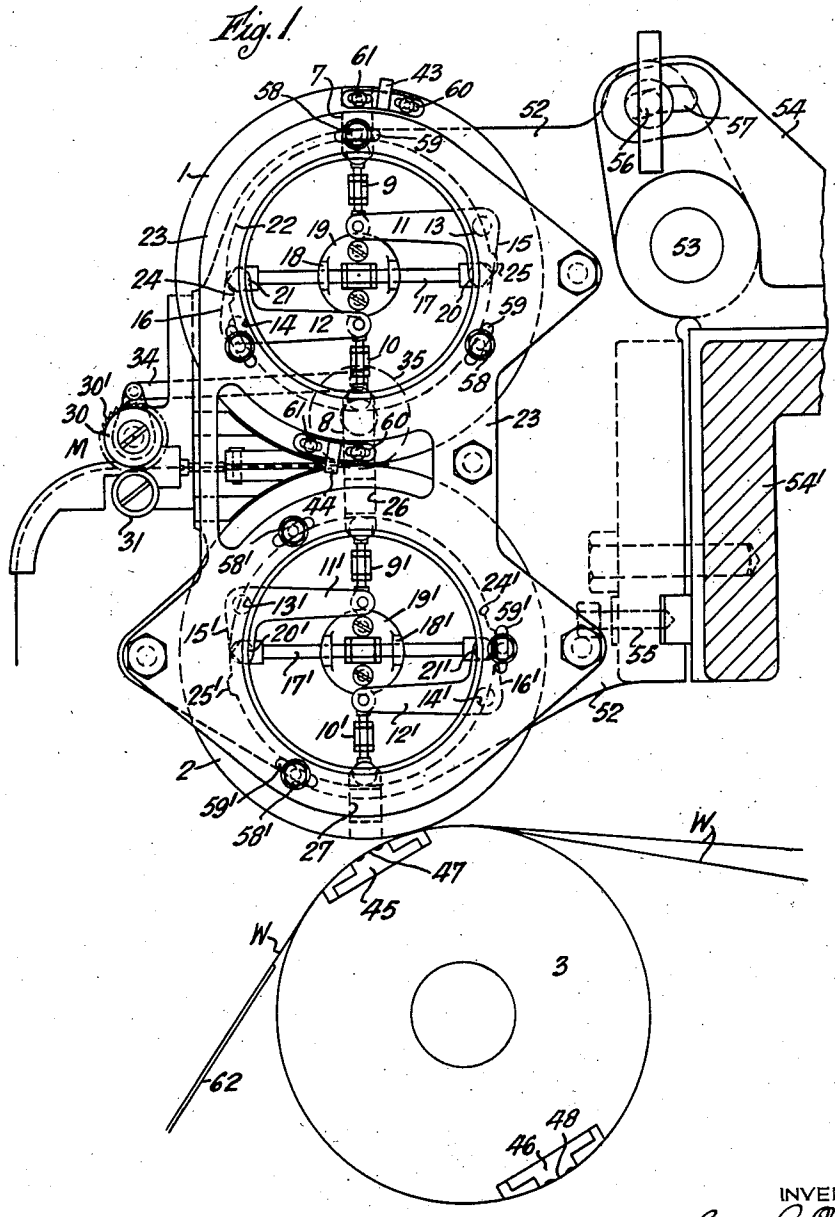
Aug. 13, 1940. C. G. QUICK ET AL 2,211,027

