Jan. 26, 1954 F. E. MONKS 2,667,108

BAND FORMING MACHINE AND PROCESS

Filed Oct. 8, 1948 6 Sheets-Sheet 1

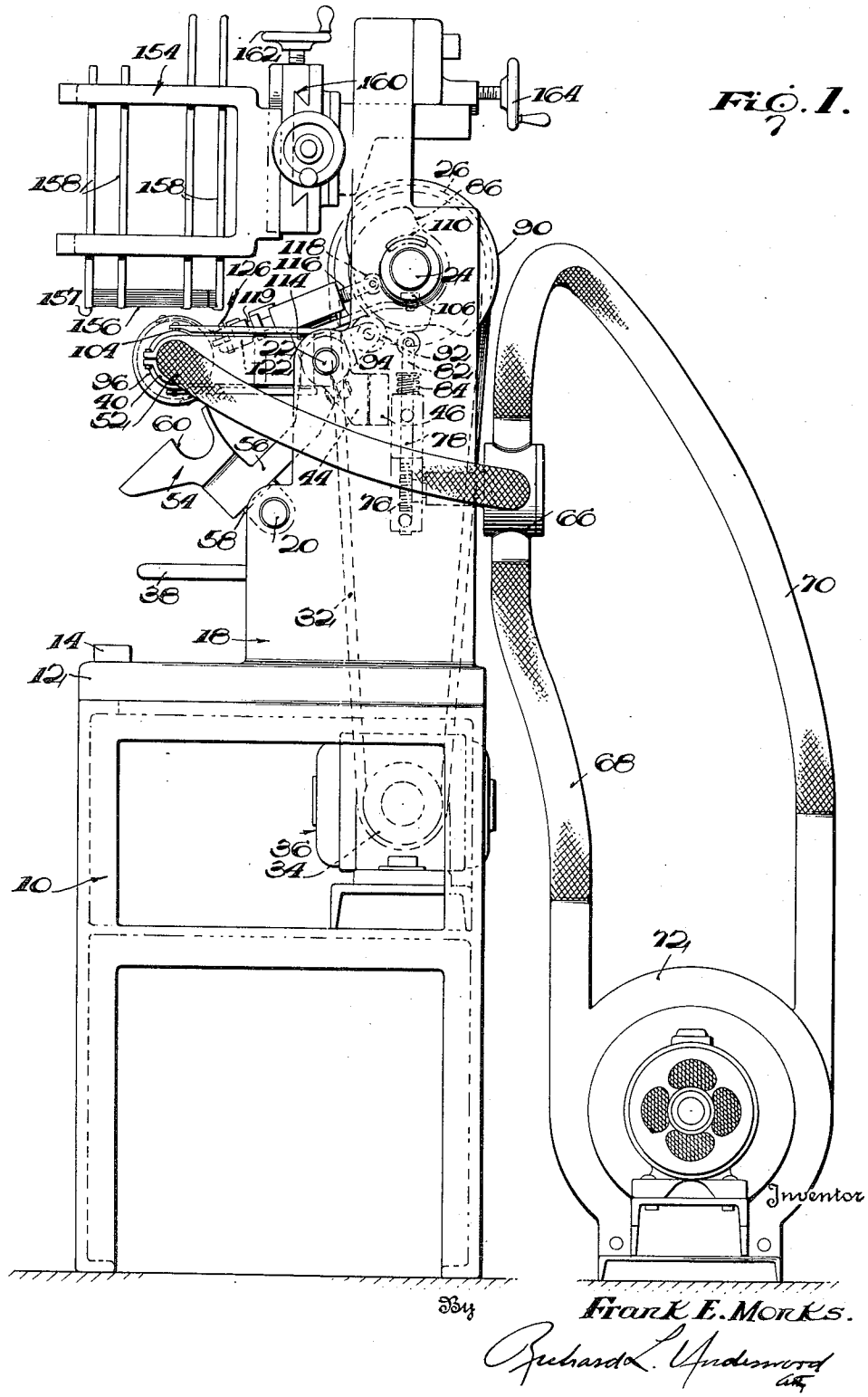


FIG. 1.

