March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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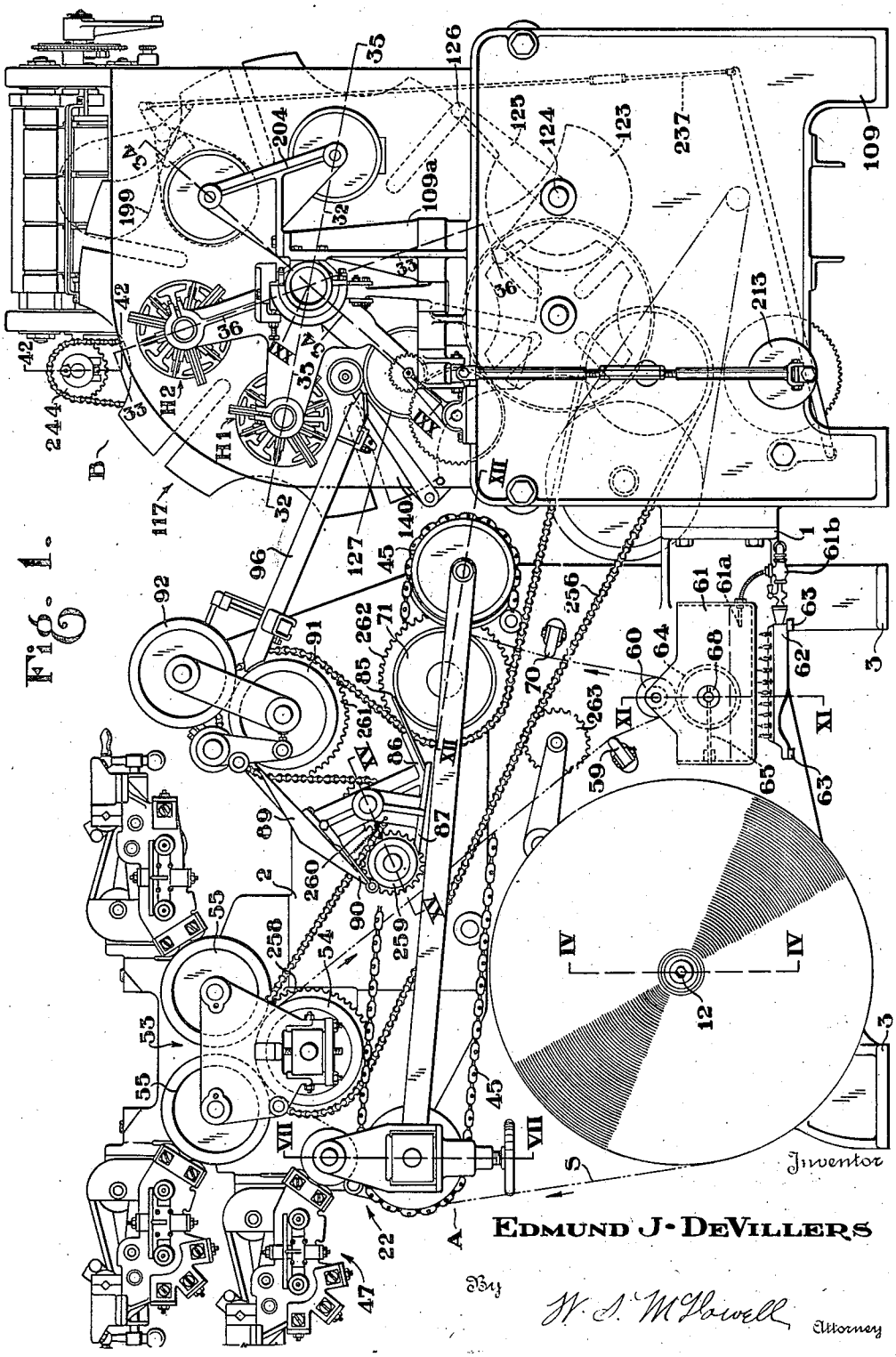


Fig. 1.

Inventor

EDMUND J. DEVILLERS

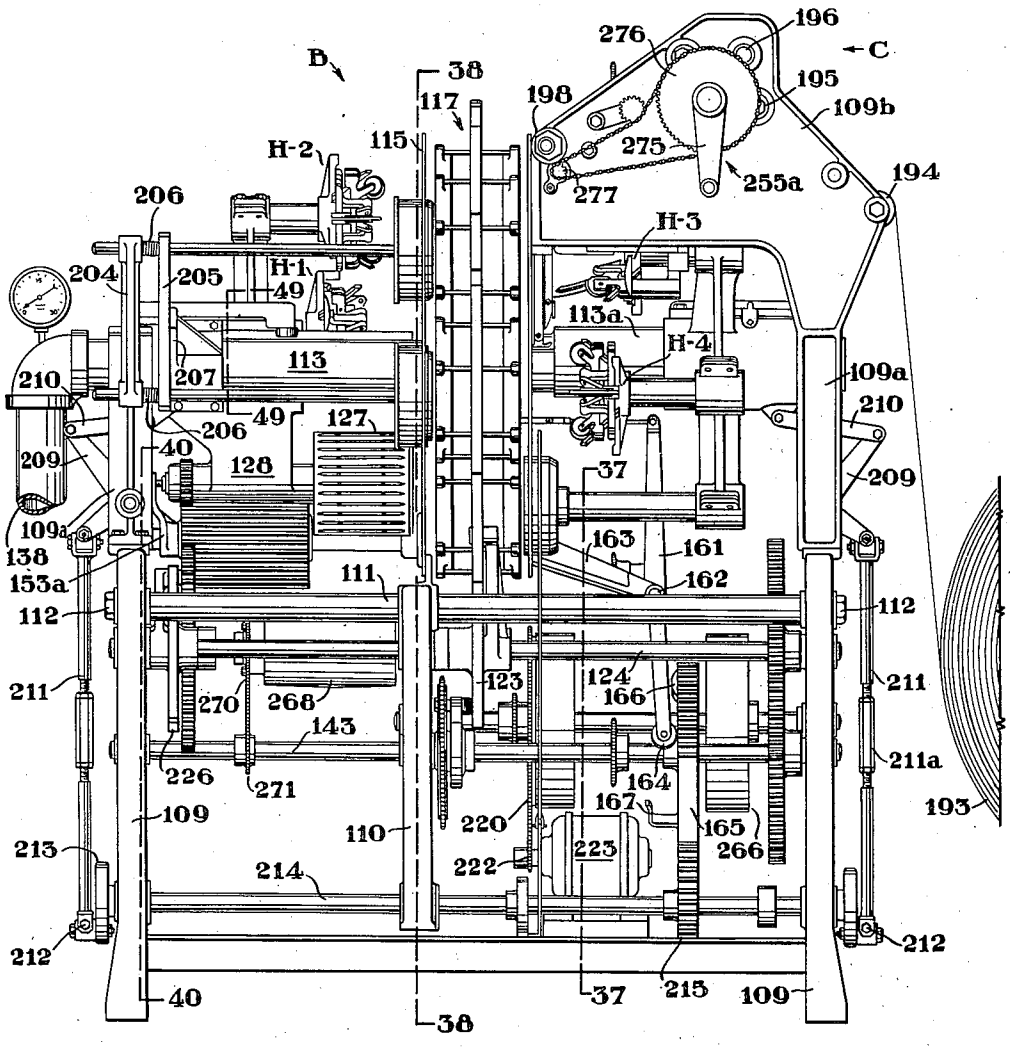
By W. S. McDowell Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 2.



Inventor

EDMUND J. DEVILLERS

By W. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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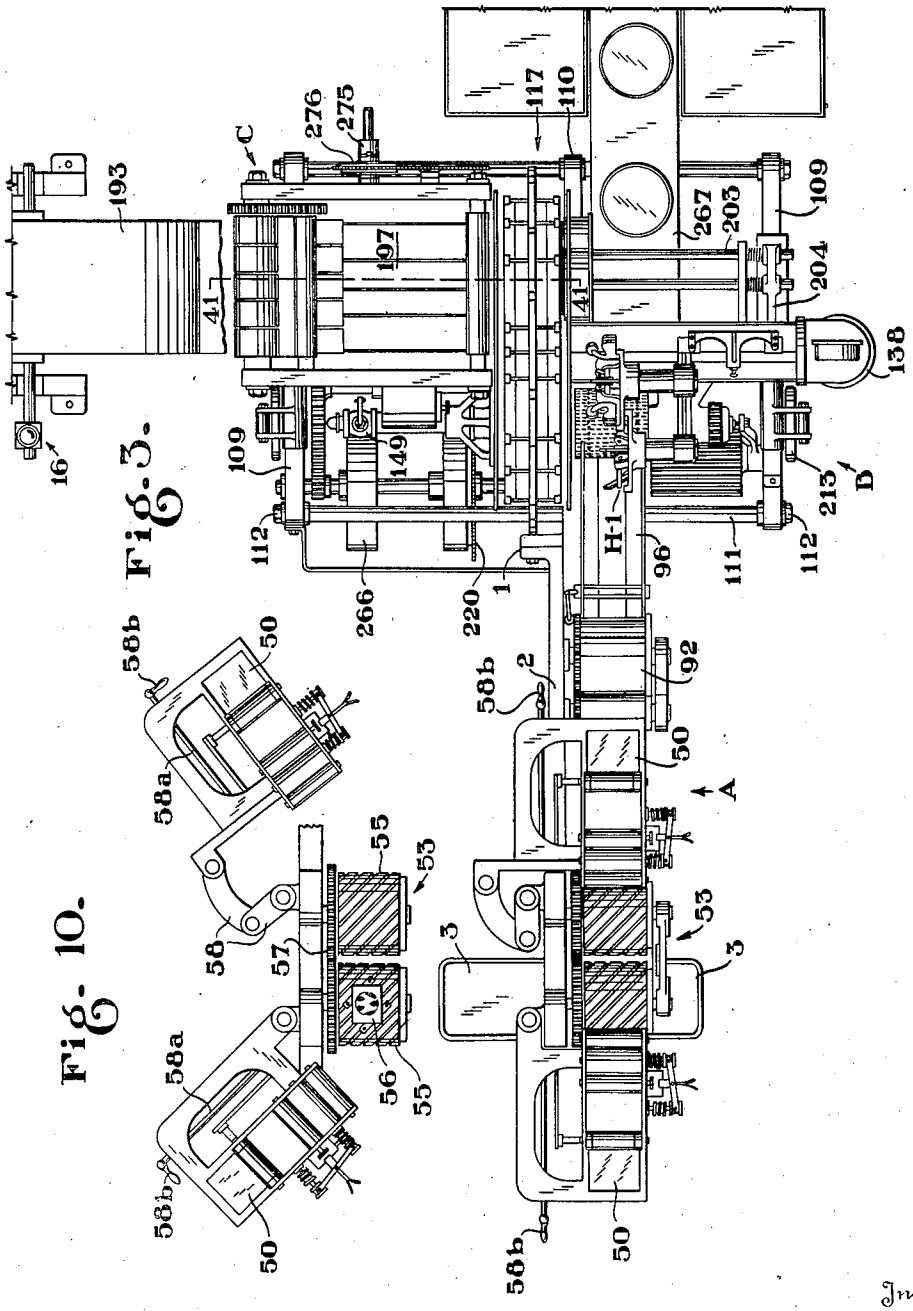


Fig. 3.

Fig. 10.

Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 4.

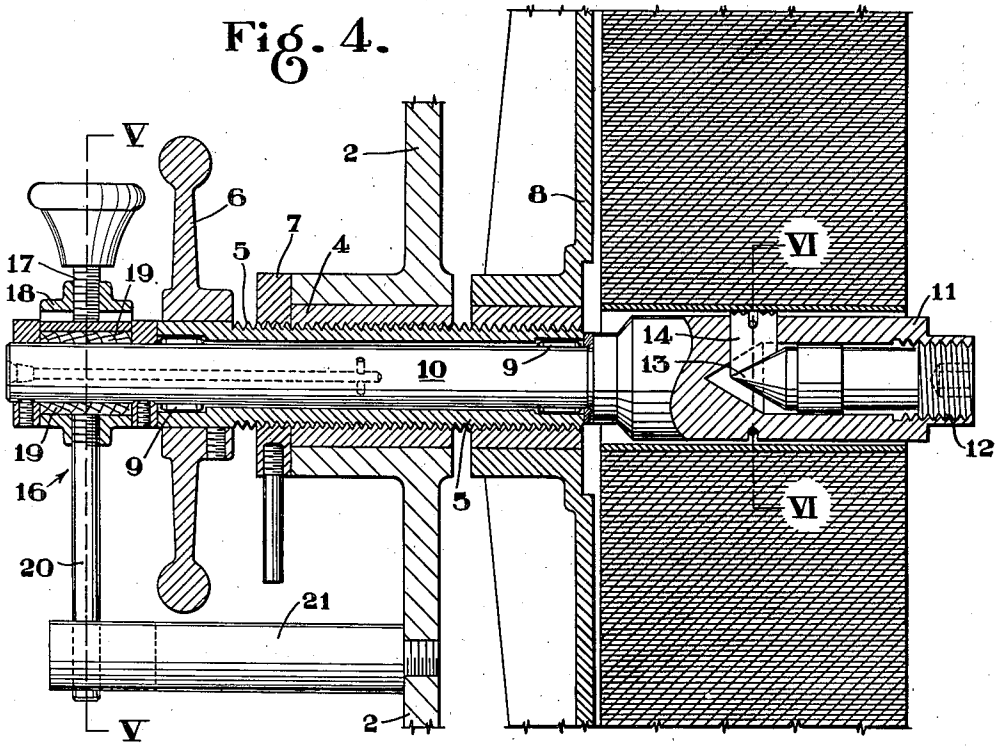


Fig. 5.

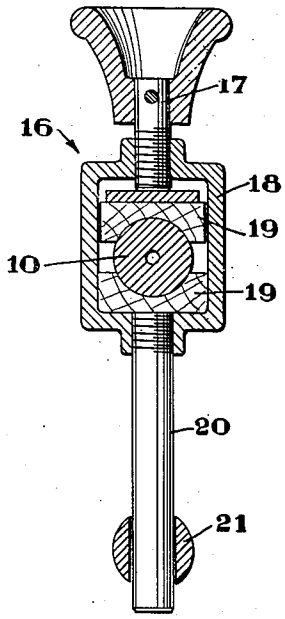
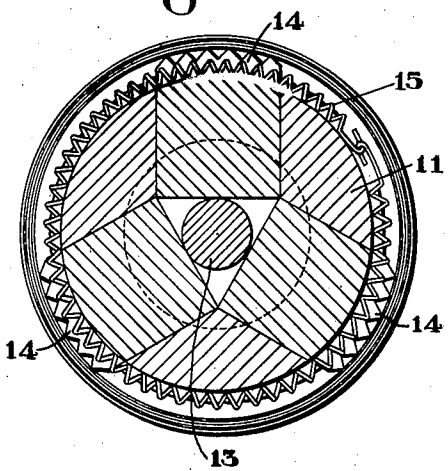


Fig. 6.



Inventor

EDMUND J. DEVILLERS

By H. S. McPowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 7.

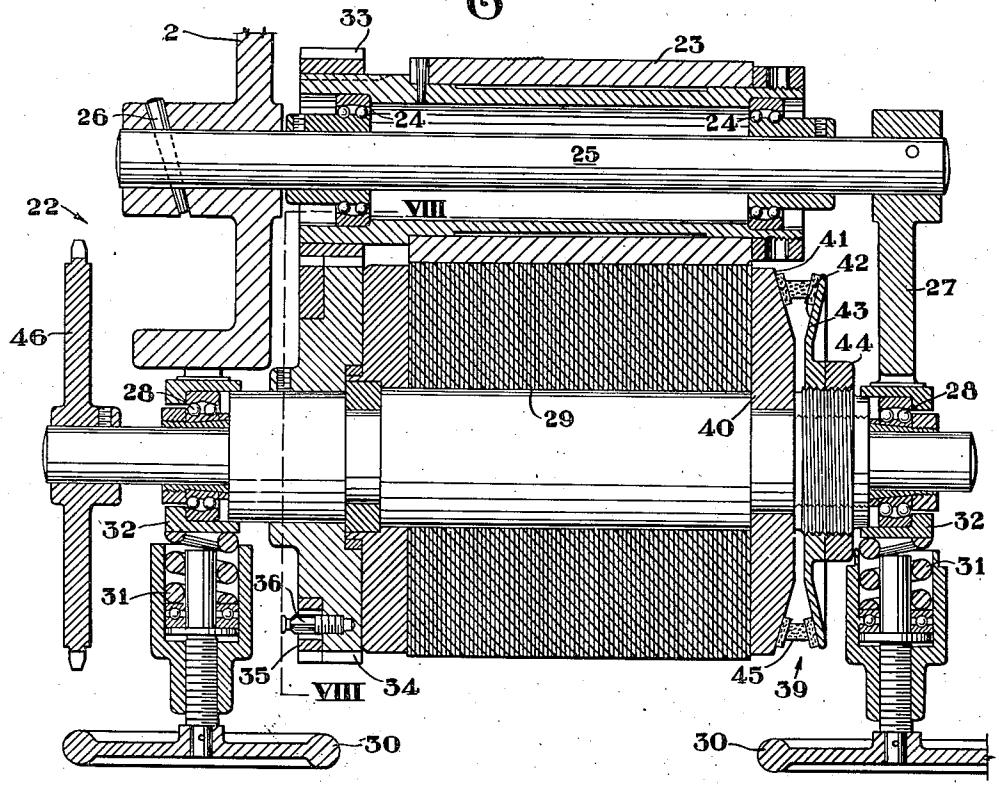


Fig. 8.