STAPLING MECHANISM

Filed Feb. 22, 1938 4 Sheets-Sheet 1

Fig. 1



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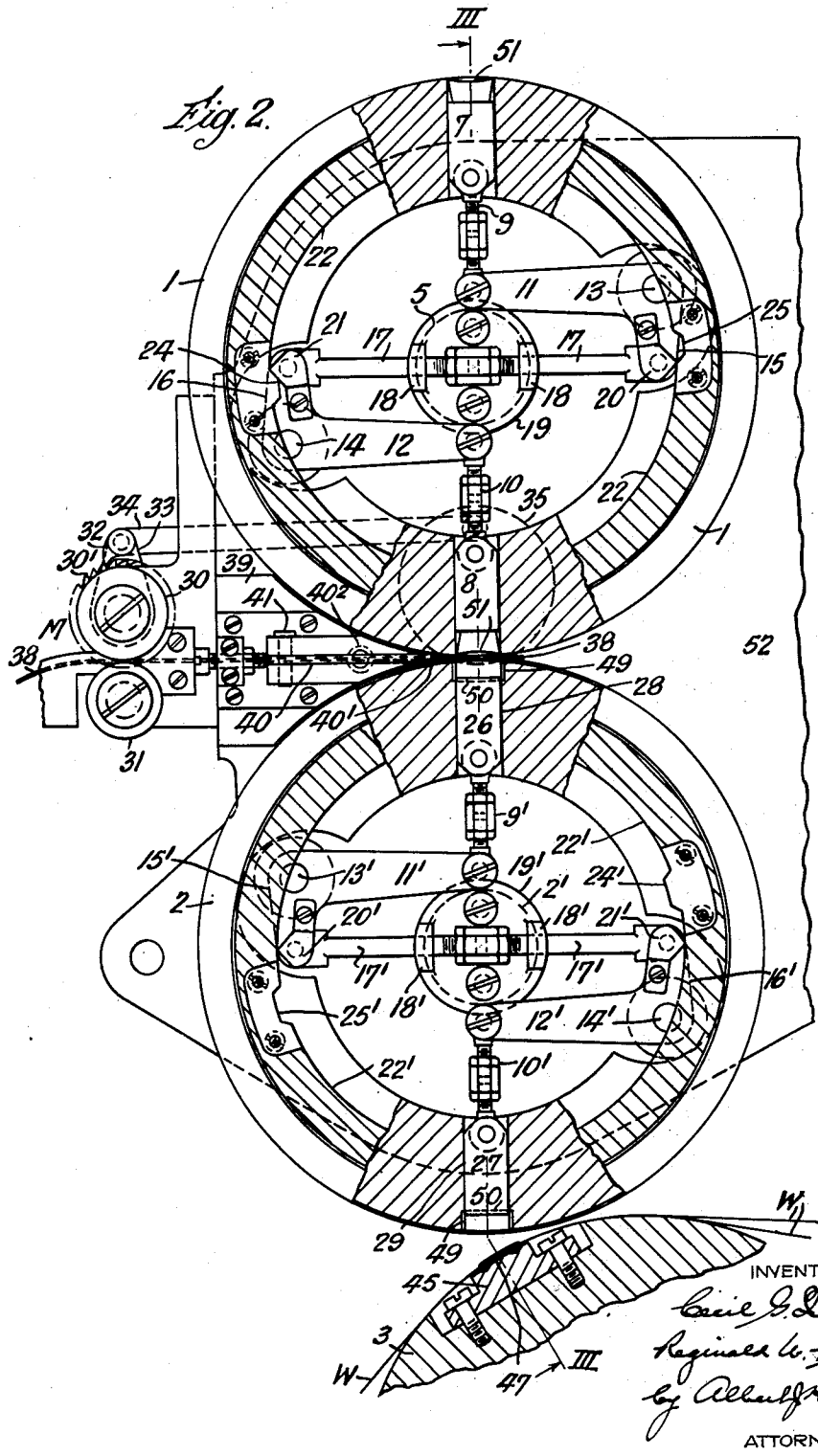
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STAPLING MECHANISM

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Fig. 2.