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BAND FORMING MACHINE AND PROCESS

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Fig. 2.

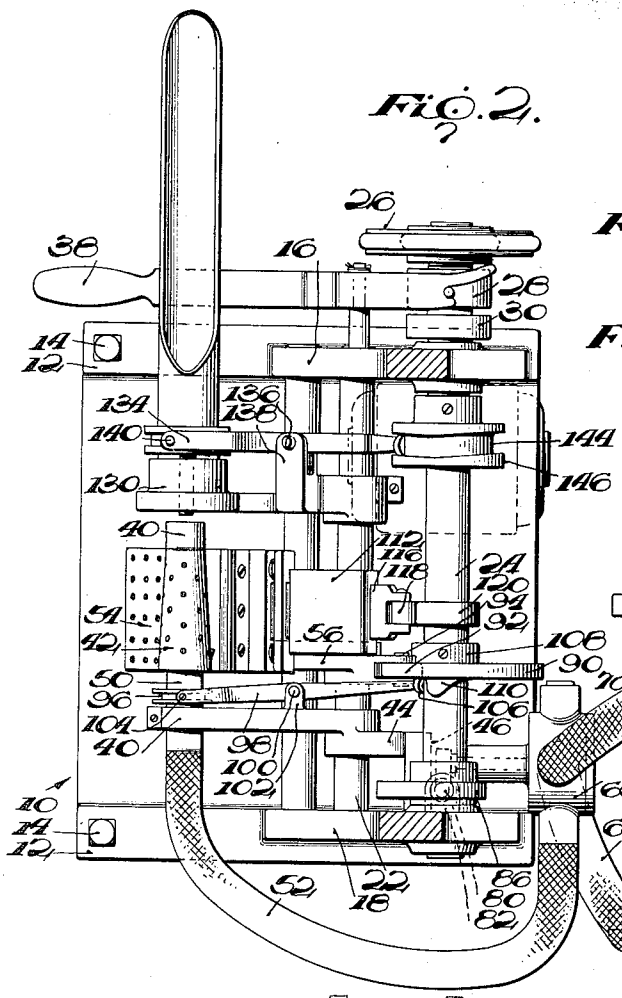


Fig. 4.

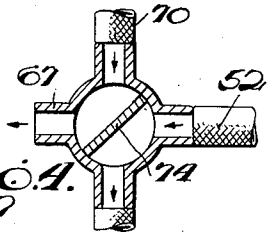


Fig. 5.

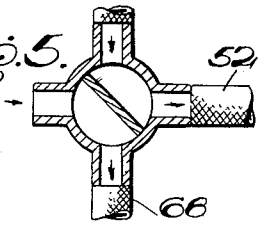
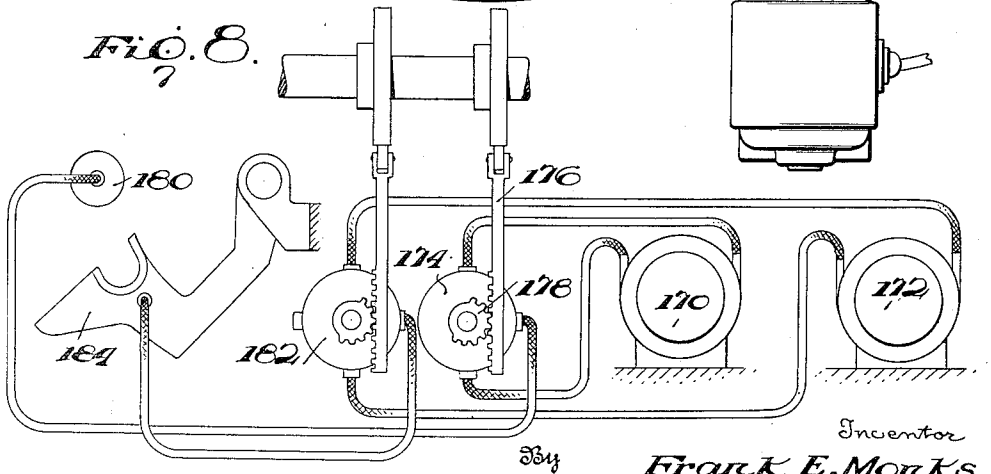


Fig. 8.