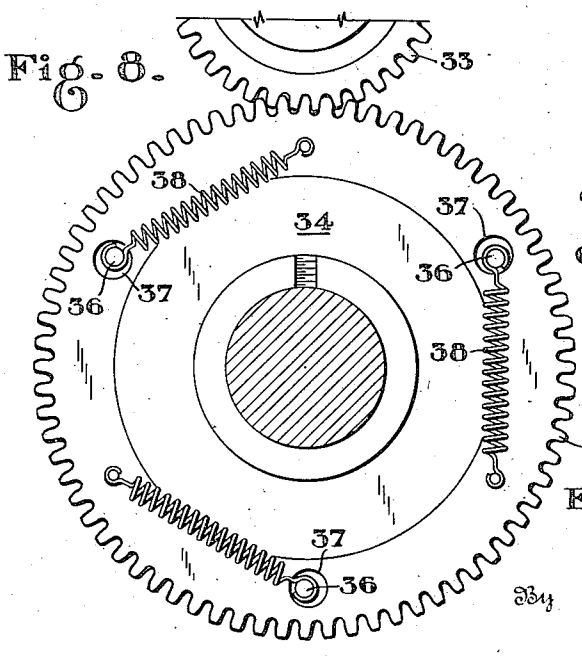
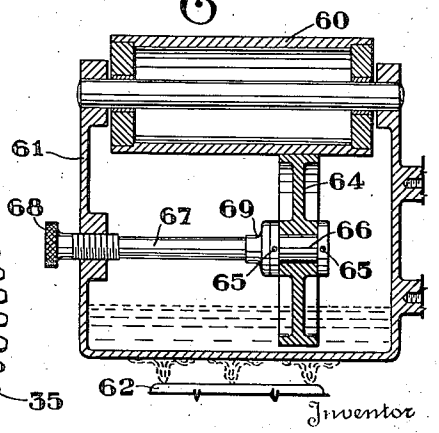


Fig. 11.



Inventor

EDMUND J. DEVILLERS

By H. A. McFarlell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 9.

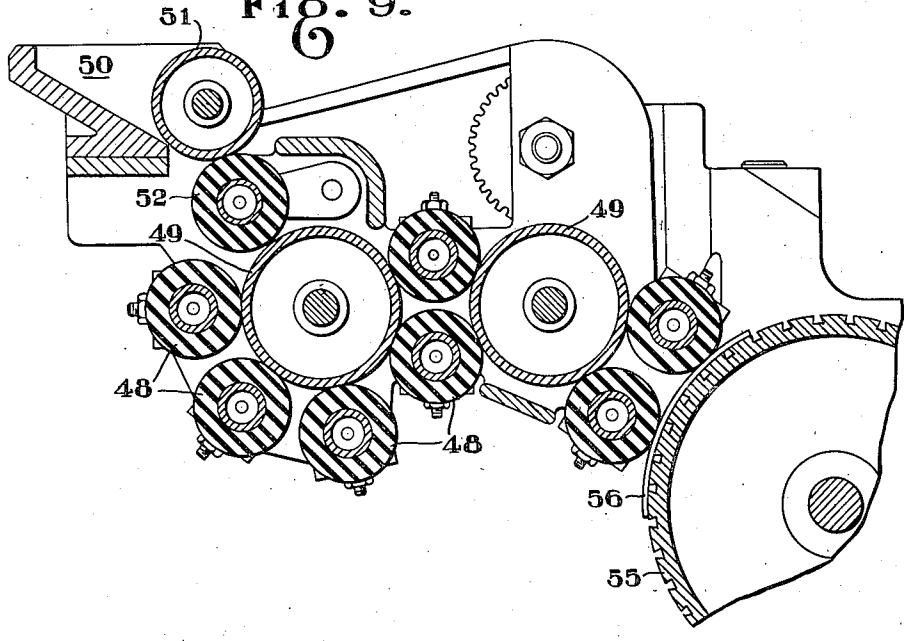
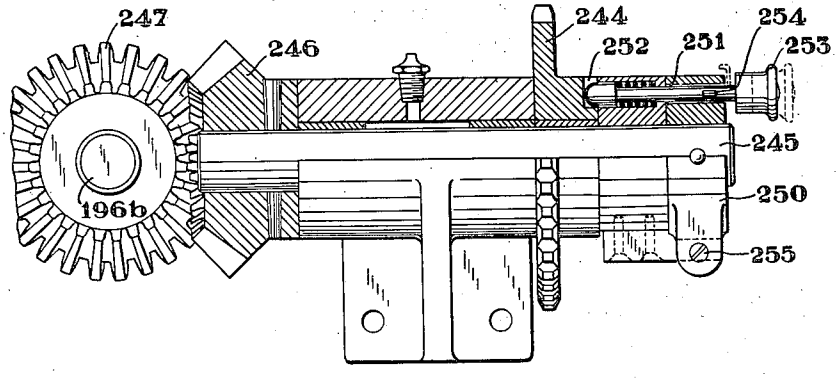


Fig. 42.



Inventor

EDMUND J. DEVILLERS

By W. J. M. Howell

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March 9, 1943. E. J. DE VILLERS 2,313,628

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Fig. 13.

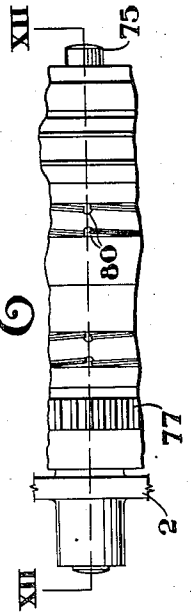


Fig. 12.

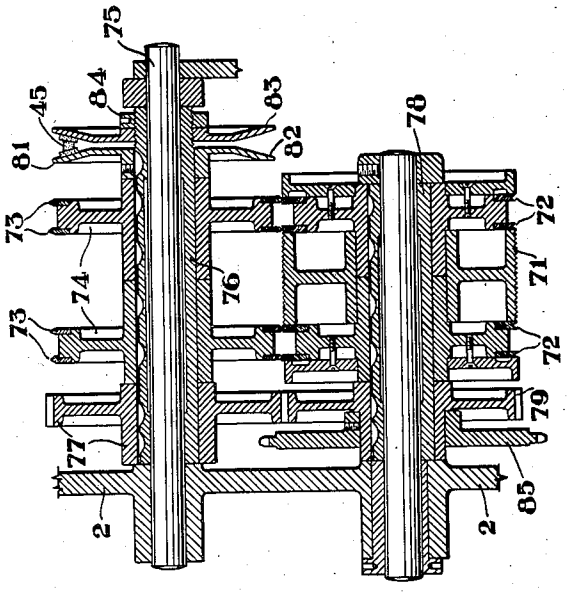
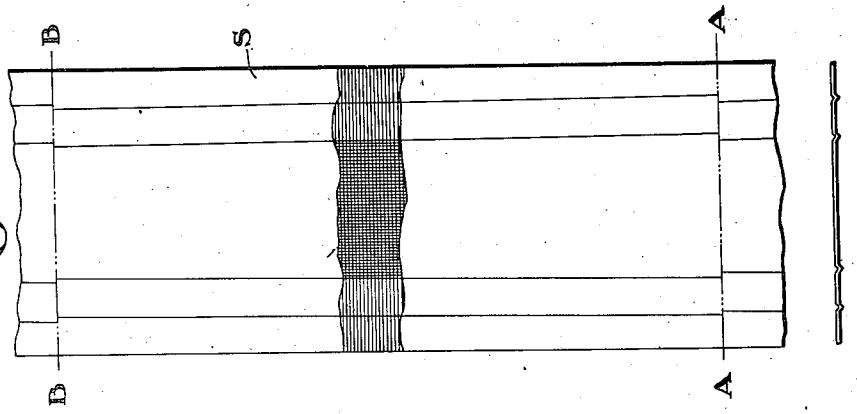


Fig. 14.



Inventor

EDMUND J. DEVILLERS

By W. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 16.

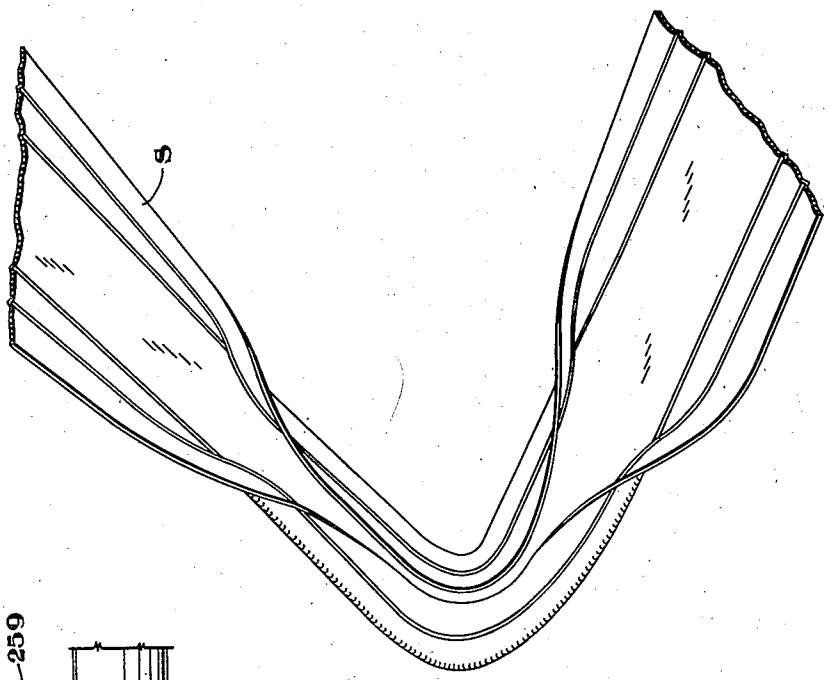
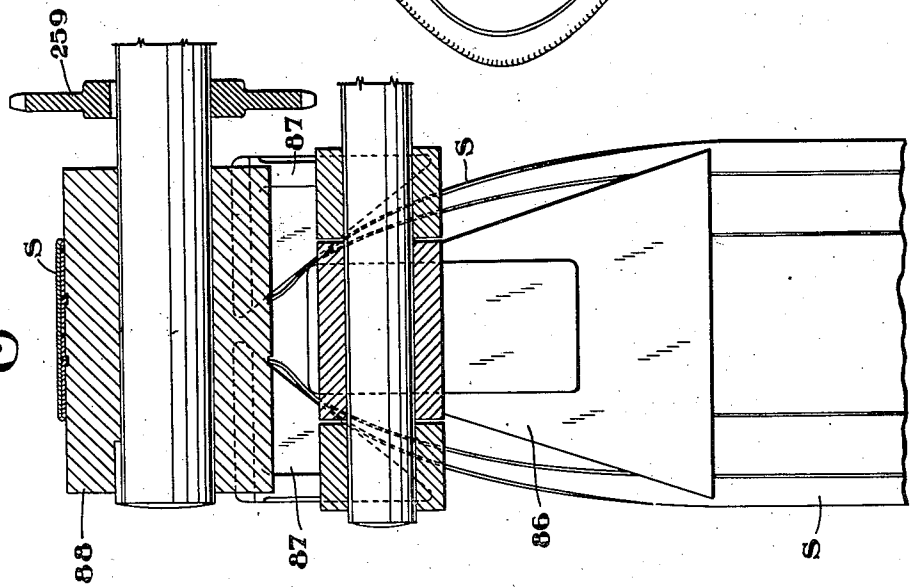


Fig. 15.



Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

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Fig. 17.

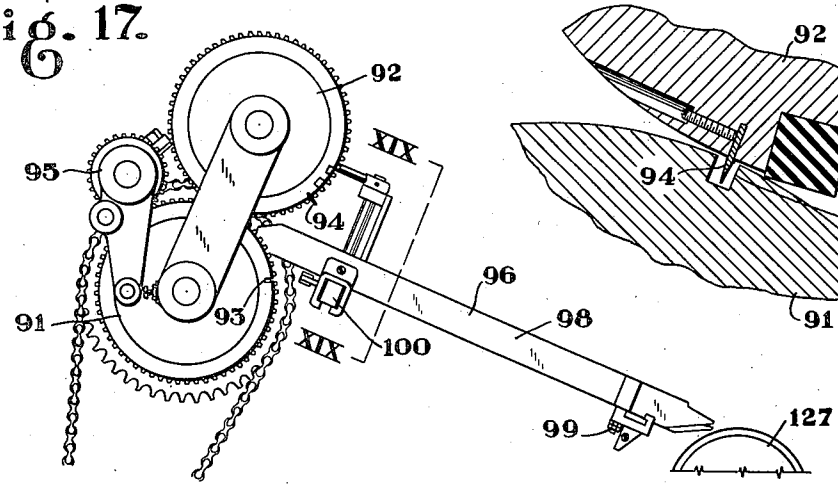


Fig. 18.

Fig. 19.

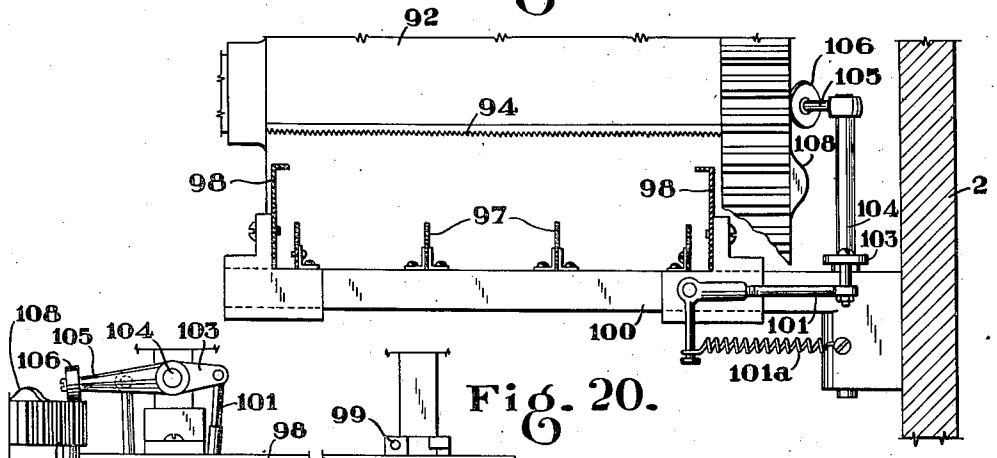


Fig. 20.

