B. ADRIANCE & A. CALLESON.

MACHINE FOR FORMING SHEET METAL ARTICLES.

APPLICATION FILED OCT. 2, 1908.

1,037,844. **Patented Sept. 10, 1912.**

8 SHEETS—SHEET 1.

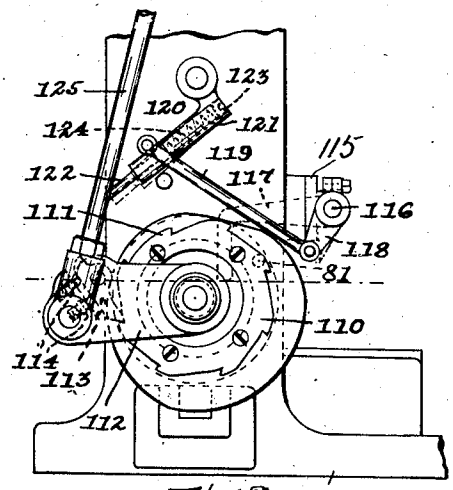

Fig. 2.

Fig. 1.

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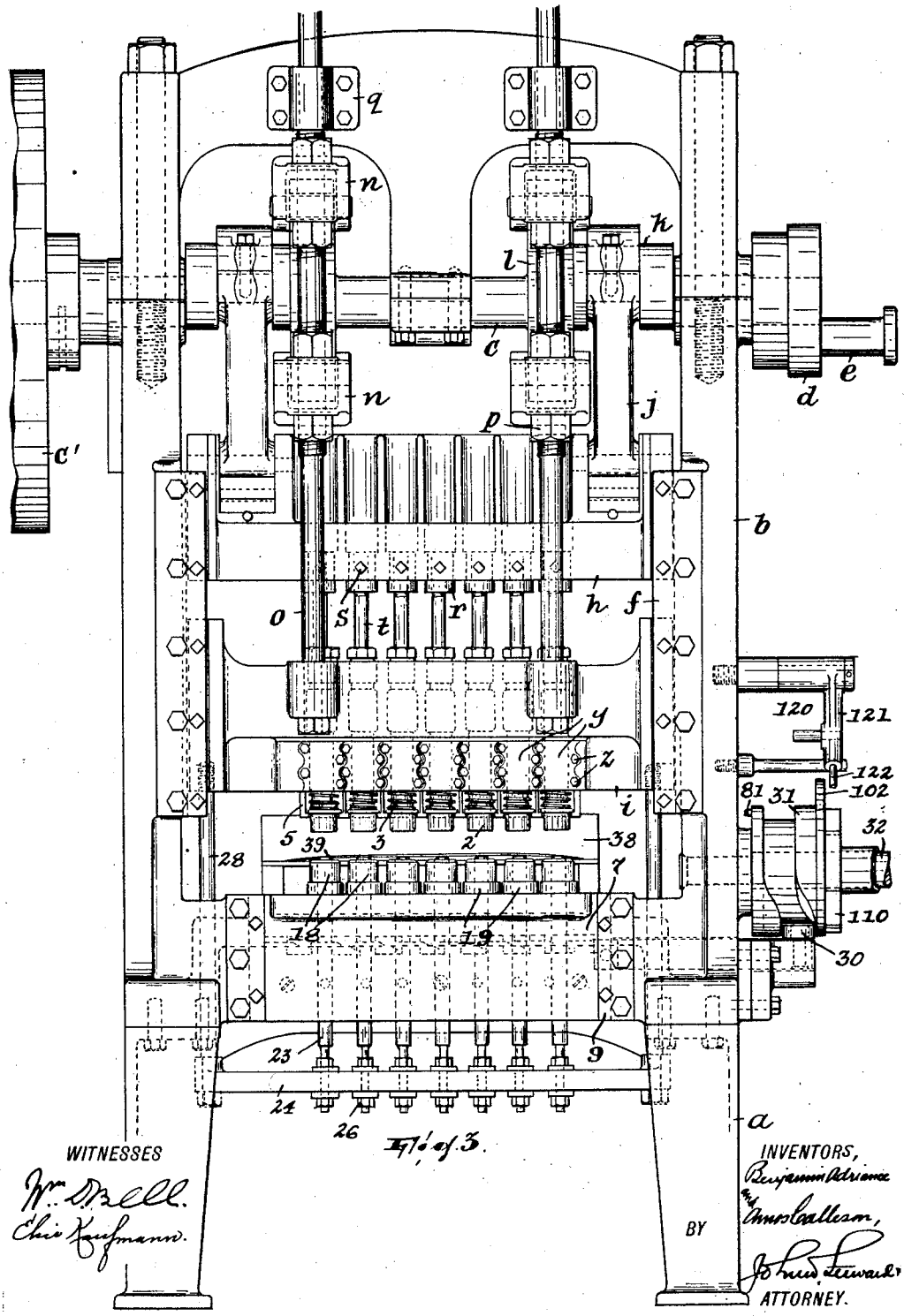

Fig. 1 of 3.

WITNESSES

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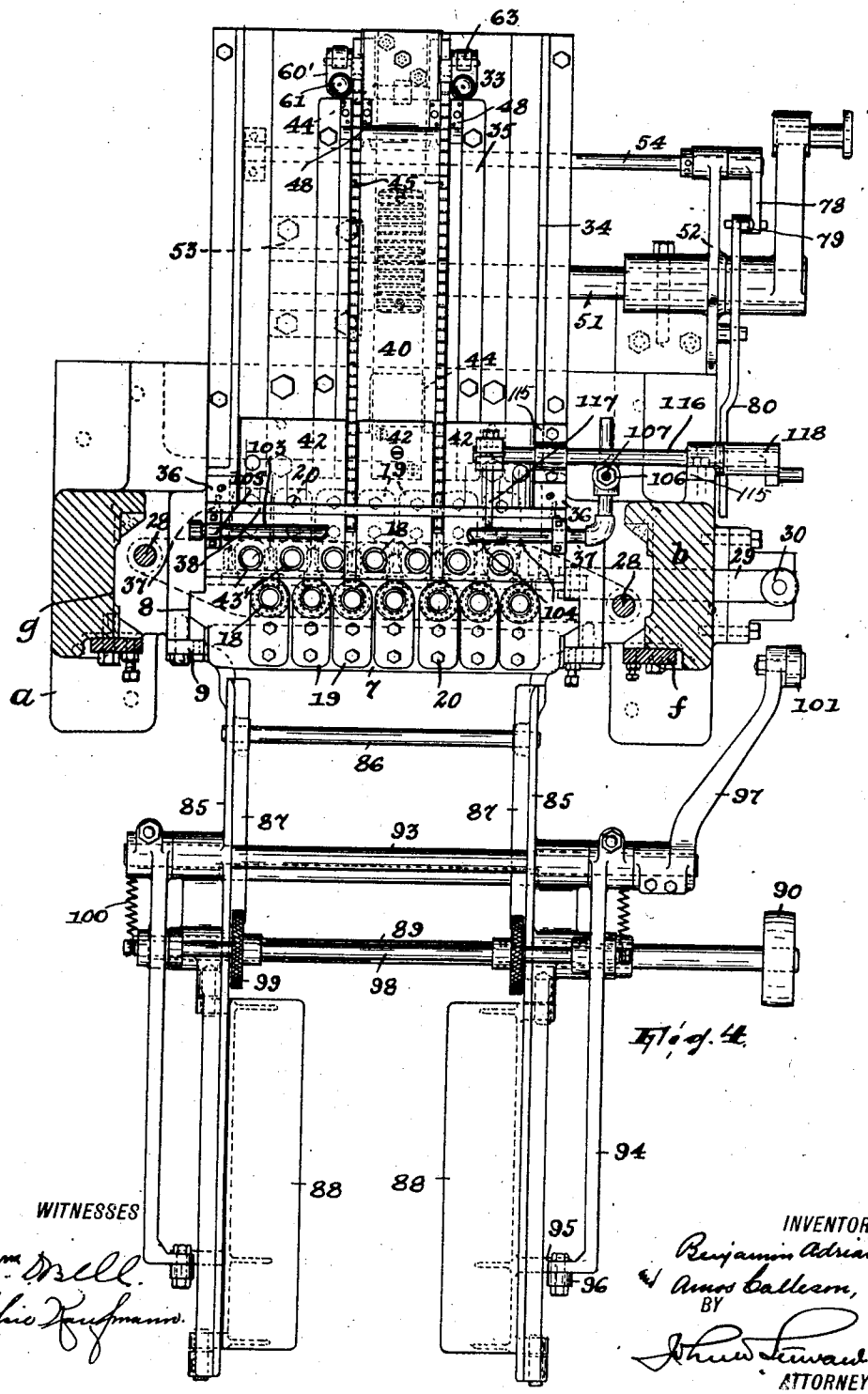

