May 3, 1927. 1,627,412

H. E. RUCKERT

METHOD AND APPARATUS FOR FORMING ARTICLES FROM SHEET MATERIAL

Filed July 18. 1924 8 Sheets-Sheet 1

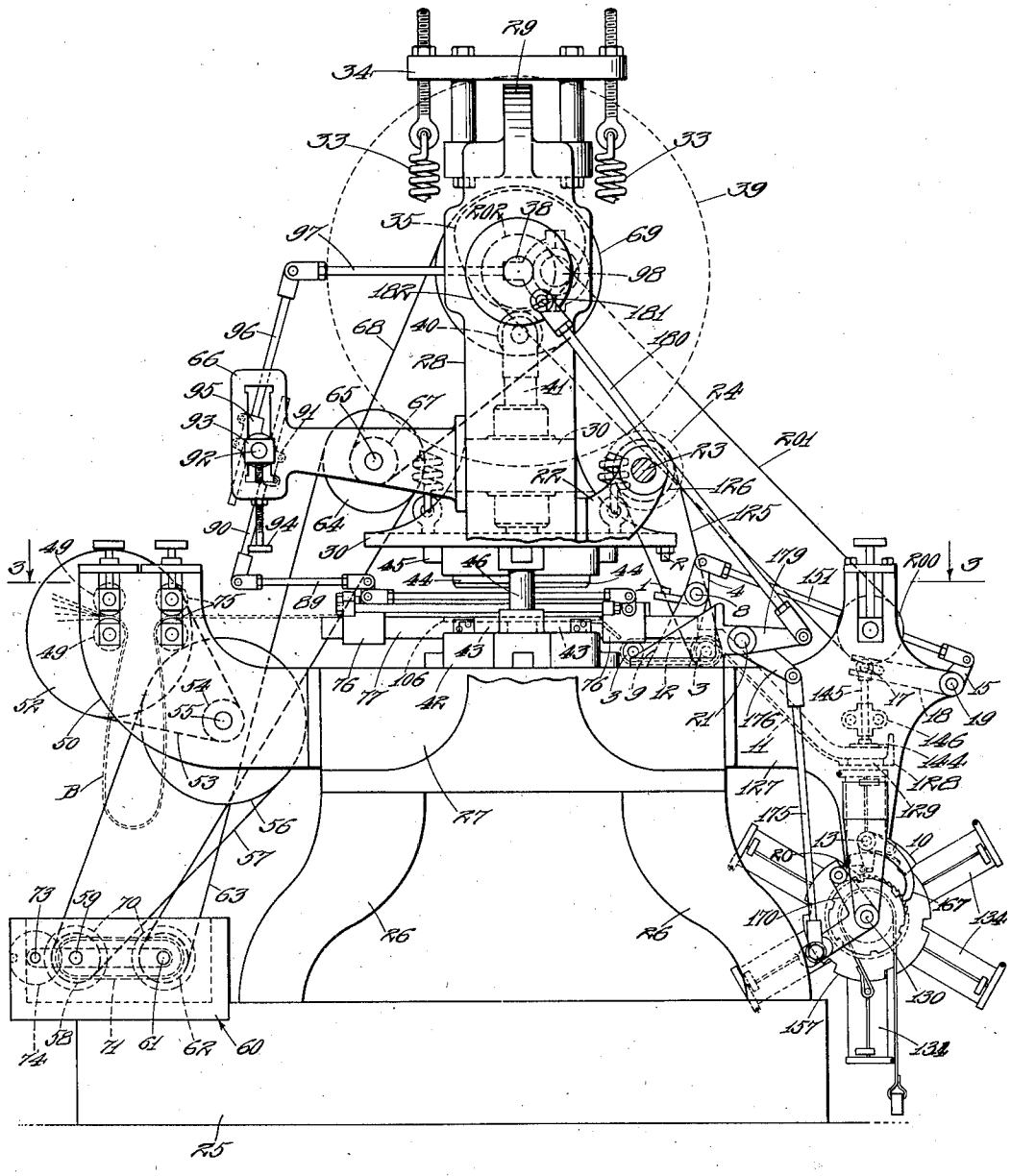

Fig. 1.

INVENTOR:
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METHOD AND APPARATUS FOR FORMING ARTICLES FROM SHEET MATERIAL

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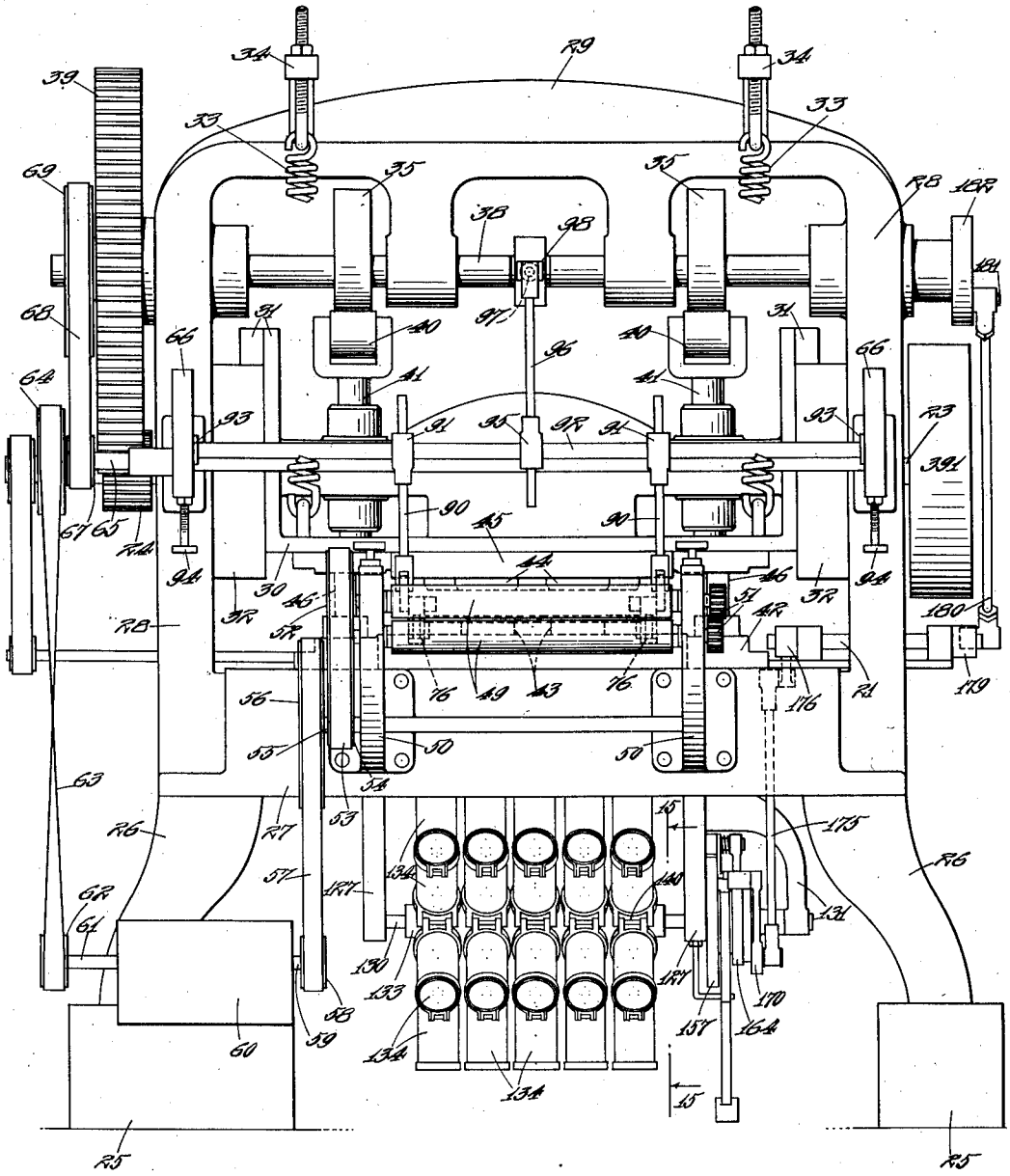

Fig. 2.

