

July 22, 1924.

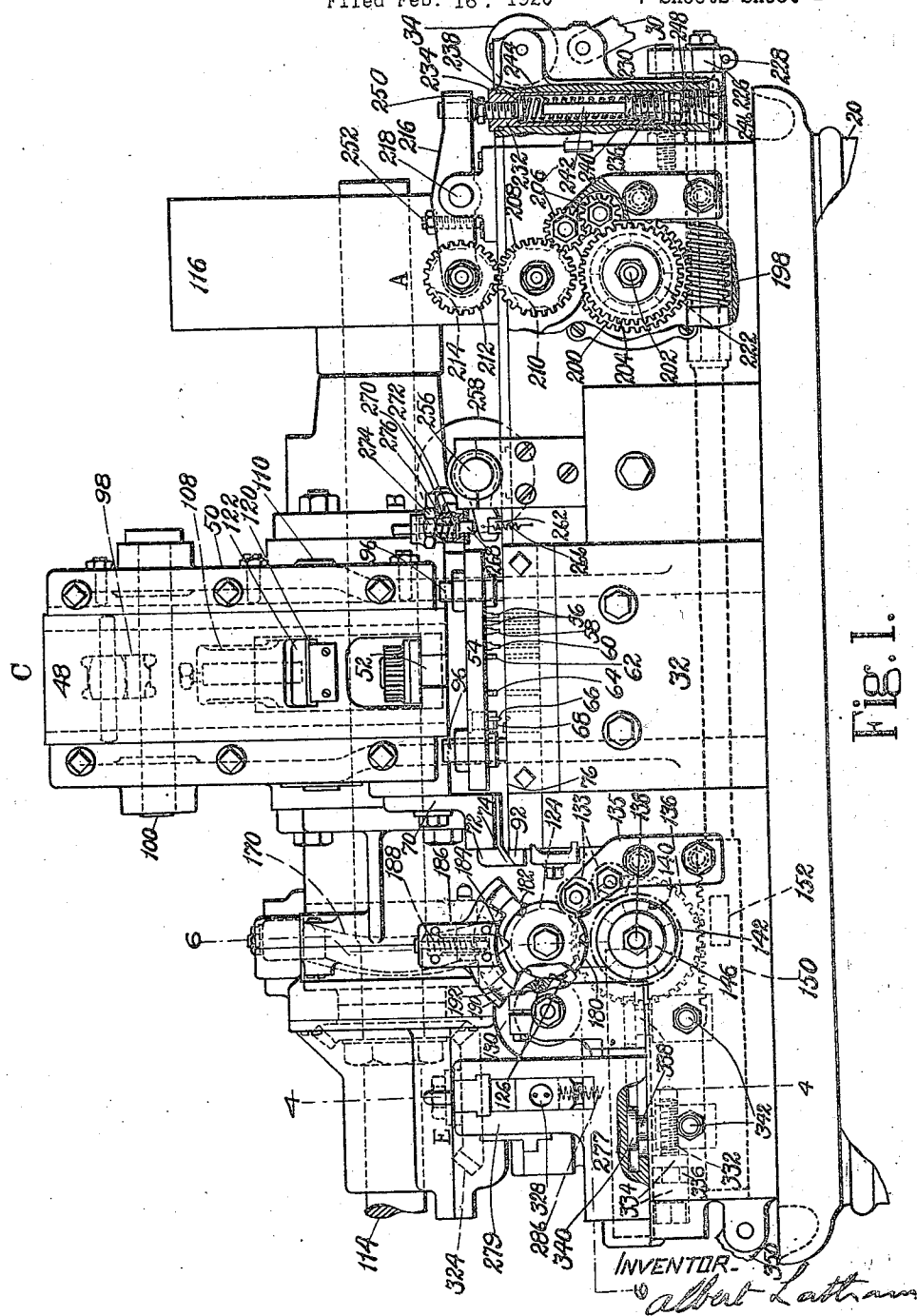
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A. LATHAM

FORMING MACHINE

Filed Feb. 16, 1920

7 Sheets-Sheet 1



July 22, 1924.

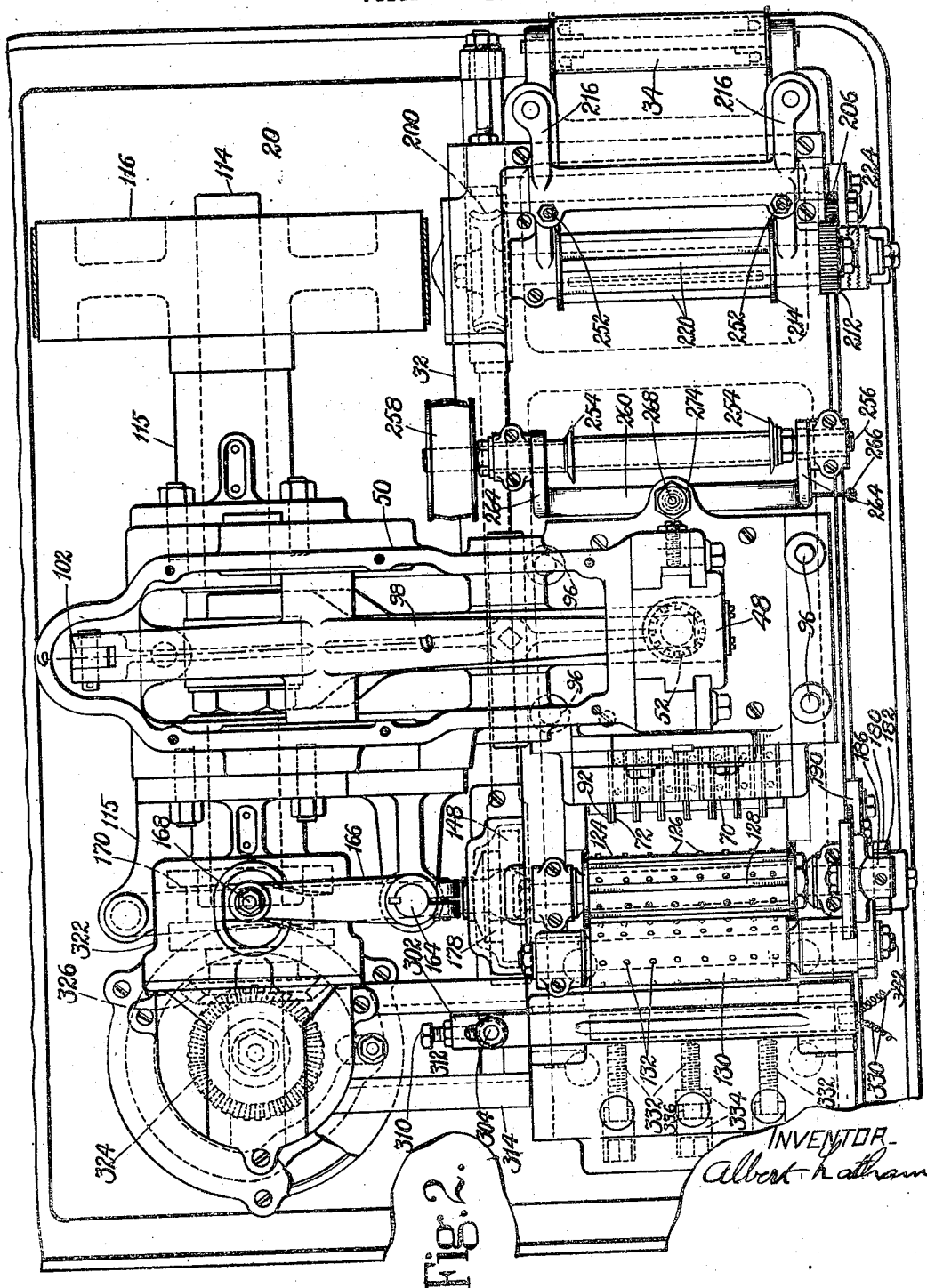
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7 Sheets-Sheet 2



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7 Sheets-Sheet 3

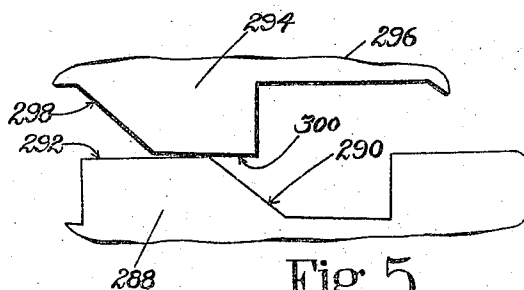


Fig. 5.

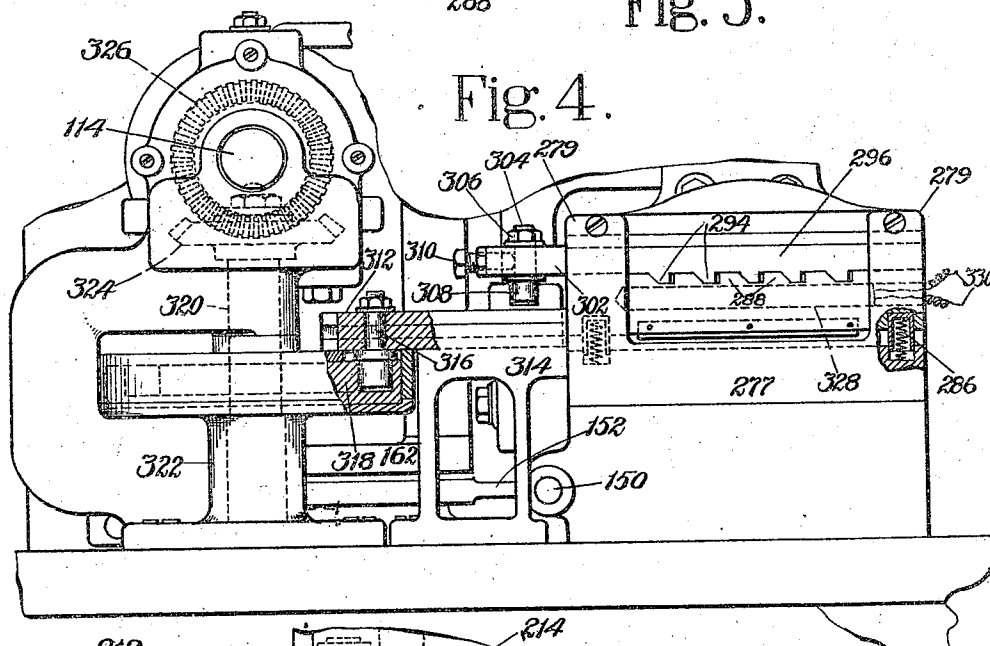


Fig. 4.