Fig. 4.

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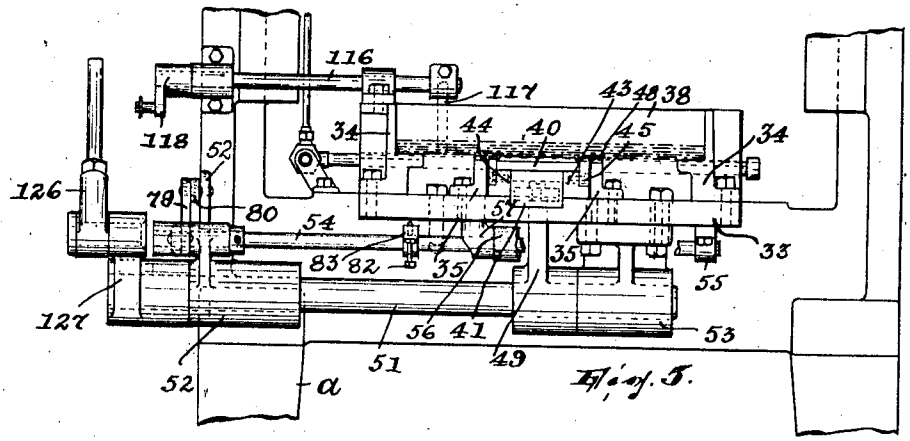

Fig. 5.

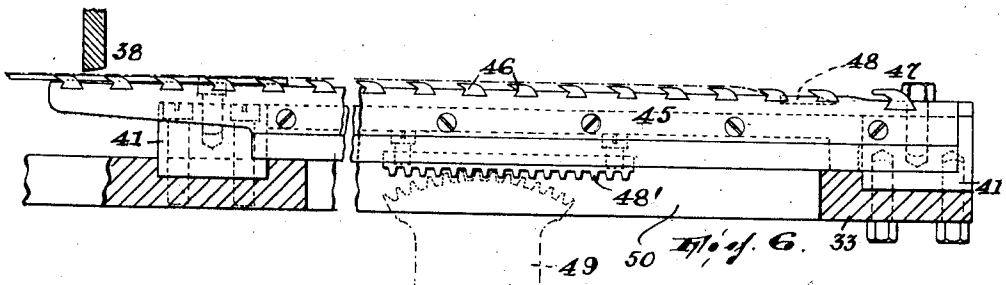

Fig. 6.

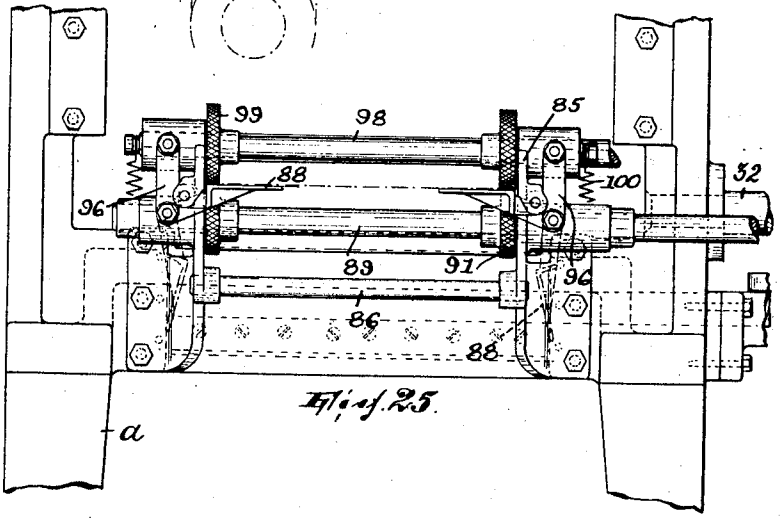

Fig. 25.

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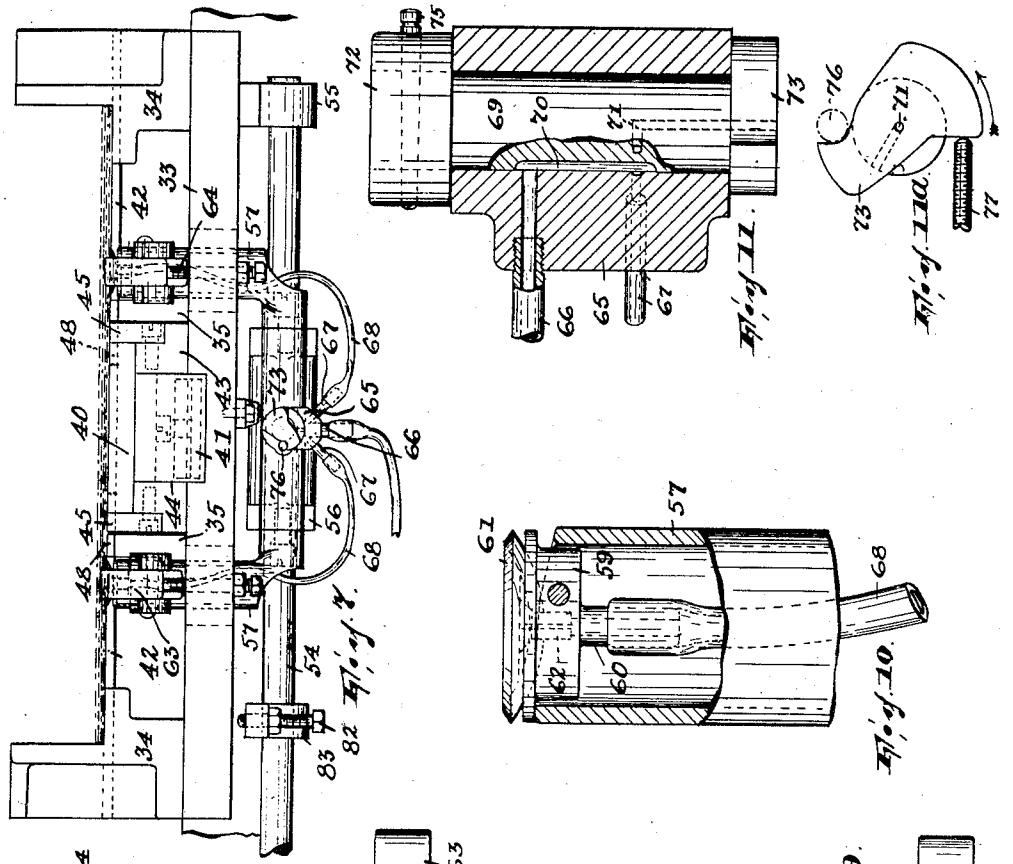

Fig. 7.