Inventor

EDMUND J. DEVILLERS

By W. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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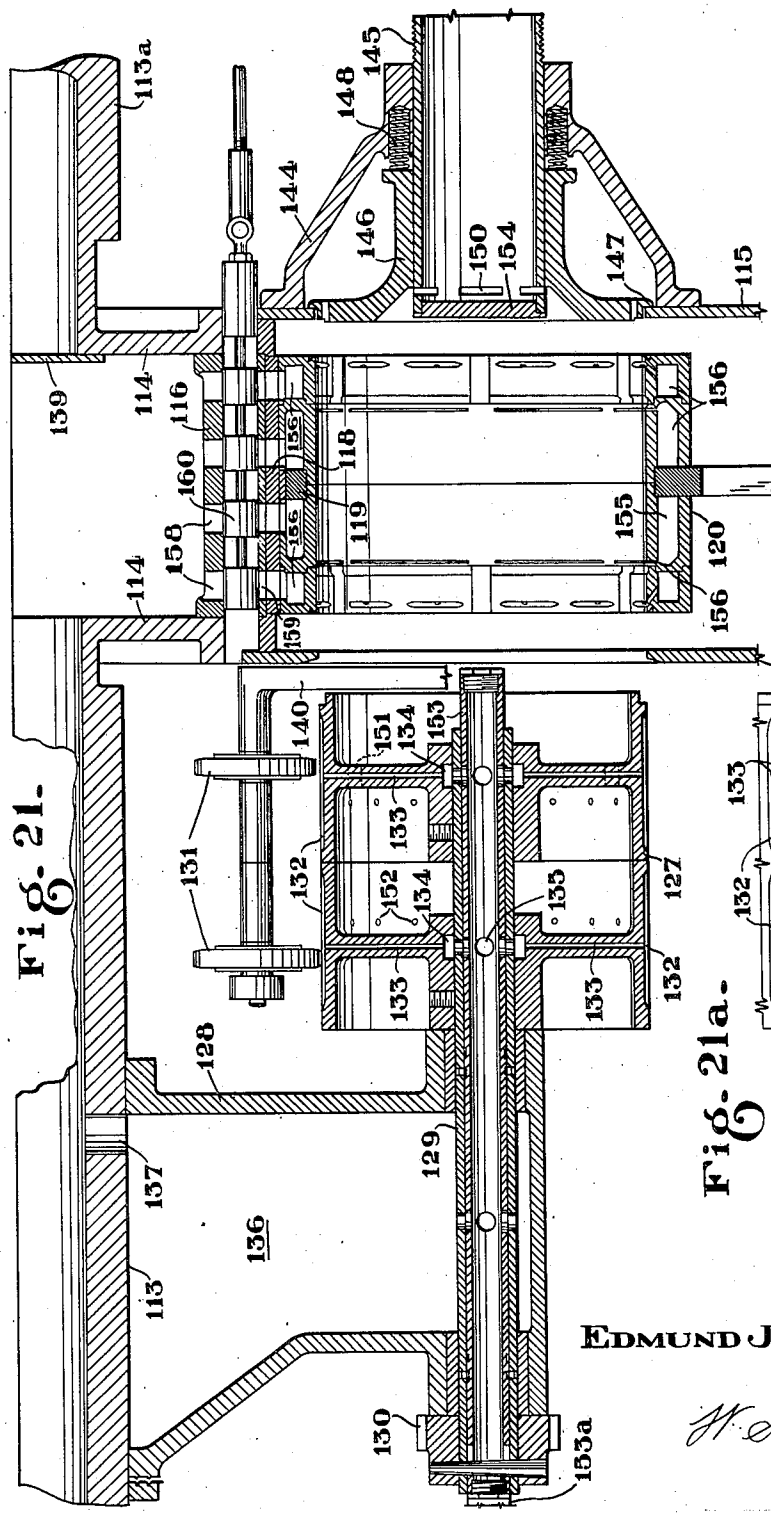


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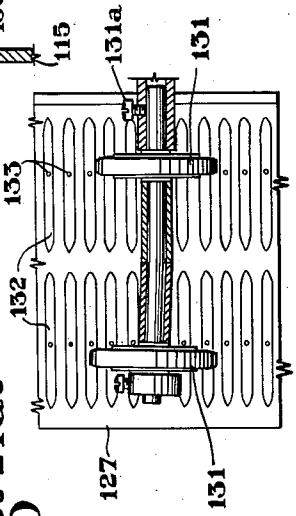


Fig. 21a.

Inventor

EDMUND J. DE VILLERS

H. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

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Fig. 22.

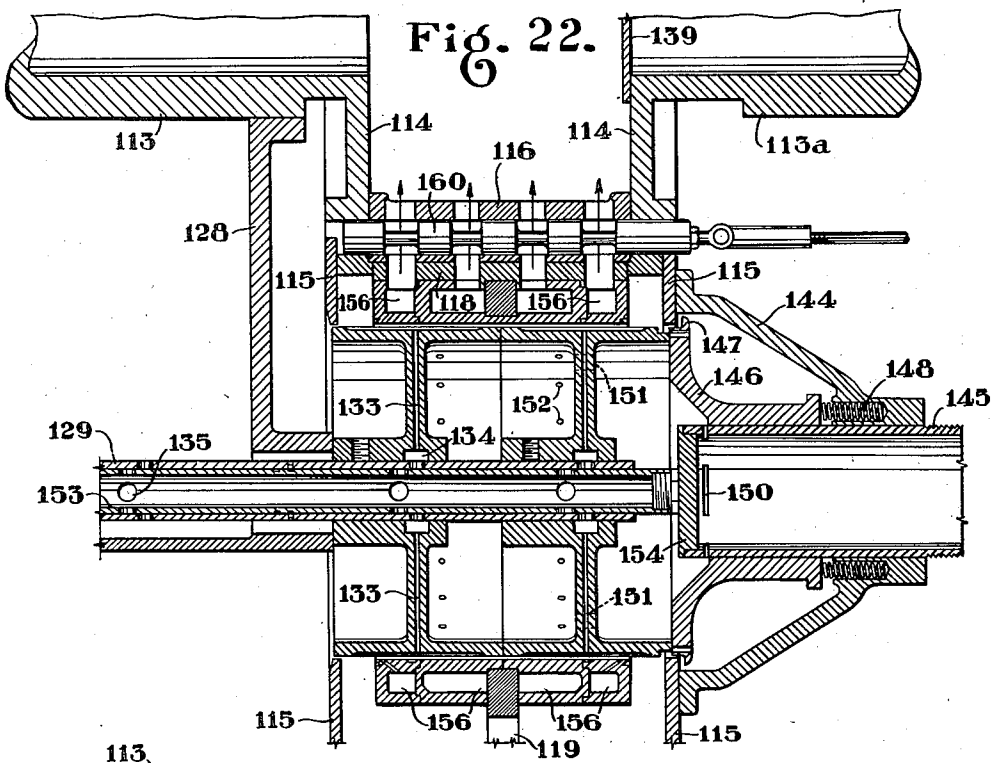
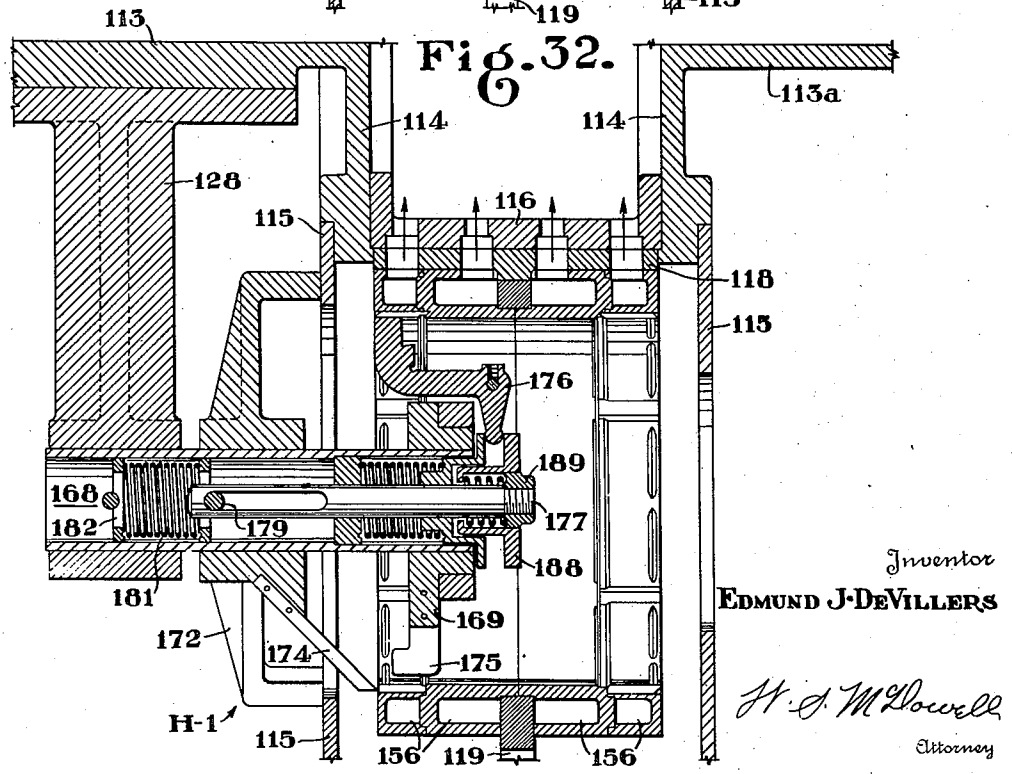


Fig. 32.



Inventor

EDMUND J. DEVILLERS

H. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 23.

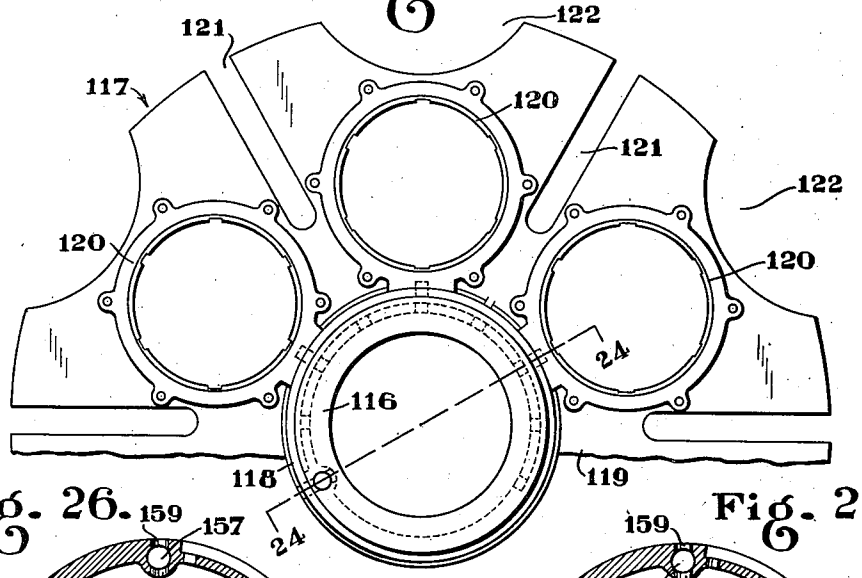


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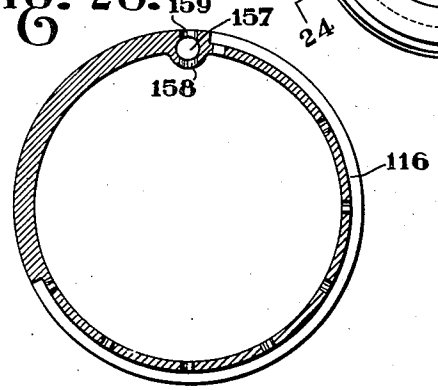


Fig. 27.

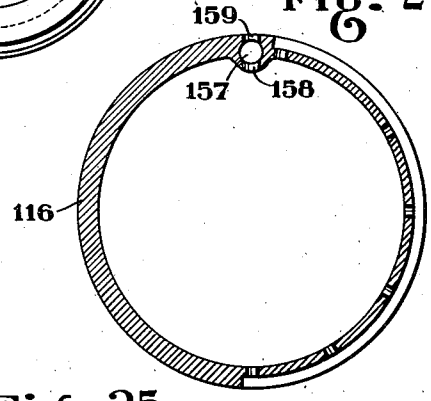


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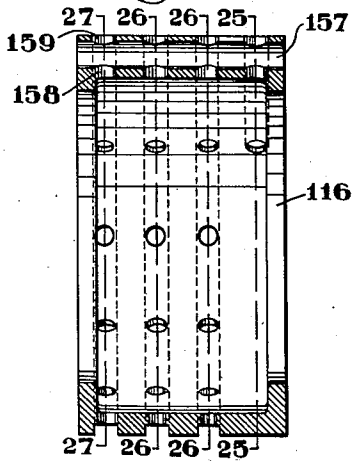
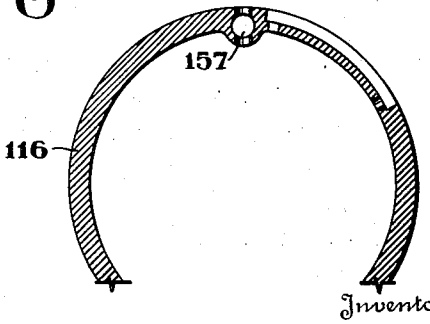


Fig. 25.



Inventor

EDMUND J. DEVILLERS

By H. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 29.

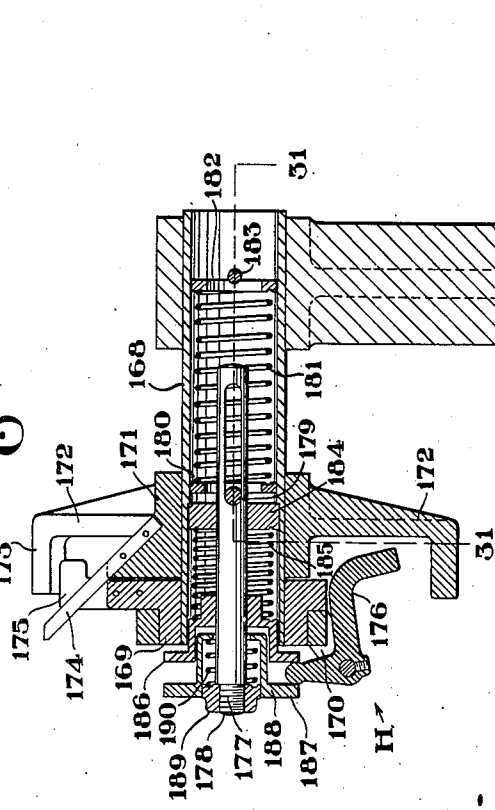


Fig. 31

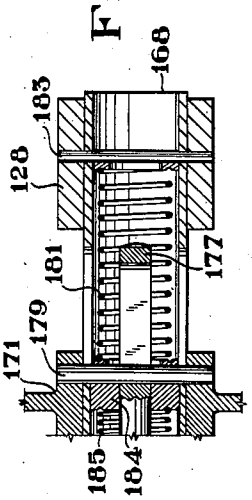


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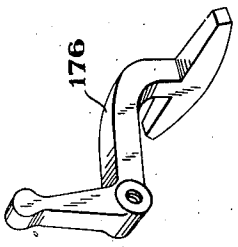
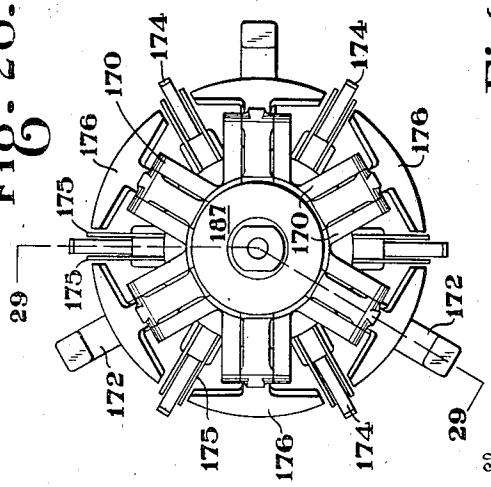


Fig. 28.



Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 34.