INVENTOR:
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METHOD AND APPARATUS FOR FORMING ARTICLES FROM SHEET MATERIAL

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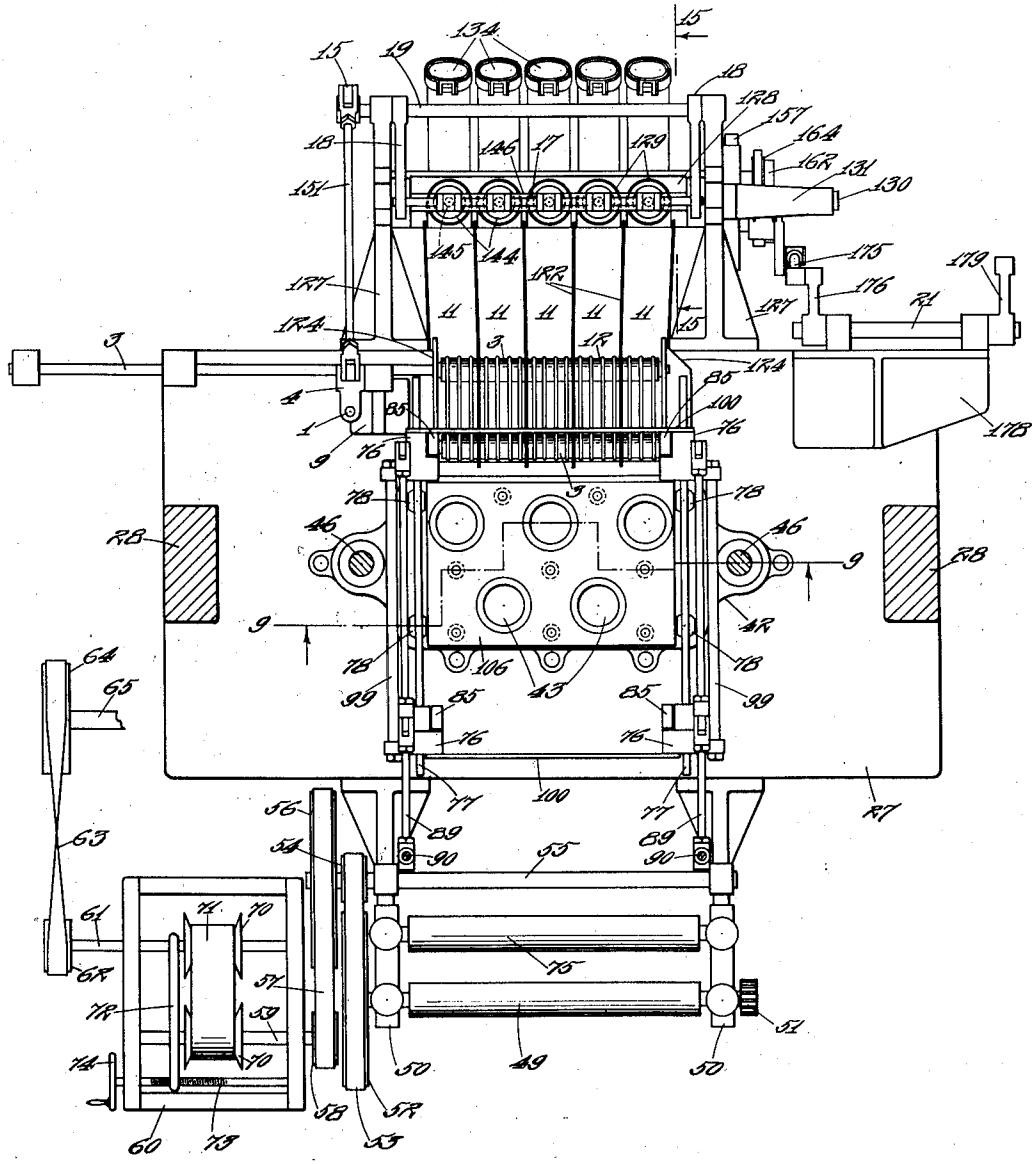

Fig. 3.

Inventor:
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METHOD AND APPARATUS FOR FORMING ARTICLES FROM SHEET MATERIAL

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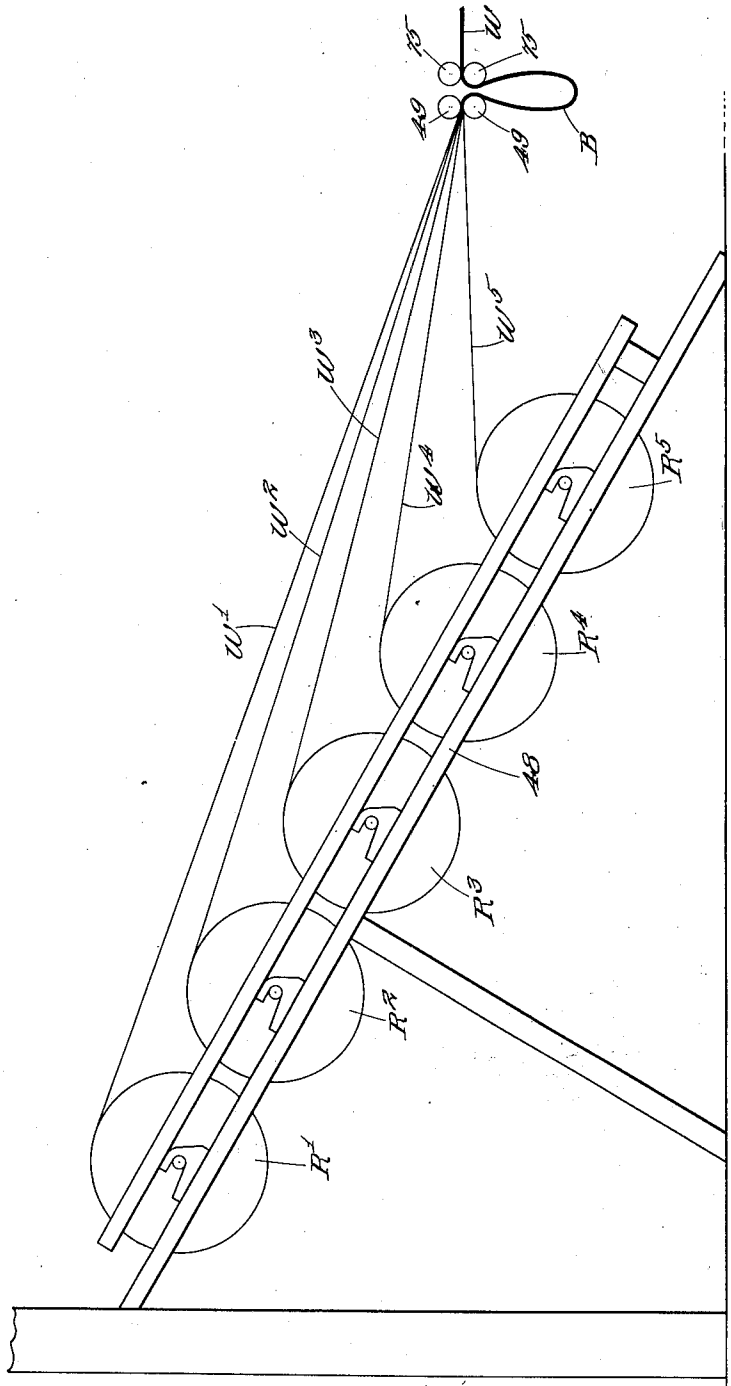


FIG. 4.

INVENTOR:
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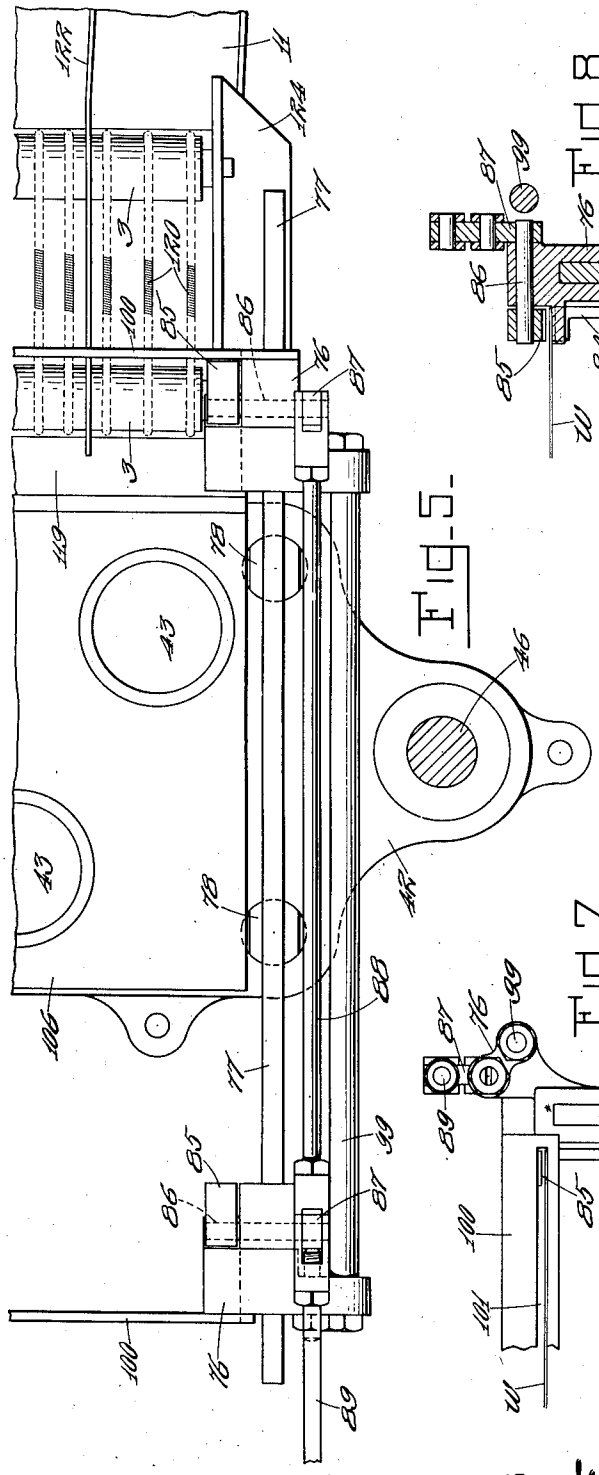

FIG. 5.

