respect to attainment of the desired effect when the knot is formed by the crushing or flattening of the coiled portion in the strapping tool; and the shape of the coiled portion, particularly in regard to the angularity and spacing of the coils, is an item of predominant concern in relation to the size or gauge of wire from which the straps are formed. For instance, too close relative spacing and/or too great angularity of the coils with respect to the body of the strap tend to fracturing of a comparatively coarse or low gauge wire by the strapping tool; while wider spacing and/or lesser angularity of the coils tend to lack of strength and relative knot or seal formed by the strapping tool if the wire be finer or of higher gauge. The strap manufacturer, upon being provided by the customer with the weight, dimensions and other characteristics of the packaging to be strapped and its shipping destination, can predetermine for the customer the number of straps, the gauge of wire from which they should be formed, and the details of the coiled portion best suited to proper strapping of the package without undue waste. However, this ability to predetermine the requirements is of small value unless the machine used in fabricating the straps can be adjusted or varied in its functional effects so as to produce with equal facility and speed straps best suited in the features above enumerated to the customer's requirements. The invention herein set forth provides a machine having these highly desirable capabilities without complication in structure, increase in cost of operation, or reduction in output per unit of time.

It will be understood that various changes may be resorted to in the form, construction, arrangement and material of the several parts of this machine without departing from the spirit and scope of the invention; and hence we do not intend to be limited to details herein shown or described except as they may be included in the claims.

What we claim is:
1. In a machine of the character described, a source of wire supply, means for feeding wire therefrom, means for bending the end of the wire at an angle to the remainder thereof, rotary means for colling the end of the wire backwardly around the wire as the latter is fed forwardly, and means for varying the relative forward speed of the feeding means and the rotary means of the colling means in order to vary the spacing of the coils with respect to each other and their angularity with respect to the wire around which they are coiled.
2. In a machine of the character described, a source of wire supply, means for feeding wire therefrom, means for bending the end of the wire at an angle to the remainder thereof, rotary
means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, and means for varying the forward speed of the feeding means in order to vary the spacing of the coils with respect to each other and their angularity with respect to the wire around which they are coiled, said last named means including cam elements of varying formation which are interchangeable for each other without removal or dislocation of any other part of the machine.

5. In a machine of the character described, means for feeding a wire, rotary means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, and means for varying the speed of the feeding means in order to vary the spacing of the coils and their angularity with respect to the wire around which they are coiled, said last named means including a split cam having a fixed element and complementary elements of varying formation any one of which can be operatively associated with and removed from operative association with said fixed element at will without requiring the removal or dislocation of any other part of the machine.

4. In a machine of the character described, means for feeding a wire, rotary means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, and means for varying the speed of the feeding means in order to vary the spacing of the coils and their angularity with respect to the wire around which they are coiled, said last named means including a split cam having a fixed element and complementary elements of varying formation any one of which can be operatively associated with and removed from operative association with said fixed element at will without requiring the removal or dislocation of any other part of the machine, said elements having cam grooves formed therein which constitute a continuous groove when two elements are in operative association, or the groove in the fixed element being wider than the cooperative ends of the grooves in the other elements.

5. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, means for steadying the wire during the feeding and coiling operations, said steadying means including a member movable to operative and inoperative positions, and positively acting means for moving the member to both positions.

6. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, means for steadying the wire during the feeding and coiling operations, said steadying means including a member movable to operative and inoperative positions, positively acting means for moving the member to both positions, and resiliently acting means for urging the member to inoperative position.

7. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, a member for steadying the wire during the feeding and coiling operations, and means for moving the member to maintain its steadying contact with the wire, said moving means including a slidable support for the said member which has a rotatable engagement therewith whereby rotation of the support will adjust the said member thereon in the line of movement of the support.

8. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, a member for steadying the wire during the feeding and coiling operations, means for moving the member to maintain its steadying contact with the wire, said moving means including a slidable support for the said member which has a rotatable engagement therewith whereby rotation of the support will adjust the said member thereon in the line of movement of the support, and means for locking the said member in adjusted positions on the said support.