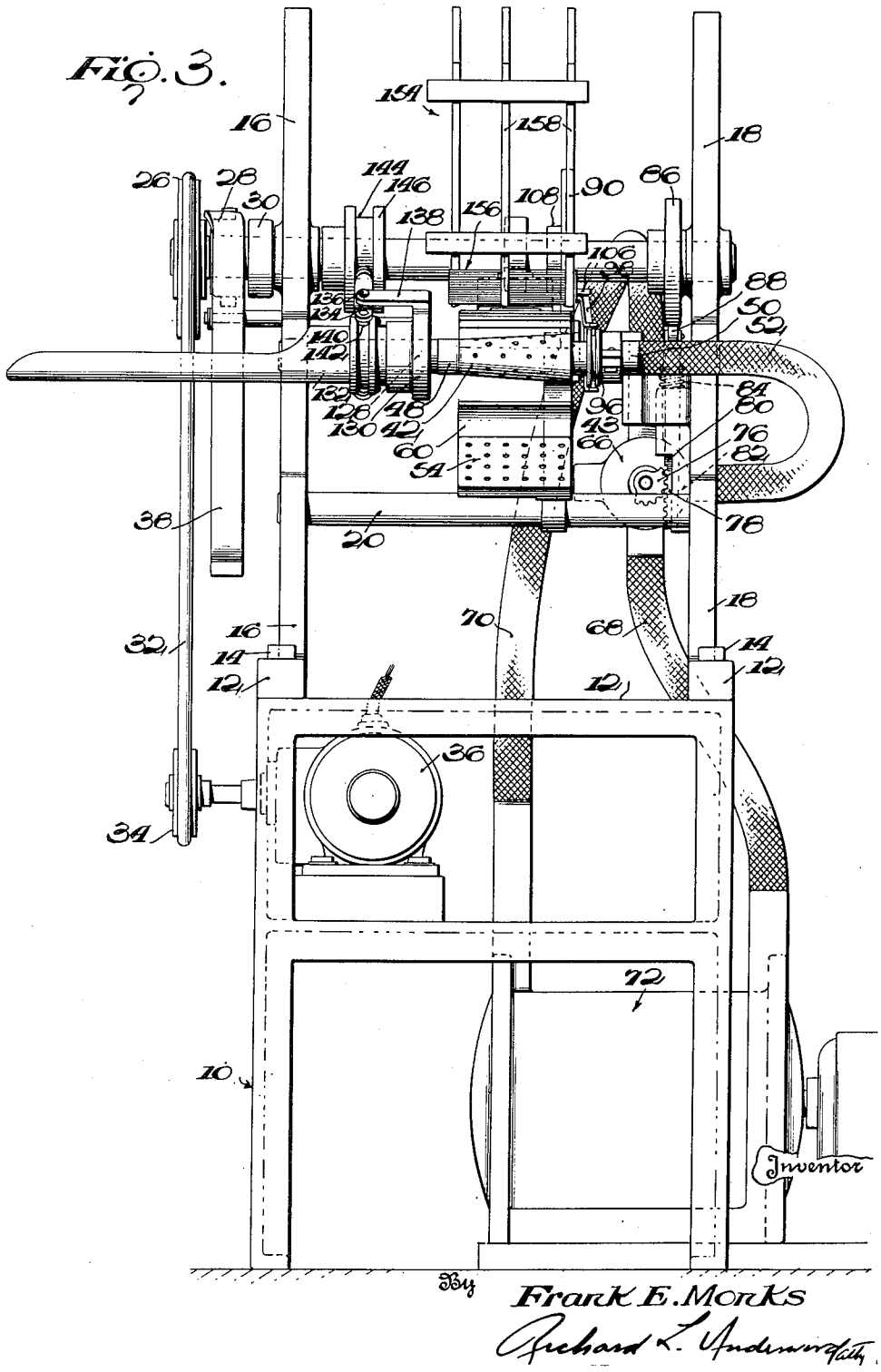
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BAND FORMING MACHINE AND PROCESS