Fig. 11.

Fig. 12.

Fig. 10.

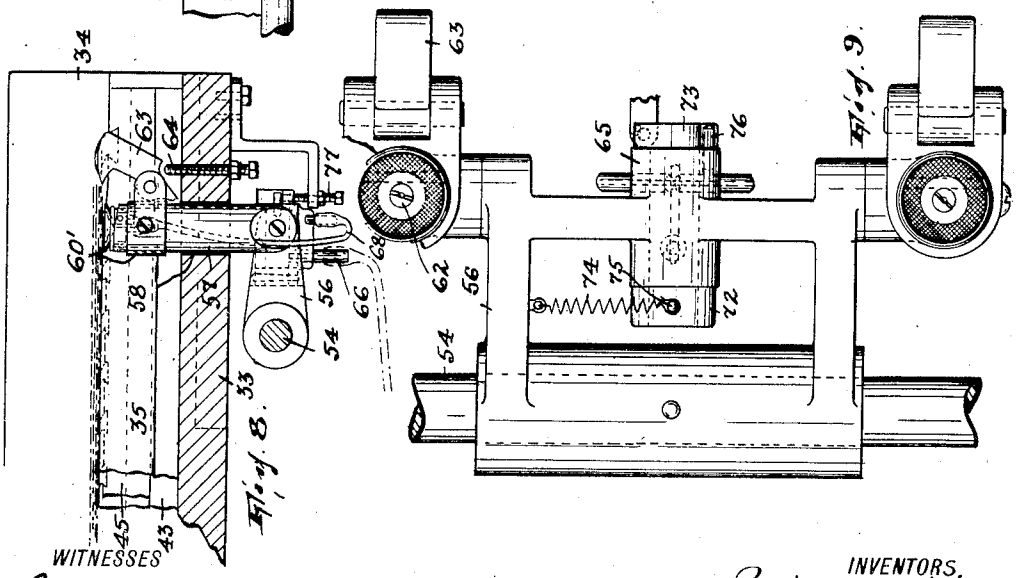

Fig. 8.

Fig. 9.

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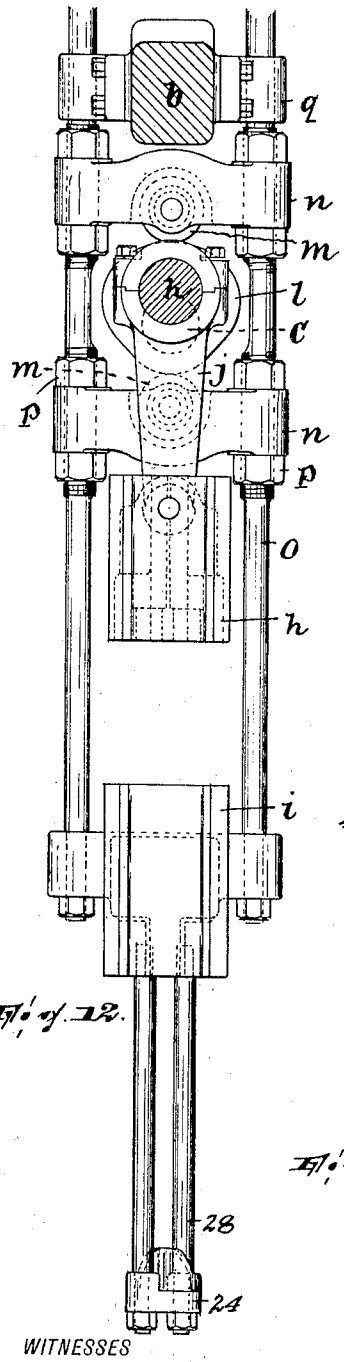

Fig. 12.

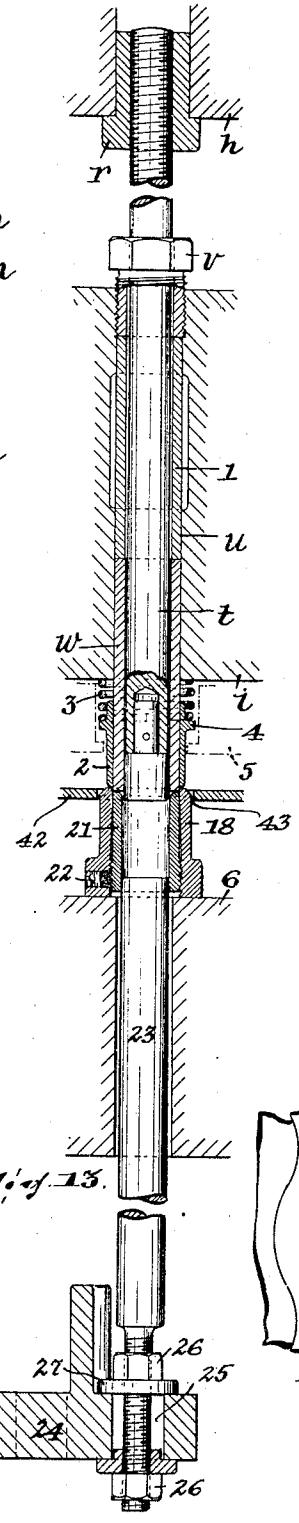

Fig. 13.

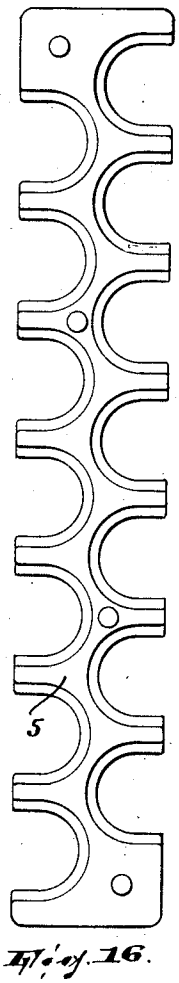

Fig. 16.

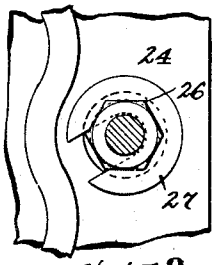

Fig. 19.