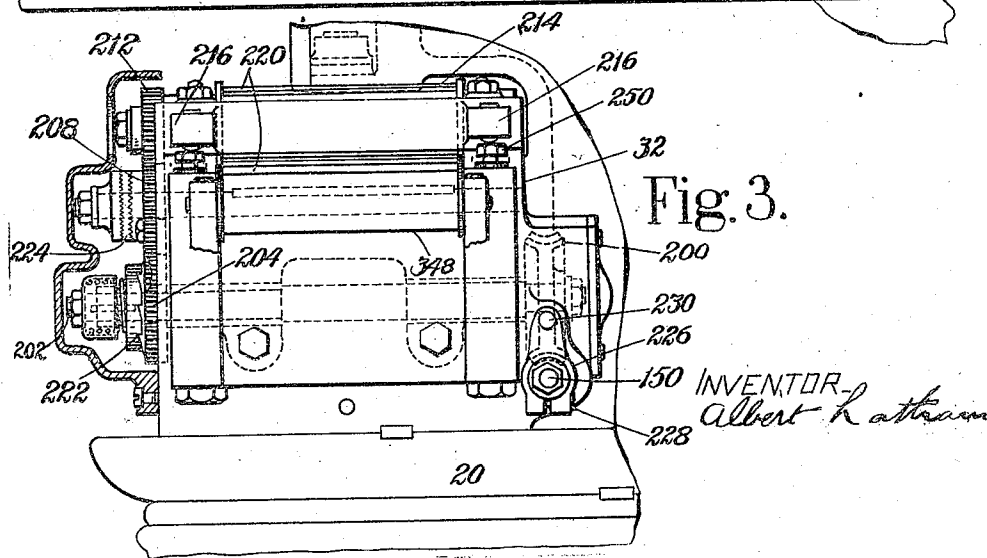


Fig. 3.

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1,502,040

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Filed Feb. 16, 1920

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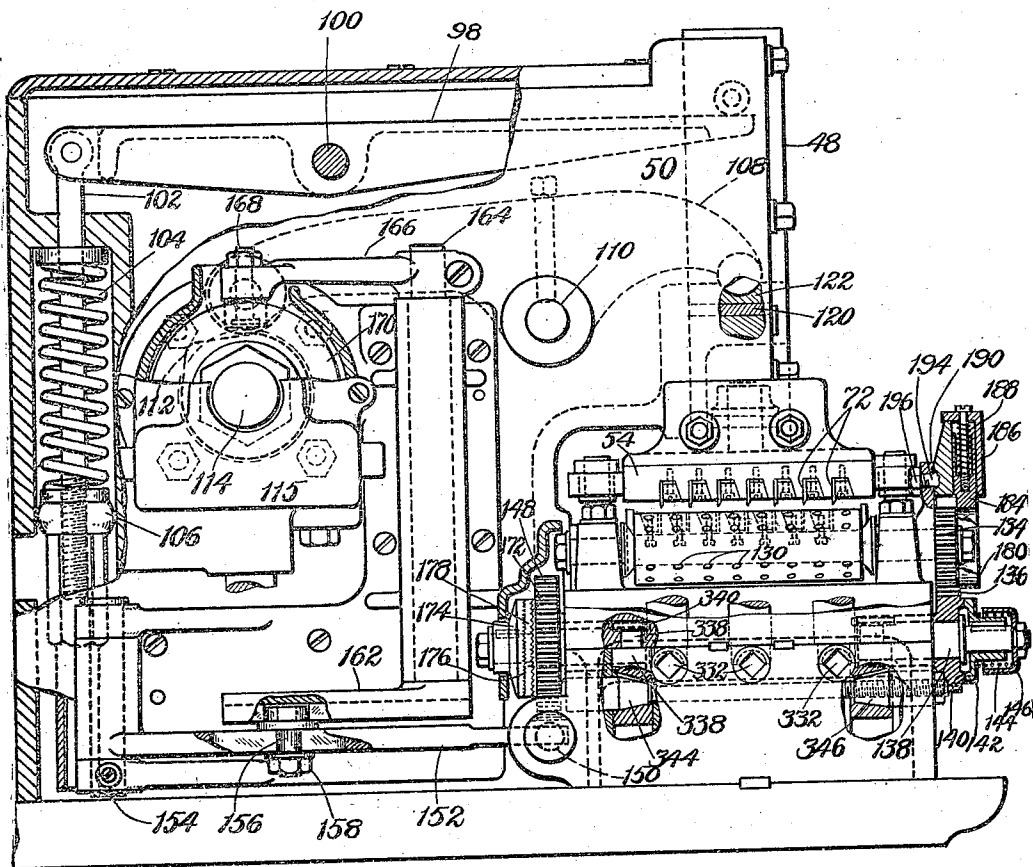


Fig. 6.

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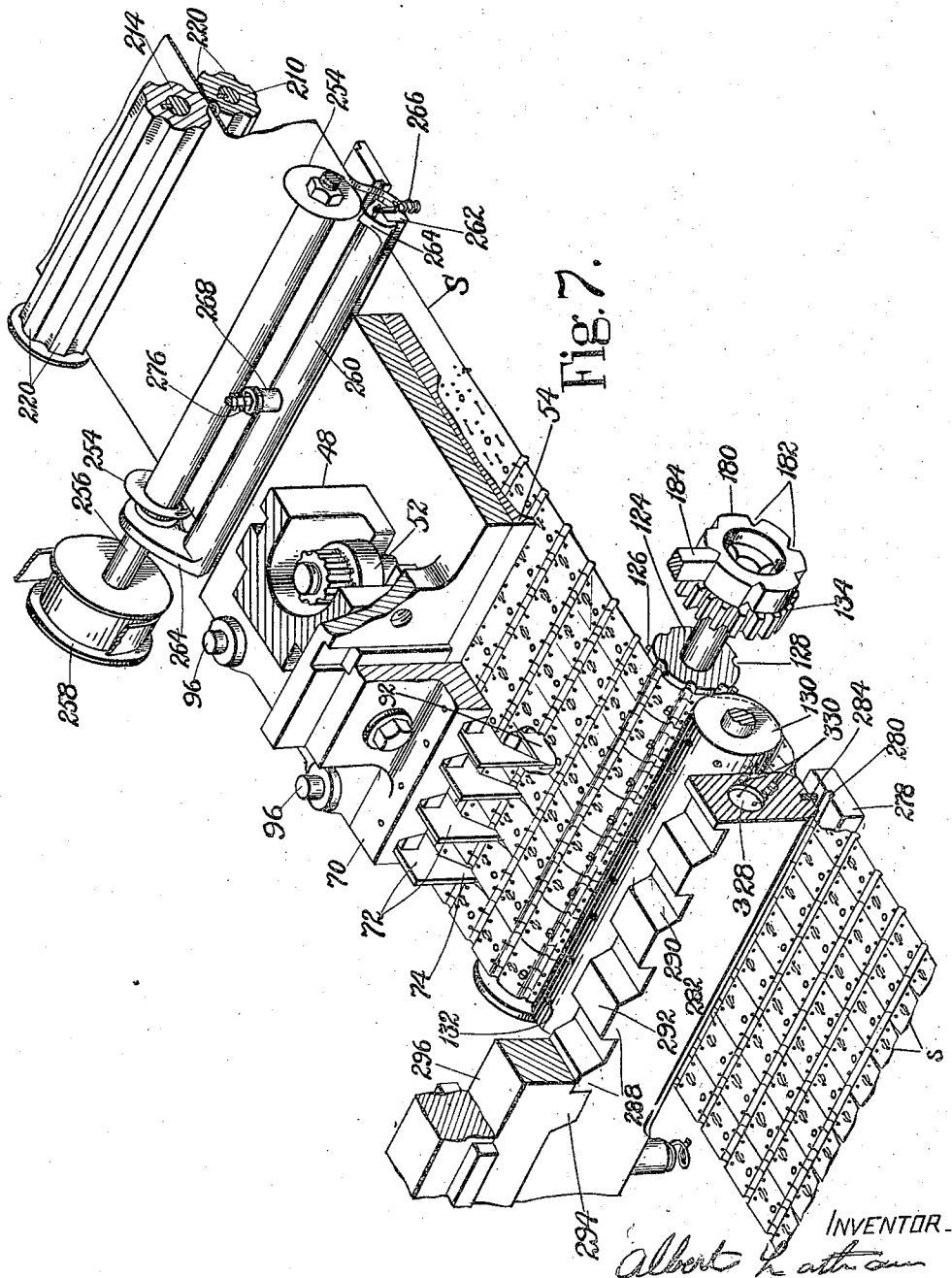
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1,502,040

A. LATHAM
FORMING MACHINE

Filed Feb. 16, 1920

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July 22, 1924.