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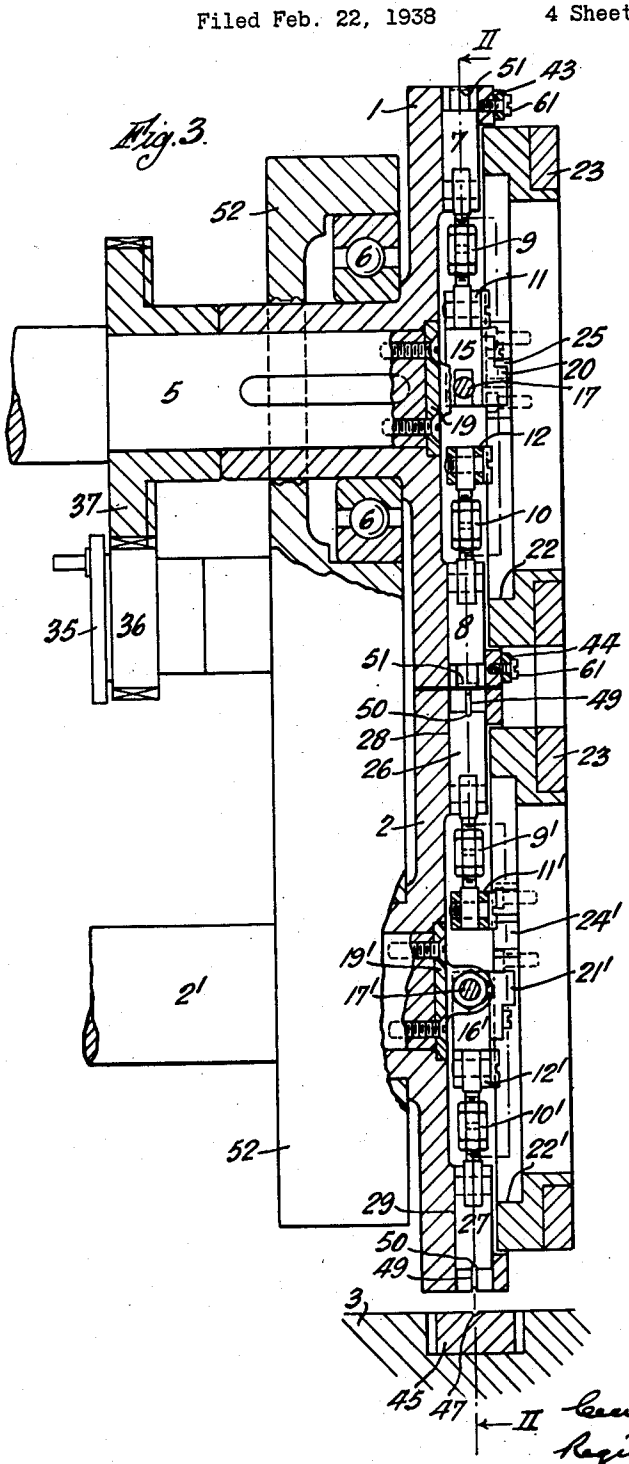
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Fig. 3.



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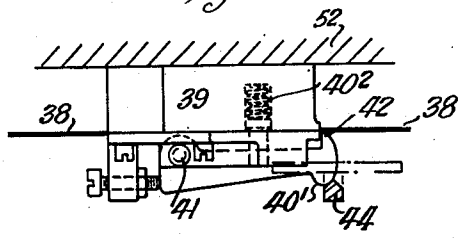
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Aug. 13, 1940. C. G. QUICK ET AL 2,211,027

STAPLING MECHANISM

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Fig. 4.