Filed Oct. 8, 1948 6 Sheets-Sheet 3

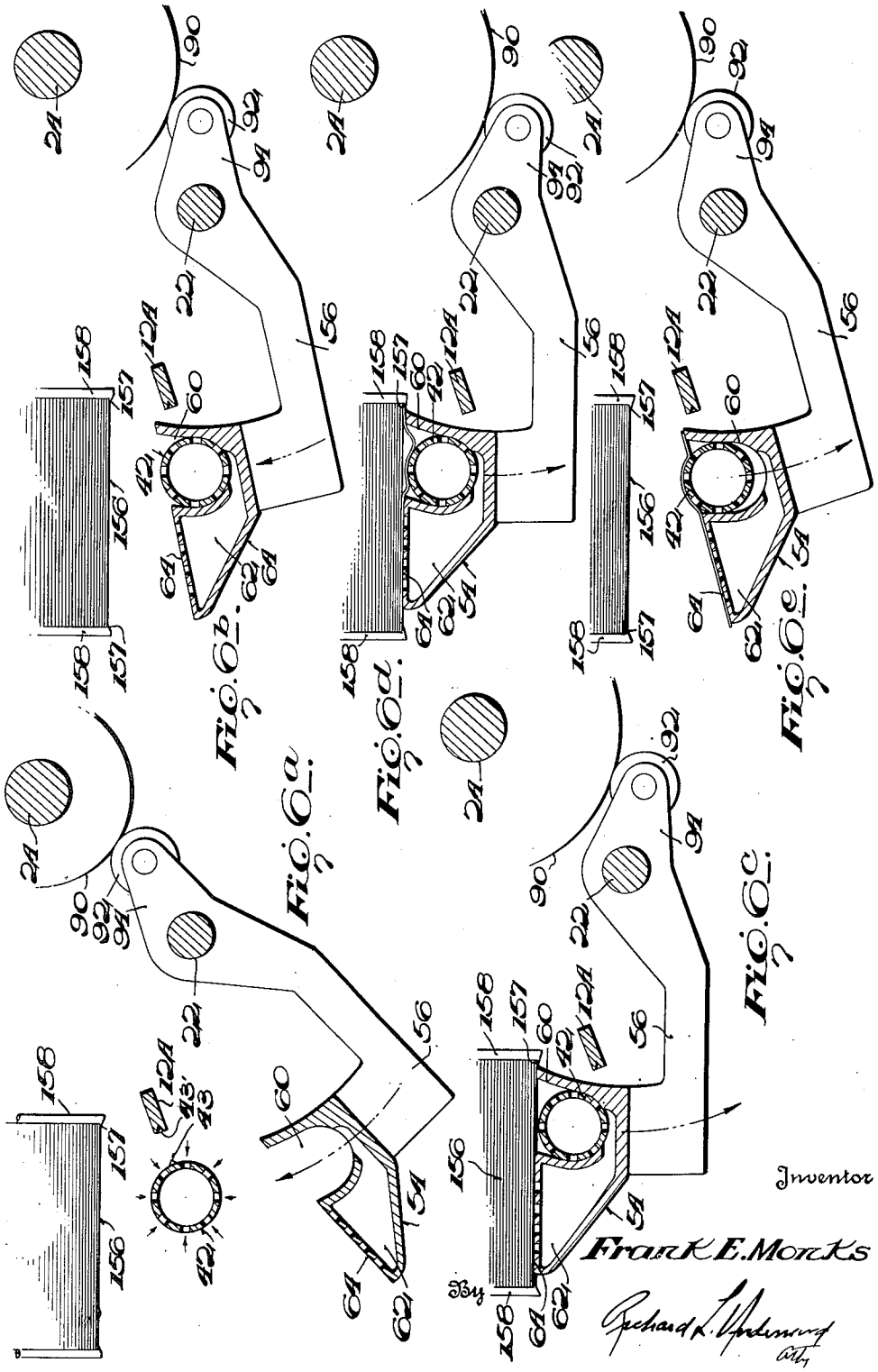
FIG. 3.