1,502,040

A. LATHAM

FORMING MACHINE

Filed Feb. 16, 1920

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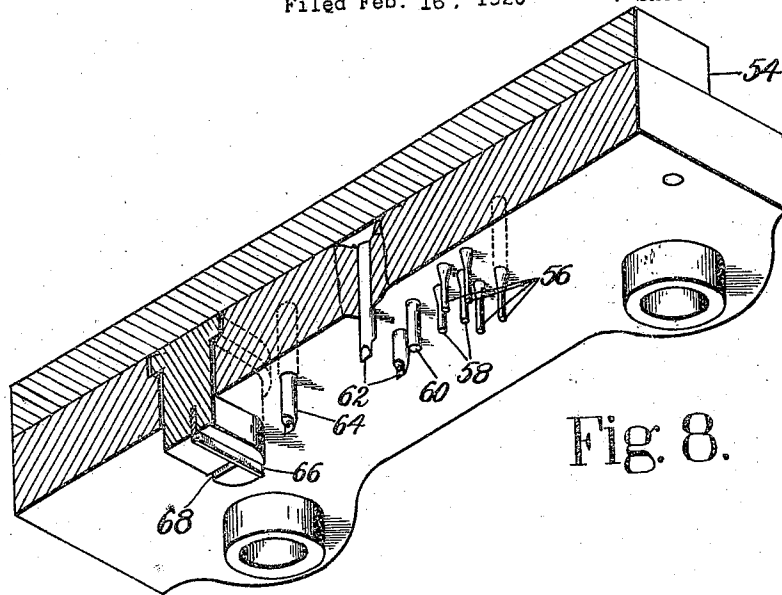
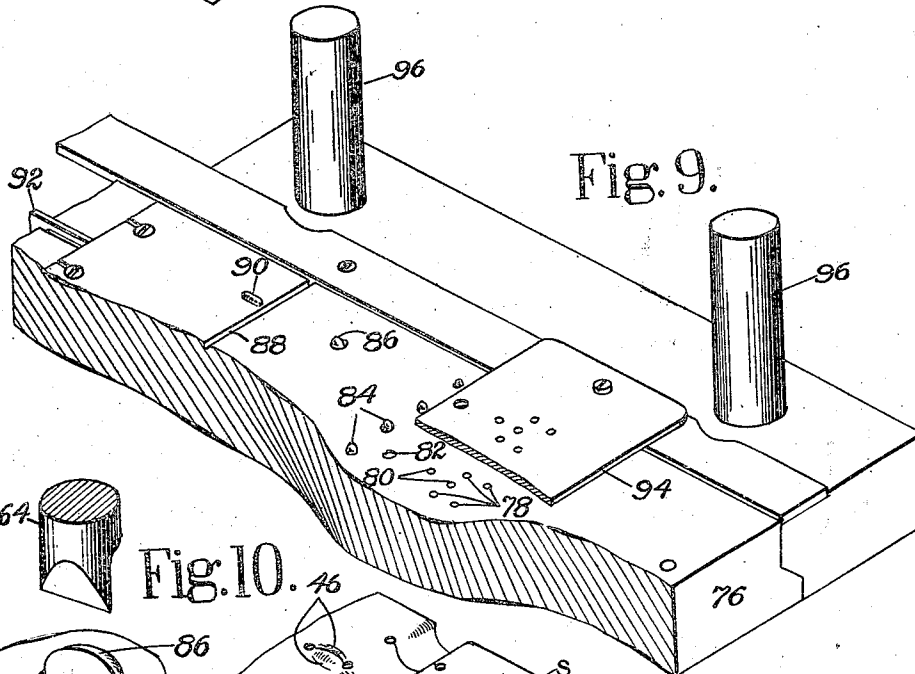
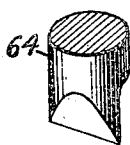


Fig. 10.

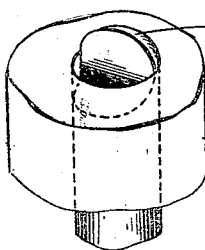
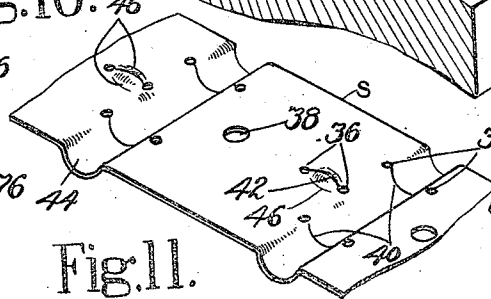


Fig. 11.



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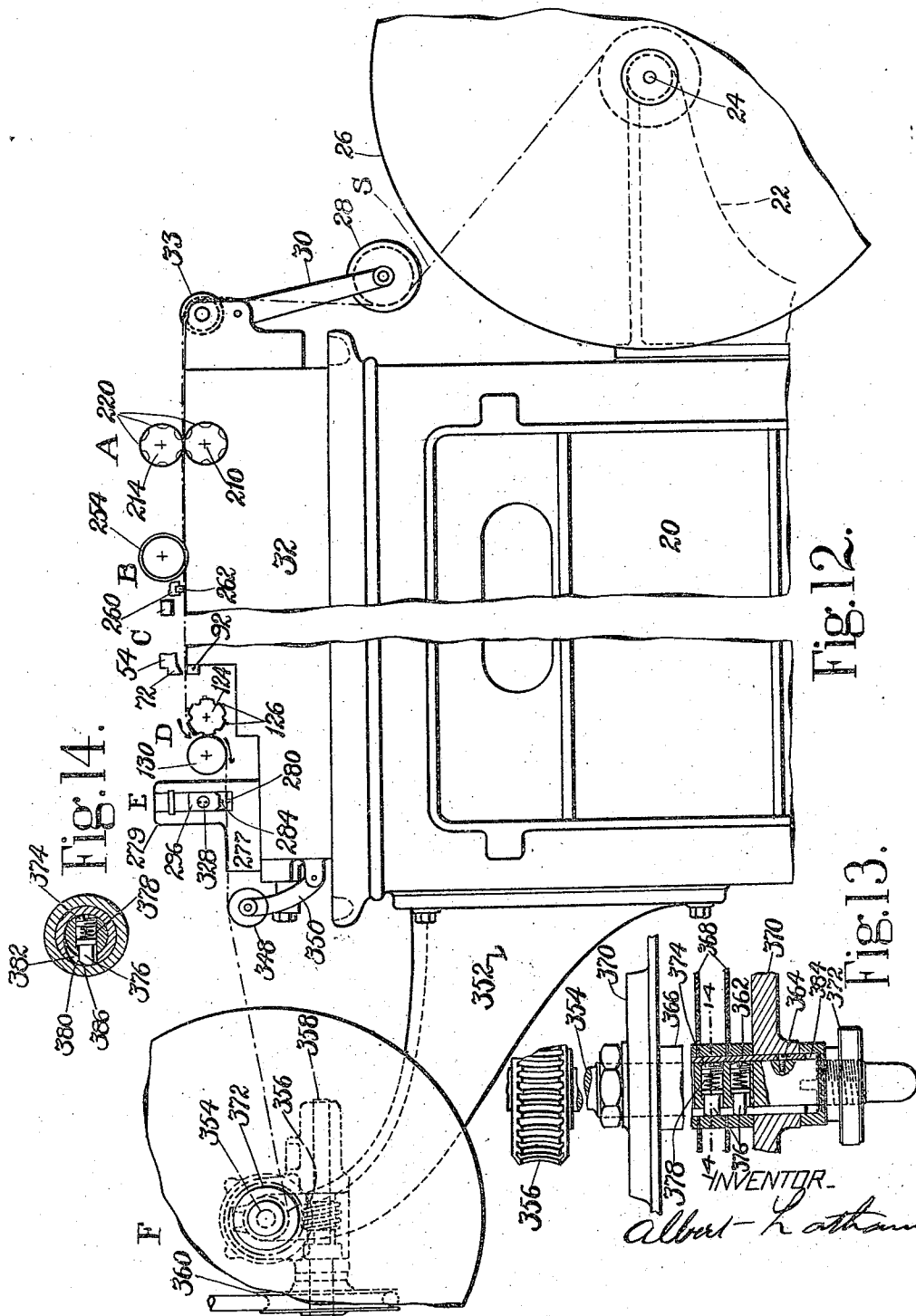
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A. LATHAM

FORMING MACHINE

Filed Feb. 16, 1920

7 Sheets-Sheet 7



UNITED STATES PATENT OFFICE.

ALBERT LATHAM, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO AMERICAN BUTTON & FASTENER CO., OF AUGUSTA, MAINE, A CORPORATION OF MAINE.

FORMING MACHINE.

Application filed February 16, 1920. Serial No. 358,962.

To all whom it may concern:

Be it known that I, ALBERT LATHAM, a citizen of the United States, residing at Beverly, in the county of Essex and State of Massachusetts, have invented certain Improvements in Forming Machines, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

The present invention relates to forming machines, and especially to those for operating upon sheet material. The illustrative machine herein disclosed is particularly adapted for forming a strip or strips of material, as paper, with closely placed perforations and associated depressions arranged in successive groups, to prepare for the mounting of such fasteners as buttons and their attaching staples in the manner, for example, disclosed in my application for Letters Patent filed September 29, 1919, Serial No. 327,176. Objects of the invention are to provide for imparting accurately to the work the desired formation at regular intervals, without tearing or deforming the material.

In the attainment of these objects, a feature of the invention consists of a plurality of operating instrumentalities, such as punches and dies, spaced from one another longitudinally of the strip and arranged to act successively thereon to produce each fastener-receiving perforation, together with means for feeding the strip step by step to present a series of receiving areas to the operating instrumentalities for the production of the completed mounting-strip. With these operating instrumentalities it is preferred to associate a device for receiving said completed strip, as by winding it in a coil. When the fasteners to be mounted consist of buttons, means are provided for forming in the strip pairs of openings to receive opposite sides of the button-eyes, and for thereafter cutting slits connecting the openings to admit said eyes and to permit their removal. If securing staples are to be associated with the buttons upon the strips, means for producing additional openings and slits for their accommodation may be provided. The operating instrumentalities are also shown as including

strip-depressing means which act between the pairs of openings at each side of the slits co-operating with the buttons, and there may also be depressing means to form corrugations transversely of the strip across the slits between the staple-receiving openings. The former depressions facilitate the introduction of the buttons to their perforations, while the latter result in the correct retention of the staples.

Since, after the forming operation has been completed, it may not be wholly effective, or other operations upon the work as it is advanced may have a distorting action upon the form which has been imparted, another feature of the invention resides in subjecting the already formed work to the action of a reforming device, which perfects or restores its form. Heating means may be associated with the reforming device, it tending to give a more permanent result. This reforming operation I find to have the greatest utility when applied to a work depression, as a corrugation. It is best accomplished by a die, acting after the work has been under the influence of feeding mechanism, which draws it from the initial forming mechanism, and may, by the tension produced, flatten the corrugation.

It may be desirable to produce the forming effect in separate series, as when several fastener mounting-strips are made simultaneously. In this connection, a feature of the invention consists in a plurality of forming devices arranged for operating upon a sheet of material, together with means for dividing the sheet into strips containing the respective series. By this arrangement, the plural strips may be rapidly produced, with the perforations or other formed portions accurately positioned upon them. For this purpose, I have shown a strip-cutting device, acting upon the work after the forming devices, and consisting of blades mounted upon the carrier with said forming devices and preferably remaining in constant engagement with the work. Such an organization gives a structure of extreme simplicity, capable of dividing the formed sheet with exactitude along a continuous line.