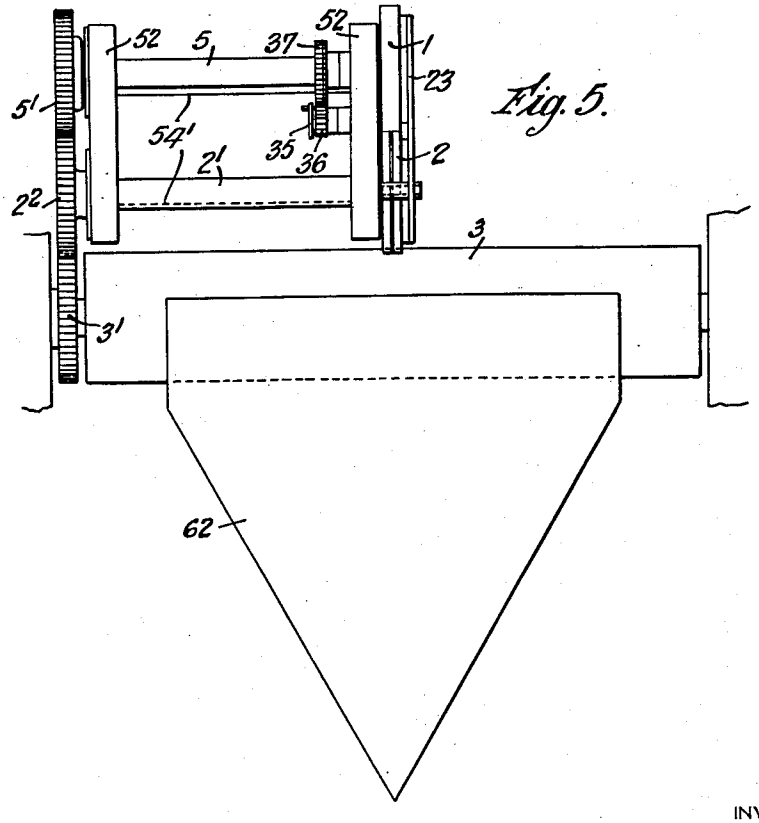


Fig. 5.

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UNITED STATES PATENT OFFICE

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STAPLING MECHANISM

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Application February 22, 1938, Serial No. 191,846
In Great Britain February 26, 1937

7 Claims. (Cl. 1—7)

This invention relates to mechanism for stapling a plurality of webs and more especially those passing from a rotary printing machine.

When it is required to unite as they are moving a plurality of webs which are later severed into lengths to constitute multi-sheet products with the sheets fastened to one another, the uniting of the two webs can be effected either by a stapling mechanism which operates to insert staples through the associated webs while they are moving, the staples being clenched over, or by a pasting mechanism which applies a line of paste to a web along a line at which another web is to be joined to it.

Moreover, the line along which the webs are united may be either transverse to the direction of travel of the webs or in the same direction as the direction of travel, the first being known commonly as a "transverse" join and the second as a "longitudinal" join.

In the usual stapling mechanism there is provided what is generally termed a stapling cylinder which takes a length of staple wire, and traverses it through a "horn" operating to bend the wire to provide a stem part and two leg parts which project radially from the cylinder and are caused gradually to penetrate the webs as the legs of the staples are caused by the rotation of the cylinder to approach a second or "die" cylinder between which and the stapling cylinder the webs pass, the die cylinder operating to roll or turn over the staple legs which project through the webs.

The stapling mechanism as heretofore commonly employed has been found in practice limited for use in making a stapled transverse join, for it has been found that such stapling mechanism will not operate to insert a longitudinal staple possibly for the reason that a longitudinal staple would (in the rotation of the stapling cylinder) present first one leg and then slightly later, the other leg to the webs and moreover while the clenching of one leg would have to be effected by rolling one leg in the same direction as that in which the stapling cylinder is rotating, the clenching of the other leg would have to be effected by rolling the other leg in the opposite direction to that of the cylinder. It may be observed that these conditions do not occur in a transverse stapling operation as (since the staple is transverse) both legs are presented together to the webs and the clenching operation is effected on both legs in a direction transverse to the direction of movement of the webs. Whatever be the cause, the known stapling mechanism was not used for longitudinal stapling, and in cases where it was necessary to make a longitudinal join the pasting mechanism had to be resorted to to apply a longitudinal line of paste. This pasting mechanism was, however, unsatisfactory, largely on account of the nature of paste and in some cases, where it would have been more convenient to make a longitudinal join, steps were taken, to enable the stapling mechanism to be employed to permit the join to be made transversely by the staple.