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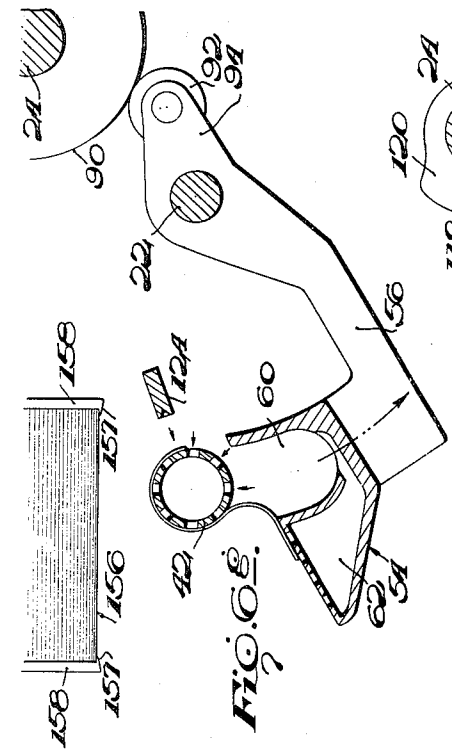


Fig. 8.

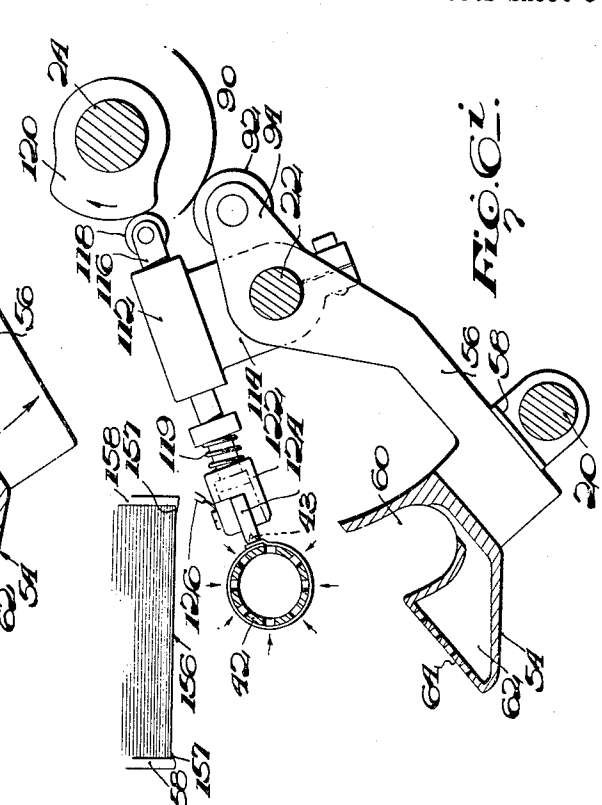


Fig. 9.

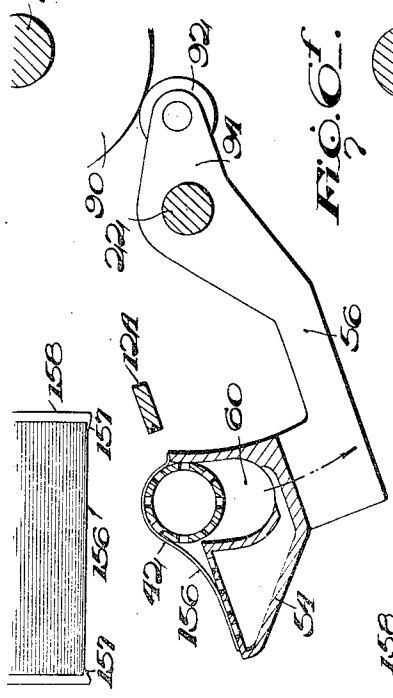


Fig. 10.