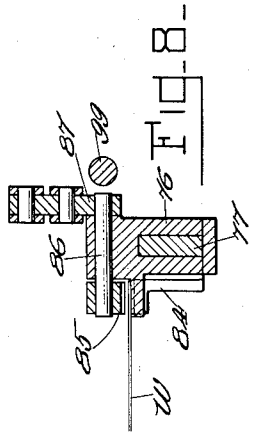

FIG. 8.

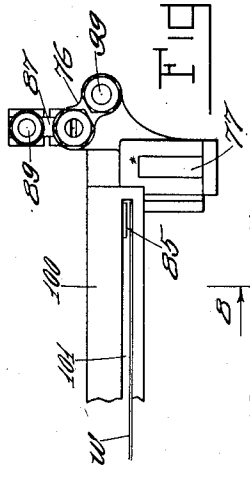

FIG. 7.

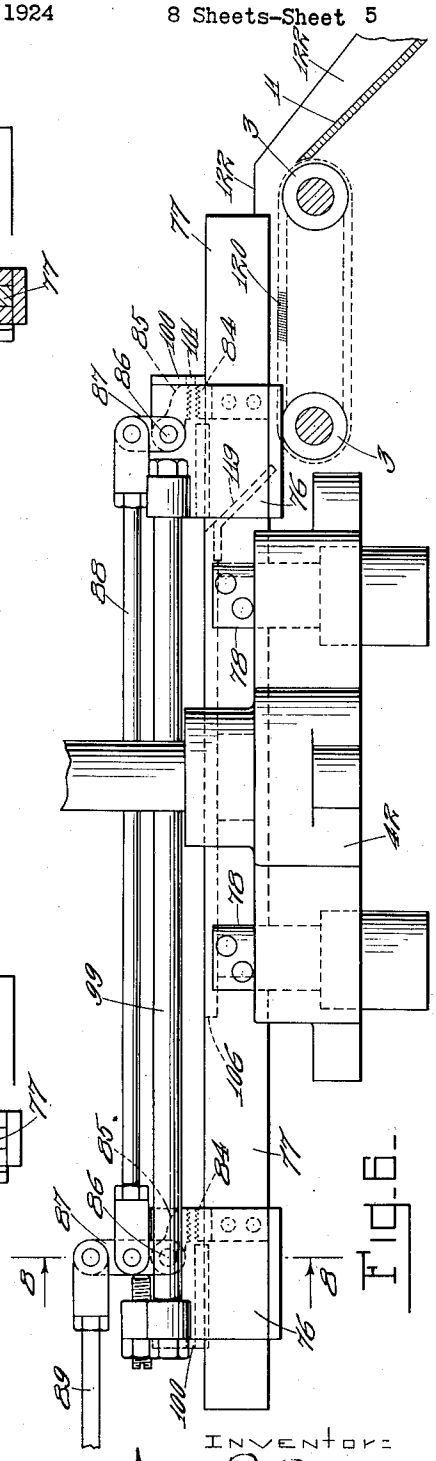

FIG. 6.

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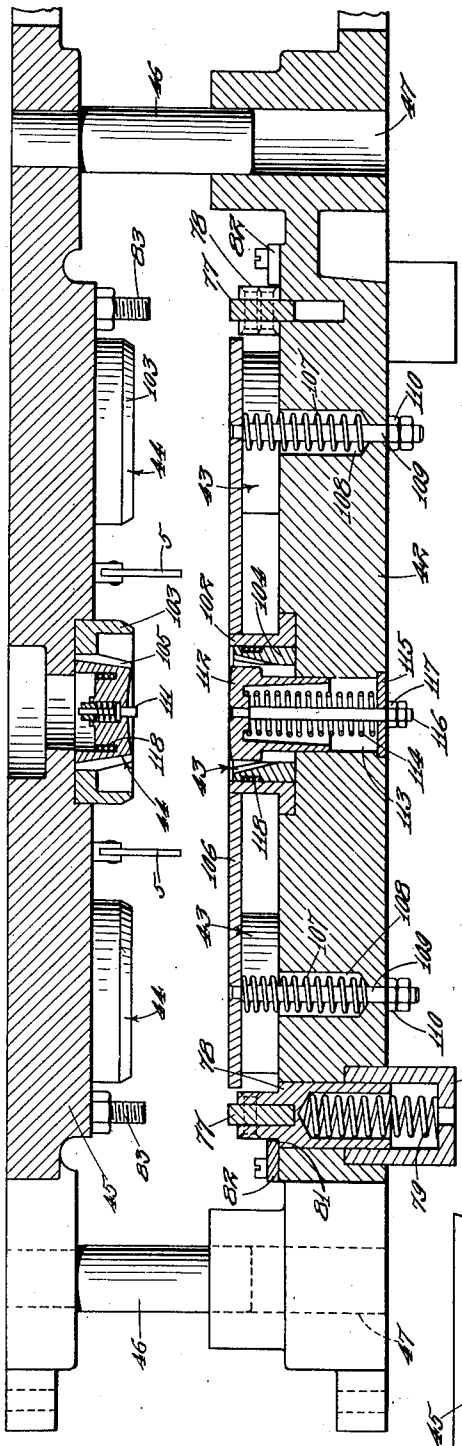

Fig. 9.

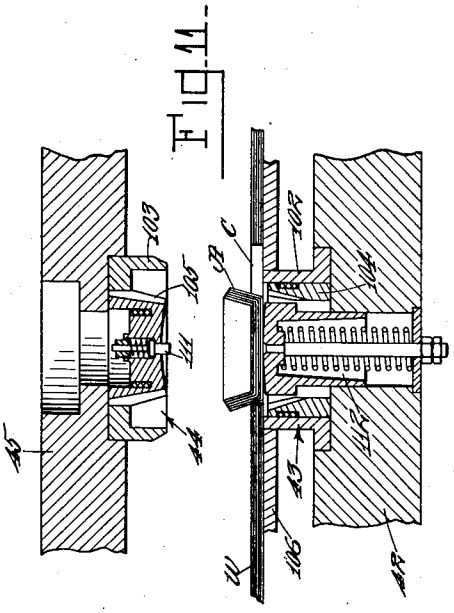

Fig. 11.

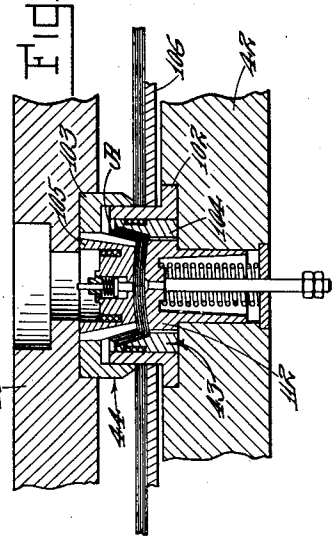

Fig. 10.

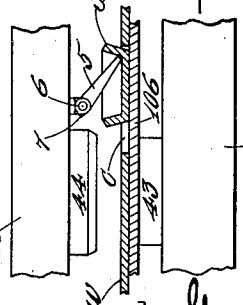

Fig. 11a.

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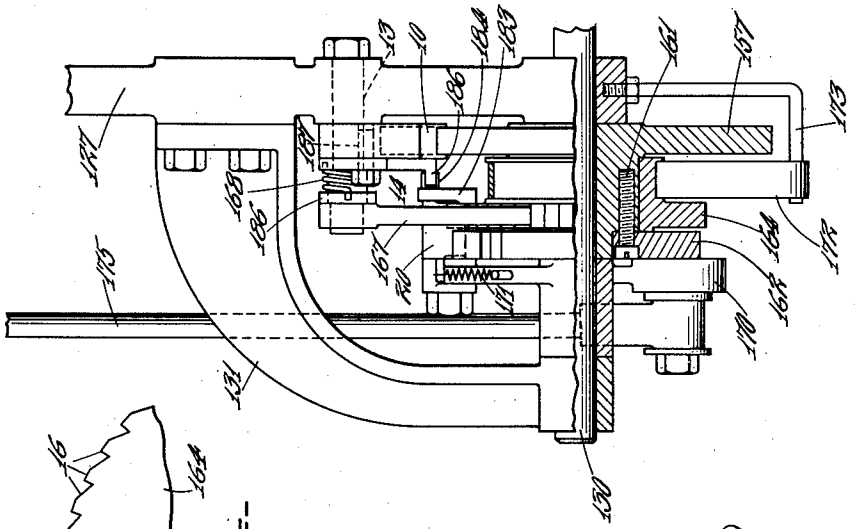

Fig. 13.

Fig. 14.