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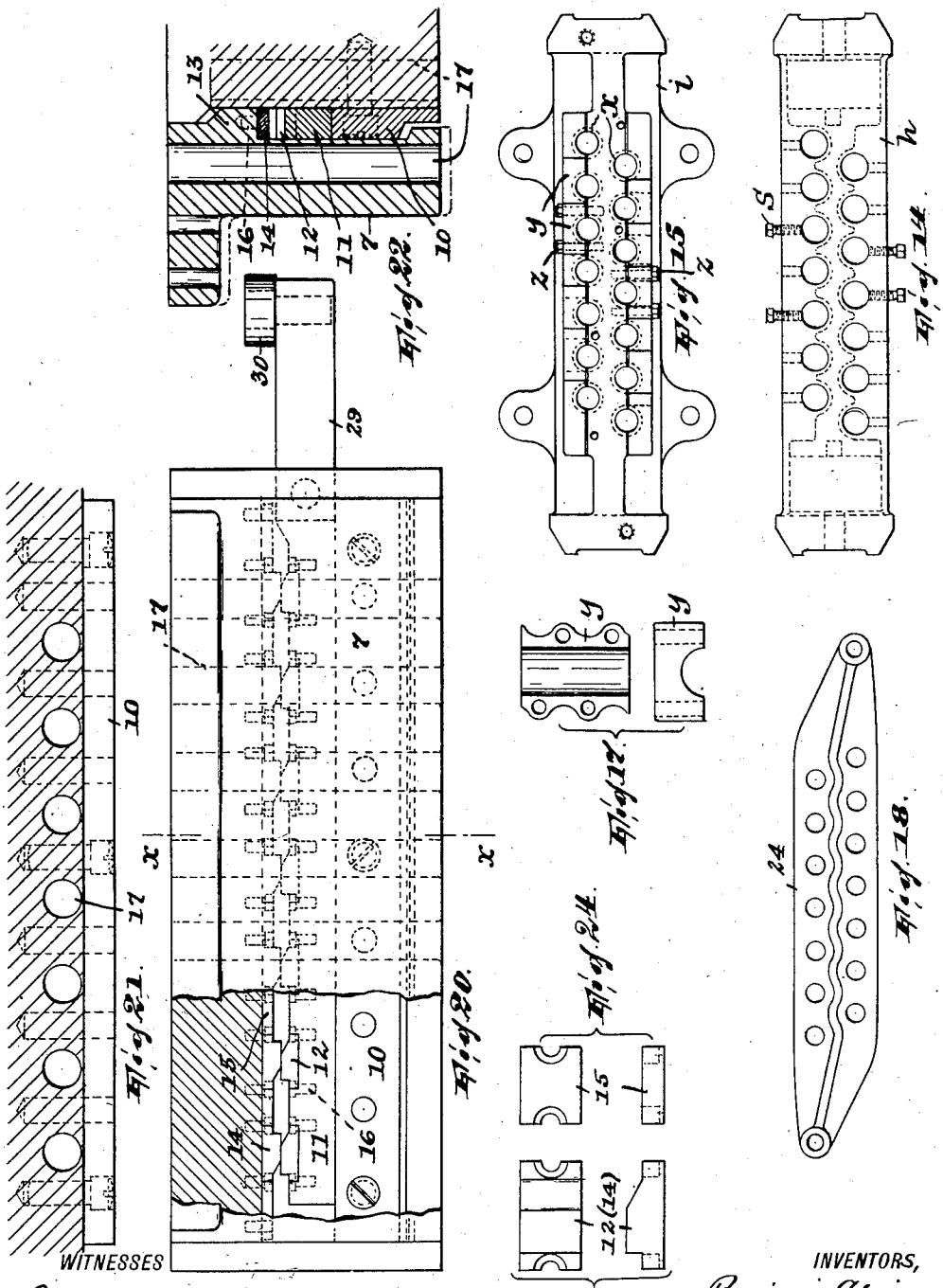
8 SHEETS—SHEET 7.



WITNESSES

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8 SHEETS—SHEET 8.

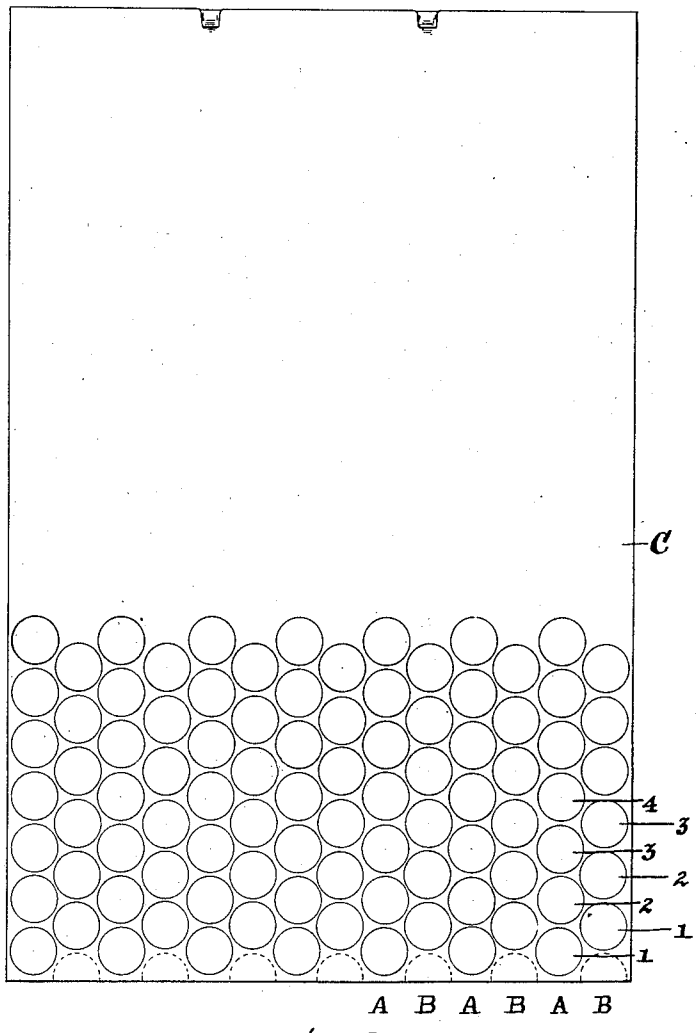

Fig. 26.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR FORMING SHEET-METAL ARTICLES.

1,037,844. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed October 2, 1908. Serial No. 455,842.

To all whom it may concern:

Be it known that we, BENJAMIN ADRIANCE and AMOS CALLESON, citizens of the United States, residing in Brooklyn, Brooklyn borough, New York, have invented a certain new and useful Improvement in Machines for Forming Sheet-Metal Articles; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to the art of forming articles of sheet metal of the nature of bottle caps and the like and it consists in certain improvements whereby a large quantity of product may be turned out in a comparatively short period of time and with the minimum of waste.

According to this invention, a pile of plates is arranged in the machine and one-by-one, precisely, they are successively advanced from the pile or stack to the forming dies; each sheet is then operated upon by the dies in such manner that the openings left in the sheet are but the fraction of an inch apart, so that no waste in appreciable degree results, this effect being accomplished by arranging the dies in a plurality of rows in which those in one row alternate with those in the other, so that any one die forms an opening in the sheet which is centrally disposed with respect to four other openings formed by the two dies nearest thereto in the other row in two succeeding cycles of the operation. As this arrangement of the dies would otherwise lead to the punching or cutting out of half-formed or mutilated articles at the forward end of the sheet or plate, provision is made herein for one row of dies to be inoperative for forming until the edge of the sheet has advanced sufficiently to clear the same, it being obvious that this arrangement not only saves undue wear on the dies but makes it unnecessary to sort the mutilated from the properly or full-formed product. As soon as each forming operation has been completed, means operates to remove the articles from the range of the dies into a suitable receptacle, so that the dies are clear for the next forming operation. When the full length of each sheet has been subjected to the action of the dies it is passed to a suitable supporting means which at the proper time allows it to fall in back of the machine, a compact pile of the perforated sheets, in convenient form to be removed from time to time by the operator, being ultimately formed in this manner. Means is also provided for so that no sheet will be operated upon to begin its advance into the control of the dies either sooner or later than it should in order to follow its predecessor in the sequence required for avoiding waste of material and idle strokes and for securing the proper coöperation of all the mechanisms involved.