The principal object of the present invention is to enable a stapling mechanism to effect a longitudinal stapling operation so avoiding the necessity for employing a pasting mechanism when a longitudinal join is required.

According to the present invention, a preformed staple is carried into a position with its legs directed towards but not in contact with the webs to be stapled and is moved through a path which will temporarily bring it to rest (or substantially to rest) with respect to the continuously moving webs and a clenching or die member. At this time the legs of the staple are forced through the webs and rolled over or clenched by the die. It will be apparent that since at the stapling operation the webs, the die and the staple are at rest (or substantially so) the stapling operation, although effected on continuously moving webs, will in its operation approximate to the operation of a normal stationary stapling machine so avoiding the difficulties due to the sequential penetration of the legs of the staple and also that due to the direction of clenching the legs as compared with the direction of movement of the webs.

In carrying out the invention there is provided what may be termed a stapling cylinder which carries a preformed staple from a staple-forming position into a position adjacent a second or die cylinder rotating in the opposite direction to the stapling cylinder, the staple being held in the stapling cylinder with its legs more or less radial but not projecting beyond the periphery of the cylinder. At the time when the staple is (by the rotation of the stapling cylinder) nearest the die cylinder, the staple is substantially at rest with respect to the die cylinder and also with respect to the webs which pass between the two cylinders. At this time, the staple is forced radially outwards of the stapling cylinder and the legs of the staple together penetrate the webs and are together turned over or clenched by the die cylinder.

The invention is illustrated in the accompanying drawings in which Figure 1 is an end eleva-

tion, Figure 2 a section on the line II—II Figure 3, Figure 3 a section on the line III—III Figure 2, Figure 4 a detail view and Figure 5 an assembly to a smaller scale.

In the drawings 1 indicates a staple forming cylinder, 2 a stapling cylinder and 3 a die cylinder. Wire from a wire feed mechanism M is fed to between the cylinders 1 and 2 which co-operate to form staples from the wire and the cylinder 2 carries round the preformed staple and punches it through webs W passing between itself and the die cylinder 3.

The cylinder 1 is secured to a shaft 5 supported in bearings 6 and rotated in an anti-clockwise direction. This cylinder is recessed to receive two diametrally opposed staple forming plungers 7, 8 which can slide radially in the cylinder. The plungers 7, 8 are pivotally connected by links 9, 10 to the arms 11, 12 of bell crank levers pivoted at 13, 14 to the cylinder and the other arms 15, 16 of these bell crank levers are connected by a link 17 which passes through guides 18 on a block 19 secured to the end of the shaft 5. There are also provided cam followers 20, 21 which engage a cam ring 22 secured to a fixed plate 23 and the cam ring is provided with cam surfaces constituted by a block having a projection 24 and a block having a recess 25 which is the obverse of the projection. When the shaft 5 is rotated the cylinder 1 is rotated and with it the plungers 7, 8. The followers 20, 21 bear against the cam ring 22 and once in each rotation one follower (say the follower 21) engages the projection 24 and at the same time the other follower 20 registers with the recess 25. The projection causes the bell crank lever 12, 16 to rock in a clockwise direction and the mating recess permits the other bell crank lever 11, 15 to rock in an anti-clockwise direction and then very shortly after the reverse action occurs, the follower 21 riding down the projection under the urge of the side wall of the recess 25 acting on the follower 20. By this means the plunger 8 will be caused quickly to be projected from the periphery of the cylinder and back again, and as the cylinder 1 rotates the follower 20 for the other plunger 7 will move past the projection 24 and this other plunger will in turn be quickly projected from the cylinder 1 and returned. It will be noted that by interconnecting the two followers 20, 21 through the link 17 a positive cam motion is provided to cause the quick projection and retraction of each plunger 7, 8 in turn.