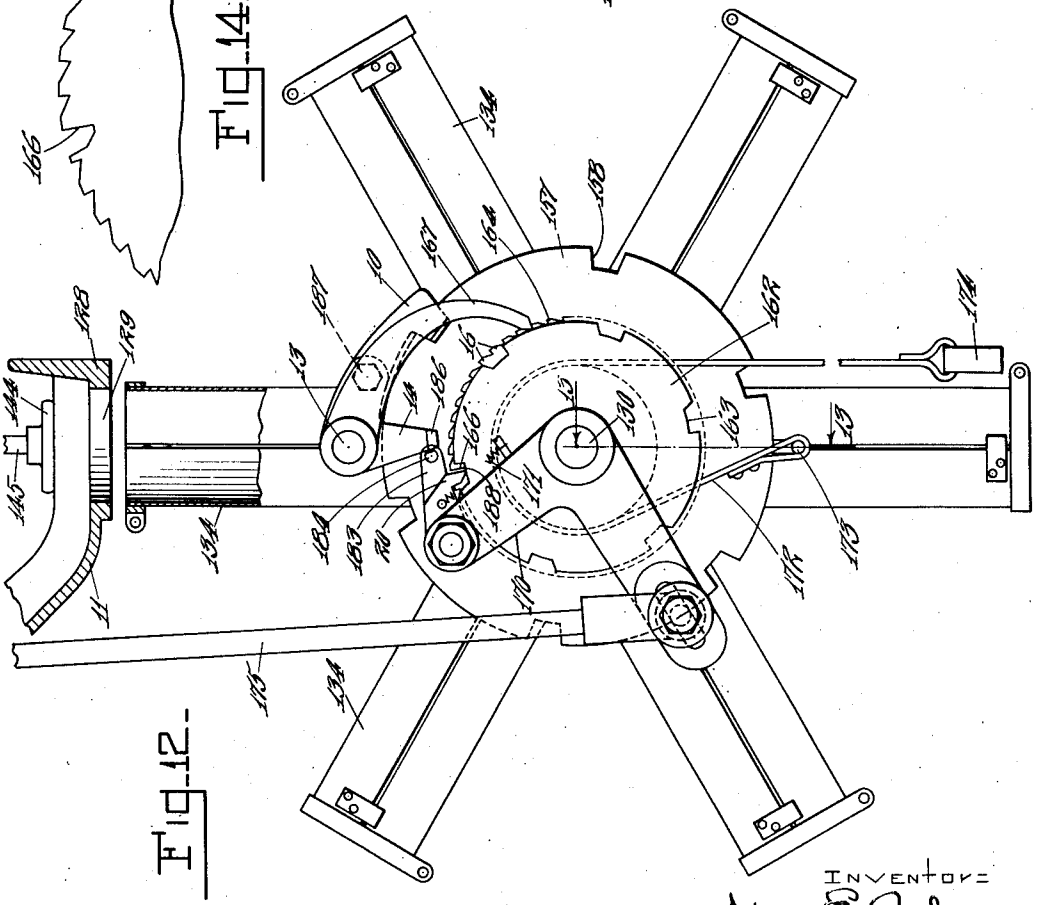

Fig. 12.

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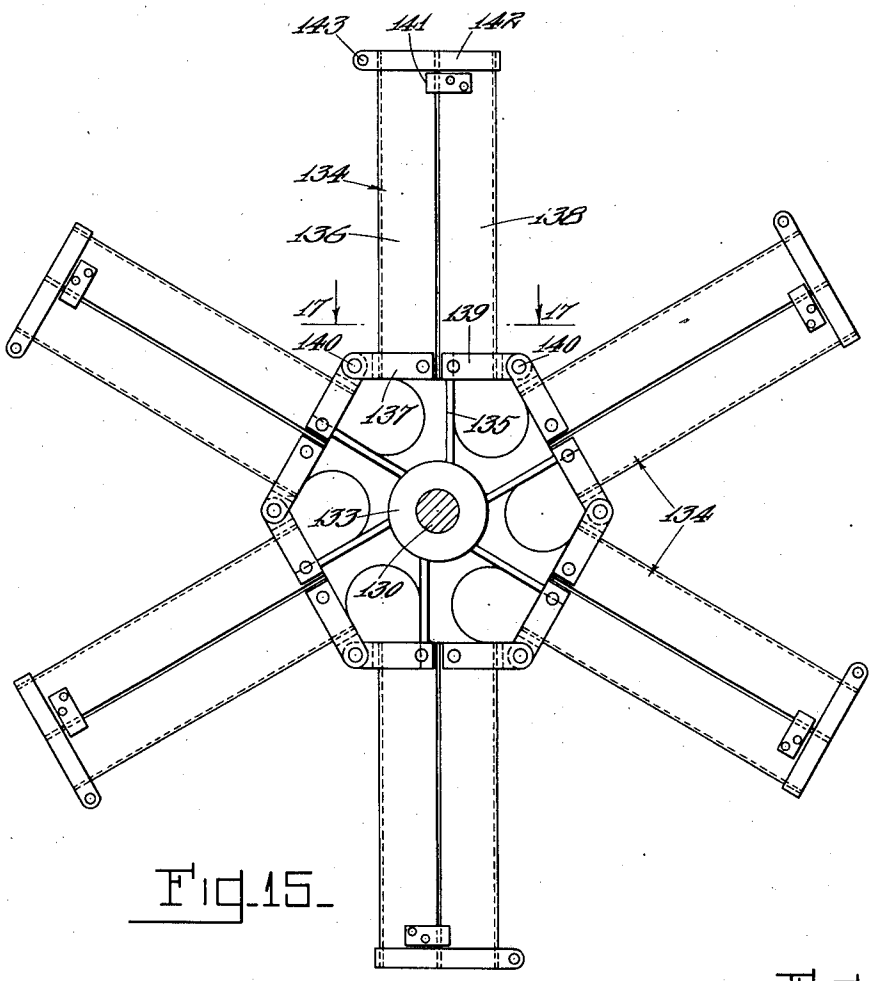



Fig. 15.

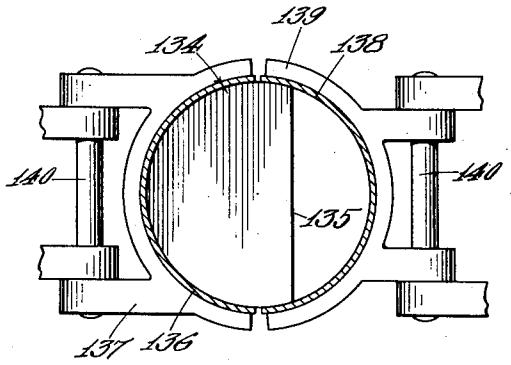
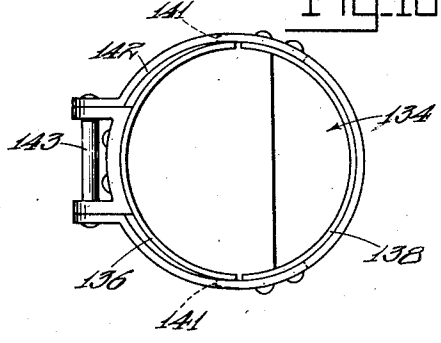



Fig. 17.

Fig. 16.




INVENTOR:
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Patented May 3, 1927. 1,627,412

# UNITED STATES PATENT OFFICE.

HARRY E. RUCKERT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SANITARY PRODUCTS CORPORATION OF AMERICA, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF VIRGINIA.

## METHOD AND APPARATUS FOR FORMING ARTICLES FROM SHEET MATERIAL.

Application filed July 18, 1924. Serial No. 726,863.

This invention relates especially, although not exclusively, to the manufacture of plates, dishes and the like from paper, fibre, and similar stock, although, as to certain of its features, being equally applicable to operations upon sheet metal in the manufacture of these and other articles from the latter material.

The invention has for its general objects to provide means for forming articles from sheet material rapidly and in large quantities and also to provide means for delivering said articles in nested relation in stacks of a predetermined number each, said operations being carried on automatically, and reducing to a minimum the necessary manual labor and personal supervision, and consequently the cost of production.

The more particular objects of the invention will best be understood from the following description of one form of mechanism by which the invention may be carried into effect, as illustrated in the accompanying drawings. It will be understood, however, that the particular constructions and operations described and shown have been chosen for illustrative purposes merely, and that the invention, as defined by the claims hereunto appended, may be otherwise practiced without departing from its spirit and scope.

In the drawings:

Fig. 1 is a side elevation, partly broken away, and

Fig. 2 a front elevation of the machine proper.

Fig. 3 is a horizontal section taken substantially on the line 3—3, Fig. 1.

Fig. 4 is a side elevation of the rack for supporting the supply of sheet material, the introduction of the latter into the machine being illustrated diagrammatically.

Fig. 5 is a plan view on an enlarged scale of portions of the bolster, web feeding mechanism, and discharging mechanism.

Fig. 6 is a side elevation of the parts shown in Fig. 5.

Fig. 7 is a rear elevation of one of the feed slides with its attached web guiding plate.

Fig. 8 is a section taken substantially on the line 8—8, Fig. 6.