In the accompanying drawings, Figure 1 is a side view of the machine; Fig. 2 is an enlarged side view of a detail of Fig. 1; Fig. 3 is a front view, certain parts being removed; Fig. 4 is a horizontal sectional view taken in a plane just above the lower forming members, certain parts being removed and others broken away; Fig. 5 is a fragmentary front view of the part of the machine wherein the sheets are initially stacked, certain parts being broken away and others removed; Fig. 6 is a longitudinal vertical sectional view of what is seen in Fig. 5 taken in a plane corresponding with that of the left face of the left-hand sheet-advancing rack in said figure; Fig. 7 is another fragmentary front view, on a larger scale than Fig. 5, certain parts being removed; Fig. 8 is a longitudinal vertical sectional view of what is shown in Fig. 7 taken in a plane corresponding with that of the center of one of the separating mechanisms, but showing said mechanism in side elevation; Fig. 9 is a plan view of said mechanism; Figs. 10, 11 and 11ª illustrate details of the suction portion thereof; Fig. 12 shows the upper forming members carrying means in side elevation and the upper part of the frame of the machine and its main shaft in vertical section; Fig. 13 is an enlarged view, partly in section and partly in side elevation, of a forming mechanism; Figs. 14 and 15 are underneath views of the two plungers shown in Fig. 12; Fig. 16 is a top plan view of a stripper-holding plate attached to the plunger of Fig. 15; Fig. 17 shows in de-

tail one of the parts *y* of Fig. 15; Fig. 18 shows the ejector carrier and Fig. 19 is a detail thereof; Fig. 20 is a front view of the vertically movable bed-section for the outer row of lower die-members, a portion thereof being broken away to show the means for effecting the movements thereof; Fig. 21 is a horizontal sectional view of so much of the main frame as appears in Fig. 22 and is taken in a horizontal plane just above a certain ledge-piece; Fig. 22 is a vertical sectional view of what is shown in Fig. 20 on line *x*—*x*; Figs. 23 and 24 show in detail certain parts 12 (14) and 15, respectively, appearing in Figs. 20 and 21; Fig. 25 is a rear view of parts of the machine, showing the means for delivering the punched sheets; and, Fig. 26 illustrates diagrammatically how the sheets progress with reference to the forming mechanism.

The frame of the machine comprises the base *a* and the arched superstructure *b* in which latter is journaled the main shaft *c* carrying a driving pulley *c'* at one end and another pulley *d* at the other end, a wrist-pin *e* being attached to the latter; the upright portions of the superstructure form, with strips *f* attached thereto, guide-grooves *g* for plungers *h* and *i* (Figs. 14 and 15, respectively). The plunger *h* is connected by means of pitmen *j* with crank *k* on shaft *c*, so as to reciprocate it vertically, and plunger *i* is also adapted to be reciprocated from shaft *c* by means of cams *l* thereon against which bear from opposite sides thereof anti-friction rolls *m* carried by cross-heads *n* (arranged one above and the other below each cam) from which plunger *i* is suspended by the rods *o* secured in the cross-heads by nuts *p* and reciprocating in guides *q* on the superstructure. The cranks *j* and the cams *l* are so arranged on the shaft that both plungers will be down at the same moment, but the shape of the cams is such that plunger *i* reaches its lower limit of movement earlier and leaves it later than plunger *h*.

Internally threaded thimbles *r* are secured in plunger *h* by means of set-screws *s* in two rows, those in one row being opposite spaces between those in the other and all being equi-distantly spaced; into each thimble is screwed the upper end of a male drawing die *t*. In alinement with the thimbles *r* in plunger *h* vertical holes *u* are formed in plunger *i* and into these at the top are screwed the nuts *v*; these holes receive at the bottom the cylindrical male cutting or punching dies *w* which in their lower portions rest in recesses *x* forming continuations of the holes and are secured in place by recessed blocks *y* which are clamped against them by the screws *z*, the dies *w* being distanced from the nuts *v* by the spacing sleeves 1. The nuts, dies *w* and sleeves are penetrated by the dies *t*. An annular stripper 2 receives the lower end of each die *w*, the same being normally pressed downwardly by a spiral spring 3, interposed between it and the plunger *i*, with its flange 4 bearing against a retaining plate 5 secured to the plunger and recessed to receive the several strippers.

The bed 6 of the base of the machine has a vertically movable rear section 7 guided in vertical grooves 8 formed in the base by the strips 9 attached thereto; the plane of division between the movable section 7 and the fixed portion of the bed is the plane midway between the two rows of dies in plungers *h* and *i*. To the vertical face of the bed 6 is secured a horizontal ledge-piece 10 on which slides laterally a wedge-bar 11 having let into its top side the wedge-blocks 12; an overhang 13 is formed on the movable section 7 of the bed and to this are attached the wedge-blocks 14. The inclines on the blocks 12 are on the top right side and on the blocks 14 on the under left side of each, so that when the wedge-bar is moved to the right the section 7 will be raised to its normal position (*i. e.*, with its top face flush with that of the fixed portion of the bed 6) and when the wedge-bar is moved to the left, the section 7 will fall, bringing its top face below that of the fixed portion of the bed. The wedge-blocks 14 alternate with spacing blocks 15, each two adjoining blocks being held in place by a screw 16. Two rows of vertical holes 17 are formed in the bed so as to coincide with the dies carried by the plungers, one row being in the fixed portion, and the other in the movable portion, of the bed. A female cylindrical cutting or punching die 18 is secured to the bed concentrically with respect to each hole 17, each die having a wing 19 to receive securing screws 20 and the wings of the dies on the fixed portion of the bed extending forwardly, and those of the dies on the movable portion of the bed extending rearwardly. Tapped into each die 18 is a female drawing die 21, a screw 22 affording means for holding it against rotation. Dies 18 correspond with dies *w* and coact therewith; dies 21 correspond to and coact with dies *t*.

23 are ejectors penetrating the holes 17 and adapted to have their upper ends raised above the tops of the dies 21 to clear the formed articles therefrom; to this end their lower threaded ends penetrate a carrier 24, the holes 25 in which are large enough to allow the ejectors to be removed downwardly therethrough for the purpose of repairs, etc., and said ejectors being held in the carrier by clamping nuts 26 the upper ones of which will also pass through the holes 25 and bear against washers 27 split

to allow their lateral removal from the ejectors. The carrier is suspended from the plunger *i* by means of the rods 28 guided in the frame (Fig. 3).

Briefly stated, the operation of punching out and forming an article, such as a bottle cap, is effected as follows: The plunger *i* descends first and, considering any one punching and drawing unit, it first causes the sheet interposed between the upper and lower dies to be gripped between the stripper 2 and die 18 and then causes die *w* to coact with die 18 to cut a disk therefrom, which disk then stands inclosed in die 18 interposed between the ends of dies *w* and 21; meanwhile, the corresponding ejector has descended with plunger *i*. Plunger *h* now descends and causes die *t* to coact with die 21 in drawing the disk into the cap form, the edges of the disk being in the meantime securely held between the ends of dies *w* and 21; thereupon plunger *h* rises and somewhat later is followed by plunger *i*, its die *w* having the perforated sheet cleared therefrom by the stripper 2 and the finished cap being left in die 21 until the ejector rises sufficiently to force the cap out of the die.

The wedge-bar 11 is actuated through a link 29, pivoted to it and carrying a roller 30, from a cam 31 in whose peripheral groove the roller travels, said cam being journaled on a stub-shaft 32 and driven in such manner, as hereinafter explained, that, through the link, it causes the dropping of the movable section 7 of the bed once for every sheet passed through the machine, *i. e.*, while the row of dies the nearer to the sheet supply is performing its second operation with respect to that sheet.

A table 33 projects from the front of the machine, being bolted upon the bed 6 forward of the dies; on this table are arranged the parallel rabbeted guides 34 and between them the parallel supports 35, the guides being adapted to support and direct the sheets, whose side edges engage therewith, and the supports serving to keep the sheets from sagging at the middle. A filler block 36 is secured to the bed back of each guide 34 and to these filler blocks is secured by screws 37 a barrier plate 38 which serves to keep back the main body of the sheets against advancement while it allows the lowermost sheet in the pile to be advanced, having its lower edge arched, as seen at 39 in Fig. 3; to further prevent the sheets from sagging at the middle, a horizontal plate 40 is secured on blocks 41, one at the front and the other at the back of table 33 and, countersunk into plate 40, guides 34, and supports 35, so that their top surfaces lie flush with the sheet-supporting surfaces of these parts are three plates 42 whose top surfaces form a curved face under the barrier plate which lies close to and parallel with its under arched edge. The plates 42 extend back to a line rear of the forward dies 18 and have openings 43′ to receive them, the tops of the dies 18 being but slightly higher than the top surfaces of the plates (see Fig. 13) whose function in this is to prevent the leading edges of the sheets from catching on the dies and clogging the machine. Fig. 6 shows the under edge of the barrier plate beveled.