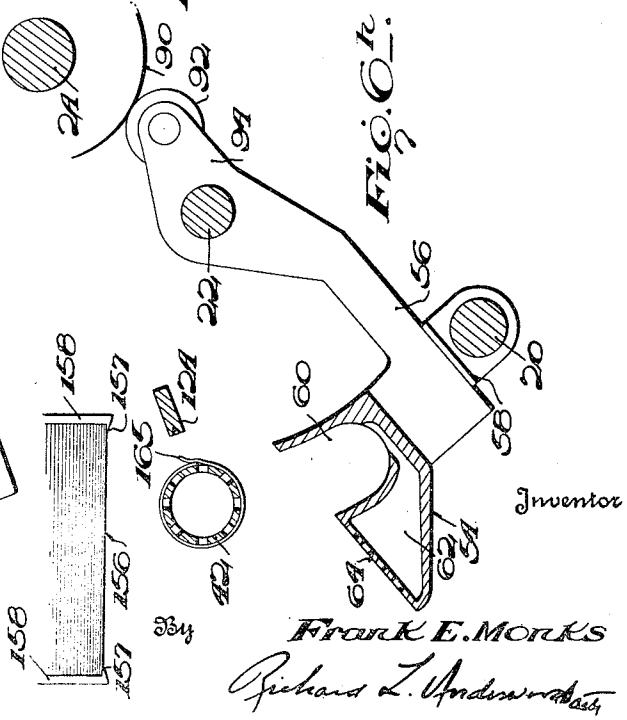


Fig. 11.

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Fig. 7a.

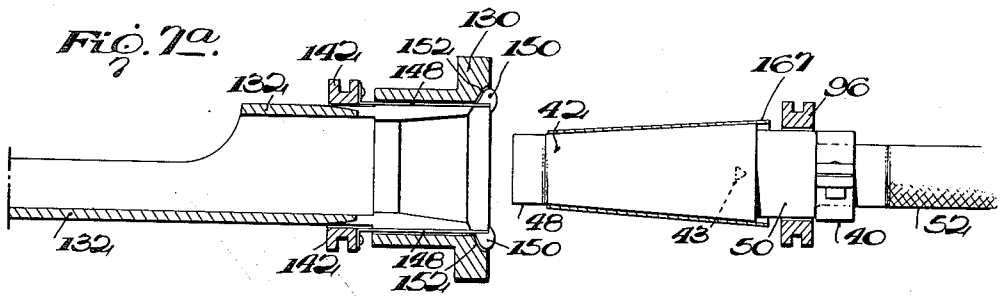


Fig. 7b.

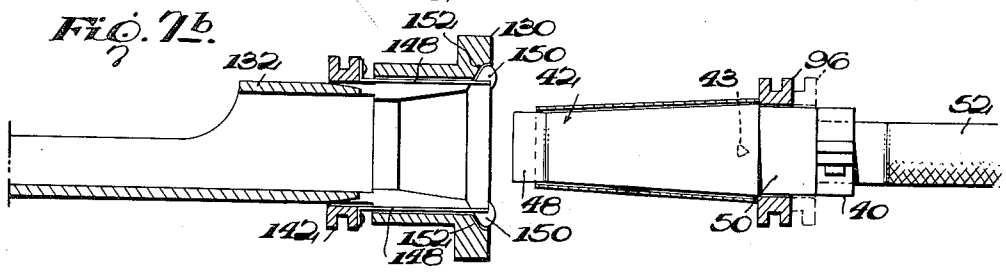


Fig. 7c.

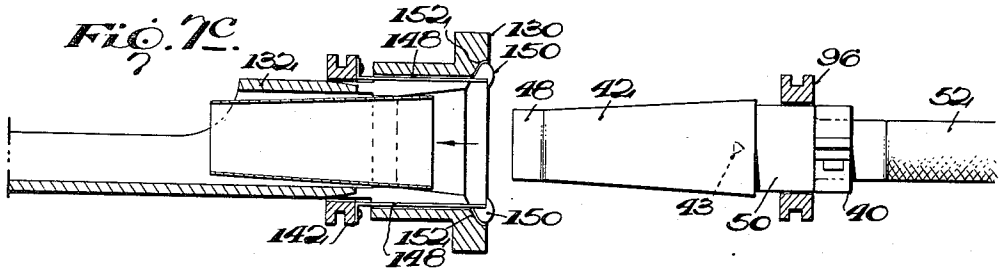


Fig. 7d.