Fig. 9 is a transverse vertical section, taken substantially on the line 9—9, Fig. 3, of the bolster and upper die carrier.

Fig. 10 is a longitudinal vertical section of one pair of cooperating dies, illustrating the forming operation.

Fig. 11 is a view similar to Fig. 10, showing the dies separated, and illustrating the removal of the completed articles by the travel of the web.

Fig. 11ª is a view similar to Figs. 10 and 11 illustrating the means for insuring the removal of the completed articles from the path of movement of the dies at the succeeding operation of the machine.

Fig. 12 is a side elevation of the nesting and counting mechanism.

Fig. 13 is a rear elevation, partly in section on the line 13—13, Fig. 12, of the mechanism shown in the latter figure.

Fig. 14 is a fragmentary detail view of a portion of the ratchet controlling the shifting of the nesting containers.

Fig. 15 is a side elevation of the nesting devices as viewed from the line 15—15, Figs. 2 and 3.

Fig. 16 is an end view of one of the containers.

Fig. 17 is a section taken substantially on the line 17—17, Fig. 15.

The invention is herein illustrated as embodied in a die press the frame of which as shown comprises a two-part base 25 (Figs. 1 and 2) upon which rest legs 26 supporting a bolster 27 (see also Fig. 3) from which rise uprights 28 integrally connected at their tops by a transverse portion 29. A ram 30 is formed with slides 31 guided in ways 32 carried by the uprights 28, said ram being lifted by springs 33 connecting said ram with cross heads 34 supported by the transverse frame portion 29, and being depressed by means of cams 35 on a main shaft 38 journalled in bearings in the upright members. The main shaft 38 is provided with a gear 39 which meshes with a pinion 24 on a power shaft 23 journalled in brackets 22 bolted to the uprights 28, said power shaft being provided with a pulley 391 through which power is supplied to the machine. The cams 35 cooperate with cam rollers 40 preferably carried by adjustable posts 41 rising from the ram. Secured to the bed 27 is a bolster 42 (see also Fig. 9) carrying lower combined blanking out and forming dies 43 which cooperate with complementary

upper dies 44 in a die carrier 45 secured to the ram 30. The bolster 42 and die carrier 45 are detachably secured, as by bolts, to the bed 27 and ram 30 respectively, so as to be readily removable for the purpose of changing the dies, and are relatively guided by means of studs 46 depending from the die carrier 45 and sliding in openings 47 (Fig. 9) in the bolster 42. The sheet material is fed intermittently, by mechanism hereinafter described, between successive depressions of the ram, over the lower dies 43 and below the upper dies 44, so that, at each stroke of the ram, a plurality of blanks are punched from the stock and said blanks simultaneously formed into articles. As shown in Fig. 3 the dies are preferably arranged in two transverse rows, the dies in each row being staggered with respect to the dies of the other row, so that at each stroke of the ram the dies of the rear row operate upon portions of stock left between the openings punched by the dies of the front row. It will be obvious, however, that the dies may be arranged in a single row or otherwise as may be preferred.

The sheet material is supplied to the machine in the form of continuous webs, a plurality of which are fed through the machine in superposed relation, so that at each stroke of the ram each pair of dies will punch from the stock a plurality of blanks and form the same into a group of nested articles A (see Fig. 10). As shown in Fig. 4, five webs $W^1$, $W^2$, $W^3$, $W^4$, and $W^5$ are supplied from five reels $R^1$, $R^2$, $R^3$, $R^4$, and $R^5$ supported by an inclined rack 48.

In order to relieve the intermittent web feeding mechanism, hereinafter described, of the relatively heavy work of drawing the webs from the several reels and leave said feeding mechanism free for the accurate control of the webs during their passage between the dies, said webs are drawn from their respective reels and introduced into the machine in the desired superposed position by means of a pair of feed rollers 49 journalled in bearings in brackets 50 supported by the bed 27, said rollers being connected with one another by gears 51 (Figs. 2 and 3) and continuously rotated at a speed equal to the resultant speed of travel of the web under the action of the intermittent feeding mechanism. As shown, the shaft of the lower feed rollers is provided with a relatively large pulley 52 connected by a belt 53 with a relatively small pulley 54 on a shaft 55 journalled in the brackets 50 and provided with a relatively large pulley 56 connected by a belt 57 with a relatively small pulley 58 on the driven shaft 59 of a variable speed transmission device indicated as a whole by the numeral 60. The driving shaft 61 of said transmission device is provided with a pulley 62 connected by a crossed belt 63 with a relatively large pulley 64 on a shaft 65 journalled in brackets 66 bolted to the uprights 28. The shaft 65 is provided with a relatively small pulley 67 connected by a belt 68 with a relatively large pulley 69 on the main shaft 38. As shown in Figs. 1 and 3, the variable speed transmission device 60 comprises a pair of double cone pulleys 70 on the shafts 59 and 61 connected by a belt 71 the engagement of which with said pulleys is controlled by a shifter 72 operated by a screw 73 provided with a hand wheel 74. By operating the hand wheel 74 the relative speeds of rotation of the shafts 59 and 61 may be determined, and the speed of rotation of the feed rollers 49 very delicately controlled. This variable speed mechanism is of well known construction and hence a further detailed description thereof is not deemed necessary. Between the feed rollers 49 and the intermittent feeding mechanism, the compound web W, formed by the several superposed webs $W^1$, $W^2$, etc., passes between a pair of idle rollers 75 adapted to support between them a slack portion B of the web in the form of a depending loop or festoon. The amount of slack B provided will at all times be sufficient to permit the operation of the intermittent feeding mechanism, and this amount may be kept substantially constant by controlling or varying, from time to time, the speed of rotation of the feed rollers 49 by operation of the hand wheel 74.

The mechanism for intermittently feeding the web (Figs. 1 to 3 and 5 to 8) comprises four slides 76, said slides being disposed in pairs located respectively at opposite sides of the web, and the slides of each pair being disposed respectively at the front and rear of the dies, as shown in Fig. 3. The two slides of each pair are mounted for longitudinal movement on a guide 77, said guide being carried by plungers 78 (Fig. 9) mounted for vertical movement in the bolster 42. Each of the plungers 78 is formed with an axial opening to receive a spring 79 supported by a thimble 80 carried by the bolster, the upward movement of said plunger, under the influence of its spring 79, being limited by engagement of a shoulder 81 thereon with a plate 82 secured to the upper face of the bolster. The spring 79 and plunger 78 constitute means for resiliently supporting the guides 77 whose normal position is fixed by the stop plates 82, but which are depressed at each stroke of the ram by abutment studs 83 on the die carrier 45. The slides 76 of each pair are rigidly connected with each other by a rod 99, while the forward and rear slides of the respective pairs are rigidly connected by transverse plates 100 having guide slots 101 through which the web

passes, said rods 99 and plates 100 connecting the several slides into a substantially rigid frame which is reciprocated as a unit on the guides 77 to effect the feeding of the web, as hereinafter explained.

Each of the slides 76 is provided with means for gripping and releasing the adjacent edge of the web W, said means as herein shown comprising a fixed gripper member 84 secured to the slide and a cooperating pivoted gripper member 85 in the form of a dog carried by a rock shaft 86 journalled in the corresponding slide 76 and having fast thereon an arm 87. The arms of the gripper dogs of each pair are connected by a rod 88, while the arm 87 of the gripper on the forward slide of each pair is extended upwardly above its point of connection with the rod 88 and has connected therewith the rear end of an operating rod 89. It will be obvious that longitudinal movement of the rods 89 toward the rear of the machine, or toward the right in Figs. 5 and 6, will cause the gripper dogs 85 to grip both edges of the web in front of and behind the dies and advance said web, while longitudinal movement of the rods 89 in the opposite direction will cause said gripper dogs to release the web and the slides to be returned to their initial position.

The operating rods 89 are connected at their forward ends to arms 90 which are longitudinally adjustable in clamps 91 secured to a rock shaft 92 in bearings 93 which are vertically adjustable in slots in the brackets 66 by means of adjusting screws 94. Between the clamps 91 (Fig. 2) the rock shaft 92 has fast thereon a third clamp 95 in which is adjustably mounted an arm 96 connected at its upper end by a rod 97 with a crank pin 98 on the main shaft 38. It will be seen that by adjusting the arms 90 and 96 longitudinally in the clamps 91 and 95, and by also adjusting the bearings 93 in the brackets 66 if necessary, the stroke of the slides can be varied in accordance with the requirements.

The cooperating dies 43 and 44 are formed with complementary blanking out portions 102 and 103 (Figs. 9 to 11) for punching blanks from the web W and with complementary forming portions 104 and 105 for forming said blanks into articles. The web W is supported and guided, during its passage between the dies, by a stripper plate 106 having openings to receive the blanking out portions 102 of the lower dies 43, said stripper plate being supported by springs 107 (Fig. 9) received in cavities 108 in the bolster 42 and surrounding rods 109 secured at their upper ends to said stripper plate, guided in the bolster, and carrying at their lower ends adjustable stop nuts 110 for fixing the normal position of said stripper plate. The upper dies 44 are provided with spring pressed ejector pins 111, while the bottom of the shaping portion 104 of each of the lower dies 43 is formed as a separate plunger 112 guided in an opening 113 in the bolster 42 and resiliently supported by a spring 114 bearing at its lower end against a disk 115 secured to the bolster and in which is guided a rod 116 secured at its upper end to the plunger 112 and provided at its lower end with a stop nut 117 for limiting the upward movement of said plunger under the influence of the spring 114.