The operation so far as the barrier plate and the part of the supporting means for the sheets which adjoins the same are concerned is the same as in the machine disclosed in our application Serial Number 384965 and may be briefly stated as follows: The purpose is to prevent more than one sheet advancing at a time. As will be later explained, the sheets are picked off one at a time from the bottom of the stack but occasionally more than one will tend to partake of the advancing action, because of adhesion in some form or other. When the advancing means, which engages positively only the lowermost of two or more sheets which it will be assumed are partaking of the advancing action, moves them against the barrier, even though their combined thickness be less than the depth of the curved slit formed between the arched edge of the carrier plate and the curved upper face of plates 42, only the one positively engaged by the advancing means will pass through the slit because a resistance is set up, by the sheets being curved in the effort to pass the barrier, which mere adhesion between two sheets cannot overcome.

The advancing of the sheets is effected step-by-step as follows: A plate 43, forked at 44 at each end to receive each block 41, is arranged to reciprocate under plate 40; attached to the sides of this plate are racks 45 having equally spaced teeth 46 which project up through the slots which are left between plate 40 and supports 35, the tops of the teeth being about flush with the tops of the plate 40 and the supports. When the tail end of the lowermost sheet has been drawn downwardly away from the next sheet (by means to be explained) it lies in the path of a bending tooth 47 at the rear end of each rack; this tooth hooks over it and, as it advances it, holds the part thereof directly caught thereby for movement only in its own plane, while at both sides of said tooth the metal at the rear edge of the sheet rides up inclined surfaces of blocks 48 set in the supports 35. The effect is the same as that attained by a similar mechanism in our application *supra*, a bend being formed at two points in the tail of the sheet affording a convenient hold for the teeth 46 of the racks which, as they reciprocate, advance the sheet step by step, equal distances. The

plate carrying the racks has a rack 48′ on the under side thereof with which engages a toothed segment 49 projecting through a slot 50 in table 33 and carried by a rock-shaft 51 journaled in brackets 52 and 53 bolted to frame-base *a* and table 33, respectively.

The drawing down of the tail end of each sheet into the control of the racks is effected as follows: A rock-shaft 54 is journaled in an arm of bracket 52 and in a bracket 55 secured to the under side of table 33 and this carries a crank 56 in which are pivoted the cylindrical shells 57 kept upright in the movements of the crank by table 33 the holes 58 in which they penetrate; the top of each shell is beveled and on a horizontal pivot therein is arranged a cup 59 having a tubular stem 60 and containing a rubber suction disk 61 held in the cup by a perforated screw 62. The bevel on the shell and the pivoting of its cup allow the cup, when suction is effected thereby and it is engaged with the sheet, to adjust itself to the curvature which it produces therein when it draws its rear end downwardly. In a collar 60′ secured to each shell is pivoted a hook 63 whose weight normally holds it retracted but which, when the shell descends with crank 56, engages an adjustable stop 64 in table 33 and thus has its hooked end thrust toward the edge of disk 61, so that it will positively separate the sheet which the suction cup has parted from the pile and hold it within the range of action of the teeth 47 on the racks 45. As the suction effected would, if continued, produce an undue drag on the sheet, it is automatically controlled as follows: The crank 56 comprises a valve-casing 65 having an exhaust nipple 66 and two other nipples 67 which are connected with the stems 60 by flexible tubing 68; in this casing rocks a valve 69 having a port 70 which in one position of the valve will connect the nipples 67 (which merge together for this purpose) with the nipple 66 and also having a port 71 which in another position of the valve will admit atmospheric pressure to nipples 67 and hence to the cups. The valve carries at one end a collar 72 and at the other a crank 73, the valve being normally held with its port 70 connecting nipple 66 with nipples 67 by a spring 74 connecting a pin 75 on the collar with crank 56, crank 73 at this time bearing against a stud 76 on the valve casing; normally, therefore, the suction cups are exhausted, but when crank 56 descends sufficiently so that the hooks 63 have a hold of the sheet, crank 73 engages an adjustable stop 77, turning the valve so that the cups are opened to the atmosphere and the exhausting medium cut off. Shaft 54 carries a crank 78 connected by a link 79 with a lever 80 fulcrumed in bracket 52 and adapted to be engaged by a stud 81 on the cam 31; normally the suction devices stand elevated, being limited by an adjustable stop 82 in an arm 83 carried by shaft 54 and being held in that position by a spring 84 connecting lever 80 with bracket 52.

It will be observed, as already stated and as shown in the drawings, that the adhesion-portion of each suction device is pivoted therein. It will also be observed that the axis of movement of said adhesion-portion is substantially parallel with the bend formed thereby in the sheet when it draws or bends the end thereof downwardly and that forward of said axis (*i. e.*, between the same and the parting edge of the sheet) said adhesion-portion of the suction device is free to move downwardly in the device as the latter descends, so that said adhesion position may adjust itself to substantially the same inclination as that which it may cause the portion of the sheet engaged by it in the drawing-down operation to assume. When, therefore, the suction device descends and bends down the edge-portion of the lowermost sheet the effect is to peel the latter from its neighbor; the accomplishment of this, involving, as it does, a separation which proceeds inwardly from the edges of the two sheets instead of a separation affecting at once more or less of the adjoining surfaces of the sheets, is important, because any resistance opposed to the separation (such as the presence of an adhesive between the sheets, not to say atmospheric pressure) is broken down piece-meal fashion, instead of all at once.

Referring, now, to the mechanism for delivering the punched sheets in a pile at the back of the machine, 85 denotes two parallel arms projecting rearwardly from the base *a* and bolted thereto (their bolted portions constituting the strips 9, if desired, and as shown in Fig. 4, although in Fig. 3 said arms are omitted) and braced by the rod 86; these arms have the sheet-supporting ledges 87 and in their rear portions are fulcrumed the sheet-supporting wings 88 which, while spaced slightly from the back ends of the ledges, normally stand horizontal in position to form continuations of said ledges. In the arms is journaled a shaft 89 carrying a belt pulley 90 and the peripherally milled rolls 91 whose tops project to about the plane of the top surfaces of the ledges; a belt 92 extends around pulleys 90 and *d*. In the arms is also fulcrumed a lever structure comprising a shaft 93, rearwardly extending arms 94, having their extremities connected with cranks 95 on the wings by links 96, and a forwardly extending arm 97; in the arms 94 is journaled a shaft 98 carrying milled rolls 99 adapted to bear down upon rolls 91, the lever structure being normally held with said rolls in con-

tact with each other by springs 100 connecting the ends of shaft 98 with the arms 85. Arm 97 carries a roller 101 adapted to be held by these springs in contact with a cam 102 formed integral with cam 31.

When a sheet has been passed through the machine, the last push of the racks 45 imparted thereto causes its rear end to enter between the rolls 91 and 99, which are being rotated from the shaft *c*, the rolls then thrusting the sheet back over the ledges 87 onto the wings 88; cam 102 then acts to oscillate the lever structure, with the result that the wings are depressed and allow the sheet to fall on the floor or other support back of the machine. In this way a compact pile of the mutilated sheets is formed, convenient for removal.