In machines of the character of that now under consideration, it is advantageous to

divide the feed of the work between a plurality of mechanisms, as two of these mechanisms situated at opposite sides of the forming mechanism. To insure such feeding means acting in complete accord, as an additional feature of the invention I operate the feeding means at different rates. In the present embodiment of the invention, the effective feed is in steps corresponding to intervals between formed portions of the work, and the advance produced by one feeding means equals the intervals, while that resulting from the other feeding means exceeds said intervals. With work fed in steps differing from the intervals at which operations are performed upon it, means are furnished for compensating for this difference to effect the correct presentation of the work to the forming mechanism. Preferably, I control the excess fed by maintaining it at the side of the forming mechanism from which the feed proceeds, thus insuring constancy of the feed steps, yet giving a slack portion drawn from the source of supply, from which the first-mentioned feeding mechanism may take material without danger of tearing it. To exercise this control, there may be employed pressure means contacting with the work between the forming mechanism and one of the feeding mechanisms, in the present instance that which advances the work the greater amount. This controlling or pressure means preferably acts alternately upon the work to retard its advance and clamp it against movement, thus determining the relation of the excess to the forming mechanism, and then holding the work at the correct point of advance for the forming operation.

Other features of the invention involve combinations of elements and structural details leading to the better coordination of the operations and generally improving the efficiency and precision of operation of forming machines.

In the accompanying drawings,

Fig. 1 shows, in side elevation, a particular embodiment of the invention, the supply and winding reels being omitted;

Fig. 2 is a top plan view of the same portion of the machine;

Fig. 3 is an end elevation, looking from the right in Fig. 1, with portions omitted;

Fig. 4 is a transverse section on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged detail, showing the actuating means for the reforming mechanism;

Fig. 6 is a transverse section on the line 6—6 of Fig. 1, with parts omitted and broken away;

Fig. 7 is a perspective view of the successive mechanisms which act upon the sheet, without the supply and winding mechanisms;

Fig. 8 shows in perspective a portion of the movable carrier-plate for the forming instrumentalities;

Fig. 9 is a similar view of the bed-plate with which the carrier-plate co-operates;

Fig. 10 illustrates in perspective a slit-cutting device;

Fig. 11 is a perspective view of a portion of a single formed strip, including two of the formed portions;

Fig. 12 is a broken side elevation of the entire machine, diagrammatic in character;

Fig. 13 is a horizontal, sectional detail through the winding mechanism; and

Fig. 14 is a transverse section thereof on the line 14—14 of Fig. 13.

As best shown in Fig. 12, a standard or base 20 has, projecting from one side, horizontal arms 22, in the extremities of which is journaled a spindle 24, about which may turn a reel 26 for a sheet S, preferably in the form of a continuous ribbon of flexible material, as paper. From the reel, the sheet passes below a tension-roll 28, rotatable in arms 30 pivoted upon the rear extremity of a frame 32 carried by the base 20. The roll 28, as here illustrated, bears, under the influence of gravity, against the sheet and takes up any slack which may result in the operation of the machine. From the tension-roll, the sheet proceeds over a guide-roll 33, journaled horizontally at the end of the frame 32 above the pivots of the tension-roll arms, and then passes in successive co-operation with feeding mechanism A, work-trimming and controlling mechanisms, indicated at B, forming and dividing mechanism C, feeding mechanism D and reforming mechanism E, to be finally received by winding mechanism F.

The machine illustrated is particularly designed, as already indicated, to produce mounting-strips for buttons and staples, such strips appearing in Fig. 7, and a short length of a single strip, being shown in Fig. 11. In each strip, disposed longitudinally, are uniformly spaced formed portions, each including groups of perforations consisting of a plurality of pairs of openings, the elements of each pair being separated from one another along the axis of the strip. The openings are preferably circular, and include two pairs 34, 34, alined with one another transversely of the strip, and beyond these pairs and midway between the axes of each, is a pair of openings 36, 36. The openings 34, 34 are spaced to receive the legs of such an attaching device as a staple; while the openings 36, 36 are adapted to hold a button eye. Each group also includes, beyond and alined with the pair of openings 36, 36 at the transverse center of the strip, a perforation 38, which may also be in the form of a circular opening, for engagement by an element of the feeding mechanism D.

Connecting the pairs of openings 34, 34 are slits 40, 40, and between the openings 36 of each pair is a like slit 42. The form of each complete perforation consequently consists of two circular spaces, from which the material of the mounting-strip is removed, with a division between points on the peripheries of the circles nearest one another, along which the material is cut, but with the opposed edges remaining in contact. The material at each side of the slit provides a tongue, which, in the case of staple legs, rests upon them, retaining them in place normally, yet separating to allow the removal of the staple when the proper disengaging force is applied; while with the button eye, the tongues pass through its opening, locking it upon the strip, these yielding to permit both its introduction and removal. Between the openings of the pairs 34, 34, lying transversely of the strip, is a corrugation 44, the slits 40 joining the openings 34 extending across this corrugation. This is to provide for the meeting of the opposed lips over the staple legs without a normal displacing stress upon them. Between the openings of the pair 36, at each side of the slit 42, is a depression 46. With these depressions, it is unnecessary to exactly aline the button eye with the receiving slit when introducing said eye, since the depressions guide the eye toward the slit and yield without danger of breaking the material.

For forming the groups of openings, slits and depressions just outlined, the mechanism C has a head 48, arranged to reciprocate in vertical ways in an upwardly extending portion 50 of the frame 32. Removably secured at 52 to the head is a horizontally disposed carrier-plate 54, and mounted upon the lower face of the plate 54 is a plurality of longitudinal series of forming instrumentalities, separated equally from one another across the width of the plate, there being here shown eight of these. In each series there are, as best appear in Fig. 8, nearest the feeding device A, first two pairs of punches 56, 56, to produce the staple openings 34, then a pair of punches 58, 58 for the eye openings 36, and then a larger punch 60 to give the feeding opening 38. These punches furnish one group of co-operating forming devices, and spaced from the center of this group in the direction of feed an amount equal to the mean or pitch distance between successive fastener-carrying portions of the strip, is a pair of cutters 62, 62, the reduced edges of which are arranged to make the slits at 40 between the pairs of previously formed openings 34, 34. Similarly spaced along the plate is a cutter 64 to make the slit 42; and still farther through another like space is a die-bar 66, lying at right-angles to the longitudinal axis of the plate,

and common to all the series of forming devices, to make the depression or corrugation 44 across the full width of the sheet operated upon, with an associated longitudinally extending mold-groove 68 for each series of forming devices, to make the depressions 46. Fixed in a holder 70 at the forward edge of the carrier-plate are longitudinal blades 72, there being one of these blades midway between each series of forming devices. The length of each blade is somewhat greater than the pitch distance between the formed portions of the work, so that, operating once for each depression of the carrier, they produce continuous cuts to divide the sheet into strips *s*. At their extreme forward ends are projections 74, which extend sufficiently beyond the plane of the work so that they never rise above the sheet operated upon, and thereby insure the correct relation of successive cuts. Removably mounted upon the frame, beneath the head 48, is a horizontal bed-plate 76, and vertically alined with the corresponding forming devices of the carrier-plate 54 are (Fig. 9) series of co-operating devices comprising openings 78, 80 and 82 to receive the punches 56, 58 and 60, cutters 84 and 86 acting with the cutters 62 and 64 and having rounded edge portions to give a shearing effect, and a mold-groove 88 and die-bars 90 registering with the bar 66 and grooves 68, respectively. Leger blades 92 at the forward extremity of the bed-plate co-operate with the blades 72 in the sheet-dividing action. A stripper-plate 94, containing openings for the punches, is mounted above the bed-plate and somewhat spaced from it above the openings 78, 80 and 82, performing the usual function of separating the work from the punches as they rise. At opposite sides of the bed-plate are vertical studs 96, arranged in pairs, these entering openings in the carrier-plate and holding the upper and lower forming instrumentalities in correct alinement.

The forming head 48 is held normally raised by a lever 98 (Fig. 6) fulcrumed at 100 in the frame portion 50, and having depending from its extremity opposite the head a rod 102 extending through an opening in the frame and surrounded by a helical spring 104. One end of this spring exerts its force against the frame, and the other end contacts with a nut 106 threaded upon the lower end of the rod. By changing the position of the nut upon the rod, the tension of the spring 102, and therefore the force with which it acts through the lever to lift the forming head, may be altered. The head is lowered to effect the forming operation by a lever 108, fulcrumed at 110 in the frame portion 50, and provided at the end farthest from the head with an anti-friction roll, contacting with a cam 112 fast

upon a main driving shaft 114 journaled in bearings 115 supported upon the base beside the frame 32. Rotation is imparted to the driving shaft through a pulley 116 belted to a suitable source of power. When the opposite end of the lever from the cam is lowered by the latter, it is forced against a saddle 122 carried by the head, thus depressing said head against the tension of the spring 104 to cause the engagement of the forming devices with the work. Shims 120 of varying thicknesses may be inserted between the saddle and head to control the extent of movement of the upper forming devices into co-operation with the lower.