The dies are preferably heated in order to enable them to operate upon and shape dry, or untempered stock, any suitable heating means being employed. As herein shown the forming portions of the dies are provided with peripheral grooves to receive electric heating elements or coils 118.

When the ram 30 descends, carrying with it the upper dies 44, the blanking out portion 103 of each upper die cooperates with the blanking out portion 102 of the corresponding lower die to punch from the stock a plurality of blanks, the stock being clamped, during the blanking out operation, between the shaping portion 105 of the upper die and the plunger 112 of the lower die, and the ejector pin 111 being forced backwardly into the upper die. As the ram continues to descend, the plunger 112 is forced downwardly against the tension of the spring 114, and the blanks are shaped into the desired articles A, as shown in Fig. 10. The shaping movement of the dies causes the web W and stripper plate 106 to be depressed by the blanking out portion 103 of the upper die, the guides 77 and feed slides being simultaneously depressed by the abutment studs 83 to correspond with the depression of the web. As the ram rises, the stripper plate 106 and guides 77 are restored to their normal positions by the springs 107 and 79, while the completed nested articles A are lifted out of the lower die by the plunger 112, acting under the influence of the spring 114, into the plane of the web W determined by the normal position of the stripper plate, as shown in Fig. 11, so that, as the web is fed, said articles will be engaged by the edge of the opening C from which the blanks were punched and thereby removed from the dies over the stripper plate by the travel of the web.

The amount of travel of the web between successive operations of the dies is relatively small, in order to reduce the waste to a minimum, while the upper edges of the articles A, if the latter be of the flaring form shown, tend to overhang the edges of the openings C in the web, said articles lagging behind the web somewhat since they, in their fin-

ished form, are somewhat smaller than the openings from which their blanks have been punched. In order to prevent the overhanging edges of each set of articles formed by the forward row of dies from being struck by the upper dies of said row upon the next succeeding descent of the latter, special means are provided for removing said articles from the path of movement of said dies. As shown in Figs. 9 and 11ª, said means comprises a set of dogs 5, equal in number to the dies of the forward row, said dogs being pivoted to studs 6 on the upper die carrier 45 and being formed with shoulders 7 which engage said studs and limit the downward swinging movement of said dogs which normally assume, under the influence of gravity, a downwardly and rearwardly inclined position. As the upper die carrier descends, said dogs engage the formed articles and, as they are swung upwardly on their pivots, push said articles rearwardly out of the way of the descending dies. Similar dogs may, if desired, be provided for the articles formed by the rear row of dies, but in the construction shown said last named articles are discharged from the stripper plate 106 prior to the next descent of the upper dies, as will now be explained.

As the articles A formed by the several sets of dies reach the rear edge of the stripper plate and the web passes through the guide slot 101 of the plate 100, said articles A fall from the openings C in the web W upon a chute 119 (see particularly Figs. 5 and 6) by which they are discharged upon an endless conveyor 12 which delivers them into a second chute 11. The conveyor 12 and chute 11 are divided transversely of the machine by a series of partitions 122 (see also Fig. 3) into a series of compartments adapted respectively to receive the articles formed by the several pairs of dies. The conveyor 12 comprises a series of endless resilient belts, preferably composed of coil springs, passing about rollers 3 journalled in brackets 124 (Fig. 5) carried by the bed 27, one of said rollers being driven by a belt 125 from a pulley 126 (Fig. 1) on the power shaft 23. The chute 11 is supported by brackets 127 secured to the rear edge of the bed 27 and carrying between them a bridge 128 (Figs. 1, 3 and 12) having a series of openings 129 with which the several compartments of the chute 11 communicate respectively.

As will be obvious from the foregoing, the formed articles A are delivered into openings 129 of the bridge 128 in nested groups each of a number corresponding to the number of superposed webs from which they are formed, the number of groups so delivered to each of the openings 129 being the same and equal to the number of strokes of the ram or cycles of operations of the machine. The groups of nested articles so delivered are in turn nested with one another and are automatically divided or segregated into nested stacks of a predetermined number each by mechanism which will now be described.

Journalled in the brackets 127 is a transverse shaft 130 one end of which is extended beyond the corresponding bracket 127 and further supported by a second bracket 131 (Figs. 2 and 13) secured thereto. Mounted on the shaft 130 between the brackets 127 is a carrier 133 (Figs. 2 and 15) for a plurality of sets of containers 134. The number of containers in each set is equal to the number of dies, and consequently to the number of groups of articles formed at each cycle of operations of the machine, and the several groups of containers are disposed radially about the shaft 130 and are arranged to be brought successively under the openings 129 in the bridge 128, so as to receive the articles therefrom, the shaft 130 being automatically and periodically rotated for this purpose by mechanism hereinafter described when the several containers of each set have received a predetermined number of articles.

Each container 134 is of a cross section corresponding substantially to the outline of the articles formed by the machine. The dies, as herein shown, are designed to form dishes of circular outline, and the containers 134 are each shown as of a corresponding cylindrical form. Each of said containers is split longitudinally into two sections, one of which, designated by the numeral 136 in Figs. 15 to 17, is bolted or otherwise fixed, together with a U-shaped hinge member 137, to the end of one of a series of radial arms 135 on the carrier 133, the end of said arm forming the bottom of the container. The other section 138 of each container has bolted or otherwise secured thereto, a U-shaped hinge member 139, the hinge members 137 and 139 of the corresponding containers of contiguous sets having overlapping lugs connected by a hinge pin 140, whereby the movable section of each container is hinged to the fixed section of the contiguous container. The hinged section 138 of each container is provided with projecting lugs 141, whereby it is guided into alinement with the corresponding fixed section 136 to close the container, which is held in closed position by a bail 142 hinged at 143 to the fixed section and surrounding the movable section. By releasing the bail 142 of any container, said container may be opened by swinging aside its hinged section 138, and the stack of nested articles removed therefrom.

The articles are packed or nested in the several containers by means of a set of reciprocating plungers 144 (Figs. 1, 3 and 12) which operate through the openings 129 in the bridge 128 and are carried by stems 145

guided in a transverse bar 146 (Figs. 1 and 3) supported at its ends by the brackets 127. The stems 145 are connected to a transverse rod 17 which is engaged at its ends by the bifurcated ends of a pair of arms 18 on a rock shaft 19 journalled at its ends in the brackets 127. The rock shaft 19 is provided at its end with a third arm 15 connected by a rod 151 with one arm of a bell crank 4 pivoted at 8 to a bracket 9 on the bed 27. The other arm of the bell crank 4 is provided with an abutment stud 1 which is engaged by a cooperating abutment stud 2 on the ram 30 at each stroke of the latter, thereby depressing the plungers 144 to pack the articles in the containers 134. The stroke of the plungers 144 is constant, being sufficient to pack and compress to the desired extent the articles in the containers when the latter have received a predetermined number of said articles.

The mechanism for rotating the shaft 130 and carrier 133, to bring a second set of containers 134 into operative position under the bridge 128 when the containers of a first set have received the desired number of articles, is illustrated in Figs. 1, 12, 13 and 14. Keyed to the shaft 130 between the bracket 131 and the adjacent bracket 127 is the hub of a locking disk 157 having in its periphery a series of notches 158 corresponding in number and angular position to the sets of containers and each adapted to receive the end of a locking pawl 10 pivoted on a stud 13 projecting from the bracket 127, said pawl acting normally to hold the shaft 130 and carrier 133 against rotation. The pawl 10 is held in locking position by a spring 168 surrounding the stud 13, one end of said spring being secured to a collar 186 on said stud, and the other being secured to a bell crank 14 pivoted on said stud and one arm of which is rigidly connected with said pawl by a screw bolt 187. Secured, as by screw bolts 161, to the hub of the locking disk 157 is an operating disk 162 also formed in its periphery with a series of notches 163 corresponding in number and arrangement to the sets of containers. Rotatably mounted on the hub of the locking disk 157 is a controlling disk 164 in the form of a ratchet having on its edge a series of teeth 16 formed by relatively shallow notches (Fig. 14) and one or more relatively deep notches 166. The ratchet 164 is held against retrograde movement by a holding pawl 167 pivoted to the stud 13 and is periodically advanced, at each cycle of operations of the machine, by an operating pawl 20 on a swinging pawl carrier 170 pivotally mounted on the shaft 130, said pawl being held in engagement with the ratchet by a spring 171 connecting the same with said pawl carrier. The ratchet 164 is held against overrunning under the influence of the pawl 20 by a brake band 172 secured at one end to an angular arm 173 projecting from the bracket 127, said brake band passing about the hub of the ratchet 164 and carrying at its opposite end a suitable weight 174. The pawl carrier 170 comprises a bell crank fulcrumed on the shaft 130, the pawl 20 being carried by one arm of said bell crank, the other arm of which is adjustably connected to one end of a rod 175 connected at its opposite end to an arm 176 on a rock shaft 21 journalled in a bracket 178 on the bed 27, said rock shaft having a second arm 179 connected by a rod 180 with a crank pin 181 projecting from a crank disk 182 on the main shaft 38.