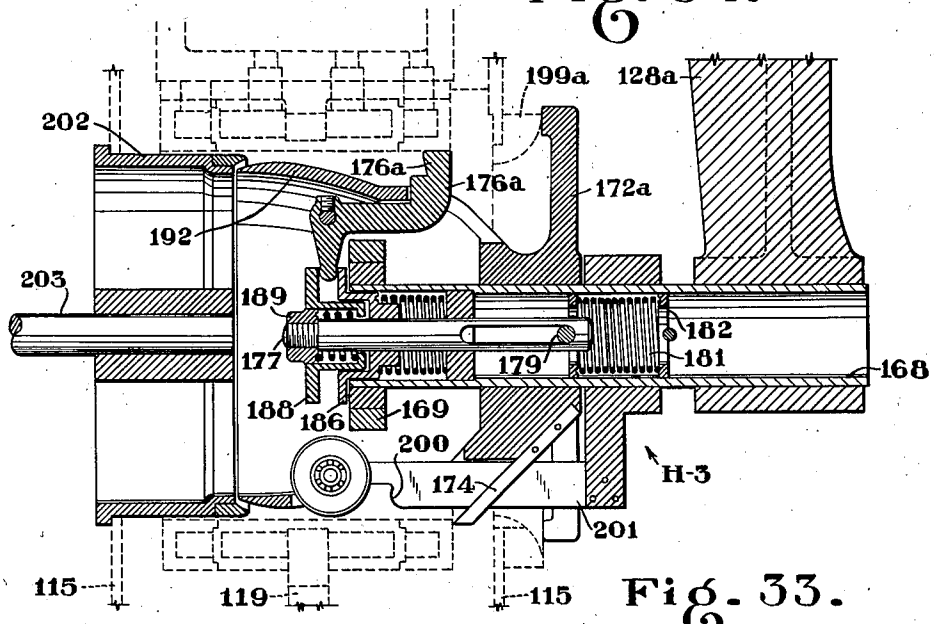
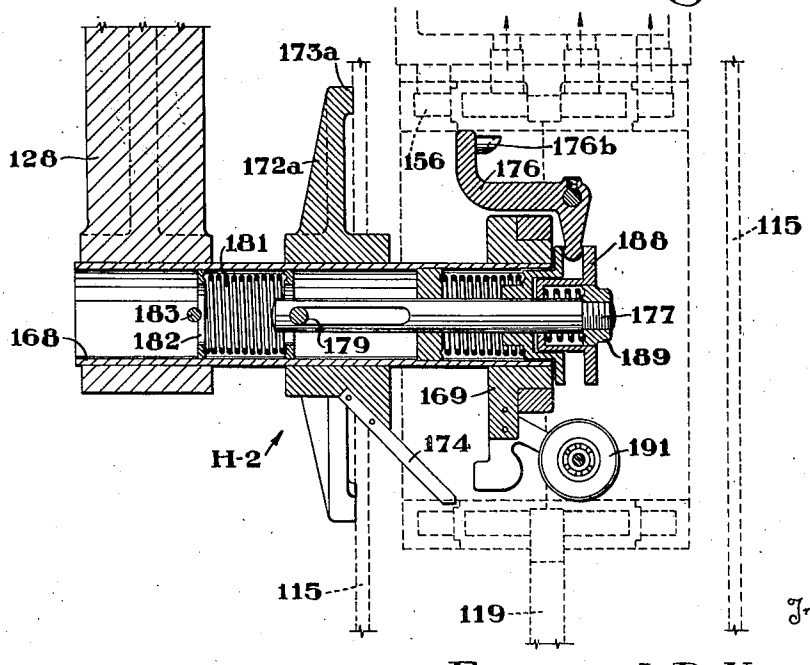


Fig. 33.



Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 36

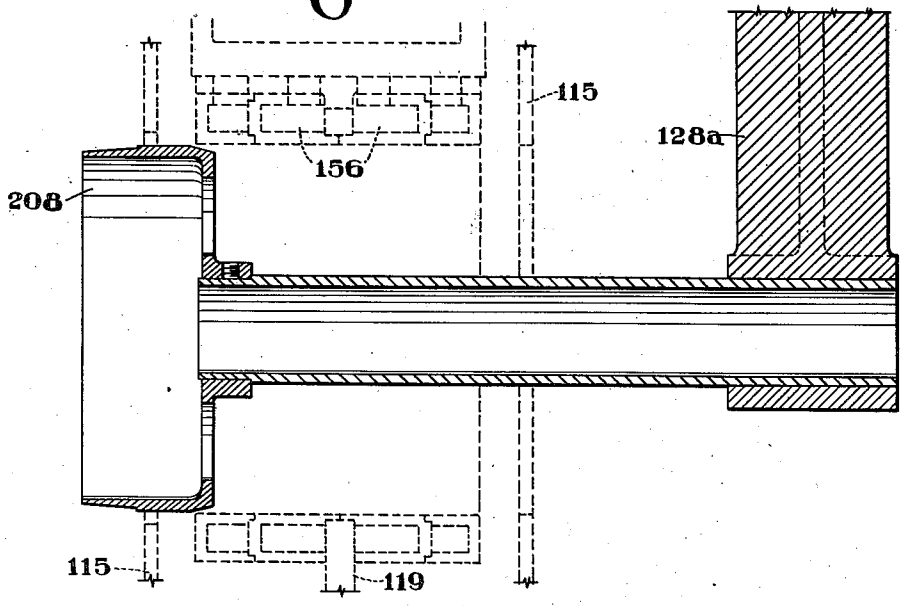
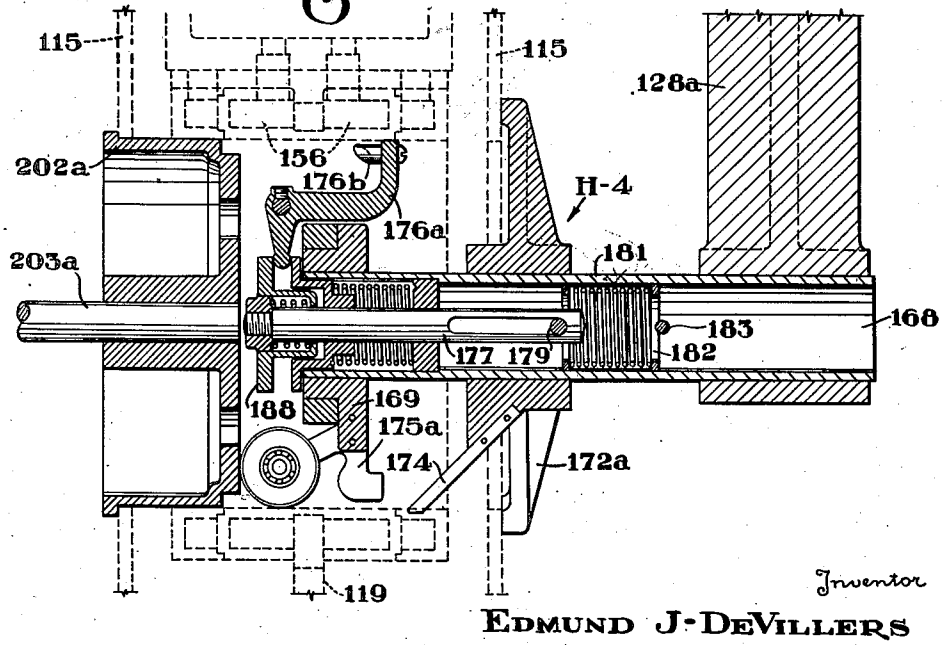


Fig. 35



Inventor

EDMUND J. DEVILLERS

By H. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 40

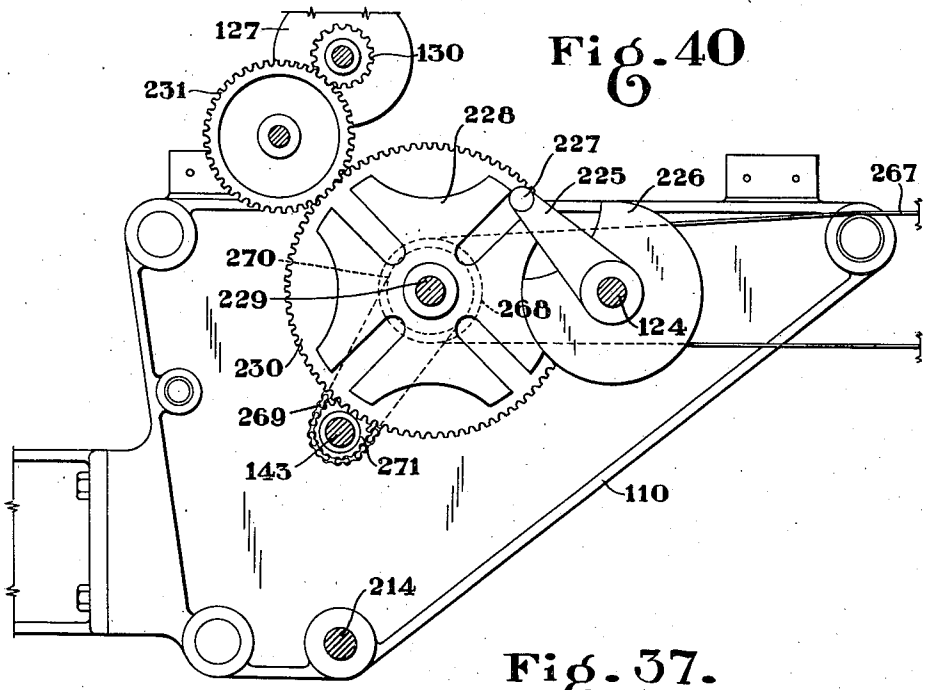
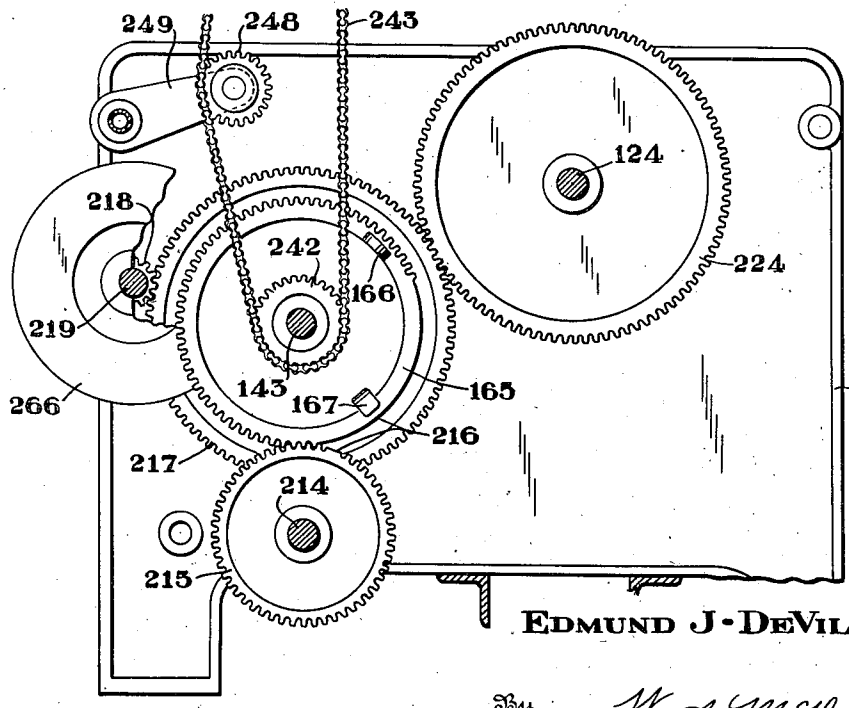


Fig. 37.



Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 38.

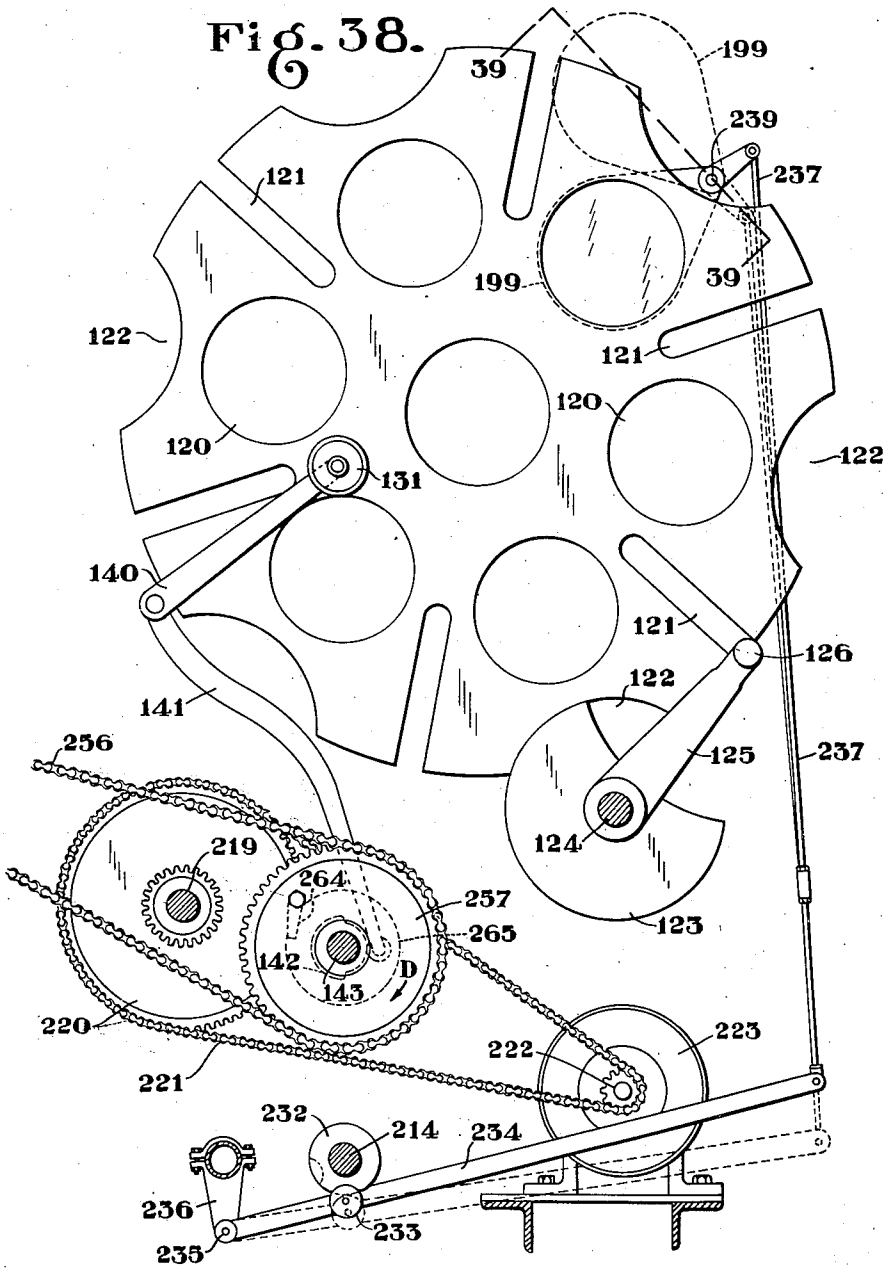
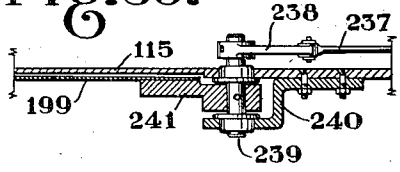


Fig. 39.



Inventor

EDMUND J. DEVILLERS

By H. S. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 41.

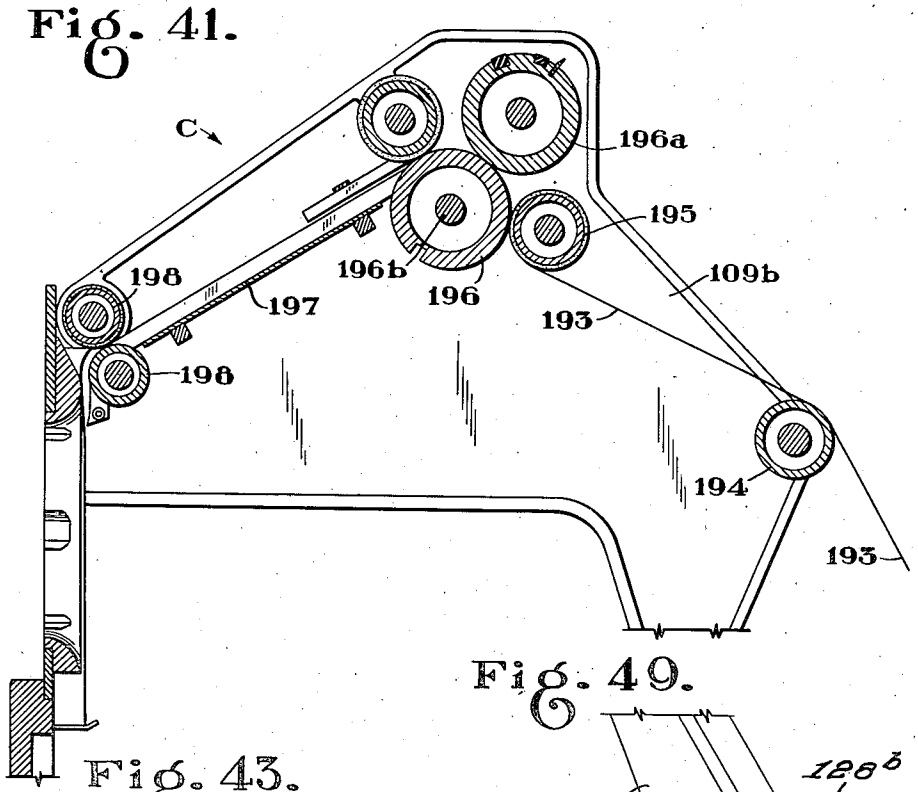


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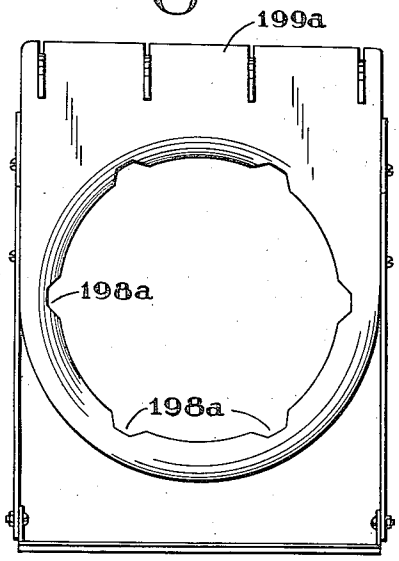
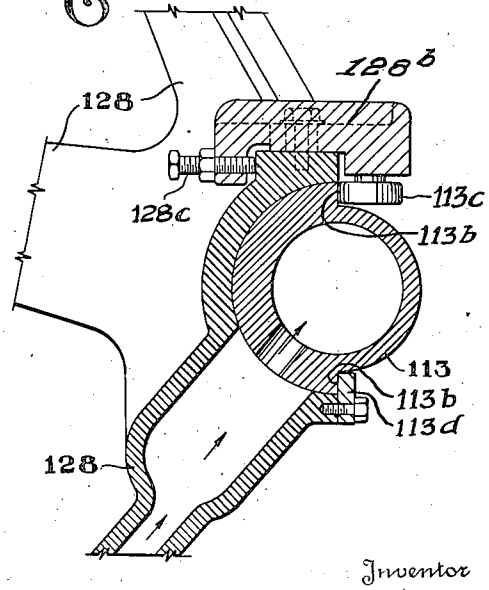


Fig. 49.