Of the two feeding mechanisms A and D which move the work along the forming devices, the latter, which exerts tension upon the work, may be considered the primary feeder, since it acts positively to cause the advance in steps which exactly equal the pitch intervals between the formed portions of the work, and likewise between the groups of forming devices upon the carrier and bed-plates. The feeding mechanism A, which draws the sheet of material from the reel 26 and pushes it toward the forming mechanism, preferably feeds the work in steps exceeding the normal intervals, acting frictionally to take from the reel 26 and present to the feeding mechanism D an ample supply, which the primary feeder may utilize without undue or rupturing stress upon the material. The feeding mechanism D (Figs. 1, 2 and 6) has a driven roll 124, located with its upper peripheral portion substantially in horizontal alinement with the upper face of the bed-plate, it being journaled, with its axis horizontal, in bearings in the frame 32. Extending about the periphery of the roll 124 are circular series of pins or projections 126, these corresponding in their spacing along the roll to that between the series of formed portions of the work, and the pins in each series being separated circumferentially of the roll by distances equal to the intervals between the perforations 38 in the strips. The circumferential surface of the roll also has longitudinal grooves or depressions 128 to receive the corrugations 44 in the strips. In advance of the driven feed-roll 124 is a pressure-roll 130 journaled in the frame with its axis parallel to that of the co-operating roll, and having a series of openings 132 into which the pins 126 extend, the roll 130 being rotated by this engagement. Fixed upon the shaft of the roll 124 is a gear 134, connected by a chain of idler gears 133, rotatable upon an arm 135 bolted to the frame, with a gear 136 loose upon a shaft 138 mounted to turn in the frame below the roll 124. These idler gears facilitate the substituting of gears of different diameters for those designated as 134 and 136 when it is desired to change the

location or spacing between the formed portions of the work. Upon the outer face of the gear 136 are formed a circular series of ratchet-teeth 140, with which co-operate corresponding teeth upon a ratchet-disk 142 splined upon the shaft 138 to rotate therewith, while being movable longitudinally over it. A spring 144, situated between the disk and a cap 146 attached to the outer end of the shaft, holds the ratchet-teeth in engagement, so that they are compelled to turn together in one direction, yet may yield relatively to permit the retention of the gear 136 against rotation upon reverse movement. The shaft 138 is oscillated to turn the gear 136, and therefore the roll 124, in successive steps in one direction, by a gear 148 carried upon the opposite end of the shaft 138 from the gear 136, and having meshing with it a rack-bar 150 arranged to slide horizontally in the lower portion of the frame 32. In this rack-bar, beneath the gear 148, is an opening to receive the extremity of a lever 152, fulcrumed at 154 in the frame, and having a longitudinal slot, in which a stud 156 is adjustably secured by a nut 158. At the upper end of this stud is an anti-friction roll, operating in a slot in the under side of an arm 162 secured at the bottom of a vertical shaft 164 mounted to oscillate in the frame. At the upper end of the shaft 164 is fixed an arm 166, upon which is a stud 168 carrying an anti-friction roll co-operating with a groove in a cam 170 upon the shaft 114. The length of throw of the rack-bar 150 from the cam 170 through the interposed lever mechanism may be altered by a variation in the position of the stud 156 in its slot. In addition to turning the feeding roll 124 through the correct angle to cause the desired feed steps, as determined by this adjustment, it is, of course, essential that the initial relation of the roll shall be such as to cause the pins 126 to exactly enter the feeding openings 38 in the work. This may be roughly arrived at by disengaging the ratchet-disk 142 and shifting the gear 136 and the roll circumferentially, to the tooth which most nearly gives the desired relation of the pins. For fine adjustment within a tooth length, a vernier device is provided, which is shown as applied to the gear 148. This gear may be turned upon the shaft 138, and has upon the end of its hub a circular series of V-shaped teeth 172. Spaced from the gear, and fixed upon the end of the shaft 138, is a disk 174, having a similar series of teeth 176, which, however, are differently spaced, they being here shown as finer. A suitable number of the two sets of teeth would be 100 and 110, respectively. Between the gear and disk is a collar 178, surrounding the shaft and having upon its opposite faces teeth corresponding in pitch to those adjacent to its at each side, so that

the collar teeth enter the disk and gear teeth and compel the rotation of the gear with the shaft. By properly proportioning the vernier teeth and setting the gear and collar at different angles about the shaft, the desired normal relation of the feeding pins to the work openings may be obtained with any degree of precision.

To hold the roll 124 against rotation during reverse movement of the ratchet mechanism, and to guard against any inaccuracy in the stopping of the feed for the forming operation, due to backlash in the gears or other connecting elements, I prefer to associate with the mechanism D other means than its driving mechanism for holding the roll in position and determining its feeding action. This means is shown as in the form of a centering device, including a disk 180 secured to turn with the roll 124 outside the gear 134, and having about its periphery regularly spaced depressions 182, the side walls of which converge to a point. These depressions may be engaged by a detent 184, the entering point of which corresponds in form to that of the depressions. This detent is mounted to slide in a housing 186, being forced by a spring 188 into contact with the circumference of the disk and its depressions. The housing is arranged for movement circumferentially of the disk upon a bracket 190 attached to the frame, said housing being guided in a groove 192 in the bracket and fixed in position therein by a stud 194 extending from the housing through a slot in the bracket, and secured in place by a nut 196. The detent is so positioned by means of its adjustment that, when its point is seated in the disk depression, the roll 124 will be stopped in its rotation at exactly the proper angle for the performance upon the work of a forming operation; and, even if the cessation of movement of the rack-bar and intermediate elements has left the feed-roll slightly out of the true position, the seating of the detent in the depression by its spring will bring the roll to the desired point.

Upon the opposite or rear extremity of the rack-bar 150 is mounted a worm 198, giving, in effect, rack-teeth. These teeth engage those of a worm-wheel 200, secured upon a shaft 202 beneath the feeding mechanism A (Figs. 1, 2 and 3). At the opposite extremity of the shaft 202 from the worm-wheel is a gear 204, joined for rotation through idler pinions 206, arranged similarly and for a like purpose as the pinions 133, to a gear 208 upon the spindle of a feed-roll 210 of the mechanism A, this being journaled horizontally in and transversely of the frame 32. From the gear 208 through a gear 212 there is driven an upper feed-roll 214, co-operating with the roll 210 and journaled in arms 216 pivoted upon the top of

the frame portion 32 at 218. The rolls 210 and 214 have their peripheries longitudinally grooved to form intermediate segmental projections 220, preferably of equal circumferential width and having the same angular relation upon the two rolls, so that they co-operate in pairs with the work passing between them to advance it. When the grooves between the projections come into registration, there is sufficient space left between the rolls for the work to move freely between them. As in the mechanism D, these rolls 210 and 214 are rotated in successive feeding steps with intermediate periods of rest, the dwell occurring when the centers of the grooves are opposite one another, and the feed when the interposed pairs of projections engage the work. To allow this intermittent movement to be imparted by the reciprocatory rack-bar, the gear 204 may be driven through ratchet mechanism 222, precisely like that associated with the gear 148, except that the ratchet-teeth are shown as of greater pitch, and the gearing is such as to produce more of an advance of the work than that resulting from the mechanism D. To synchronize or permit the establishment of the correct time relation between the mechanism A and other portions of the machine, as the controlling mechanism B, which determines the relation to the forming mechanism of the excess of material fed by the mechanism A, the angular positions of the rolls 210 and 214 may be accurately adjusted by vernier mechanism 224. This mechanism appears associated with the gear 208, being in no essential particular different from that adjustably securing the gear 148 to its shaft, and functioning in the same manner.

I prefer also to have an adjustment for one of the gear-engaging portions of the rack-bar, so that, in addition to the variation in length of stroke obtained by a change of the stud 156 and affecting both feeding mechanisms, the time relation between them may be altered. In the present instance, the worm 198 is made variable in position. To this end, it is mounted to rotate about a cylindrical portion of the bar, being normally held by an arm 226, split to engage the bar and clamped thereon by a screw 228, the arm having an opening to receive a pin 230 projecting horizontally from the adjacent end of the frame. When the clamp is fixed upon the worm, its engagement with the pin 230 holds said worm against rotation; but if it is desired to adjust the angle of the gear 200, the clamp is loosened, the worm turned as required, and again fixed by setting the screw 228.

The roll 214 is urged into feeding engagement with the roll 210 by a spring device, in which the spring member is maintained normally under stress independently of its action upon the pressure member, said spring

and its mounting being removable as a unit without affecting the adjustment. Beneath the rear ends of the levers 216 are vertical bores or openings in the frame, each adapted to loosely receive a casing or holder 232, having at its upper end a flange 234 to limit downward movement. The bottom of the casing is threaded internally to receive a screw-plug 236. Within the cylindrical chamber of this casing, between an abutment-disk 238 at its upper end and a flange 240 upon a plunger 242, is a helical spring 244 surrounding the stem of the plunger. The plug 236 has an axial opening to receive an extension 248 of the plunger, this extension passing through the plug and being arranged for contact with a screw 246 threaded into the lower extremity of the frame opening. The upper end of the casing carries a screw 250, which may be adjusted in position until, when the extension 248 of the plunger is supported by the screw 246, the head of the screw 250 is bearing against a contact portion of the corresponding lever 216. With a casing and its directly associated elements removed from the frame, the tension of the spring may be varied as desired, by altering the position of the plug 236. Then the casing is inserted in the frame opening, and the screw 250 raised into co-operation with the lever 216. When the roll 214 is raised by the passage of the work beneath it, the levers, acting upon the screws 250, force the casings down in their bores, there being space beneath the flanges 234 to permit this. Since the plunger extension resting upon the screw 246 is held against movement, the casings travel down, compressing the springs 244, which thus serve to hold the roll 214 in yielding contact with the work.

After leaving the feeding mechanism A, the ribbon S of paper is trimmed to give even edges, separated from one another by a distance equal to the sum of the width of all the strips s to be produced, by disk-knives 254, 254 (Fig. 2), properly spaced from one another upon a shaft 256 journaled above the bed portion of the frame, over which the work moves from the feeding mechanism A to the forming mechanism C. The knives are rotated at a relatively high speed by means of a pulley 258 fast upon the shaft 256 and belted to the source of power.

Just in advance of the trimming knives is shown means for controlling the excess in the length of the feed forced toward the forming mechanism by the feeding mechanism A, over that drawn from it by the mechanism D. This controlling means, as here illustrated, see especially Figs. 1 and 2, consists of a bar 260, lying horizontally above the work, and having a contact portion 262 arranged to bear upon said work. The bar is mounted upon arms 264, 264,

turning about the bearings of the shaft 256. In addition to the weight of these elements, the normal frictional resistance to the travel of the work beneath the portion 262 may be increased by tension-springs 266, 266, connecting its arms to the frame. As the forming head descends, the frictional effect of the part 262 upon the work is augmented by contact with the bar near its center of a pressure-member. This member is shown as consisting of a plunger 268, carried for vertical movement in a casing 270 supported upon the upper forming plate 54. Between a flange 272 upon the plunger and a cap 274 of the casing, surrounding a reduced portion of the plunger, is a helical spring 276, forcing the plunger downwardly to its normal position, and permitting it to yield when it contacts with the bar 260. When the forming head is raised, the contact-member 262 drags upon the work with relatively light pressure, sufficient to maintain the excess of material fed by the rolls 210 and 214 and not taken up by the positive feeding roll 124 at the left, as viewed in Fig. 1 of the drawings, or between the forming mechanism and this feeding mechanism. At the termination of this step, the rolls 210 and 214 are at rest, and the grooves between their projections are alined, giving a space through which this excess is permitted to straighten and is taken up by the tension-roll 28. Then, as the head descends for the forming operation before the forming devices reach the work, the plunger 268 contacts with the bar and urges it with greater force toward the work, which is positively clamped against movement for the forming operation.