At each cycle of operations of the machine, the pawl carrier 170 is oscillated through an angular distance corresponding substantially to the angular spacing of the sets of containers 134, and by engagement with the teeth 16 of the controlling ratchet 164 operates to advance the latter through a corresponding angular distance. The spacing of the teeth 16 is so proportioned to the angular movement of the pawl carrier that the pawl 20 is brought into engagement with the deep notch 166 only once in a predetermined number of operations. When said pawl is engaged with the shallow notches forming the teeth 16 it is held out of engagement with the operating disk 162, but when said pawl is engaged with the deep notch 166 it is permitted also to engage one of the notches 163 in said disk 162 so as to turn the latter and with it the shaft 130 and carrier 133, bringing into operative position another set of containers 134. The pawl 20 is provided with an arm 183 having a lug 184 which cooperates with a lug 186 on the free arm of the bell crank 14. When the pawl 20 is engaged with the shallow notches of the ratchet 164 the lug 186 is out of the path of movement of the lug 184 which moves idly thereover. When, however, said pawl is engaged with the deep notch 166, and with a notch 163 in the operating disk 162, the lug 184 is brought into a position to engage the lug 186, so that upon oscillation of the pawl carrier 170 the locking pawl 10 is lifted, thereby disengaging the locking disk 157 and unlocking the carrier. The notches 163 in the operating disk 162 are of a sufficient width to permit a small amount of lost motion between said disk and the pawl 20, as indicated at 188 in Fig. 12, so that said pawl is given an opportunity to disengage the locking pawl 10 from the locking disk 157 before moving the operating disk 162.

The complete operation of the machine may be briefly reviewed as follows:

The several webs, $W^1$, $W^2$, etc., of sheet material from which the articles are to be formed are continuously drawn from the reels $R^1$, $R^2$, etc., by the feed rollers 49, and the composite web W formed by the super-

posed individual webs passes through the idle rollers 75 between which and the feed rollers 49 a slack portion B of said web depends. The web W is then intermittently fed between the dies 43 and 44 by the feed slides 76, the material advanced at each operation of said feed slides being drawn through the rollers 75 from the slack B which is kept substantially constant by the continuous operation of the rollers 49. Between successive movements of the web by the feed slide 76, the ram 30 descends with the upper dies 44, causing blanks to be punched from the web and formed into articles A, the number of articles formed at each operation by each pair of dies corresponding to the number of superposed individual webs making up the web W. When the upper dies descend, the web W, stripper plate 106, and guides 77 for the feed slide 76 are depressed, as indicated in Fig. 10, said parts being, however, lifted substantially to the top of the lower dies 43 when the ram ascends, as indicated in Fig. 11, and the formed articles A being lifted by the plungers 112 to the level of the upper surface of the stripper plate 106 upon which the web W is guided. When, therefore, the web W is again advanced, the articles A, which still remain in the openings C in the web from which the blanks were punched, are carried forward with the web to the rear edge of the stripper plate where they fall from the holes C upon the chute 19. The scrap portion of the web W passes rearwardly through the slot 101 in the rear guide plate 100 and, in order to prevent the same from interfering with the nesting and counting mechanism, may, if desired, be passed over a roller 200 (Fig. 1) journalled in the brackets 127 and rotated by a belt 201 from a pulley 202 on the main shaft 38. The articles A slide down the chute 119 onto the conveyor 120 in their respective compartments formed by the partitions 122, from which they are discharged by the several compartments of the chute 11 through the corresponding openings 129 in the bridge 128 into the respective containers 134 of the set then in operative position beneath said bridge, being packed into said containers in nested relation by the plungers 144. At each operation of the machine, the ratchet 164 is advanced by the pawl 20, and after a predetermined number of operations said pawl enters the notch 166 which permits the same to engage one of the notches 163 in the disk 162. The next operation of said pawl, therefore, causes the same to release the locking pawl 10 and turn the shaft 130 and carrier 133 through a sufficient arc to remove the set of filled carrier 134 from beneath the bridge 128 and bring the next succeeding set into position beneath said bridge. The bails 142 of the filled containers are then released, the hinged sections 138 of said containers swung aside, the stack of nested articles removed, and the containers closed.

It will be seen that a machine constructed in accordance with the invention may be made of large capacity, so that its rate of production will be very high in proportion to the amount of manual labor or personal supervision required, the machine being entirely automatic in its operation and delivering the finished articles in nested stacks of a predetermined number each ready for shipment, so that the only labor or supervision required is the renewal of the stock when exhausted and the removal of the fully completed, nested, and counted articles. As herein shown, the machine is provided with five sets of cooperating dies, each operating upon five superposed webs of material, so as to produce twenty-five articles at each cycle of operation of the machine, the nesting and counting mechanism including five sets of containers, each set having six containers, (the number of sets corresponding to the number of sets of dies), the several sets being moved successively into operative position after each fifty operations of the machine, so that at each movement of the container carrier twelve hundred and fifty articles will be delivered in five nested stacks of two hundred and fifty each.

Having thus described my invention, I claim:

1. In a machine for forming articles from sheet material, the combination with means for supplying a plurality of sheets of said material in superposed relation, of punching and forming means movable together for first punching blanks from all of said sheets simultaneously and then forming said blanks into a corresponding number of nested articles.

2. In a machine for forming articles from sheet material, in combination, a rack, a plurality of reels of sheet material supported by said rack, means for drawing webs of material from all of said reels and feeding the same in superposed position, and punching and forming means movable together for first punching blanks from all of said webs simultaneously and then forming said blanks into a corresponding number of nested articles.

3. In a machine for forming articles from sheet material, the combination with a reciprocating die press having combined blanking out and forming dies one movable relatively to the other and one of the dies having a part movable with the other die during the forming operation, of means for supplying a plurality of sheets of said material and feeding the same in superposed position between said dies.

4. In a machine of the class described, the

combination of means for supplying a plurality of sheets of material in superimposed relation, cutting and forming means simultaneously movable for first cutting blanks from all of said sheets and then forming the same into a corresponding number of nested articles, and yielding means for centrally supporting the nested articles during the forming operation.

5. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of reciprocating means for feeding a web of material intermittently between successive operations of said devices, and rotary means for feeding said web continuously to said intermittent feeding means.

6. In a machine for forming articles from sheet material, in combination, means for supplying a plurality of webs of said material in superposed relation, intermittently operating devices for punching blanks from all of said webs simultaneously and forming said blanks into a corresponding number of nested articles, means for feeding said superposed webs intermittently between successive operations of said devices, and means for feeding said superposed webs continuously to said intermittent feeding means.

7. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of means for feeding a web of material intermittently between successive operations of said devices, means for feeding said web continuously to said intermittent feeding means, and means for supporting a slack portion of said web between said continuous feeding means and said intermittent feeding means.

8. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of means for feeding a web of material intermittently between successive operations of said devices, and a pair of continuously rotating rollers for feeding said web to said intermittent feeding means.

9. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of means for feeding a web of material intermittently between successive operations of said devices, a pair of continuously rotating rollers for feeding said web to said intermittent feeding means, and a pair of idle rollers between said feed rollers and intermittent feeding means, said feed rollers and idle rollers supporting between them a slack portion of said web.

10. In a machine of the class described, the combination of means for supplying a plurality of superimposed sheets, movable means for cutting and forming all of said sheets into a plurality of nested articles, and also for bodily moving said sheets in the direction of cutting.

11. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of a reciprocating slide having web gripping means thereon for feeding a web of said material intermittently between successive operations of said devices, and means for feeding said web continuously to said slide.

12. In a machine for forming articles from sheet material, the combination with intermittently operating blanking-out devices, of a reciprocating slide having web-gripping means thereon for feeding a web of said material intermittently between successive operations of said devices, and a pair of continuously rotating rollers for feeding said web to said feed slide.

13. In a machine for forming articles from sheet material, the combination with intermittently operating blanking out devices, of a slide having web gripping means thereon, means for reciprocating said slide to feed a web of material between successive operations of said devices, said means having provision for adjusting the stroke of said slide, and means for feeding said web continuously to said slide.

14. In a machine for forming articles from sheet material, the combination with intermittently operating blanking-out devices, of a slide having web-gripping means thereon, means for reciprocating said slide to feed a web of material between successive operations of said devices, said reciprocating means having provision for adjusting the stroke of said slide, a pair of rollers for feeding said web to said feed slide, and means for continuously rotating said rollers at an adjustable speed.

15. In a machine for forming articles from sheet material, the combination with cooperating dies, of slides located respectively at opposite sides of said dies, web gripping devices carried by said slides, and means for reciprocating said slides in unison to feed a web of said material past said dies.