Inventor

EDMUND J. DEVILLERS

By W. J. McDowell

Attorney

March 9, 1943. E. J. DE VILLERS 2,313,628

PAPER CAP-FORMING MACHINE

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Fig. 44.

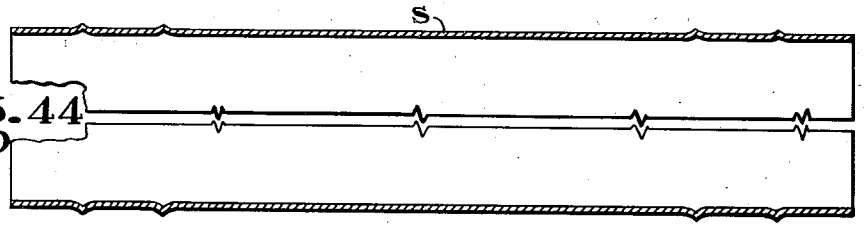


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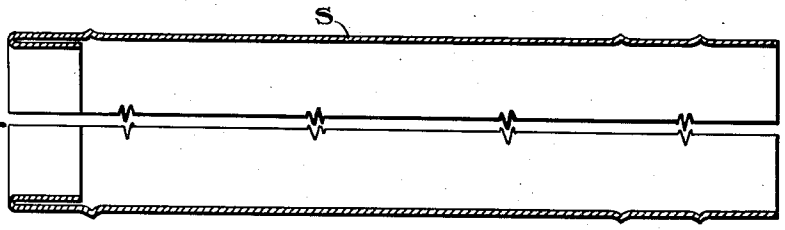


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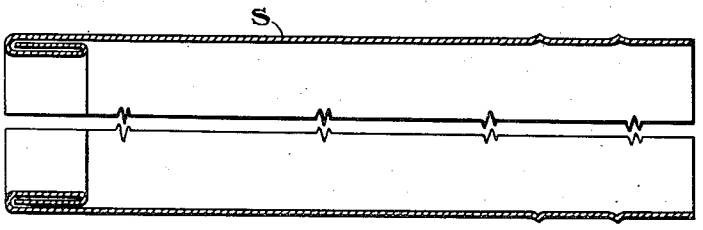


Fig. 47.

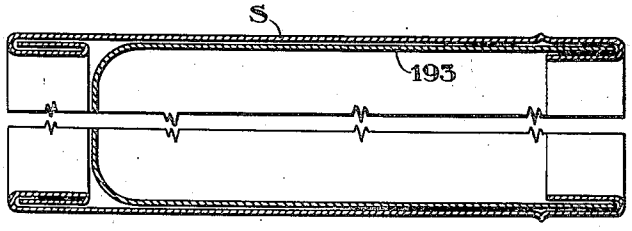
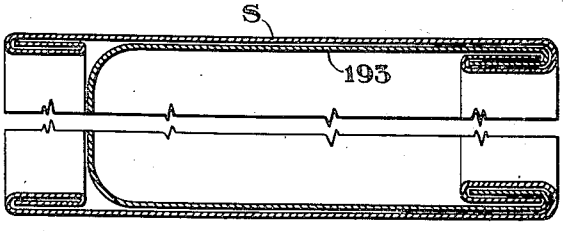


Fig. 48.



Inventor

EDMUND J. DEVILLERS

By W. S. McDowell

Attorney

Patented Mar. 9, 1943

2,313,628

UNITED STATES PATENT OFFICE

2,313,628

PAPER CAP-FORMING MACHINE

Edmund J. De Villers, Columbus, Ohio, assignor to White Castle System, Inc., Columbus, Ohio, a corporation of Delaware

Application December 28, 1940, Serial No. 372,150

11 Claims. (Cl. 223—7)

This invention relates to a mechanism for producing headgear of the type used by chefs, waiters, bakers and storekeepers. Usually if such attendants wear caps, they are formed of fabric, such as linen, which must be laundered frequently to maintain them in a sanitary and neat-appearing condition. This repeated cleansing causes the caps to prematurely deteriorate and they must therefore be replaced within relatively short periods. Because of the expensiveness of these requirements, the use of such caps has not become as widespread as it might have otherwise.

An object of this invention resides in the provision of a machine which will produce caps of the type mentioned from relatively inexpensive sheet or strip material in order that the caps may be discarded when they become soiled. Caps so produced are similar in appearance to the linen caps but because of their low cost, due to their manner of production and discardability, they become more desirable.

The machine forming the present invention comprises an improvement over that disclosed in the patent to Glenn A. Shaffer et al., No. 2,023,152 dated December 3, 1935, whereby the practicability, efficiency and productivity of the machine is increased and the degree of personal attention required to maintain the machine in proper operating condition diminished.

It is an object of the invention to provide a cap making machine having a series of sets of rollers operated by power driven means to unwind a strip of paper from a supply roll; emboss the paper to cause it to simulate fabric; print advertising or other indicia thereon; waterproof a longitudinally extending zone of reduced width on the strip; form a plurality of longitudinally extending creases in the strip; successively sever sections of predetermined length from the strip and feed these sections to mechanism provided on the machine which will operate on the strip sections to roll and fold the same into collar-like band-forming bodies, additional means cooperating with the last named mechanism to apply sheets of thin paper to the bodies to close one end of each and form the crowns of the finished caps.

An object also resides in providing means adjacent to certain of the sets of rollers, mentioned above, to apply color and designs to the paper passing between the rollers, means being provided to mount the color and design applying means on the machine in such manner that they may be readily moved into and out of operating positions.

Another object resides in providing the strip rolling and folding mechanism with a turret head having a plurality of mold chambers circumferentially spaced thereon, means being provided to intermittently move the turret head to successively register the mold chambers with apparatus for inserting the strip sections into the chambers, performing various operations on the strip sections while they are disposed within the chambers and discharging the caps from the turret, the turret moving means being so designed as to facilitate the smooth, rapid production of caps and reduce to a minimum the attention required to keep the mechanism in operating condition.

A further object rests in providing improved mechanism for introducing the crown forming sheets to the molds containing the partially folded strip sections, the sheet introducing mechanism having roller means for withdrawing paper from a supply roll, knife means for cutting the paper into proper size pieces; means for positioning these pieces in registration with a mold chamber while maintaining them in a flat condition; and means for moving the pieces into the mold at the proper time.

Other objects will be apparent from the following description and the accompanying drawings in which a machine formed in accordance with the present invention has been disclosed in detail.

Fig. 1 is a front elevational view of the cap forming machine formed in accordance with the invention;

Fig. 2 is an elevational view looking toward the end of the cap forming section of the machine;

Fig. 3 is a plan view;

Fig. 4 is a detail vertical sectional view of mechanism used to support a roll of strip material from which the bands of the caps are formed, the plane of this section being indicated by the line IV—IV of Fig. 1;

Fig. 5 is a detail vertical sectional view taken on the plane indicated by the line V—V of Fig. 4;

Fig. 6 is a similar view taken on the plane indicated by the line VI—VI of Fig. 4;

Fig. 7 is a detail vertical sectional view taken on the plane indicated by the line VII—VII of Fig. 1 and shows a pair of rollers used to emboss the strip material from which the caps are formed;

Fig. 8 is a detail vertical sectional view taken on the plane indicated by the line VIII—VIII of Fig. 7;

Fig. 9 is a vertical longitudinal sectional view taken through mechanism employed to apply designs to the band forming strip and means for applying ink to such mechanism;

Fig. 10 is a plan view of the design applying

mechanism illustrating the inking means in inoperative position;

Fig. 11 is a vertical transverse sectional view taken on the plane indicated by the line XI—XI of Fig. 1, showing the means for applying a stripe of paraffin or other waterproofing material to the band forming strip;

Fig. 12 is a horizontal sectional view taken on the plane indicated by the line XII—XII of Fig. 1 and shows a set of double rollers employed to apply a plurality of longitudinally extending creases to the strip material;

Fig. 13 is a plan view of a portion of the sets of rollers showing the offset relation of the ends of the crease-forming means;

Fig. 14 is a plan view of a portion of the strip material after it has passed through the rollers shown in Fig. 12;

Fig. 15 is a detail horizontal sectional view taken on the plane indicated by the line XV—XV of Fig. 1 showing means for guiding and folding the strip;

Fig. 16 is a perspective view of a portion of the strip showing how the strip is folded and unfolded as it passes through the mechanism shown in Fig. 15;

Fig. 17 is a side elevational view of means employed to sever predetermined lengths from the strip and guide these lengths to the cap forming section of the machine;

Fig. 18 is an enlarged detail vertical sectional view showing the cut-off rollers in position to sever the strip;

Fig. 19 is a detail vertical sectional view taken on the plane indicated by the line XIX—XIX of Fig. 17;

Fig. 20 is a plan view of the means for guiding the lengths of material from the severing mechanism to the cap forming section of the machine;

Fig. 21 is a detail sectional view taken through the drum employed in coiling the band forming blank prior to inserting it into a mold chamber in a rotatable turret head constituting a part of the cap forming section of the machine, the plane of this section being indicated by the line XXI—XXI of Fig. 1;

Fig. 21*a* is a fragmentary plan view of the strip winding drum and the guiding rollers cooperating therewith;

Fig. 22 is a similar view showing the material coiling drum within the mold chamber of the turret;

Fig. 23 is a front elevational view of a portion of the turret head;

Fig. 24 is a detail sectional view taken on the plane indicated by the line **24—24** of Fig. 23;

Fig. 25 is a detail vertical sectional view taken on the plane indicated by the line **25—25** of Fig. 24;

Figs. 26 and 27 are detail vertical sectional views on the planes indicated by the lines **26—26** and **27—27** respectively of Fig. 24;

Fig. 28 is a view in front elevation of a head used to fold the longitudinal edge of the band forming strips while they are positioned in the molds of the turret;

Fig. 29 is a detail longitudinal sectional view taken through the head on the plane indicated by the line **29—29** of Fig. 28;

Fig. 30 is a perspective view of a bell crank lever carried by the folding head;

Fig. 31 is a detail longitudinal sectional view taken on the plane indicated by the line **31—31** of Fig. 29;

Fig. 32 is a detail vertical sectional view taken on the plane indicated by the line **32—32** of Fig. 1 showing the turret head at the second stage of the cap forming operation, a folding head being in operative position within the mold chamber;

Fig. 33 is a vertical sectional view taken through the turret head on the plane indicated by the line **33—33** of Fig. 1 showing the third state of cap forming operation, the folding head being disposed within the mold chamber;

Fig. 34 is a similar view taken on the plane indicated by the line **34—34** of Fig. 1 showing the turret head in the fourth stage of cap forming operation, the folding head being provided with means for moving the crown forming sheet into the mold chamber prior to performing the folding operation;

Fig. 35 is a similar view taken on the plane indicated by the line **35—35** of Fig. 1 showing the turret head in the fifth stage;

Fig. 36 is a similar view on the plane indicated by the line **36—36** of Fig. 1 showing the final stage at which the finished cap is ejected from the mold chamber;

Fig. 37 is a vertical sectional view taken on the plane indicated by the line **37—37** of Fig. 2;

Fig. 38 is a similar view on the plane indicated by the line **38—38** of Fig. 2;

Fig. 39 is a detail sectional view taken on the plane indicated by the line **39—39** of Fig. 38;

Fig. 40 is a vertical sectional view taken on the plane indicated by the line **40—40** of Fig. 2;

Fig. 41 is a vertical sectional view taken through the crown sheet feeding mechanism, the plane of this section being indicated by the line **41—41** of Fig. 3;

Fig. 42 is a detail vertical sectional view taken on the plane indicated by the line **42—42** of Fig. 1;

Fig. 43 is a front elevational view of a plate secured to a portion of the frame in registration with the crown sheet inserting means;

Fig. 44 to Fig. 48, inclusive, are detail sectional views taken through a cap during the various stages of its formation in the machine;

Fig. 49 is a detail vertical sectional view taken on the plane indicated by the line **49—49** of Fig. 2.

Referring more particularly to the drawings, the machine shown therein comprises a material preparing, cutting and feeding section and a cap forming section, the former being designated generally by the letter A and the latter by the letter B. These sections each include frame means joined to form a rigid unit as at 1. The frame 2 of the material feeding section extends longitudinally of the machine and is vertically arranged, it being somewhat plate-like in form and having laterally projecting feet 3 at the lower end. Near the left hand portion of the frame 2, when it is viewed from the front as in Fig. 1, there is provided a reel for supporting a supply roll of strip material S from which the cap bands are formed.

This reel, which is best illustrated in Figs. 4, 5 and 6, includes a sleeve 4 disposed within a boss formed on the frame 2. The sleeve is internally threaded for the reception of a similarly threaded hollow screw 5, one end of which has a handle 6 secured thereto. This handle is disposed at the rear of the frame 2 where it may be grasped by an operator when it is used to adjust the screw in the sleeve 4. The screw is maintained in its positions of adjustment by a jam nut 7 disposed on the screw and

engaging the outer end of the boss provided on the frame. The inner end of the screw has a plate 8 mounted thereon, this plate being provided for straightening the paper strip in the supply roll so that it will feed properly.

The hollow screw has a plurality of needle bearings 9 at the ends for the rotatable support of a shaft 10 on which the supply roll is positioned. The end of the shaft receiving the supply roll is enlarged as at 11 and has a longitudinally extending opening formed therein for the reception of a screw 12 employed to lock the supply roll to the shaft. The inner end of the screw is pointed as at 13 for engagement with the inclined ends of wedge blocks 14 which extend through transverse guide openings formed in the shaft 10. The outer ends of the blocks 14 have saw teeth formed therein whereby the paper roll will be positively keyed to the shaft. In applying the paper roll, the screw 12 is turned to move it outwardly and permit the blocks 14 to be retracted into the enlarged head on the shaft, this movement being facilitated by an endless coil spring 15 extending around the shaft and engaging the outer ends of the blocks 14. The supply roll is then slipped onto the enlarged head and forcibly engaged with the plate 8 to straighten the convolutions of the strip material in the roll. The screw 12 is then turned back into the opening to cause the conical point on the screw to force the blocks 14 outwardly and embed the saw teeth at the outer ends thereof in the supply roll core. After the supply roll has been locked to the shaft, the jam nut 7 may be turned to release the screw 5 and permit the handle 6 to be turned to move the entire assembly including the supply roll toward or away from the frame 2 to align the strip with other mechanism on the frame. At this time, the plate 8 may be rotated on the hollow screw and backed away from the supply roll to prevent any interference to rotation. When the supply roll is rotated, the shaft will be forced to turn in the bearings 9. To prevent the momentum which might be set up from unwinding an excessive amount of strip material, the shaft is provided with a brake or friction applying means 16. This means engages the rear end of the shaft and grips it in proportion to the amount of compressive force applied through the adjustment of a set screw 17.