The caps are made to clear the dies as fast as formed as follows: A pipe 103 having a longitudinal row of perforations 104 at the back is secured in brackets 105 on the two outer plates 42 just forward of the dies; this pipe is connected with a suitable air-pressure source and has a normally closed valve 106 whose stem 107 extends up through a projection 108 on plunger *h* and has a head 109 whereby, when said plunger rises, the stem will be raised and the valve opened to allow the air to escape. The escaping air, it will be understood, blows the caps away from the dies, they ultimately falling through the openings formed in the sheet into a receptacle placed for them between the stack of mutilated sheets and the machine.

It will be understood that, whatever length the sheets may have, no sheet should begin its advance through the machine, or at least come within the influence of the dies, until its predecessor has fully cleared the dies. To this end a controlling mechanism is employed which is under the influence of the sheets and in the adaptation shown is actuated from a sheet about to be delivered.

110 is a ratchet formed as one with the cams 31 and 102; this ratchet has one tooth 111 depressed within the circle of its other teeth. A crank 112 oscillates freely on shaft 32 and it carries a pivoted pawl 113 engageable with the ratchet and normally held by two spring-pressed pins 114 with its point within the circle of the tips of the main teeth of the ratchet but outside the circle in which stands the tip of tooth 111. When the crank is oscillated, it will advance the ratchet step-by-step until tooth 111 approaches its pawl, whereupon the pawl being then clear thereof, the advance of the ratchet will cease. In brackets 115 is journaled a rock-shaft 116 carrying a finger 117 which rests upon the sheet being operated upon; it also carries a crank 118 connected by a link 119 with a yielding stop 120 pivoted in the superstructure and comprising the socket 121, a pin 122, an adjusting screw 123 and a spring 124 interposed between the pin and screw. The sheet keeps the finger elevated to an extent corresponding with its thickness, and through parts 116, 118 and 119 the yielding stop is likewise elevated above the arc of movement of the heel of pawl 113; when, however, the sheet clears the finger and the yielding stop is thus allowed to drop under the weight of the parts, the stop stands in the path of the heel of the pawl and tends to push its toe inwardly relatively to the ratchet. The ratchet is kept oscillating continuously from wrist-pin *e* by a pitman 125 connecting its crank with the wrist-pin.

126 is another pitman connecting wrist-pin *e* with a crank 127 on shaft 51.

Thus, describing the operation of the machine in general and of the controlling mechanism in particular: A pile of sheets is placed on table 33 between guides 34 and the shaft *c* started rotating. Assuming that pawl 113 happens to be at the start opposite the low tooth of ratchet 110 (which it usually will not be, however), when the pawl is raised with crank 112 from shaft *c* it will engage the now-depressed yielding stop 120, its point being thrust into engagement with said low tooth; in its advance movement the pawl will turn the ratchet one step—that is, enough so that, until the low tooth again comes around, the pawl and ratchet will coöperate in the usual manner. Cams 31 and 102 rotate with the ratchet, so that ultimately stud 81 causes the lever mechanism controlling the suction devices to be vibrated and the sheet at the bottom of the pile to be drawn down at its back edge into the control of the racks, which are meanwhile being continually reciprocated from shaft *c*; once the sheet has been drawn into the control of the racks (in the manner already fully described) the racks advance it in a step-by-step movement, the teeth 46 engaging the sheet in the bends formed in it by the teeth 47 of the racks. After each advance of the sheet, the dies operate to form the caps, which, on the up-stroke of the plunger *h*, are blown off the sheet by the blast of air from pipe 103. When the full complement of caps has been formed from the sheet, its last advance brings it within the control of the coacting rotating milled rolls 91, 99, which draw it back onto the wings 88; cam 102 now operates the mechanism controlling the wings so that the sheet is allowed to fall downwardly. Meanwhile the ratchet has been rotating, under the actuation of pawl 113, until its low tooth approaches the pawl, when (in the case where the sheet is of such length that the ratchet completes its cycle of movement before the sheet has cleared

finger 117) it stops, the pawl oscillating idly; when the sheet now clears the finger the pawl reëngages the ratchet and puts it again in rotation, with the result that the now lowest sheet in the pile begins its advance and passes through the same operations as its predecessor.

At the beginning of the operation of the dies on each sheet the rearward row of dies is rendered inoperative by cam 31 causing bed-section 7 to be depressed. The necessity for this grows out of the fact that, in order to utilize as much of the sheet as possible, the points in the sheet engaged by one row of dies are as close into the spaces between the points in the sheet engaged by the other row of dies as the nature of the material of the sheet will stand and the proper formation of the articles permit; and, this being so, if the rear row of dies remained active during (in the present instance) the second operation of the front row of dies on the sheet, half cuts would be formed at the front edge of the sheet, involving the difficulties already stated. The diagram (Fig. 26) will illustrate this. The rows of holes extending lengthwise of the sheet C and marked A are formed by the front row of dies; the rows marked B are formed by the rear row of dies. The succeeding holes in each row are marked 1, 2, 3, etc. The first operation of the dies at the advance end of each sheet leaves the sheet with the holes A^1; these holes are formed by the front row of dies, the rear row on this stroke of the mechanism going out of action, by the depression of bed-section 7. On the next operation of the dies the holes A^2 are formed by the front dies; at this time, if the rear dies were not inactive, cuts would be formed in the front edge of the sheet C, as indicated by the dotted half-circles. On the third operation of the dies with respect to the sheet C, the holes A^3 are formed by the front row of dies, and, the rear row of dies having meanwhile come again into action by the raising of the bed-section 7, the holes B^1 are formed. On the fourth operation of the dies, the holes A^4 and B^2 are formed, and so on.

Referring to the parts 110 and 112, it is to be understood that any mechanism including an advancing member, such as 112, and an advanced member, such as 110, one of said members having a clutch surface (for instance, the toothed surface of member 110) extending in the direction of advance and the other a clutch device (for instance, the pawl 113) normally confined to a path of movement extending in said direction, said clutch surface including primary and secondary portions (*e. g.*, the high teeth and low tooth of the ratchet, respectively) respectively disposed within and beyond the operative reach of the clutch device, and said clutch device and secondary surface portion being movable one into engagement with the other upon their assuming coincidence with each other in the advancing operation, will fall within the scope of our invention.

Broad claims for the means for advancing the sheets step by step, for the means for drawing down the tail end of each sheet into the control of said advancing means, for the means for insuring against more than one sheet at a time being carried forward to the dies by the advancing means, and for the arrangement and construction of the forming mechanism will be found embodied in our application, *supra*, and in our application Serial No. 444,272.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:

1. The combination of the frame, means adapted to operate on the material, and mechanism for controlling said means including an advancing member and an advanced member one having a clutch-surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch-surface including primary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, and said clutch device and secondary surface portion being movable one into advance-transmitting engagement with the other upon their assuming coincidence in the advancing operation, substantially as described.

2. The combination of the frame, means adapted to operate on the material, and mechanism for actuating said means including an advancing member and an advanced member one having a clutch surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch-surface including primary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, and said clutch device and secondary surface portion being movable one into advance-transmitting engagement with the other upon their assuming coincidence in the advancing operation, substantially as described.

3. The combination of the frame, means adapted to operate on the material, and mechanism for controlling said means including an advancing member and an advanced member one having a clutch-surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch-surface including pri-

mary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, and means for establishing the clutch-device and secondary surface portion within advance-transmitting reach of each other upon their assuming coincidence in the advancing operation, substantially as described.

4. The combination of the frame, means adapted to operate on the material, and mechanism for actuating said means including an advancing member and an advanced member one having a clutch-surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch surface including primary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, and means for establishing the clutch-device and secondary surface portion within advance-transmitting reach of each other upon their assuming coincidence in the advancing operation, substantially as described.