The stapling cylinder 2 is secured to a shaft 2' and the shaft 2' is provided with a gear 2^2 in mesh with a gear 5' on the shaft 5, and the gear 2^2 is also in mesh with a gear 3' secured to the die cylinder 3 referred to, this gearing causing the various cylinders 1, 2 and 3 to rotate with equal peripheral speeds. The cylinder 2 is provided with stapling plungers 26, 27 which are slidable radially in recesses 28, 29 formed in the cylinder, the ends of the plungers 26, 27 and the recesses 28, 29 constituting staple forming recesses: these plungers 26, 27 are operated in an exactly similar manner by a positive cam mechanism as has been described for the plungers 7, 8 on the cylinder 1 so that each plunger 26, 27 (which is normally within the periphery of the cylinder 2) is moved up to the periphery of the cylinder once in each rotation. In view of the similarity of the parts, it is believed to be sufficient to indicate those parts of the cam mechanism for the plungers 26, 27 which correspond to the already described parts for the plungers 7, 8 with an index, it being however noted that the plate 23 which carries the cam rings 22, 22' is common to these rings.

The die cylinder is provided with two die blocks 45, 46 formed in a well known manner with grooves 47, 48 which operate to bend over the legs of a U-shaped staple.

The wire feeding mechanism M operates to feed wire to between the cylinders and for this purpose the mechanism comprises wire feeding rolls 30, 31 one of which is fast with a ratchet wheel 30' engaged by a pawl 32 on an arm 33 connected by a link 34 to a disc 35 fast with a gear 36 in mesh with a gear 37 on the shaft 5. Hence as the shaft 5 rotates, the disc 35 imparts an angular motion to the arm 34 which in turn causes the pawl 32 to rotate the rolls 30, 31 when it is moved in one direction and to slide over the ratchet wheel when it is moved in the reverse direction. To sever a length of wire from the strip as it is fed, the wire indicated at 38 passes through a feed aperture in a block 39 and on this block is mounted a wire severing device constituted by a blade 40 pivoted at 41 to the block: this blade has a severing part 42 which passes over the edge of the block (see Figure 4) and has a projection 40' adapted to be engaged by one or other of two strikers 43, 44 secured to the cylinder 1. Hence, when the projection 40' is struck by one of the strikers 43, 44 the blade 40 is forced downwardly against a return spring 40^2 and the severing part operates to sever that length of wire which has been fed beyond the end of the block 39.

The cam ring 22 is so positioned that the plungers 7, 8 are caused by the projection 24, to be quickly projected in the manner described from the cylinder 1 when the plungers successively register with one of the recesses 28, 29 in the cylinder 2. The cam ring 22' is so positioned that the plungers 26, 27 are caused quickly to be moved up to the periphery of the cylinder 2 (and back again) when the plungers successively register with the grooves 47, 48 in the die blocks 45, 46. It may here be noted that regarding the operation as a whole, the cam ring 22 operates rather later than the cam ring 22'.

It will now be seen that as one or other of the plungers 7, 8 is projected from the periphery of the cylinder 1 when the plunger registers with one or other recess 28, 29, a length of wire which has been fed between the cylinders 1, 2 will be punched into the recess against the end of the plunger 26 or 27 to form the familiar U-shaped staple. It will be noted that the strikers 43, 44 are positioned to engage the projection 40' on the wire severing blade at this time so that the plunger 7 or 8 operates on a severed length of wire. It will also be observed that as the stapling forming plungers 7, 8 are not operated by their cam ring 22 until just after the stapling operation has been effected, the plunger 26 or 27 will be in position to form a base against which the staple forming plunger 7 or 8 operates to punch the staple.

A staple so formed is then carried round with the stapling cylinder 2 until the plunger 26 or 27 which is below the staple is in register with one or other groove 47, 48, the legs of the staple being radial and slightly below the periphery of the cylinder 2. The plunger 26 or 27 is then operated to punch the preformed staple through the webs W and the groove 47 or 48 operates to turn over the legs of the staple.