The brake means includes a yoke 18 in which a pair of wood blocks 19 are supported, these blocks having arcuate recesses for the reception of the shaft 10 and being moved toward one another by the set screw 17 to grip the shaft. The yoke has a pin 20 depending therefrom, the lower end of which is positioned in a slot formed in a bar 21 projecting from the rear surface of the frame 2. The engagement of the bar with the pin prevents the yoke from turning when the supply roll imparts rotation to the shaft 10.

Above the supply roll, the frame 2 supports a pair of rolls, designated generally by the numeral 22, used to emboss the strip as it is withdrawn from the supply roll. These embossing rolls 22 are illustrated in detail in Figs. 7 and 8 and include a small roll 23 on which a die is formed by engraving or other suitable means to emboss the paper strip to make it simulate linen or other material.

The roll 23 is rotatably supported by bearings 24 carried by a bar 25 which is pinned as at 26 to a boss on the frame 2. The bar 25 projects forwardly from the frame and supports a bracket 27 at its outer end. This bracket in turn supports bearing means 28 in registration with similar bearings carried by the frame 2. A shaft is journaled in the bearings 28 and receives a roll 29 formed of disk-like laminations of paper or other impression-receiving material. The roll 29 constitutes a matrix, the design of the die being impressed therein through the rotation of the roll in engagement with the roll 23.

Yieldable engagement between the rolls 23 and 29 is maintained by providing adjustable hand wheels 30 and compression openings 31, the latter being disposed between shoulders on the threaded shanks of the hand wheels and bearing cases 32 surrounding the bearings 28. Through the rotation of the hand wheels, the degree of compressive engagement between the rolls can be varied. As the paper strip passes between the rolls 23 and 29, it will be embossed by the die forcing the material of the strip into the impressions in the roll 29.

By means of gears 33 and 34, the rolls 23 and 29 are caused to rotate at the same peripheral speed. This driving engagement will insure the registration of the design on the die with the impressions in the matrix roll. As illustrated in Fig. 8, lost motion between the gears 33 and 34 is eliminated by providing the latter with a supplemental gear section 35 which is supported for rotation on a hub formed with the gear 34. The latter gear carries a plurality of pins 36 which project through openings 37 formed in the gear 35 and have their outer ends grooved to receive hooks formed at the ends of tension springs 38. The opposite ends of these springs are connected with pins projecting from the outer side of the gear 35. By reason of the tension applied by the springs 38, the gear 35 will rotate relative to the gear 34 and take up any lost motion which may develop between the gears 33 and 34. The extent of movement of the supplemental gear relative to the gear 34 is limited by the size of the openings 37 relative to the pins 36.

Rotation is imparted to the embossing rolls through a belt drive of which a pulley 39 formed with the end of the matrix roll constitutes a part. This pulley includes a plate 40 having an inclined surface 41 registering with an oppositely inclined surface 42 formed on a second plate 43, the latter being adjustably carried by the shaft of the matrix roll. The relative position of the plate 43 on the shaft is maintained by a nut 44. The pulley formed by the plates 40 and 43 is of the variable type, the size being changed by moving the plate 43 toward or away from the plate 40. When the plate 43 is moved away from the other plate, the effective size of the pulley will be decreased and the belt 45 will engage the inclined surfaces 41 and 42 nearer the center of rotation of the pulley. At this time, the matrix roll will be driven at a greater rate of speed than when the belt engages the outer portions of the plates.

After a period of use, the die or matrix roll may wear to such an extent that the strip will not be properly embossed. At such time, the matrix roll may be renovated by positively moving it toward the die and rotating the rolls while maintaining such positive engagement. In performing this operation, the springs 31 are removed and suitable blocks, not shown, are positioned between the ends of the hand wheel shanks and the bearing cases. When the hand wheels are adjusted to move the shafts inwardly, the roll 29 will be positively engaged with the die roll 23 and rotation of the roll during such engagement will

deepen the impressions of the die in the matrix. To impart rotary movement to the rollers during this running in operation, the matrix roll shaft has a sprocket 46 secured thereto at the rear of the frame 2, this sprocket receiving a chain which extends around a power driven shaft and rotates the sprocket 46. This operation is only performed when the depressions become so shallow that the paper will not be properly embossed.

In some instances, it is desirable to color a portion of the embossed strip. To accomplish this purpose, an inking mechanism 47 is carried by the frame 2 adjacent to the die roll 23. This ink applying mechanism is of the form shown in Fig. 9 wherein a plurality of resilient rollers 48 are disposed between the embossing roller and a pair of longitudinally oscillating ink spreading rolls 49. Additional resilient rolls engage the first oscillating roll to spread the ink uniformly over the outer surface thereof during the transfer of the ink from the reservoir 50 to the embossing die. A feeding roll 51 is journaled at one side of the reservoir, this roll being alternately engaged by a traveling roll 52 which moves back and forth from the roll 51 to the first roll 49. The inking mechanism is so mounted on the frame that it may be moved away from the embossing roll when it is not desired to color the strip.

After the strip has been embossed, it passes between a plurality of printing rolls, designated generally by the numeral 53, mounted on the frame 2 above and to one side of the embossing means. The printing mechanism includes a roll 54 and a pair of type or design carrying rolls 55. These latter rolls have spiral grooves formed therein to receive blocks or other portions of type or dies 56 which may be secured to the rolls. The type or design carrying rolls are geared together as at 57 so that the relative relation of the type or designs carried thereby will be maintained at all times, this provision being necessary to permit registration of the letters or designs applied to the strip. Ink is supplied to the letters or designs by mechanism similar to that employed in connection with the embossing roll and illustrated particularly in Fig. 9.

As shown in Figs. 3 and 10, the inking mechanisms for the printing rolls may be pivotally carried by the frame 2 to permit the former to be moved away from the rolls. The mounting for the inking mechanism on the second roll is slightly different than the mounting for the first in that a pair of links 58 are employed, these links providing for rearward movement of the inking mechanism prior to pivotal movement. The close proximity of additional mechanism on the frame 2 requires the second inking apparatus to be so mounted. Prior to swinging the inking mechanisms on their pivots, they are released from the frame 2 by turning attaching screws 58*a* having handles 58*b* at their outer ends.

After the strip has passed the printing mechanism, it moves downwardly over a guide 59 and around a roller 60 journaled in the upper portion of a pan-like container 61 in which a quantity of paraffin or other waterproofing material is confined. This material is maintained in a liquid state through the provision of a gas burner 62 or other heating unit supported in connection with the container by lugs 63 projecting from the frame 2. The paraffin is held at a substantially uniform temperature by providing the container with a thermostat 61*a* having an operating connection with a valve 61*b* disposed in the gas line leading to the burner 62. By thus controlling the flow of gas to the burner, the paraffin can be kept in a liquid condition and yet at a sufficiently low temperature to prevent excessive vaporization.

Within the container 61, as shown in Figs. 1 and 11, there is journaled a relatively narrow roller 64, the lower portion of which extends downwardly into the pool of paraffin. The roller 64 is yieldably supported by a pair of flexible rods 65 secured at one end to bosses formed with the container wall, the opposite ends of the rods extending into openings formed in a stub shaft 66 upon which the roller 64 is journaled. The longitudinal position of the roller 64 relative to the roller 60 is varied through the provision of an adjusting screw 67 threadedly carried by the side wall of the container 61. The outer end of the screw 67 has a manipulating knob 68 while the inner end is provided with a head 69 for engaging one end of the shaft 66.

It will be noted from Fig. 11 that the roller 64 is spaced intermediately of the ends of the roller 60 and closer to one end whereby the waterproof stripe applied by the roller 64 will be located in predetermined spaced relation from one of the longitudinal edges of the strip. As the strip passes from the roller 60, it moves over a guide 70 and around a roller 71 having female sections 72 of creasing dies secured thereto. These sections of dies register with the male sections 73 carried by rollers 74 journaled for rotation about a shaft 75 projecting forwardly from the frame 2. The rollers 74 are secured to a sleeve 76 which is positioned on the shaft 75, the sleeve serving to connect the rollers 74 with a gear 77. The roller 71 is composed of a plurality of sections which are joined to form a unitary structure and this member is secured to a sleeve 78 journaled on a shaft projecting from the frame 2 in spaced parallel relation to the shaft 75.

The sleeve 78 is provided with a gear 79, the teeth of which mesh with the teeth of the gear 77 to cause the rollers 71 and 74 to rotate in unison. The gears 77 and 79 must have the same pitch diameter to prevent relative movement between the male and female die sections. As illustrated in Fig. 13, these die sections each have relatively offset end portions 80, the sections being so secured to the rollers that they will extend spirally therearound through one revolution. By reason of this construction, the paper strip will be provided with substantially longitudinally extending sets of creases which converge as illustrated in Fig. 14 between lines AA and BB spaced a distance equal to the circumference of the dies 72 or 73. The converging creases are employed because the strip is coiled in the formation of the cap band in such manner as to have the ends overlap, the end portion with the smallest space between the creases being disposed within the other portion and the creases being substantially in registration when the edges of the strip are folded.

The dies are spaced to position the sets of creases near the edges of the strip in order to leave a blank space in the longitudinal center, this space having a width corresponding to the height of the bands of the caps to be formed. It will be noted at this point that the design on the embossing die is such that the portion of the strip between the sets of creases will be embossed to represent fabric or other material and the remaining portions of the strip will be transversely corrugated, as indicated in Fig. 14, to enable the strip to be more easily coiled when it is being

formed into the cap band. The transverse corrugations also facilitate certain bending operations which are performed during the cap forming operations. The indicia applying means are arranged on the rollers 55 in such manner that the impressions thereof, including designs, size indications, etc., will be applied to the areas between the creases in a way which will cause it to be visible and readable after the cap is formed.

One end of the sleeve 76 is provided a variable pitch pulley 81 which receives the belt 45 employed to transmit power from the shaft 76 to the matrix roller 29. The pulley 81 includes a pair of plates 82 and 83, the latter being adjustably carried by the sleeve 76, the positions of adjustment being maintained through a lock ring 84. The gears 77 and 79 transmit power to the sleeve 76 from the sleeve 78 to which power is introduced by means of a sprocket 85. The manner in which the sprocket is driven will be set forth hereafter.

To facilitate the formation of the cap band, the strip is folded along certain of the creases after they have been made by the dies 72 and 73. To perform this folding operation, the strip passes between folding guides 86 and 87, shown particularly in Figs. 1 and 15. The guide 86 engages the central portion of the strip while the other guides engage the edges and turn them over the central portion as shown in Fig. 16. After passing between the members 86 and 87, the folded strip moves around a roller 88 whereby sufficient tensioning force is applied to the strip to weaken the material at the lines where it is folded. This weakening of the material permits it to be more readily folded when the band of the cap is being formed. After the strip has passed around the roller 88, it is unfolded by a shoe 89 having a wedge-like point 90 for entering the space between the body of the strip and the side portions which have been folded. These side portions are moved away from the body as the strip moves along the shoe 89 and when the strip reaches the rear end of the shoe, it will be completely flattened and possess its original width.

The strip passes between the final set of rollers 91 and 92 shown particularly in Figs. 1 and 17. The first of these rollers has a longitudinally extending slot 93 for the reception of the sharpened edge of a saw-tooth knife blade 94 secured to and extending longitudinally of the roller 92. As the rollers 91 and 92 revolve with the paper strip therebetween, the knife 94 will sever a section of paper, having a length equal to the circumference of the roller 92, from the strip. The speed of the rollers and their timing is so arranged that the blade 94 will cut the strip at the offset ends of the sets of creases indicated in Fig. 14 by the lines AA and BB. When a section of the strip has been cut therefrom, the strip will be prevented from falling from the roller 91 by a supplemental roller 95 which engages the roller 91 in advance of the roller 92.

At the discharge side of the rollers 91 and 92, there is disposed an inclined slide 96 which is formed from a plurality of strips 97 arranged on edge and at the sides of the slide, guide angles 98 are supported to prevent the strip sections from moving off the slide as they travel longitudinally thereof. The guide angles are pivotally supported as at 99 adjacent to the discharge end of the slide while the opposite ends of the guides are mounted for limited lateral movement on a bracket bar 100 extending from the frame 2. Movement is imparted to the upper ends of the guides to align the paper as it moves from the cut-off rollers.

The guides are connected by links 101 and 102, as shown in Fig. 20, with opposite ends of a lever 103 mounted for pivotal movement about the axis of a pin 104. The lever is connected with the pin adjacent to one end thereof while the opposite end of the pin has a finger 105 connected therewith. This pin projects rearwardly toward the roller 92 and is provided with a small roller 106 which runs on the side of a gear 107 secured to the roller 92. This gear has a projection 108 for engagement with the roller 106 to cause the finger to move and oscillate the pin 104. This movement will be transmitted to the lever 103 and then to the guides through the links 101 and 102. The roller 106 is maintained in yieldable engagement with the side of the gear 107 through the provision of a spring 101*a* connected at its ends with the bracket bar 100 and the link 101.

The mechanism above described constitutes the material preparing and feeding portion of the machine. When the strip sections leave the slide 96, they pass to the cap forming section per se. This section of the machine designated generally by the letter B includes a plurality of spaced frame sections 109 and 110, as illustrated in Fig. 2. Connecting rods 111 extend between the sections 109 and 110, the rods receiving nuts 112 to secure the frame sections in fixed relatively spaced order. Rising from the upper edges of the sections 109 are supplemental frame sections 109*a* which support aligned tubular members 113 and 113*a* having flanged inner ends 114 disposed in spaced relation. These flanged portions are provided with recesses for the reception of plate members 115 mounted in spaced vertical relation substantially midway between the frame sections 109. One of the plates is connected at its lower edge with the frame section 110 while the other plate is connected at its upper portion with elevated frame brackets 109*b* carried by the upper end of the supplemental frame section 109*a* at the back of the machine.

As illustrated in Figs. 21 and 22, the flanges 114 on the members 113 and 113*a* are connected by an annulus 116. This member is illustrated in detail in Figs. 23 to 27, inclusive. It is rigidly secured to the flanges 114 and forms a bearing for the rotatable reception of a turret designated generally by the numeral 117. The turret includes a sleeve 118 which closely fits the annulus 116 and a disk 119 connected with the sleeve substantially midway of its length. The disk is provided with a plurality of circularly spaced openings in which mold chambers 120 are disposed. The disk also has alternately arranged radial slots 121 and arcuate recesses 122 entering it from the outside edge. The recesses and slots are provided for the reception of members, illustrated in Fig. 38, which are employed to transmit intermittent rotary movement to the turret.

The turret is held in stationary relation by a section of a disk 123 which is secured for rotation with a shaft 124 journaled in the frame sections 109. An arm 125 is also secured to the shaft 124 adjacent to the disk 123, the arm having a lateral projection 126 at its outer end for reception by the slots 121. When this projection enters a slot 121, the rotation of the shaft 124 and the arm will cause the turret to rotate about the axis of the annulus 118. After the arm has passed through a predetermined degree of rotation, the projection 126 will move out of

the slot and rotation of the turret will be discontinued. Before the projection moves out of the slot 121, the edge of the disk 123 will enter one of the arcuate recesses 122 and hold the turret until the projection 126 enters the next slot 121. This type of motion transmitting means is generally termed a Geneva drive and is employed where it is desired to intermittently rotate machine parts.

When the disk 123 is disposed within a recess 122 and the turret is at rest, one of the mold chambers will be in registration with a drum 127, illustrated in Fig. 21, carried by a bracket 128 mounted for sliding movement on the tubular member, 113.

As disclosed in Fig. 49, the member 113 has longitudinally extending guides 113*b* formed thereon for engagement by roller and lug means 113*c* and 113*d* carried by the bracket 128. The roller and lug means serve to connect the bracket to the member 113 and provide for longitudinal sliding movement of the former on the latter. To compensate for wear and to eliminate excessive clearance between these elements, the bracket has a roller carrying block 128*b* adjustably secured thereto, a screw 128*c* being provided to effect relative movement between the block and the bracket. When the screw is adjusted in one direction, the engagement between the roller and its guide will prevent movement of the block and therefore a reaction will be set up in the bracket which will cause the same to move into closer engagement with the member 113. This structure is duplicated on each side of the turret to effect the connection between the brackets 128—128*a* and their complemental supporting members 113—113*a*.