After the strips s with the corrugations 44 formed upon them by the die-bar 66 has been subjected to the tension of the feeding-roll 124, it may be so deformed as not to be in the best condition to receive the fasteners. To perfect the contour of the corrugations, I have here shown a reforming mechanism E (Figs. 1, 2 and 4), operating upon the strips after the feeding mechanism D. Resting upon the forward extremity of the frame 32 is a support 277, having at each side a vertical standard 279. Between these standards upon the bed of the support is mounted a mold 278, most clearly illustrated in Fig. 7, having a groove 280 extending transversely of the strips at right angles to their axes. The form of this groove is that which it is desired to impart to the finished corrugations. Mounted to slide in ways in the adjacent sides of the standards 279 is a carrier 282, and upon this is mounted a die-bar 284, formed and located for cooperation with the mold-groove 280. The carrier 282 is held normally raised by springs 286, situated between the support and the ends of the carrier, and has upon

its upper face cam-projections 288 (Figs. 4 and 5), each of which has an inclined surface 290 terminating in an upper horizontal surface 292. With these projections co-operate projections 294 upon an actuating bar 296, arranged to slide horizontally through the standards 279. Each of these projections is provided with an inclined surface 298 for contact with a corresponding surface 290 upon a projection 288 and a lower surface 300 to engage a surface 292. One of the surfaces 292 or 300 is preferably inclined to the horizontal, the latter being so illustrated. The width of the projections 294 is less than the spaces which they enter, there being a substantial clearance left between the sides of the upper and lower projections. The bar 296 has an extension 302, which is slotted to receive a stud 304, which may be fixed in different positions along the slot by a nut 306, threaded upon the stud. A screw 310, passing through the extension 302 at the end of the slot, assists in positioning the stud when the nut 306 is loosened. The lower end of the stud, which may carry an anti-friction roll, enters a groove extending across a slide 312, mounted to move in transverse ways in a table 314 secured to the base 20. Depending from the slide is a stud 316, entering a groove in the upper face of a cam 318 secured upon a vertical shaft 320 rotatable in bearings 322 rising from the base. Fast upon the upper end of the shaft 320 is a bevel-gear 324, meshing with a similar gear 326 upon the shaft 114. The relation of the cam-groove and intermediate connections is such that during the advance of the work the projections in the actuating bar 296 enter the depressions in the carrier 282, so that the springs 286 hold the carrier at its highest point, leaving a space between the mold 278 and the die-bar 284 between which the work travels. During the period of rest of the work, while the forming operation is taking place, the cam moves the bar 296 to the left (Fig. 4), and as the inclines 298 pass over those of the carrier, said carrier is rapidly depressed to bring the die-bar into proximity with a corrugation 44, which is now positioned in the mold-groove 280. Then, as the slightly inclined end 300 of each bar-projection rides over the corresponding end 292 of the carrier, a limited gradual depression of the die-bar occurs, bringing the reforming pressure upon the work. To increase the permanency of this action, I prefer to heat the die-bar, this being accomplished conveniently by an electric heating unit 328 inserted in a horizontal bore in the carrier above the bar 284, and supplied with current through conductors 330. The extent of this final movement may be varied, to provide for the exertion of the proper amount of force with-

out endangering the work by cutting or breaking it, by a movement of the stud 304 along the slot in the actuating bar-extension. This alters the initial position of the projections 294 in the spaces of the carrier, so that the extent of the movement of the inclines 300 over the co-acting surfaces 292 is changed, and consequently the extent of the depression of the die-bar.

The distance of the mold 280 and the die 284 from the feed-roll 124 must be such that they exactly engage the already formed corrugations presented to them. For this purpose, the support 274 is made adjustable to move the mold and die together toward and from the forming and feeding mechanisms (Figs. 1, 2 and 6). The support is arranged to slide in ways in the frame 32, and may be moved therein by screws 332 threaded horizontally through the end of the frame 32, the central screw having upon it collars or flanges 334 operating upon opposite sides of a wall 336 depending from the under side of the support, while the other screws exert pressure only to correctly aline the support. To fix the support in its adjusted position, separated plugs 338, 338 arranged in transverse pairs have heads 340 entering slots in the under side of the support. Each pair of plugs is drawn down to cause the frictional retention of the support, by a horizontal rod 342 threaded through the outer wall of the frame, and having at its inner end a conical portion 344 and an oppositely inclined conical collar 346, internally threaded to engage the threaded portion of the rod. The lower inclined faces of these conical portions bear against the lower sides of correspondingly inclined openings in the plugs 338. When the rods 342 are turned in the frame to move the portion 344 outwardly, the collar 346 travels inwardly, and both inclines are drawn against those of the plugs, thus bringing the heads 340 into binding engagement with the slots in which they operate, locking the support in place.

After leaving the reforming mechanism E, the strips *s* pass over a roll 348 lying transversely of the frame, at the end of the support 277, and being journaled in arms 350 (Fig. 12). This roll guides the strips to a winding mechanism, shown at F. In arms 352, bolted to the forward end of the frame, is journaled a spindle 354, driven by worm-gearing 356 through a short shaft 358 rotatable in the arm 352 and having secured upon it a pulley 360, from which a belt leads to the power source. Surrounding the spindle is a sleeve 362, which is free to turn through a limited angle upon the spindle, though held against longitudinal movement by a screw 364 threaded into said spindle, and having its head lying in a slot in the sleeve. About the sleeve are a series of core-sections

366 to receive the strips of formed material, these cores being spaced from one another by separating disks 368, serving to aline the edges of the strips in true vertical planes.

5 The cores and separating disks are held in their alternate positions against longitudinal movement upon the sleeve by end disks or heads 370, all retained in position by a thumb-nut 372, threaded upon the spindle end. Since the rate at which the strips

10 are wound increases as they accumulate upon the cores, it is necessary to connect the latter frictionally with the winding spindle. For this purpose, at the positions occupied

15 by the cores, the spindle is provided with lateral bores (Figs. 13 and 14), each closed at one end by a screw-plug 374, and having projecting from the other end a plunger 376, forced outwardly by a helical spring 378

20 situated between the plug and plunger. These plungers pass through openings 380 in the sleeve 366, and bear against the cores with sufficient force to carry them about as the spindle rotates, but permitting any one

25 to slip independently of the others as the winding speed exceeds the rate of advance of the work. To enable the operator to free the cores from the pressure-plugs, so that they may be removed easily, and to lock

30 said plugs to facilitate restoring the cores for another winding operation, the sleeve is provided with means for temporarily holding the plugs within the spindle bores. This means is shown as in the form of an in-

35 clined groove 382, leading into each sleeve opening 380, and converging therefrom toward the interior surface of the sleeve. Upon the outer extremity of the sleeve are slots 384, to which a turning tool may be ap-

40 plied after the removal of the nut 372. By rotating the sleeve, the outer walls of each groove 382 may be caused to ride over an inclined surface 386 at the end of a plug, forcing it against the tension of its spring into

45 the spindle bore, and there retaining it while the cores and separators are withdrawn. Fresh cores and the appropriate separators may then be applied to the sleeve and spindle, and the plungers released by reverse ro-

50 tation of the sleeve, restoring the plugs to their winding engagement with the cores.

To generally outline the operation of the machine, reference being had particularly to Figs. 7 and 12, a ribbon S of paper mounted

55 upon its reel 26 is placed upon the spindle 24, and initially carried through the machine, if desired, by previously perforated leaders secured to it until its forward extremity reaches the winding mechanism D.

60 It being assumed that this has been accomplished, the reciprocation of the rack-bar 150 causes the simultaneous intermittent operation of the feeding devices A and D.

65 D, by the positive engagement of its pins

with the openings 38 of the work, advances said work the exact mean space between the portions to be formed, this space or pitch distance equaling the spaces between the

70 groups of forming instrumentalities upon the carrier-plate 54. During this feed, the material is drawn frictionally from the supply reel by the co-operating projections 220 of the feeding mechanism A to a length

75 greater than that taken up by the mechanism D, so that the force which the projections of the last-mentioned mechanism are required to exert upon the relatively frail paper or other material is slight. The feed-

80 ing movement ends with the grooves in the rolls of the mechanism A alined. The excess of the work fed by this mechanism A and retained by the controlling bar 260 is allowed to straighten through the space be-

85 tween the rolls in the direction from which the feed proceeds for the next forming operation. At this time, the forming plate 54 descends, first pressing down the controlling

90 bar to so clamp the work that it may not shift during the forming operation, and then simultaneously subjecting it to the action of the groups of punches, cutters and

95 dies of all the series, which produce in it the perforations and the registering depressions which are the constituent parts of the complete formed portions. Upon the next feed-

100 ing step, the work is so carried forward that the area operated upon by the punches 56, 58 and 60 of each series is subjected to the influence of the succeeding cutters 62, and

105 then, upon the following steps, the same portion is acted upon by the single cutter 64, and finally the forming of this particular area is completed by the die and mold

110 devices. By operating in this manner, this comparatively complicated form is completed without introducing difficulties in mounting the devices which produce it, yet

115 without sacrifice of time, since the combined effect of all the groups of devices is such as to complete the action upon a formed area for each depression of the carrier. Up to

120 this point, the work has been in a continuous sheet, which has been reduced only by the trimming of its edges through the agency of the disks 254. But after the

125 forming of the portions across the entire sheet, it is divided into strips s by the action of the blades 72 incidentally with a forming movement of the plate. After passing

130 the feeding mechanism D, which may impair the form of the corrugations 44 by its tension, this portion of the work is reformed by the mechanism E, and more permanently set by the heat imparted to it. It is then,

135 at the mechanism F, wound on the central cores, upon which it is to be supplied to the apparatus which is to attach the fasteners to it.

Having described my invention, what I 130

claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for forming a mounting-strip having a series of fastener-receiving perforations, a plurality of operating instrumentalities spaced from one another longitudinally of the strip and arranged to act successively thereon to produce each fastener-receiving perforation, and means for feeding the strip step by step to present a series of receiving areas to the operating instrumentalities for the production of the completed mounting-strip.