9. In a machine of the character described, means for coiling an end of a wire backwardly around the wire, a member for steadying the wire during said coiling operation, and said movable support for said member to move it as the coil forming operation proceeds, said support having a screw threaded engagement with said member whereby the latter may be adjusted on the former in the direction of its movement by rotation on the former, and the threaded portion of the support being enlarged with respect to the remainder thereof, the part of said member which engages the threaded portion of the support being expendable and contractable to permit rotating the support in the member and locking the same in adjusting positions.

10. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, a member for steadying the wire during the feeding and coiling operations, and means for moving the member to maintain its steadying contact with the wire, said moving means including a slidable support for the said member upon which the member is pivotally mounted for movement in operative and inoperative positions, said pivotal mounting including means for adjusting said member in both directions at right angles to the plane of its pivotal movement.

11. In a machine of the character described, means for feeding a wire, means for coiling the end of the wire backwardly around the wire as the latter is fed forwardly, a member for steadying the wire during the feeding and coiling operations, means for moving the member to maintain its steadying contact with the wire, said moving means including a slidable support for the said member which has a rotatable engagement therewith whereby rotation of the support will adjust the said member thereon in the line of movement of the support, and a pivotal mounting for said member on said support for movement of the member to operative and inoperative positions, said pivotal mounting including means for adjusting said member in both directions at right angles to the plane of its pivotal movement.

12. In a machine of the character described, means for coiling an end of a wire backwardly around the wire, and means for steadying the wire during said coiling operation, said last named means including a member movable to operative and inoperative positions, a bracket in which said member is pivotally mounted for such movement, a support for said bracket, means for sliding said support in a direction at right angles to the said movement of said member, a device...
arranged for contact by said member when the bracket is moved by the support for bringing the member to operative position, and means for adjusting the pivotal mounting of said member in the same direction as the movement of said support.

13. In a machine of the character described, means for colling an end of a wire backwardly around the wire, and means for steadying the wire during said colling operation, said last named means including a member movable to operative and inoperative positions, a bracket in which said member is pivotally mounted for such movement, a support for said bracket, means for sliding said support in a direction at right angles to the said movement of said member, a device arranged for contact by said member when the bracket is moved by the support for bringing the member to operative position, means for adjusting the pivotal mounting of said member in the same direction as the movement of said support, and means for adjusting the bracket on the support in the same direction.

14. In a machine of the character described, means for colling an end of a wire backwardly around the wire, and means for steadying the wire during said colling operation, said last named means including a member movable to operative and inoperative positions, a bracket in which said member is pivotally mounted for such movement, a support for said bracket, means for sliding said support in a direction at right angles to the said movement of said member, a device arranged for contact by said member when the bracket is moved by the support for bringing the member to operative position, said device being adjustable in a direction at right angles to the movement of said support, means for adjusting the pivotal mounting of said member in the same direction as the movement of said support, and means for adjusting the bracket on the support in the same direction.

15. In a machine of the character described, means for colling an end of a wire backwardly around the wire, and means for steadying the wire during said colling operation, said last named means including a member movable to operative and inoperative positions, a bracket in which said member is pivotally mounted for such movement, a support for said bracket, means for sliding said support in a direction at right angles to the said movement of said member, a device arranged for contact by said member when the bracket is moved by the support for bringing the member to operative position, said device being adjustable in a direction at right angles to the movement of said support, and means for adjusting the pivotal mounting of said member in the same direction as the movement of said support, and a formation intermediate said fingers and said extremity for the pivotal mounting of said member.

16. In a machine of the character described, means for feeding a wire, means for colling the end of the wire the movement of the latter is fed forwardly, means for severing the wire following the completion of the colling operation to permit delivery of the completed strap from the machine and to provide a wire end for a succeeding colling operation, a mounting for the severing means, and means for adjusting said mounting with respect to the colling means in order to predetermine the length of wire to be used in said succeeding colling operation and thereby establish the length of the coil on the straps produced by the machine, said adjusting means including devices for both coarse and fine adjustments, the coarse adjustment being obtained by moving the mounting for the severing means and the fine adjustment being obtained by moving the severing means itself.