As this operation is timed to occur when the stapling plunger is in registration with the die, the staple, the webs W passing between the stapling and die cylinders 2, 3 and the die 45 or 46 on the die cylinder 3 will be relatively at rest.

It will be observed that it is, with the construction described, necessary to have rapid movements of the forming plungers 7, 8 and stapling plungers 26, 27 in order to take advantage of the temporary conditions of relative rest when the forming plunger 8 and recess 28 move into register and when the stapling plunger 27 and die 45 move into register. This rapid movement is, however, beneficial for it has been found that on the one hand the staple when formed with a quick action is less liable to tend to return towards its original shape after having been forced into shape, and on the other hand is less liable to be distorted when being forced through a number of paper webs.

To facilitate the positioning of the staple within the recesses 28, 29 the walls of these recesses and the outer end of the plungers 26, 27 which constitute the base of the recesses are grooved as indicated at 49, 50 to receive the staple forming wire more or less snugly. In addition to facilitate the forming of a staple by the plungers 7, 8 these plungers are as shown in Figure 2 backed off at 51.

In order to provide for adjustment between the stapling and die cylinders 1, 2 and 3 to accommodate varying thicknesses of webs W to be stapled, the bearings for the shafts 5, 2' for the cylinders 1, 2 are carried in brackets 52 pivotally mounted at 53 on a part 54 secured to the frame 54' of the machine framing: the bracket 52 has an adjusting bolt 55 by adjustment of which the bracket 52 can be rocked to vary the clearance between the cylinders 2 and 3 and a clamping bolt 56 passing through an arcuate slot 57 in the part 54 and screwing into the bracket 52 being provided to clamp the bracket 52 in the desired position.

Adjustment of the time of operation of the cam rings 22, 22' is provided for by connecting the cam rings to the pplate 23 through bolts 58, 58' which pass through arcuate slots 59, 59', the slots permitting the rings 22, 22' to be angularly adjusted to vary the time of operation thereof. Similarly, the strikers 43, 44 are adjustable angularly on the cylinder to vary their times of operation, the strikers being for this purpose formed with arcuate slots 60 through which pass clamping screws 61.

It will be appreciated that any other convenient form of staple preforming mechanism can be employed. Hence, the usual staple-forming horn could if desired be employed, provided that the staple when formed is arranged with the ends of its legs below the periphery of the stapling cylinder before passing into register with the webs.

While the mechanism described could be located at any convenient zone in the path of the web, it is convenient to locate the cylinders at the head of the former folder when such is employed to form a longitudinal fold in the webs, the fold being along the longitudinal line of the staples.

In such a case, the die cylinder 3 could constitute the usual roller at the head of the former which is indicated at 62 (see Figure 5) these formers and their operation being well understood by those skilled in the art.

It may be observed that while from the foregoing, the mechanism in accordance with the invention has for its primary purpose to enable a stapling mechanism to insert a longitudinal staple, the mechanism could equally well be employed for inserting transverse staples. In this case, and referring to the particular construction described, the staple wire would be fed at right angles to the direction in which it is fed for a longitudinal staple so that the staple forming plunger would form a U shaped staple lying in a plane parallel with the axis of rotation of the stapling cylinder.

It will be apparent that the distance between successive longitudinal staples (i. e. the pitch of the staples) will depend upon the diameter of the stapling and die cylinders 2, 3 and also upon the number of dies and stapling plungers in each cylinder. It is generally necessary to have a product stapled at two points and the arrangement of parts shown in the drawings is arranged to effect this by having the circumferential length of the stapling and die cylinders 2, 3 equal to the required length of product and to have in these cylinders two stapling plungers 26, 27 and two dies 45, 46 and also to provide the cylinder 1 with two plungers 7, 8.

It may here be observed that the term "cylinder" employed in the specification and in the annexed claims is employed in the manner common in the printing machine art to denote rotatable parts of generally cylindrical form and does not necessarily denote a cylinder in the mathematical sense.