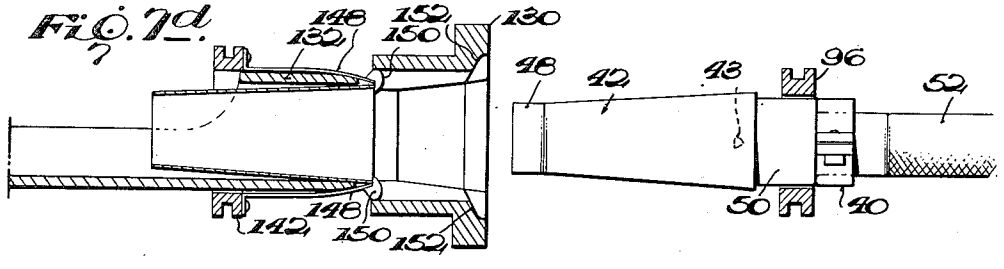
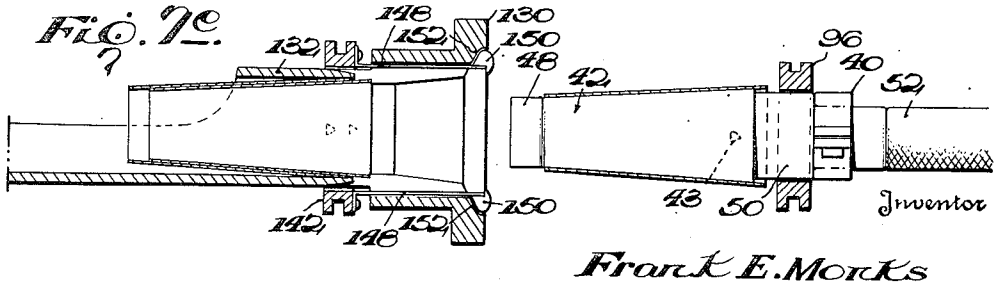


Fig. 7e.



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UNITED STATES PATENT OFFICE

2,667,108

BAND FORMING MACHINE AND PROCESS

Frank E. Monks, Pittsburgh, Pa., assignor to Fuller Label & Box Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application October 8, 1948, Serial No. 53,557

16 Claims. (Cl. 93—79)

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This invention relates to a machine for and the process of forming tubes or bands from single blank sheets of flexible material. While the invention in its broadest aspects is in no way limited to the particular type of band or tube, or to the many variable uses to which such bands might be put, it has for purposes of illustration been described herein with particular reference to neckbands for bottles.

An object of the invention is to facilitate the speed and accuracy of manufacture and particularly to improve upon the broad concept of utilizing fluid or pneumatic pressure in the process of manufacture. The use of vacuum or suction and/or pressure in the manufacture of tubes or bands from blanks of flexible material is not broadly novel. However, a particular desideratum of this invention is to utilize pressure means, especially pneumatic pressure, to accomplish as many as possible of the various operations necessary to form a completed band.

A further object of the invention is to utilize fluid pressure in a sequential manner and direct such force successively at different phases of manufacture to accomplish the necessary operations. An important phase of the invention resides in the manner in which the various parts of the mechanism are associated with one another and in relation to a fluid pressure source to accomplish this end.

Still another important object of the invention is to mechanically control the application of the pressures above described in timed relation to one another by simple mechanical means which, in addition, operate to control various other movements of different mechanisms which cooperate to produce the desired end product.

An overall advantage sought to be derived through this invention is the simplification of mechanism adapted to withdraw individual sheets from a pile of blanks, form the tube or band, and then stack the bands successively as they are formed in such manner that the nested or stacked blanks do not bind and therefore ready removal of individual bands from the nested stack is possible.

As hitherto stated, the invention has been illustrated herein in conjunction with a band adapted to be slipped over the neck of a bottle and to this end the blank is such that a conical tube or band is formed and of course a forming mandrel of similar shape is utilized in this particular instance. Likewise the blank used for this particular adaptation of the invention is such that the band when formed is frusto-conical in shape, having a squared bottom and a squared

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top. These bands may be readily positioned by hand over the necks of bottles which they are designed to fit.