17. In a machine of the character described, means for feeding a wire, means for colling the end of the wire backwardly around the wire as the latter is fed forwardly, means for severing the wire following the completion of the colling operation to permit delivery of the completed strap from the machine and to provide a wire end for a succeeding colling operation, a mounting for the severing means, and means for adjusting said mounting with respect to the colling means in order to predetermine the length of wire to be used in said succeeding colling operation and thereby establish the length of the coil on the straps produced by the machine, said adjusting means including devices for both coarse and fine adjustments, the device for fine adjustment embodying a fixed blade carried on a threaded stem, a threaded support for said stem, a movable blade, and a mounting engaging said threaded stem, whereby rotation of said stem in its support will adjust the fixed blade carried thereby and correspondingly adjust the movable blade.

18. In a machine of the character described, means for feeding a wire, rotary means for colling the end of the wire backwardly around the wire as the latter is fed forwardly, means for severing the wire following the completion of the colling operation to permit delivery of the completed strap from the machine and to provide a wire end for a succeeding colling operation, a mounting for the severing means, and means for adjusting said mounting with respect to the colling means in order to predetermine the length of wire to be used in said succeeding colling operation and thereby establish the length of the coil on the straps produced by the machine, said adjusting means including devices for both coarse and fine adjustments, the coarse adjustment being obtained by moving the mounting for the severing means and the fine adjustment being obtained by moving the severing means itself.

19. In a machine of the character described, means for feeding a wire, rotary means for colling the end of the wire backwardly around the wire as the latter is fed forwardly, means for severing the wire following the completion of the colling operation to permit delivery of the completed strap from the machine and to provide a wire end for a succeeding colling operation, a mounting for the severing means, and means for adjusting said mounting with respect to the colling means in order to predetermine the length of wire to be used in said succeeding colling operation and thereby establish the length of the coil on the straps produced by the machine, said adjusting means including devices for both coarse and fine adjustments, the coarse adjustment being obtained by moving the mounting for the severing means and the fine adjustment being obtained by moving the severing means itself.

20. In a machine of the character described, means for feeding a wire, rotary means for colling the end of the wire backwardly around the wire as the latter is fed forwardly, means for severing the wire following the completion of the colling operation to permit delivery of the completed strap from the machine and to provide a wire end for a succeeding colling operation, a mounting for the severing means, and means for adjusting said mounting with respect to the colling means in order to predetermine the length of wire to be used in said succeeding colling operation and thereby establish the length of the coil on the straps produced by the machine, said adjusting means including devices for both coarse and fine adjustments, the coarse adjustment being obtained by moving the mounting for the severing means and the fine adjustment being obtained by moving the severing means itself.
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DESCRIPTION

22. In a machine of the character described, means for colling an end of a wire backwardly around the wire, means for feeding the wire during said colling operation, and means for feeding the wire at greater speed following the colling operation, said last named means including a driven wheel for moving the wire, a second wheel for forcing the wire into contact with the first named wheel, a rotary adjustable cam for controlling the duration of operative activity of said second wheel, and a device for operatively connecting said second wheel and said cam, said device including an oscillatory rod upon which said second wheel is eccentrically mounted, a bifurcated arm mounted for movement in a rotary direction on said rod, a cam roller carried by said arm for contact with said cam, a finger fixed against movement in a rotary direction on said rod between the bifurcations of said arm, and an element for imparting adjustable pressure by said finger upon said arm to maintain contact between said cam and said roller.

JOHN SHOLTIS, JR.

HAROLD K. EMBREE.

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Certificate of Correction

April 6, 1948.

JOHN SHOLTIS, JR., ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Column 14, line 26, claim 9, for the words "rotation on" read rotation of; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of May, A. D. 1948.

THOMAS F. MURPHY,
Assistant Commissioner of Patents.
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Signed and sealed this 25th day of May, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.