What we claim is:

1. Web stapling mechanism for stapling a plurality of continuously moving webs with staples having their lengths in the direction of travel of the web comprising a staple forming cylinder, a stapling cylinder, a die cylinder, means supporting the stapling cylinder with its periphery adjacent the staple forming cylinder and the die cylinder, means continuously advancing the webs to be stapled between the stapling and die cylinders, means continuously rotating the staple forming and die cylinders in one direction, means continuously rotating the stapling cylinder in the opposite direction, the directions being such that the peripheries of the stapling and die cylinders move in the same general sense as the webs, and means causing the stapling cylinder to co-act at one point in its rotation with the staple forming cylinder to form a staple within said stapling cylinder with its legs disposed apart in the circumferential direction thereof and at a later point to register with the die cylinder and project the preformed staple through the webs with its length in the direction of travel thereof.

2. Rotary stapling mechanism for stapling a plurality of continuously moving webs with staples having their length in the direction of travel of the webs, the said mechanism comprising a staple forming cylinder having a male staple forming member, a die cylinder having a die for clenching the legs of a staple, a staple cylinder which is contiguous the forming and die cylinders, and has a female staple forming member to cooperate with the male forming member to form a staple contained within the periphery of the stapling cylinder and with its legs disposed apart in the circumferential direction of the stapling cylinder, means to feed staple forming wire in a tangential direction between the staple forming and stapling cylinders, means timed to cause the male member quickly to force a length of wire into the female member when the members rotate into register, and means timed to force the formed staple quickly from the stapling cylinder

when the staple moves in the continued rotation of the stapling cylinder into register with the die on the die cylinder, whereby the legs of the staple will penetrate webs led between the stapling and die cylinders and be turned over by the die on the die cylinder.

3. Mechanism as claimed in claim 2 and in which the staple forming cylinder is hollow and the means timed to cause the male member to force a length of wire into the female member, includes a camming projection provided on the interior periphery of said forming cylinder.

4. Mechanism as claimed in claim 2 and in which the stapling cylinder is hollow and the means timed to cause the female member to force the formed staple from the stapling cylinder, includes a camming projection provided on the interior periphery of said stapling cylinder.

5. In a web stapling mechanism for applying to a plurality of moving webs staples having their length disposed in the direction of the travel of the webs, a staple forming cylinder having a slidable male staple forming member thereon, a stapling cylinder having a slidable female staple forming member thereon to cooperate with said male staple forming member to form a staple in said stapling cylinder with its legs disposed apart in the circumferential direction of the stapling cylinder, and means to actuate said male stapling member to form a staple.

6. In a web stapling mechanism for applying to a plurality of moving webs staples having their length disposed in the direction of the travel of the webs, a staple forming cylinder having a slidable male staple forming member thereon, a stapling cylinder having a slidable female staple forming member thereon to cooperate with said male staple forming member to form a staple in said stapling cylinder with its legs disposed apart in the circumferential direction of the stapling cylinder, means to actuate said male stapling member to form a staple, means to actuate said female staple forming member to force the formed staple from said stapling cylinder, and a die cylinder having a staple closing die thereon to cooperate with said female staple forming member to close a formed staple as it is forced thereby from said stapling cylinder through webs moving between said stapling and die cylinders with the length of said staple disposed in the direction of the travel of the webs.

7. A rotary stapling mechanism for stapling a plurality of continuously moving webs with staples having their length in the direction of travel of the webs, the said mechanism comprising a stapling cylinder having a female staple forming part to form a staple with its legs disposed apart in the circumferential direction of the stapling cylinder, a member adapted to thrust a length of staple forming wire into the female part, means to operate said member at one point in the rotation of the stapling cylinder, a die cylinder having a die to turn over the legs of a staple, the webs to be stapled passing between the stapling and die cylinders, and additional means operating to force a formed staple from the stapling cylinder at a later point in the rotation thereof when the staple moves into register with the die on the die cylinder, the legs of the staple penetrating the webs and being turned over by the die.

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