The drum is secured on a hollow shaft 129 journaled for rotary movement in the bracket 128, the drum being mounted on one end of the shaft while a pinion 130 is fastened to the opposite end. It will be noted from Fig. 1 that the drum 127 is placed at the discharge end of the slide 96. The center of rotation of the drum is slightly below the slide in order to locate the upper surface of the drum in position to receive strip sections discharged from the slide.

A pair of spaced rollers 131 are journaled adjacent to the drum and one engages the surface thereof at the point where it will be first engaged by the strip sections as they are discharged from the slide 96. These rollers serve to guide the strip into engagement with the drum and prevent them from falling or otherwise being displaced. To insure the proper coiling of the sections, the shaft for the roller 131 which engages the drum is bent intermediate of its ends and is rotatably adjustable in its supporting member after loosening set screw 131*a*, shown in Fig. 21*a*, whereby the axis of rotation of the outer roller may be changed with relation to that of the drum. This adjustment also varies to a certain extent the friction between the roller and the drum. Through this medium, the action of the strip, as it is coiled, may be controlled and the edges aligned or misaligned, depending upon the style of cap being manufactured and the necessities of the situation.

As the strip sections are being coiled, they are held on the drum by suction forces introduced into longitudinally extending recesses 132 formed in the outer surface of the drum 127. Each recess is connected by a passage 133 with a chamber 134 formed in the hub of the drum, suction forces being introduced to the chamber through ports 135 formed in the hollow shaft 129. The suction forces are introduced to the shaft 129 by way of a passage 136 formed in the bracket 128 and communicating with the hollow member 113 by a port 137. This member is connected with an evacuating pump, not shown, by a pipe 138.

As illustrated in Figs. 21 and 22, the inner end of the member 113*a* is closed by a plate 139 to prevent the entrance of air into the space provided by the flanges 114 and the annulus 118. This space is also under a suction force since it is in direct communication with the member 113. By reason of the recesses 132 and the negative pressures introduced thereto, the strip sections will be retained on the drum and coiled or formed into collar-like bodies as the drum rotates. When a strip section has been completely coiled on the drum, the rollers 131 will move away from the drum and this member will then be moved into a mold chamber registering therewith. To move the rollers away from the drum, they are carried by a pivoted lever 140, as illustrated in Fig. 38, to which oscillatory movement is imparted by a second lever 141 and a cam 142 secured for rotation with a shaft 143. The cam is so formed that it will hold the rollers 131 in elevated positions until the drum has moved into the mold chamber and back to its normal position.

The drum is arranged in front of the turret when the machine is viewed from the front as illustrated in Fig. 1. In registration with the drum on the opposite side of the turret, as shown in Figs. 21 and 22, there is provided a bell member 144 having a pipe section 145 extending through the central portion thereof. Around the pipe section between the bell and the rear plate 115, there is provided a thimble 146 having a flanged edge 147. This edge engages the plate 115 and prevents movement of the thimble through the opening in the plate. The hub of the thimble engages light weight coil springs 148 which are disposed in sockets in the hub of the bell 144. The springs 148 resiliently hold the flange 147 in engagement with the plate 115 until the thimble is engaged by the edge of the strip section on the drum when it is inserted into a mold chamber.

The pipe 145 communicates with a supply of compressed air, the flow of which is controlled by a valve 149 shown in Fig. 3. At the inner end of the pipe 145, there are a plurality of laterally directed outlet openings 150 through which the compressed air may escape from the pipe and flow into the interior of the drum through openings 151 formed in the body of the drum. The valve 149 is actuated when the drum has reached the innermost position in a mold chamber to permit the flow of compressed air. This air flows from the interior of the drum through openings 152 into the recesses on the outer surface of the drum and causes the strip coiled thereon to be quickly released.

From Fig. 22, it will be seen that the outlets 150 register with inclined surfaces of the thimble 146. This arrangement causes a vibration of the thimble as the compressed air flows through the openings so that the coiled strip engaging the thimble will be jostled and more perfectly positioned in the mold.

Prior to the opening of the valve 149, the suction forces are cut off from communication with the drum recesses by longitudinal movement of the shaft 129 with respect to a closed end tube 153 extending through the shaft. The relative move-

ment between the tube and shaft takes place when the end of the tube engages the plug 154 in the inner end of the pipe 145. The normal position of the shaft and sleeve wherein the ports are in registration will be restored after the drum registers wth the end of the slide, by engagement of the outer end of the tube with a stationary stop member 153a.

In the present machine but six mold chambers are illustrated. These chambers are identical in construction, each including inner and outer circumferential walls spaced to provide pockets 155 which are partitioned to form adjoining annular passages 156. The inner wall has a plurality of longitudinally spaced sets of circumferentially spaced recesses connected with the registering passages 156 by small ports. In registration with the mold chambers, the sleeve 118 has longitudinally spaced ports communicating with grooves formed in the outer surface of the annulus 116. The grooves in the annulus are spaced longitudinally thereof and extend various distances around this member as illustrated in Figs. 25, 26 and 27. The member 116 is also formed with a valve chamber 157 with which ports 158 extending from the interior of the annulus are connected. These ports establish communication between the space enclosed by the annulus and the flanges 114 and chamber 157, thus providing for the introduction of subatmospheric pressures in the passages 156 when a mold is positioned in registration with the ports 159 leading from the chamber 157.

While the drum is arranged exteriorly of the mold chamber and receiving the strip sections, communication between the ports 158 and 159 is interrupted by a valve member 160 slidably positioned in the chamber 157. When the drum has been inserted in a mold chamber and the valve 149 actuated to initiate the flow of compressed air into the drum, the valve 160 is operated to establish communication between the ports 158 and 159 and introduce suction forces to the passages 156. These forces will be communicated to the recesses within the mold chamber and the coiled strip section will be held in the mold without danger of displacement when the drum is moved outwardly. By reason of the introduction of compressed air, the strip sections will be quickly transferred from the drum to the mold and less danger of wrinkling or otherwise destroying the strip sections will be encountered.

The valve 160 is moved longitudinally in the chamber 157 by a lever 161, shown particularly in Fig. 2, which is pivoted intermediately of its ends as at 162 on the outer end of a bracket 163 carried by the lower portion of the rear plate 115. The end of the lever 161 opposite that to which the valve 160 is connected, carries a roller 164 for engagement with the side of a gear 165 having a projection 166 which is engaged by the roller to move the lower end of the lever 161. When the lever moves, the valve 160 will be opened. It will remain in this position until a second hook-shaped projection 167 formed on the gear engages the roller and moves the lever in an opposite direction. After a coiled strip section has been deposited in a mold, the turret is rotated one step by the driving mechanism 123 and 126 as previously described and another mold will then register with the drum so that a coiled strip may be inserted thereinto in the same manner.

When the drum is moved into the second mold, a folding head H1 also carried by the bracket 128 will move toward the mold in which the first coiled strip is positioned. This head, shown particularly in Figs. 28, 29 and 31, includes a tubular member 168 rigidly carried by the bracket and projecting toward the turret. The outer end of the member 168 carries a collar 169 formed with a plurality of spaced arms 170. The member 168 also carries a spider 171 having a plurality of radiating legs 172 formed at their outer ends with lateral extensions 173. The spiders have strip engaging fingers 174 which are inclined in such manner that the outer portions thereof project forwardly a slight distance beyond the outer ends of the extensions 173. When the bracket 128 moves toward the turret, the extensions 173 will engage the outer plate 115 at which time the spider will stop moving. Before the extensions 173 engage the plate, the outer ends of the fingers 174 engage the edge of the coiled strip, moving it toward the center of the mold. When the spider stops moving, continued movement of the bracket 128 will move the member 168 and radially extending members 175 positioned at the sides of the fingers 174 will engage the inturned strip edge to complete the fold.

To permanently crease the folded portion, the collar 169 has a plurality of lever members 176 pivotally supported between the arms 170. The members 176 have arcuate heads at their outer ends and are somewhat elbow-shaped whereby the opposite ends extend toward the axis of the tubular member 168 and terminate in rounded knobs. Within the member 168, there is disposed for longitudinal movement a slotted bar 177 having a threaded outer end 178. A pin 179 extends transversely through the member 168 and the slot in the bar 177, the member 168 also being slotted to permit the pin 179 to be connected with the spider and move longitudinally relative to the member 168. A ring 180 surrounds the bar 177 and is engaged by the pin 179, the ring being engaged on the opposite side by a compression spring 181. The opposite end of this spring engages a similar ring 182 stationarily held in the member 168 by a pin 183.

A spring stop 184 engages a shoulder formed in the member 168 and a second coil spring 185 is disposed between the stop 184 and a shouldered plug 186. This plug has a flange at its outer end for engagement with the rear surfaces of the knobs on the lever 176. The opposite surfaces of the knobs are engaged by a flange 187 provided on a thimble 188 carried by the bar 177 and positioned for limited longitudinal movement in a recess formed in the plug 186. The threaded end of the bar 177 receives a nut 189 and between this member and the inner end of the thimble, there is a small compression spring 190. This spring maintains the engagement between the flanges 186 and 187 and the knobs on the levers 176.

When the spider is stopped by the plate 115, and the member 168 continues to move, the spring 181 will be compressed. Continued movement of the member 168 will carry the collar 169 and the arms 176 into the mold until the members 175 complete the fold and the end of the slot in bar 177 engages the pin 179. The member 168 will continue to move a slight distance but, due to the engagement of the pin 179 with the end of the slot in bar 177, the knob ends of the levers 176 will remain stationary and the pivots for the levers will move with the member 168. This motion will swing the arcuately headed ends of the levers 176 outwardly until they engage the folded edge of the coiled strip and exert a sufficient pressure to permanently crease it at the

fold. Continued movement of the member 168, after the bar 177 has engaged the pin 179, will compress the spring 185 and no danger to these parts will result. As the member 168 moves outwardly, the springs 181 and 185 will expand to return the parts of the head to their normal positions. The spring 185 will expand first, withdrawing the levers 176 from engagement with the strip so that the head may be removed from the mold without injuring the coiled strip.

After the head has been withdrawn from the mold, the turret will again be moved one step to present another mold to the feeding drum and the second mold to the folding head H1. The first mold will now be in registration with a second folding head H2. This head is substantially identical with the head H1 except that the lateral projections 173*a* on the spider 172*a* are shorter than the corresponding parts of the spider 172. The head H2 also has rollers 191 which prevent the first fold from being disrupted as the head H2 enters the mold. The fingers 174 on this head serve the same purpose as those on the first head but are moved into the mold a greater distance to engage the strip.

When the second fold is formed, the material of the first fold will be disposed between that of the second fold and the body of the strip as indicated in Fig. 46. It will be noted from Fig. 45 that, as the edge of the strip is folded, the width of the strip will be decreased and certain of the recesses in the mold uncovered. It will be necessary to cut off the suction forces from these recesses, otherwise the reduced pressures would be destroyed and the coiled strip permitted to fall from the mold. To discontinue the introduction of these forces to the uncovered recesses in the mold, certain of the grooves in the annulus 116 are interrupted as shown in Figs. 25, 26 and 27. Where this interruption occurs, the ports leading to certain of the passages 156 registering therewith, will be closed and the flow of suction forces discontinued.

While the second folding operation is being performed as above described, a first folding operation is being carried out on the second strip section inserted and at the same time a third strip section is being inserted in the turret. When these operations have been completed, the turret will advance the molds one step, causing the registration of the mold containing the first strip section with a third folding head H3 carried by a bracket 128*a* mounted for sliding movement on the member 113*a* at the rear of the turret. The construction of the head H3 is similar to the head H1 but the spider of the former has a crown sheet pusher 192 projecting forwardly beyond the end of the head H3.

Prior to the movement of the head H3 into the mold, a crown sheet is cut from a supply and positioned over the front end of the pusher by the mechanism shown at C in Figs. 2 and 41. The supply of material is indicated by the numeral 193 and constitutes a roll of crepe paper or other sheet material. The roll 193 is journaled adjacent to the machine and the strip material extends from the roll over a roller 194 journaled between the frame sections 109*b*. From this roller, the crown sheet material extends under a friction roller 195 and between a pair of cut-off rollers 196 and 196*a*. These rollers operate in a manner similar to the cut-off rollers 91 and 92, the length of the sections cut being determined by the diameter of the knife carrying roller.

After the crown sheet has been cut from the supply, it moves downwardly over an inclined surface 197 and between the sheet timing rollers 198. When the sheet is released by these rollers, it will drop edgewise downwardly to a point in registration with the crown pusher and the turret. During this sheet positioning operation, a shutter 199 is held in the space between the crown pusher 192 and the turret 117. This shutter prevents air currents generated by the movement of the turret or by air passing to the recesses in the mold from wrinkling or otherwise distorting the crown sheet. As soon as this sheet is in proper position, the shutter is swung outwardly from between the pusher 192 and the turret and the head H3 will be moved into the mold, carrying with it the crown sheet previously released by the rollers 198. To prevent the crown sheet from being torn during this operation, a plate 199*a* having an opening with a rounded outer edge is positioned adjacent to the opening in the plate 115. The edge of the opening is notched at spaced points, as at 198*a* to permit the fold starting fingers 174 to pass through the plate. When the crown sheet has almost reached its innermost position, the fingers 174 on the head H3 will start to turn the second longitudinal edge of the strip inward and this folding operation will be completed by the shoulders 200 formed on roller supporting strips 201. The head H3 has levers 176*a* corresponding to those on the head H1, these levers performing the same operation on the first fold at the second edge of the strip.

To prevent the crown sheet from being inserted into the mold to an undesirable degree, a gage 202 is provided for insertion in the mold from the opposite side at the same time the pusher 192 is inserted. The gage 202 is mounted at one end of a rod 203 positioned for sliding movement in a bracket 204 secured to the frame section 109*a* mounted on the front of the machine. The means for moving the gage 202 into the mold will be set forth hereafter.

When the crown sheet has been positioned within the mold and the partially formed band, and head H3 is removed from the mold, the turret will be moved to position the mold in registration with the head H4 which performs the final folding of the strip. This head is similar to those previously described and operates in substantially the same manner, the fingers 174 initiating inward movement of the strip edge which has been folded once and the members 175*a* completing this operation. This final fold is permanently creased by the levers 176*a* in the same manner as in the previous folding operations. The final fold positions the paraffin stripe within the band where it will engage the wearer's head.

As shown in Figs. 33 and 35, the levers 176*a* on the folding heads H2 and H4 which form the final folds at each edge of the band have forwardly projecting pins 176*b* carried by their outer ends. These pins have inclined end surfaces to engage the previously folded portion of the strip and force it outwardly so that it may be engaged by the arcuate heads of the levers 176*a*. These pins are only needed on the heads used for the final folds at each edge of the crown because of the bulkiness resulting from the prior folding operation.

It will be noted from Fig. 35 that a second gage 202*a* is provided in registration with the head H4 to prevent the partially formed cap from being moved out of the mold. The gage

202a is carried at one end of a bar 203a which is also slidably positioned in the bracket 204. Bars 203 and 203a have a strip 205 rigidly connected therewith. Between this strip and the bracket 204 and surrounding the bars 203 and 203a are coil springs 206. An arm 207 is joined with the bracket 128 and engages the bar 205 when the bracket 128 moves to its normal position wherein the drum 127 registers with the slide 96. When the arm 207 engages the strip 205, the springs 206 will be compressed and the gage members 202 and 202a will be withdrawn from the molds in the turret. As the bracket 128 moves to position the drum in a mold, the springs 206 will expand and move the gages into molds in registration therewith. The degree of movement of the gages into the molds is limited by shoulders formed on the gages and contacting the edges of the openings in front plate 115.

After the final folding operation has been completed and the head 84 withdrawn from the mold, the turret will advance the mold to a cap discharging position wherein a pusher member 208 will move through the mold causing the cap to be ejected. When the mold containing the completed cap reaches the discharge position, all suction forces are cut off from the mold to permit the cap to be ejected without danger of tearing or otherwise mutilating it. The pusher member 208 closely fits the inner surface of the mold and engages the lower edge of the completed cap to prevent injury thereto. When the pusher 208 has been withdrawn from the mold, the turret will move this mold into registration with the drum for the reception of the first coiled strip on the next cycle of operation of the turret.