16. In a machine for forming articles from sheet material, the combination with cooperating dies, of means for feeding a web of said material past said dies comprising slides located at opposite sides of said dies, a web gripping dog pivoted to each of said slides, a rod connecting said dogs, and means connected to one of said dogs for reciprocating said slides.

17. In a machine of the character described, web feeding mechanism comprising slides located respectively at opposite sides of the web, a plate connecting said slides and having a slot through which the web passes, devices carried by said slides for

gripping the edges of the web, and means for reciprocating said slides in unison.

18. In a machine of the character described, web feeding mechanism comprising a slide having web gripping means, a rock shaft, clamps carried by said rock shaft, an arm adjustably secured to said rock shaft by one of said clamps and operatively connected with said slide, a second arm adjustably secured to said rock shaft by another of said clamps, and operating means connected with said second arm.

19. In a machine of the character described, web feeding mechanism comprising a slide having web gripping means, a rock shaft, an adjustable bearing for said rock shaft, clamps carried by said rock shaft, an arm adjustably secured to said rock shaft by one of said clamps and operatively connected with said slide, a second arm adjustably secured to said rock shaft by another of said clamps, and operating means connected with said second arm.

20. In a machine for forming articles from sheet material, in combination, means for feeding a web of said material, devices for punching blanks from said web and forming the same into articles, and means for supporting said web, said parts being constructed and arranged to cause said articles to remain in the openings in said web from which said blanks have been punched and to be withdrawn from the machine by the travel of the web.

21. In a machine for forming articles from sheet material, the combination with means for feeding a plurality of webs of said material in superposed relation and for supporting the same, of devices for punching blanks from all of said webs simultaneously and forming said blanks into a corresponding number of nested articles and including means for supporting the articles in the plane of the web.

22. In a machine for forming articles from sheet material, the combination with mechanism for feeding a web of said material and for supporting the same, of devices for punching blanks from said web and forming the same into articles, said web-feeding mechanism comprising slides located respectively at opposite sides of said web beyond said punching and forming devices, a plate connecting said slides and having a slot through which the web passes, devices carried by said slides for gripping the edges of the web, and means for reciprocating said slides in unison.

23. In a machine for forming articles from sheet material, in combination, means for feeding a web of said material, a fixed lower die, a reciprocating upper die cooperating with said lower die to punch blanks from said web and form the same into articles, and a movably supported stripper plate associated with said lower die and over which said web is fed.

24. In a machine for forming articles from sheet material, in combination, a reciprocating slide provided with gripping means for engaging and feeding a web of said material, devices for punching blanks from said web and forming the same into articles, and a resiliently supported guide for said slide.

25. In a machine for forming articles from sheet material, in combination, a reciprocating slide provided with gripping means for engaging and feeding a web of said material, a resiliently supported guide for said slide, a fixed lower die, a reciprocating upper die cooperating with said lower die to punch blanks from said web and form the same into articles, and a resiliently supported stripper plate associated with said lower die and over which said web is fed.

26. In a machine for forming articles from sheet material, in combination, a bed, a ram, cooperating punching dies carried by said bed and ram respectively, a resiliently supported stripper plate cooperating with the dies on said bed, guides resiliently supported on said bed, and a slide mounted to reciprocate on said guides and provided with gripping means for engaging and feeding a web of material past said dies.

27. In a machine for forming articles from sheet material, in combination, means for feeding a web of said material, devices for punching blanks from said web and forming the same into articles, means for supporting said web, said parts being constructed and arranged to cause said articles to remain in the openings in said web from which said blanks have been punched and to be withdrawn from said punching and forming devices by the travel of the web, a chute into which said articles fall from said openings, and a conveyor for receiving said articles from said chute and discharging the same from the machine.

28. In a machine for forming articles from sheet material, in combination, means for feeding a web of said material, devices for punching blanks from said web and forming the same into articles, means for supporting the articles in the plane of said web, means for guiding the web out of the machine, and means for permitting discharge of said articles through the web.

29. In a machine for forming articles from sheet material, in combination, devices for punching blanks from a web of said material and forming the same into articles, a pair of slides located respectively at opposite sides of the web, devices carried by said slides for gripping the edges of the web, means for reciprocating said slides in unison to feed the web past said punching and forming devices, a plate connecting said slides and having a slot through which the

web passes beyond said punching and forming devices, and means for supporting the web adjacent said punching and forming devices, said supporting means being spaced from said plate whereby the formed articles are withdrawn from the machine by the travel of the web but are permitted to fall therefrom between said supporting means and plate.

30. In a machine for forming articles from sheet material, the combination with devices for feeding a web of said material and for normally supporting and guiding the same in a predetermined plane, of devices for punching blanks from said web and forming the same into articles, said devices having means for restoring the formed articles to the normal plane of said web, whereby they are withdrawn from the machine by the travel of the web.

31. In a machine for forming articles from sheet material, the combination with devices for feeding a web of said material and for normally supporting and guiding the same in a predetermined plane, of cooperating dies for punching blanks from said web and forming the same into articles, said dies being provided respectively with ejecting means for restoring the formed articles to the normal plane of said web, whereby they are withdrawn from said dies by the travel of the web.

32. In a machine for forming articles from sheet material, in combination, a bed, a ram, lower and upper cooperating blanking out and forming dies carried by said bed and ram respectively, devices for feeding a web of material past said dies and for normally supporting and guiding the same in a predetermined plane, an ejector associated with the upper die for releasing the formed articles therefrom, and a lifter associated with the lower die for restoring the formed articles to the normal plane of said web, whereby they are withdrawn from said dies by the travel of the web.

33. In a machine for forming articles from sheet material, in combination, means for supporting and feeding a web of said material, devices for punching blanks from said web and forming the same into articles, said parts being constructed and arranged to cause said articles to remain in the openings in said web from which said blanks have been punched and to be withdrawn from the machine by the travel of the web, and additional means for removing said articles from said punching and forming devices in the direction of movement of the web.

34. In a machine for forming articles from sheet material, in combination, means for feeding and guiding a web of said material, a fixed lower die, an upper die cooperating with said lower die to punch blanks from said web and form the same into articles, a reciprocating carrier for said upper die, said parts being constructed and arranged to cause said articles to remain in the openings in said web from which said blanks have been punched and to be withdrawn from the machine by the travel of the web, and a dog pivoted to said die carrier for engaging said articles and moving the same out of the path of movement of said upper die when the latter descends.

35. In a machine of the character described, in combination, means for blanking out and forming articles from a web of material, means for intermittently moving the said web, and additional means for moving the formed articles relative to, and in the direction of the moving web.

36. In a machine for forming articles from sheet material, the combination with means for feeding a plurality of webs of said material in superposed relation, of means for punching blanks from all of said webs simultaneously and forming said blanks into a corresponding number of nested articles, means for restoring said articles to the openings in the web from which said blanks have been punched, and means for moving said articles relative to and in the direction of movement of said web.

37. The herein described method of forming articles from sheet material which consists in supplying a plurality of sheets of said material in superposed relation, punching blanks from all of said sheets and forming said blanks into a group of nested articles while supporting the blanks in the plane of the sheets.

38. The herein described method of forming articles from sheet material which consists in supplying a plurality of sheets of said material in superposed relation, punching blanks from all of said sheets simultaneously and simultaneously forming said blanks into a group of nested articles, restoring said group of articles to the alined holes in the superposed sheets from which said blanks have been punched, and moving said sheets in unison to carry away said group of articles.

39. The herein described method of forming articles from sheet material which consists in supplying a plurality of sheets of said material in superposed relation, moving said superposed sheets intermittently and between successive movements thereof, punching blanks from all of said sheets simultaneously and simultaneously forming said blanks into a group of nested articles, restoring said group of articles to the alined holes in the superposed sheets from which said blanks have been punched, and moving said groups of articles away from their point of formation independently of the movement of said sheets.

40. In a machine of the character de-

scribed, in combination, a bed, a ram, cooperating dies carried by said bed and ram for blanking out and forming articles from a sheet of material, and means carried by said ram for engaging the formed articles and removing them from proximity to said dies.

41. In a machine of the character described, in combination, a bed, a ram, cooperating dies carried by said bed and ram for blanking out and forming articles from a sheet of material, and means operated by said ram for engaging the formed articles and removing them from proximity to said dies.

42. In a machine of the character described, in combination, a bed, a ram, cooperating dies carried by said bed and ram for blanking out and forming articles from a sheet of material, and means carried by said ram and operated by movement thereof for engaging the formed articles and removing them from proximity to said dies.

43. In a machine of the class described, the combination of cooperating relatively movable die members, means for supplying a web therebetween, and means for operating said die members to bodily move the web and to simultaneously cut and form a blank from the web while maintaining the blank in the plane of the web.

44. The combination of cooperating mechanism for cutting blanks from a web and forming them into hollow articles, said mechanism including reciprocating means for supporting and reciprocating the web and the blank during the forming operation.

45. The combination with an intermittently operating device for forming an article from sheet material, of means for feeding a web of material intermittently between successive operations of said device, and means for feeding said web continuously to said intermittent feeding means.

In testimony whereof I affix my signature.

HARRY E. RUCKERT.