2. In a machine for forming a mounting-strip having a series of fastener-receiving perforations, a plurality of operating instrumentalities spaced from one another longitudinally of the strip and arranged to act successively thereon to produce each fastener-receiving perforation, means for feeding the strip step by step to present a series of receiving areas to the operating instrumentalities, and a device for receiving the completed mounting-strip.

3. In a machine for forming a mounting-strip having a series of button-receiving perforations, means for forming in the strip pairs of openings arranged to receive the opposite sides of the button-eyes, means spaced from the associated forming means for forming in the strip between the openings slits to admit the button-eyes and complete the perforations, and means for feeding the strip in steps corresponding to the distance between successive button-receiving perforations.

4. In a machine for forming a mounting-strip having a series of button-receiving perforations, means for forming in the strip pairs of openings arranged to receive the opposite sides of the button-eyes, means spaced from the associated forming means for forming in the strip between the openings slits to admit the button-eyes and complete the perforations, means for feeding the strip in steps corresponding to the distance between successive button-receiving perforations, and a winding device for the completed strip.

5. In a machine for forming a mounting-strip having a series of button-receiving perforations, means for forming in the strip pairs of openings arranged to receive the opposite sides of the button-eyes, means for forming in the strip between the openings slits to admit the button-eyes and complete the perforations, means for producing in the strip a depression at each side of each slit and extending from one eye-receiving opening to another at each button-receiving perforation, and means for feeding the strip in steps corresponding to the distance between successive button-receiving perforations.

6. In a machine for forming mounting-strips for buttons and their securing staples,

means for forming pairs of button-eye-receiving openings, means for forming pairs of associated staple-receiving openings, and means for forming slits between each pair of openings.

7. In a machine for forming mounting-strips for buttons and their securing staples, means for forming pairs of button-eye-receiving openings, means for forming pairs of associated staple-receiving openings, means for forming slits between each pair of openings, and means for corrugating the strip across the slits between the staple-receiving openings.

8. In a machine for forming mounting-strips, means for forming pairs of openings spaced longitudinally of the strip, and means for thereafter cutting longitudinal slits connecting the formed openings.

9. In a machine for forming mounting-strips, means for forming pairs of openings spaced longitudinally of the strip, means for thereafter cutting longitudinal slits connecting the formed openings, and means for corrugating the strip transversely, such corrugations extending across the slits.

10. In a forming machine, a strip-support, means for feeding a strip over the support, a reciprocatory carrier cooperating with the support, pairs of punches mounted upon the carrier and spaced in the direction of feed, and cutters mounted upon the carrier and acting upon the strip longitudinally thereof and between the openings produced by the punches.

11. In a forming machine, a strip-support, means for feeding a strip over the support, a reciprocatory carrier cooperating with the support, pairs of punches mounted upon the carrier and spaced in the direction of feed, cutters mounted upon the carrier and acting upon the strip longitudinally thereof and between the openings produced by the punches, and a die situated upon the carrier for engaging the strip between the pairs of openings.

12. In a forming machine, a strip-support, means for feeding a strip over the support, a reciprocatory carrier cooperating with the support, pairs of punches mounted upon the carrier and spaced in the direction of feed, cutters mounted upon the carrier and acting upon the strip longitudinally thereof and between the openings produced by the punches, and a die extending transversely of the carrier for engagement with the strip between the pairs of openings.

13. In a machine for forming mountings for fasteners, a support for the mounting, and a carrier, said support and carrier being provided with mounting-perforating and slitting instrumentalities, said instrumentalities being arranged to produce openings to receive the fasteners and slits to facilitate their introduction or removal.

14. In a machine for forming mountings for fasteners, a support for the mounting, and a carrier, said support and carrier being provided with mounting-perforating and pressing instrumentalities, said instrumentalities being arranged to produce openings to receive the fasteners and depressions to facilitate their introduction.

15. In a forming machine, a forming device, means for operating upon the work subsequently to the forming operation, and a reforming device thereafter acting upon the work.

16. In a forming machine, a forming device operating upon the work, feeding means for the formed work, and a reforming device to which the feeding means delivers.

17. In a forming machine, a forming device operating upon the work, means for exerting tension upon the formed work, and a reforming device acting upon the work after its subjection to the tension.

18. In a forming machine, a forming device, means for operating upon the work subsequently to the forming operation, a reforming device thereafter acting upon the work, and means for heating the reforming device.

19. In a forming machine, a forming device operating upon the work, feeding mechanism for drawing the work from the forming device, and a reforming device acting upon the work after it has been under the influence of the feeding mechanism.

20. In a forming machine, a corrugating die operating upon the work, and a feeding roll for drawing the work from the corrugating die, said roll having a depression to receive the corrugation.

21. In a forming machine, a corrugating die operating upon the work, means operating upon the work and tending to destroy the formed corrugations, and a corrugating die thereafter acting upon the previously formed corrugation.

22. In a forming machine, a corrugating die operating upon the work, a feeding roll for drawing the work from the corrugating die, and a corrugating die situated at the opposite side of the feeding roll from that first mentioned and acting upon the previously formed corrugation.

23. In a forming machine, a forming device, means for operating upon the work subsequently to the forming operation, a reforming device thereafter acting upon the work, and arranged to impart thereto a form identical with that given by the forming device and means arranged to vary the relation between the forming means and reforming means.

24. In a forming machine, a forming device, means for operating upon the work subsequently to the forming operation, a reforming device thereafter acting upon the

work, and arranged to impart thereto a form identical with that given by the forming device and means arranged to vary the distance between the forming means and reforming means.

25. In a forming machine, a plurality of forming devices spaced from one another and constructed and arranged to act successively upon the work to perform upon the same areas like forming operations, and means arranged to move one of the devices toward and from another.

26. In a forming machine, a forming mechanism, a support, a forming member fixed upon the support, a forming member movable upon the support and co-operating with the fixed member, and means arranged to move the support toward and from the forming mechanism.

27. In a forming machine, corrugating mechanism, recorruating mechanism, means for feeding the work from one mechanism to the other, and means arranged to vary the relation between the mechanisms and thereby effect coincidence of their fields of action.

28. In a forming machine, a corrugating mechanism, a support, a recorruating mold fixed upon the support, a recorruating die mounted to reciprocate upon the support into co-operation with the mold, and means arranged to vary the relation of the support to the corrugating mechanism.

29. In a forming machine, a corrugating mechanism, a support, a recorruating mold fixed upon the support, a recorruating die mounted to reciprocate upon the support into co-operation with the mold, means arranged to vary the relation of the support to the corrugating mechanism, actuating mechanism for the die, and slotted connections between said actuating mechanism and die.

30. In a forming machine, relatively movable forming members, means for effecting movement for each forming operation in different periods, and means arranged to vary the extent of movement during one period only.

31. In a forming machine, relatively movable forming members, means for effecting movement for each forming operation in periods of approach and application of pressure, and means arranged to vary the extent of movement during the application of pressure.

32. In a forming machine, relatively movable forming members, actuating means therefor provided with co-operating projections and depressions, and means arranged to permit the change of the initial position of the projections in the depressions.

33. In a forming machine, a plurality of forming devices arranged for simultaneously effecting operations of different character in separate series upon a sheet of material,

and means effective after the completion of the forming operation for dividing the sheet into strips containing the respective series.

43. In a forming machine, forming mechanism, a plurality of feeding means for the work, and means for operating the feeding means at different rates and arranged to produce slack in the work.

34. In a forming machine, a plurality of forming devices arranged for effecting operations in separate series upon a sheet of material, forming means acting across the sheet in conjunction with all the forming devices, and means for dividing the sheet into strips containing the respective series.

44. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps differing in length from said intervals, and means for feeding the work in steps equaling said intervals.

35. In a forming machine, forming devices, means for feeding work past the forming devices, and strip-cutting devices arranged to divide the work into a plurality of formed strips extending in the direction of feed.

45. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps differing in length from said intervals, and means for feeding the work in steps equaling said intervals, the feeding means being situated upon opposite sides of the forming mechanism.

36. In a forming machine, a movable carrier, forming devices moved by the carrier to act upon the work, and cutting devices mounted on the carrier and remaining in constant engagement with the work.

46. In a forming machine, forming mechanism, feeding means for the work situated at opposite sides of the forming mechanism, and means for operating the feeding means at different rates and arranged to produce slack in the work between said feeding means.

37. In a forming machine, forming devices, means for feeding work past the forming devices, and cutting devices arranged to act upon the work at opposite sides of the formed portion.

47. In a forming machine, forming mechanism, feeding means for the work situated at the front and rear sides of the forming mechanism, and means for operating the rear feeding mechanism more rapidly than the front feeding mechanism.

38. In a forming machine, a carrier, work-perforating devices arranged in adjacent series upon the carrier, means for feeding work in the direction of extension of the series, and a cutting device mounted upon the carrier between the perforating devices.

39. In a forming machine, a carrier, work-perforating devices arranged in adjacent series upon the carrier, corrugating means extending transversely of all the series, means for feeding the work in the direction of extension of the series, and a cutting device mounted upon the carrier between the perforating devices.

48. In a forming machine, forming mechanism, feeding means situated at the front of the forming mechanism and positively engaging the work in the feeding operation, and means at the rear of the forming mechanism for advancing the work a greater amount than does the other feeding means.

40. In a forming machine, a carrier, work-perforating devices arranged in adjacent series upon the carrier, means for feeding work in the direction of extension of the series, and blades fixed to the carrier near its forward edge and arranged to co-operate with the work during its feed.

49. In a forming machine, forming mechanism including work-forming means and work-perforating means, acting simultaneously, and work-feeding means situated in advance of the forming mechanism and arranged to engage the perforations produced by the forming means.

41. In a forming machine, a carrier, work-perforating devices arranged in adjacent series upon the carrier, means for feeding work in the direction of extension of the series, and blades fixed to the carrier between the perforating devices and having projections remaining in constant engagement with the work.

50. In a machine for forming mountings for fasteners, devices for forming a mounting to receive the fasteners, means for producing in the mounting feeding perforations, and feeding means engaging said perforations.

42. In a forming machine, a carrier, forming devices arranged in a series upon the carrier for co-operation with the work, means for feeding the work along the forming devices in steps equal to the spacing between said devices in the series, and a cutting blade mounted upon the carrier and being of as great effective length as the steps of the feed.