Movement of the brackets, the drum and the heads toward and away from the turret is imparted through bell crank levers 209 mounted for pivotal movement about horizontal axes on the frames 109a. One arm of each bell crank is connected with the sliding bracket on the same side of the turret by a link 210 while the other arms of the bell cranks have pitmans 211 connected at one end therewith. The opposite ends of the pitmans are connected with wrist pins 212 projecting from the disks 213 fixed for rotation with a shaft 214. As the shaft is revolved, the disks will rotate and motion will be imparted to the bell cranks by the pitmans. When the lower arms of the bell cranks move upwardly, the brackets will be moved toward the turret. The motion will be in the opposite direction when the pitmans move downwardly.

The starting and stopping points of the drum and folding heads with respect to the turret may be varied through the adjustment of turnbuckles 211a forming a part of the pitmans.

Rotation of the shaft 214 is effected by providing it with a gear 215 having the teeth thereof in meshing engagement with teeth on the gear 165. These gears have a portion of the teeth omitted from each as at 216 so that gear 215 will only rotate part of the time and be held stationary the rest of the time. When the blank space 216 is presented to that on the gear 215, the disks 213 will remain stationary and the brackets 128 and 128a will be held in their outermost positions. The gear 165 is fixed to the shaft 143, this shaft having another larger gear 217 fixed thereto adjacent to the rear end. Power is introduced to the shaft 143 through the engagement of the teeth on the gear 217 with a pinion 218 fixed for rotation with a shaft 219. The shaft 219 is also provided with a large sprocket 220, around which a chain 221 is trained. This chain transmits power from a small sprocket 222 carried by the armature shaft of an electric motor 223. When electric current is introduced to the motor and the sprocket 222 rotates, the chain will transmit this movement to the shaft 219. From this shaft, the motion will be transmitted by the pinion 218 to the large gear 217 and the shaft 143. From this shaft, the motion will be transmitted to shaft 214 as previously described.

Rotary movement will also be transmitted by the gear 217 to another gear 224 of the same diameter fixed for rotation with the shaft 124. This shaft carries the turret operating lever 125 which imparts intermittent movement to the turret when the shaft 124 rotates. At the forward end of the shaft 124, a second Geneva arm 225 is provided, this arm having a disk 226 disposed adjacent thereto. The arm has a projection 227 at its outer end for engagement with a slotted and notched disk 228 which is fixed for rotation with a shaft 229 journaled between the front frame section 109 and the center section 110. A gear 230 is fixed to rotate with the shaft 229, the teeth of the gear being in mesh with a smaller diameter gear 231 journaled on the frame slightly above the gear 230. The gear 231 has an extremely wide face and its teeth are engaged by the teeth of the pinion 130. Due to the intermittent rotation of the shaft 229 through the Geneva drive formed by the arm 225 and the disk 226, intermittent rotation will be transmitted by the gear 231 to the pinion 130. This pinion is directly connected with the shaft to which the strip winding drum 127 is connected.

When the engagement between the arm 225 and the disk 226 is broken, the drum will be prevented from rotating. At this time, the shaft 214 will be revolved to impart movement to the bell crank levers 209 and the brackets 128 and 128a will move toward the turret. This movement will carry the drum 127 into a mold in registration therewith and continued rotation of the shaft 214 will withdraw the drum. Meshing engagement of the pinion 130 and the gear 231 will be maintained during this longitudinal movement of the drum because of the wide face on the gear 231.

The shaft 214 has a cam 232 secured thereto, this member having a notch for the reception of a roller 233 carried by a lever 234. This lever is pivoted at one end as at 235 to a bracket 236 fixed to one of the tie rods connecting the frame sections 109. The other end of the lever 234 is connected by a pitman 237 with a crank arm 238 secured to a stub shaft 239 journaled on the rear plate 115 and a bracket 240 secured thereto. This shaft has a hub fixed for rotation therewith and the shutter 199 is fastened to this hub. When the roller 233 engages the periphery of the cam 232, the shutter will be held out of engagement with the opening in the plate 115 and the crown pusher carried by the third folding head. When the roller drops into the opening in the cam, the shutter will be permitted to move downwardly into the space between the turret and the third folding head for the purpose above set forth. When the shutter is so positioned, the rollers 198 will release the crown sheet, permitting it to drop into position between the crown sheet pusher and the plate 199a. Immediately before the bracket 128a starts to move toward the turret, the shutter will be returned to its normal inoperative position by the movement of the roller 233 from the recess in the cam.

Motion is imparted to the crown sheet feeding and cutting mechanism by providing the shaft 143 with a sprocket 242 which is engaged by an endless chain 243 also trained over another sprocket 244 carried by a shaft 245 journaled on a bracket secured to one of the frame sections 109b. The shaft 245 has a beveled gear 246 secured for rotation therewith, this gear meshing with a similar gear 247 carried by shaft 196b on which roller 196 is mounted. Thus when shaft 143 revolves, rotary movement will be imparted to the roller 196 through the chain 243, the sprocket 244, shaft 245, gears 246 and gear 247. The slack in chain 243 is taken up by an idler sprocket 248 mounted on a swinging arm 249. When the sprocket 244 is coupled with the shaft 245, the mechanism for cutting and feeding crown sheets will operate in unison with the rest of the machine.

It has been found desirable to provide a severable connection between the sprocket and its shaft whereby the crown sheet feeding mechanism may be disconnected from the driving means. To effect this disconnection, the shaft 245 has a collar 250 clamped thereto, this collar having a spring pressed pin 251 extending therethrough. The inner end of this pin is adapted for engagement in a slot 252 formed in the hub of the sprocket 244. The outer end of the pin is equipped with a knob 253 which may be engaged when it is desired to disconnect the crown sheet feeding means. The knob may be pulled out to disengage the end of the pin from the sprocket and may be retained in its outer position by a wire 254 formed for engagement with the outer surface of the collar 250. A pair of screws 255 are carried by the collar 250 to adjust the position of the sheet feeding rollers with respect to the shaft 143.

When the sprocket 244 is disengaged from the shaft 245, the crown sheet feeding mechanism may be manually operated through the crank and chain drive indicated generally by the numeral 255a on Fig 2. This drive mechanism includes a crank 275 and a sprocket 276 which is fixed for rotation with the shaft carrying the roller 196. The crank has a recess for the reception of a dog on the sprocket so that the crank may be connected or disconnected at will with the sprocket. A chain extends around the sprocket 276 and another reduced sprocket 277 fixed to one of the rollers 193 so that this roller will operate in unison with the roller 196. When the sprocket 244 is disconnected from the shaft 245, the crank may be moved toward the sprocket 276 and turning movement of the crank will impart rotation to the crown sheet feeding rollers. This mechanism may be employed when the crown sheet strip is being trained through the feeding mechanism.

The strip preparing and feeding mechanism A is driven from the shaft 143 through a chain 256 which extends around a sprocket 257 secured to the shaft 143 and a second sprocket 258 which is carried by the shaft for the roller 54. Both the sprocket and the roller are secured to the shaft so that when rotary movement is imparted to the sprocket, the roller will also revolve. As the chain travels from the sprocket 258 to the sprocket 257, it passes around sprockets 259, 260, 261 and 262. The sprocket 259 is connected with the roller 86 between the folding guides 85 and 87 and the unfolding shoe 89. The sprocket 260 is merely an idler serving to hold the chain in driving engagement with the sprocket 259. The sprocket 261 is secured for rotation with the roller 91 forming part of the last set of strip rollers. After the chain leaves the sprocket 261, it extends around sprocket 262 which is secured for rotation with the roller carrying the female creasing dies. Between the sprockets 257 and 258, a second idler 263 is engaged with the chain to eliminate all slack. The rotation of shaft 143 causes similar rotary movement to be transmitted by the chain 256 to the rollers 54, 88, 91 and 71. This movement is imparted to the roller carrying the male creasing die by gears 77 and 79, as illustrated in Fig. 12. Rotary movement is transmitted from the male creasing die carrying roller by the chain 45 which extends around the variable diameter pulleys 81 and 39 to the embossing rollers. This variable drive has been provided since it has been found that the operation of embossing the paper sometimes varies its length and the speed of movement of the paper strip between the embossing rollers must be varied to compensate for the difference in length.

Sometimes during the operation of the machine, it becomes necessary to manually operate the strip preparing and feeding mechanism. To permit this mechanism to be moved without moving the rest of the apparatus, the sprocket 257 is provided with a spring pressed dog 264, which normally engages a shoulder provided on a disk 265 fixed to the shaft 143 at the side of the sprocket 257. This sprocket is loosely received by the shaft and is driven in a forward direction as indicated by the arrow D when the shaft revolves in this direction through the engagement of the shoulder with the dog. When the cap forming section B is at rest, the strip feeding section A may be manually operated by grasping the chain 257 and moving it in the sheet feeding direction. The dog 264 will ride over the disk 265 by reason of the yieldable connection provided by the spring connected with the dog.

To make the machine operate smoothly, the shaft 219 is provided with a flywheel 266. This shaft is also provided adjacent to the sprocket 220 with a clutch having suitable manual control means through the operation of which the shaft 219 may be disconnected from the driving motor 223. After the caps have been completed and ejected from the turret, they are moved away from the machine on a conveyor belt 267 which extends to the right of the machine as viewed in Fig. 1. This conveyor belt moves around a pulley 268 journaled on the shaft 229. Rotation is imparted to the pulley by a chain 269 extending around a sprocket 270 fixed to the pulley and a second sprocket 271 secured for rotation with the shaft 143.

What is claimed is:

1. Cap forming apparatus comprising a rotatable turret having a plurality of mold chambers circumferentially spaced thereon, a drum journaled adjacent to said turret for registration with said chambers upon rotation of said turret, means for feeding strips of sheet material to said drum to be coiled thereon, strip folding means spaced circumferentially relative to said turret and registering with said chambers when said turret is rotated, power operated driving means, a Geneva type motion transmitting device connecting said driving means and turret and intermittently rotating the latter to successively register the mold chambers with said drum and folding means, and a second Geneva type motion transmitting device connecting said drum

and driving means whereby said drum will be intermittently rotated, said motion transmitting devices being set to operate simultaneously.

2. Cap forming apparatus comprising a frame, a series of sets of feeding rollers journaled on said frame, means for supplying a strip of sheet material to the first set of rollers, embossing means carried by one set of rollers to impress a design in said strip, means disposed adjacent to certain of said rollers to apply multicolor indicia to said strip, means cooperative with one of said rolls to apply a moisture-proof stripe to said strip, interfitting means carried by a pair of rollers for forming spaced sets of longitudinally extending creases in said strip, guide means disposed between spaced sets of rolls to fold and unfold said strip, knife means carried by the final set of rollers for severing said strip into predetermined lengths, slide means for conducting said severed sections from said final rollers, a drum journaled at the discharge end of said slide means, means for intermittently rotating said drum to coil the strip sections delivered thereto, a rotatable turret journaled on said frame adjacent to said drum, said turret having a plurality of mold chambers therein, a plurality of strip folding heads spaced circumferentially relative to said turret, said drum and heads registering with the mold chambers when said turret is at rest, power driven means for moving said turret step by step to successively register the mold chambers with said drum and folding heads, means disposed adjacent to one of said heads for supplying crown forming sheets of thin material to the strip containing mold chambers when positioned in registration with said head, a shutter mounted for movement into and out of the space between said last-named head and said turret during the operation of supplying said crown sheets, and means for ejecting the completed caps from said molds following the final folding operation.

3. In a cap forming machine of the type having a turret provided with a plurality of molds, means for supplying coiled strips of sheet material to the molds, spaced folding heads for operating upon the strips disposed within the molds, driving means for moving the turret step by step to successively register the molds with the folding heads, crown sheet supplying means disposed adjacent to said turret for positioning crown sheets one by one between one of said folding heads and a mold on said turret, the combination of a shutter mounted adjacent to said crown sheet supplying means for movement into and out of the space between the particular folding head and the turret during the operation of positioning each crown sheet, and timed means for moving said shutter.

4. In a cap forming machine of the type having a turret provided with a plurality of molds, means for supplying coiled strips of sheet material to the molds, spaced folding heads for operating upon the strips disposed within the molds, driving means for moving the turret step by step to successively register the molds with the folding heads, crown sheet supplying means disposed adjacent to said turret for positioning crown sheets one by one between one of said folding heads and a mold on said turret, the combination of a shutter mounted adjacent to said crown sheet supplying means for movement into and out of the space between the particular folding head and the turret during the operation of positioning each crown sheet, a lever, timed means for moving said lever, and a connecting rod for transmitting motion from said lever to said shutter.

5. In a cap forming machine of the type having a mold supporting turret and means for imparting step by step movement to said turret, means for feeding coiled sections of strip material to the molds on said turret comprising a drum rotatably supported in registration with a mold on said turret when the latter is at rest, means terminating adjacent to said drum for conducting strip sections thereto, passage means formed in said drum for introducing subatmospheric pressures to the strip section delivered to said drum, said negative pressures serving to retain the strip on the drum, movable means for sliding said drum into a mold on said turret, valve means for cutting off the negative pressures in said drum passages and introducing super-atmospheric pressure to the inner side of the strip to effect instantaneous release thereof from said drum, passage means in said mold for introducing negative pressures to the exterior of said strip, and valve means for controlling the introduction of negative pressures to the passages in said mold, all of said valve means being simultaneously operated.

6. In a machine for forming articles from sheet material, a member provided with a mold chamber, a winding drum journaled in registration with said mold chamber, said drum receiving and coiling strips of sheet material thereon, means for moving said drum into and out of said mold chamber from one end thereof, a spring-pressed thimble member disposed adjacent to the opposite end of said mold chamber, the edge of a strip coiled on said drum engaging said thimble when said drum is inserted in said mold, and means for imparting vibratory movement to said thimble while said strip is in engagement therewith.

7. In a machine for forming articles from sheet material, a member provided with a mold chamber, a winding drum journaled in registration with said mold chamber, said drum receiving and coiling strips of sheet material thereon, means carried by said drum for conducting suction forces to the inner surface of said coiled strips to retain the same on said drum, means for moving said drum and coiled strips into said mold chamber from one end, a spring-pressed thimble member disposed adjacent to the opposite end of said mold chamber, the edge of the strip coiled on said drum engaging said thimble when said drum is inserted in said mold, means for discontinuing the conduction of suction forces to the inner surface of the strip on said drum and providing for a flow of fluid under pressure thereto, and means for imparting vibratory motion to said thimble while said strip is in engagement therewith.

8. In apparatus for forming articles from sheet material, a turret mounted for rotary movement, said turret having a plurality of circumferentially spaced mold chambers, bracket means mounted for sliding movement toward and away from said turret, strip winding and folding head means carried by said bracket for positioning strip sections in said mold chambers and performing operations thereon, and means for adjusting said bracket means around the axis of rotation of said turret to align said winding and folding head means with the mold chambers on said turret.

9. Cap forming apparatus comprising a rotat-

able turret having a plurality of mold chambers circumferentially spaced thereon, the walls of said chambers having recesses, a drum having circumferentially spaced recesses journaled adjacent to said turret for registration with said chambers upon rotation of said turret, means for feeding strips of sheet material to said drum to be coiled thereon, means for producing suction forces in the recesses of said drum to retain the coiled strips thereon, power operated means for moving the drum and coiled strip into the mold chamber in registration therewith, valve means operative to cut off the suction forces when said drum reaches a fully inserted position in the mold chamber, port means in said drum communicating with said recesses, a source of fluid under pressure, said port means being coupled to said pressure source when said head is fully inserted in the mold chamber, valve means actuated when said head occupies said mold chamber to admit fluid from said source to said recesses through said port means, and means for simultaneously producing suction forces in the recesses in said mold chamber to hold the coiled strip therein during outward movement of said head and rotation of said turret.

10. In a cap forming machine of the type having mechanism for coiling and folding strips of sheet material to form head bands, means for applying a crown sheet to the head bands, and means for feeding crown sheet blanks to said latter means; the combination of a shutter and means for moving said shutter between said crown sheet applying means and the head bands before the crown sheet blank feeding operation, and removing said shutter after such feeding operation and before the crown sheet applying operation.

11. In a cap forming machine of the type having a rotatable turret head provided with mold chambers, means for introducing coiled strips of sheet material into said mold chambers, folding means movable into said chambers to engage and form the coiled sheets into a head band, means for applying a crown sheet to the head bands in said chambers, feeding means adjacent to said crown applying means to supply crown sheet blanks thereto, a shutter pivotally supported adjacent to said crown applying means for movement into and out of the space between said crown applying means and said turret, and means for imparting movement to said shutter, said means being timed to position said shutter between said crown applying means and said turret while the sheets are being supplied to the former and removed while the sheets are being applied to said head bands.

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