5. The combination of the frame, means adapted to operate on the material, and mechanism for controlling said means including an advancing member and an advanced member one having a clutch-surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch surface including primary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, said clutch-device being movable into advance-transmitting engagement with said secondary surface portion and means for moving the clutch-device into advance-transmitting engagement with the secondary surface portion upon their assuming coincidence in the advancing operation, substantially as described.

6. The combination of the frame, means adapted to operate on the material, and mechanism for actuating said means including an advancing member and an advanced member one having a clutch-surface extending in the direction of advance and the other a clutch-device normally in advance-transmitting engagement with said surface, said clutch-surface including primary and secondary portions respectively disposed normally within and beyond the normal advance-transmitting reach of the clutch-device, said clutch-device being movable into advance-transmitting engagement with said secondary surface-portion and means for moving the clutch-device into advance-transmitting engagement with the secondary surface portion upon their assuming coincidence in the advancing operation, substantially as described.

7. The combination of the frame, means for operating upon the material, means for forwarding the pieces of material, successively, to the operating means, and means, controlled from the pieces of material which have been operated upon, for controlling the forwarding means, substantially as described.

8. The combination of the frame, mechanism for operating on the material to be treated, intermittently, a rotary driven member controlling said mechanism, a driving member, one of said members having a contact portion formed with a depressed part and adapted to receive the interlocking impact of the other member and the other being normally engageable only with the high part of said contact portion, and means, controlled by the material passing through the operation, for causing said other member to engage the first-named member in the depressed part of its contact portion, substantially as described.

9. The combination of the frame, mechanism for operating on the pieces of material to be treated, successively, a rotary driven member controlling said mechanism, a driving member, one of said members having a contact portion formed with a depressed part and adapted to receive the interlocking impact of the other and the other being normally engageable only with the high part of said contact portion, and means, controlled by each piece of material passing through the operation, for causing said other member to engage the first-named member in the depressed part of its contact portion, substantially as described.

10. The combination of the frame, mechanism for operating on the pieces of material to be treated successively, a rotary driven member controlling said mechanism, a driving member, one of said members having a toothed contact portion formed with a depressed part and adapted to receive the interlocking impact of the other and the other being normally engageable only with the high part of said contact portion, and means, controlled by each piece of material passing through the operation, for causing said other member to engage the first-named member in the depressed part of its contact portion, substantially as described.

11. The combination of the frame, mechanism for operating on the material to be treated, intermittently, a crank, a rotary member controlling said mechanism and having a toothed contact portion formed with a depressed part, a pawl carried by said crank and normally engageable only with the high part of said contact portion,

means for oscillating the crank, a member movable into and out of position to engage said pawl and to move it into the depressed part of said contact portion and means, operative from the material being treated, for controlling the position of said second-named member, substantially as described.

12. The combination of the frame, means for operating upon the pieces of material, means for advancing the material, means for successively establishing the pieces of material within the control of the advancing means, and means, controlled from the pieces of material which have been previously advanced, for controlling the third-named means, substantially as described.

13. The combination of the frame, means for operating on the material comprising members one of which is movable relatively to the other and also comprising a plurality of acting parts carried by one of said members and set progressively relatively to the direction of advance of the material, and means for periodically rendering one of said parts inactive while retaining the other part active, substantially as described.

14. The combination of the frame, periodically acting means for operating on pieces of material comprising members one of which is movable relatively to the other and also comprising a plurality of acting parts carried by one of said members and set progressively relatively to the direction of advance of the material, means for rendering one of said parts occasionally inactive relatively to the other of said parts, and means for effecting, as between the pieces of material and said first-named means, the advance of the one relatively to the other, substantially as described.

15. The combination of the frame, periodically acting means for operating on pieces of material comprising members one of which is movable relatively to the other and also comprising a plurality of acting parts carried by one of said members and set progressively relatively to the direction of advance of the material, means for rendering the relatively advanced part occasionally inactive relatively to the other of said parts, and means for effecting, as between the pieces of material and said first-named means, the advance of the one relatively to the other, substantially as described.

16. The combination of the frame, means for operating upon the material having a plurality of acting parts set progressively relatively to the direction of advance of the material, and means, controlled from the material, for rendering one of said parts occasionally inactive while retaining the other part active, substantially as described.

17. The combination of the frame, periodically acting means for operating on pieces of material having a plurality of acting parts set progressively relatively to the direction of advance of the material, means, controlled from the material, for rendering one of said parts occasionally inactive while retaining the other part active, and means for effecting, as between the pieces of material and said first-named means, the advance of the one relatively to the other, substantially as described.

18. The combination of the frame, means for operating on the material, said means comprising a plurality of acting parts set progressively relatively to the direction of advance of the material and one of said parts being adapted to assume an active or inactive condition and the other remaining active and means controlled from the material being operated upon for controlling said first-named part, substantially as described.

19. The combination of the frame, periodically acting means for operating on pieces of material, said means comprising a plurality of acting parts set progressively relatively to the direction of advance of the material and one of said parts being adapted to assume an active or inactive condition and the other remaining active, means, controlled from the pieces of material passing through the operation, for controlling said first-named part, and means for effecting, as between the pieces of material and said first-named means, the advance of the one relatively to the other, substantially as described.

20. The combination of upper and lower dies, separate members receiving said dies, the one being movable toward and from the other and one of said dies being movable in its support to and from its active position, and a part, interposable between the movable die and a part of its receiving member and controlled from the material being operated upon, for controlling the position of said movable die, substantially as described.

21. The combination of upper and lower dies, both the upper and lower dies being arranged in a plurality of sets disposed progressively relatively to the direction of advance of the material, a plunger carrying the upper sets of dies, a support for the lower sets of dies having the part thereof carrying one set movable to bring the latter into and out of its active position, and automatic means for controlling the position of said movable part, substantially as described.

22. The combination of a support, coöperating dies, a plunger carrying one die, a part arranged in the support and carrying the other die, said part being movable into and out of position to coöperate with the plunger and means, controlled from the

material being operated upon for controlling the position of said part, substantially as described.

23. The combination of a support, coöperating dies, a plunger carrying one die, a part arranged in the support and carrying the other die, said part being movable into and out of position to coöperate with the plunger, and a wedge-bar controlling the position of said part and controlled from the material being operated upon, substantially as described.

24. The combination, with means for holding a stack of sheets, of a movable adhesion device for bending outwardly an edge-portion of an outermost sheet, a positive interposable separator for the sheets movably arranged on said device, and a fixed stop engageable by the separator, substantially as described.

25. In combination, with means for holding a stack of sheets, means for separating the sheets comprising a rectilineally reciprocatory supporting device, a separator arranged to move in said device toward the edges-side of the stack and a stop engageable by the separator, substantially as described.

26. In a delivery mechanism for a machine operating on sheet material, the combination of the frame, supports adapted to receive the material, rotary parts peripherally engageable with each other, means for rotating one part, a lever-structure carrying the other part, and means for oscillating said lever-structure, substantially as described.

27. In a delivery mechanism for a machine operating on sheet material, the combination of the frame, downwardly movable supports adapted to receive the material, rotary parts peripherally engageable with each other, means for rotating one part and means, adapted to move one part intermittently into and out of engagement with the other, for effecting the movement of said supports, substantially as described.

28. In a delivery mechanism for a machine operating on sheet material, the combination of the frame, downwardly movable pivoted supports adapted to receive the material, a lever-structure normally maintaining said supports elevated, links connecting said lever and said supports, rotary parts peripherally engageable with each other, one of said parts being journaled in said lever-structure, means for rotating one of said parts, and means for actuating the lever-structure, substantially as described.

In testimony, that we claim the foregoing, we have hereunto set our hands this 25″ day of Sept. 1908.

BENJAMIN ADRIANCE.
AMOS CALLESON.

Witnesses:
JAMES VAN WICKLEN,
GEORGE DORRMAN.