51. In a forming machine, a carrier, forming devices mounted upon the carrier and co-operating with the work, a punch mounted upon the carrier and arranged to produce a perforation in the work for each forming operation, and feeding means entering the perforations.

52. In a forming machine, a carrier, forming devices mounted upon the carrier and co-operating with the work, a punch mounted upon the carrier and arranged to produce a perforation in the work for each forming operation, and a rotatable roll pro-

vided with projections engaging the perforations.

53. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps differing in length from said intervals, and means for compensating for this difference to effect the correct presentation of the work to the forming mechanism.

54. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps exceeding said intervals in length, and means for controlling the relation of the excess fed to the forming mechanism.

55. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps exceeding said intervals in length, and means for maintaining the excess at the side of the forming mechanism from which the feed proceeds.

56. In a forming machine, forming mechanism, a plurality of feeding mechanisms for the forming mechanism, and frictional retaining means co-operating with the work between the feeding mechanisms.

57. In a forming machine, forming mechanism, a plurality of feeding mechanisms situated at opposite sides of the forming mechanism, and retaining means co-operating with the work at the incoming side of the forming mechanism.

58. In a forming machine, forming mechanism, a plurality of feeding mechanisms situated at opposite sides of the forming mechanism and acting to advance the work different amounts to produce slack in said work, and pressure means contacting with the work between the forming mechanism and one of the feeding mechanisms and arranged to maintain the slack in the work at the side toward said feeding mechanism.

59. In a forming machine, forming mechanism, a plurality of feeding mechanisms situated at opposite sides of the forming mechanism and acting to advance the work different amounts, and pressure means contacting with the work between the forming mechanism and the feeding mechanism advancing the work the lesser amount.

60. In a forming machine, forming mechanism, means for feeding the work to the forming mechanism in excess of the length necessary, and means for maintaining said excess at the side of the forming mechanism toward the feeding mechanism, said feeding mechanism being arranged to permit movement of the excess through it in a direction reverse to the feed.

61. In a forming machine, forming mechanism, means for intermittently feeding work to the forming mechanism in excess

of the length necessary, and means for resisting the movement of said excess toward the forming mechanism, said feeding mechanism being arranged to permit a movement of the excess toward it during intermittencies of the feed.

62. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps exceeding said intervals in length and during intermediate periods freeing the work, and means for limiting the movement of the work while thus freed to a direction away from the forming mechanism.

63. In a forming machine, forming mechanism, a plurality of means for feeding the work to the forming mechanism, and means for operating the feeding means at different rates, one of said feeding means being arranged to advance and free the work alternately.

64. In a forming machine, forming mechanism, feeding means for the work situated at opposite sides of the forming mechanism, and means for operating the feeding means at different rates, the more rapidly operating feeding means being arranged to alternately advance and free the work.

65. In a forming machine, forming mechanism, feeding means for the work situated at opposite sides of the forming mechanism, means for operating the feeding means at different rates, the more rapidly operating feeding means being arranged to alternately advance and free the work, and means for retaining the excess of material fed on the side of the forming means toward said rapidly operating means.

66. In a forming machine, forming mechanism, feeding mechanism therefor, and means acting alternately upon the work to retard its advance and to clamp it against movement.

67. In a forming machine, forming mechanism, feeding mechanism therefor, a friction member normally resting upon the work, and means for pressing said member against the work with different degrees of force.

68. In a forming machine, forming mechanism, feeding mechanism therefor, a friction member normally resting upon the work, and means actuated by the forming mechanism for pressing said member forcibly against the work.

69. In a forming machine, forming mechanism, feeding means for the work situated at opposite sides of the forming mechanism, means for operating the feeding means at rates producing slack in the work, and work-retarding means acting upon the slackened portion.

70. In a forming machine, forming mechanism, feeding means for the work situated

at opposite sides of the forming mechanism, means for operating the feeding means at different rates, and work-retarding means situated between the forming means and the more rapidly operating feeding means.

71. In a forming machine, forming mechanism, feeding means for the work situated at opposite sides of the forming mechanism, means for operating the feeding means at different rates, work-retarding means situated between the forming means and one of the feeding means, and pressure means carried by the forming means and movable into engagement with the retarding means.

72. In a forming machine, forming mechanism, means for feeding the work along the forming mechanism, mechanism for intermittently actuating the feeding means, and means independent of the actuating mechanism for modifying the feeding action.

73. In a forming machine, forming mechanism, means for feeding the work along the forming mechanism, means for intermittently actuating the feeding means, and a centering device co-operating with the feeding means.

74. In a forming machine, forming mechanism, means for feeding the work along the forming mechanism, means for intermittently actuating the feeding means, a centering device co-operating with the feeding means, and means arranged to vary the relation of the centering device to the feeding means.

75. In a forming machine, a series of forming devices, means for feeding the work in steps determined by the spacing of the forming devices, and a centering device co-operating with the feeding means and having engaging elements spaced similarly to the forming devices.

76. In a forming machine, forming mechanism, a rotatable roll for feeding the work in steps along the forming mechanism, actuating mechanism for said roll, a disk rotatable with the roll and having depressions corresponding in spacing to the feed stops, and a detent co-operating with the depressions.

77. In a forming machine, forming mechanism, a rotatable roll for feeding the work in steps along the forming mechanism, a disk rotatable with the feeding roll and having depressions corresponding in spacing to the feed steps, a detent co-operating with the depressions, and means arranged to adjust the detent circumferentially of the disk.

78. In a forming machine, forming mechanism, means for feeding work to the forming mechanism in excess of the length necessary, means for retaining said excess from movement toward the forming mechanism, said feeding mechanism being arranged to permit a movement of the excess toward it, and means arranged to vary the time rela-

tion between the action of the feeding means and the forming means.

79. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps exceeding said intervals in length and during intermediate periods freeing the work, means for limiting the movement of the work while thus freed to a direction away from the forming mechanism, and means arranged to synchronize the action of the feeding means with that of the movement-limiting means.

80. In a forming machine, forming mechanism arranged to operate upon the work at predetermined intervals, means for feeding the work in steps exceeding said intervals in length and during intermediate periods freeing the work, means for limiting the movement of the work while thus freed away from the forming mechanism, and vernier means arranged to synchronize the action of the feeding means with that of the movement-limiting means.

81. In a forming machine, movable forming mechanism, a plurality of feeding mechanisms acting simultaneously upon a single work-piece to advance it to the forming mechanism, and means arranged to vary the time relation between the action of the forming and feeding mechanisms.

82. In a forming machine, movable forming mechanism, a plurality of feeding mechanisms for the forming mechanism, and means arranged to simultaneously vary the action of the feeding mechanisms with reference to the forming mechanism.

83. In a forming machine, movable forming mechanism, a plurality of feeding mechanisms for the forming mechanism, means arranged to simultaneously vary the action of the feeding mechanisms with reference to the forming mechanism, and means arranged to independently vary the action of each of the feeding mechanisms.

84. In a forming machine, movable forming mechanism, a plurality of feeding mechanisms for the forming mechanism, means arranged to simultaneously vary the action of the feeding mechanisms with reference to the forming mechanism, and vernier means arranged to independently vary the action of each of the feeding mechanisms.

85. In a forming machine, mechanism for forming the work, feeding means engaging the formed portions of the work, and means arranged to determine the correct registration of the feeding means with the formed portions.

86. In a forming machine, mechanism for perforating the work, feeding means having projections to enter the perforations, and means arranged to adjust the normal engagement of the feeding projections with the perforations.

87. In a forming machine, mechanism for perforating the work, a feeding roll having projections to enter the perforations, and means arranged to adjust the normal angular relation of the roll to the work.

88. In a forming machine, mechanism for perforating the work, a feeding roll having projections to enter the perforations, and vernier means arranged to vary the angular relation of the roll to the work.

89. In a forming machine, mechanism for forming the work, a pressure-member co-operating with the forming mechanism, a spring acting upon the pressure-member, and means for maintaining the spring normally under stress independently of its action upon the pressure-member.

90. In a forming machine, mechanism for forming the work, a pressure-member co-operating with the forming mechanism, a spring, a holder for the spring, means associated with the holder arranged to compress the spring, and means for connecting the spring and pressure-member.

91. In a forming machine, mechanism for forming the work, a pressure-member co-operating with the forming mechanism, a spring acting upon the pressure-member, means for maintaining the spring normally under stress independently of its action upon the pressure-member, and means arranged to vary the normal stress.

92. In a forming machine, mechanism for forming the work, a pressure-member co-operating with the forming mechanism, a spring, a holder for the spring, and a member movable in the holder in contact with the spring and extending outside said holder, the movable member and holder co-operating to transmit the stress of the spring to the pressure-member.

93. In a forming machine, mechanism for forming the work, a pressure-member co-operating with the forming mechanism, a spring, a holder for the spring, a member movable in the holder in contact with the spring and extending outside said holder, the movable member and holder co-operating to transmit the stress of the spring to the pressure member, and means adjustable

upon the holder for varying the stress of the spring.

94. In combination, forming mechanism for operating upon a strip, and a winding mechanism for the formed strip comprising a support, a core surrounding the support and upon which the strip is wound, a friction member carried by the support and contacting with the core, and means associated with the support and arranged to control the engagement of the friction member with the core.

95. In combination, forming mechanism for operating upon a plurality of strips, and a winding mechanism for the formed strips comprising a support, cores surrounding the support and upon which the strips are to be respectively wound, a friction member for each core carried by the support, and means associated with the support for simultaneously controlling the engagement of the friction members with the cores.

96. In combination, forming mechanism for operating upon a plurality of strips, and a winding mechanism for the formed strips comprising a spindle, a sleeve surrounding the spindle, cores for the strips surrounding the sleeve, and friction members carried by the spindle and extending through the sleeve into engagement with the cores, the sleeve being provided with means for retracting the friction members from engagement with the cores.

97. In combination, forming mechanism for operating upon a plurality of strips, and a winding mechanism for the formed strips comprising a spindle, a sleeve surrounding the spindle and having a series of openings with an inclined groove extending from each opening, cores for the strip surrounding the sleeve over the openings, and friction members carried by the spindle and extending through the sleeve openings into engagement with the cores, the sleeve and spindle being relatively movable to bring the inclined surfaces of the sleeve into co-operation with the friction members.

In testimony whereof I have signed my name to this specification.

ALBERT LATHAM.