Various other objects and meritorious features of the invention will be apparent from the following description taken in conjunction with the drawings, wherein like numerals refer to like parts throughout the several figures, and wherein:

Fig. 1 is a side elevation of my improved machine;

Fig. 2 is a plan view;

Fig. 3 is a front elevation;

Figs. 4 and 5 are details illustrating the operation of a fluid valve control;

Figs. 6A to 6I illustrate various phases of operation of the forming mechanism;

Figs. 7A to 7E illustrate various phases of operation of the mandrel freeing and stacking operation, and

Fig. 8 illustrates a modified arrangement for fluid pressure control.

Referring now to Figs. 1–3, the mechanism comprises a frame or support broadly designated by the numeral 10 to which the base 12 of the machine may be bolted as indicated at 14. Side plates 16 and 18 extend upwardly from the base. Positioned by side plates 16 and 18 in parallel relationship to one another are shafts 20, 22 and 24, shaft 24 being rotatably journaled in the plates and extending at one end beyond plate 16. A drive pulley 26 is integral with clutch collar 28 which is rotatably mounted on the projecting end of shaft 24 and a cooperating clutch collar 30 is integral with shaft 24. The driving pulley is rotated by a belt 32 from a pulley 34 driven by a motor 36 suitably secured to some portion of the frame. The clutch collars 28 and 30 are moved into and out of engagement by means of a clutch lever 38.

Pivotally mounted on shaft 22 is an arm 40, at the free end of which is a clamping collar within which is secured end 50 of a forming mandrel 42. The pivotal movement of arm 40 about shaft 22 in a downward direction is limited by lug 44 integral with arm 40 which abuts a stop 46. The lower extreme of pivotal movement is indicated by the position of the forming mandrel 42 in Fig. 3.

Mandrel 42 is tubular and provides a conical forming surface, the wall of which is apertured throughout its circumference. Beyond the forming portion of the mandrel 42 the tube is closed by cap 48 and a hose 52 slipped over tubular end 50.

A picker valve member broadly designated by

the numeral 54 is supported at the outer free end of an arm 56 which is pivotally mounted about shaft 22. Shaft 20 is provided with a cushioned seat 58 forming a stop limiting downward movement of picker valve 54. The valve may be made of any suitable material such as steel, plastic, etc., and it embodies a groove or seat 60 which is cut to the exact taper and dimensions of the forming portion of the mandrel 42 so that the latter may be accurately seated within it. The exact construction of the picker valve is more clearly illustrated in Fig. 6A, wherein it will be seen that there is a hollow chambered portion 62, the upper flat surface 64 of which is apertured. The chamber 62 communicates with the bottom of mandrel seat or groove 60 through a throat extending the full length of the forming portion of the mandrel. As valve 54 is lifted by arm 56, it seats the forming portion of the mandrel 42 in groove 60 and lifts the same with it about its supporting arm 40 for purposes which will be brought out more clearly hereinafter.

Hose 52 is connected with one port of a four-way air valve 66. Port 67 is open to atmosphere and the other two ports are connected by hoses 68 and 70 with the intake and exhaust ports, respectively, of a pump 72. The positions of valve 66 are clearly illustrated in Figs. 4 and 5. In Fig. 4 hose 52 leading to the forming mandrel is connected with the intake of the pump whereas in Fig. 5 hose 52 communicates with the exhaust from the pump. Rotation of vane 74 connects hose 52 with ports 68 or 70 of the valve.

The position of vane 74 is, in turn, controlled by rotation of a segment 76 secured to the rotative axis of the vane, the segment engaging a vertically movable rack 78 at one end of an arm 80 supported for sliding movement in a bracket 82. The rack arm 80 is normally held in its uppermost position by the bias of a spring 84 and vertical or reciprocating movement thereof is obtained through a cam 86 secured to shaft 24, the outer periphery of which bears on a cam roller 88 at the upper end of rack arm 80.

The periphery of cam 90 secured to shaft 24 engages a roller 92 in the end 94 of arm 56 which carries the valve 54. End 94 is on the opposite side of shaft 22 from the valve carrying portion 56 of the arm and downward movement of arm 94 when actuated by cam 90 forces the valve 54 upwardly into seating engagement with the forming portion of the mandrel 42. Continued movement of the valve 54 carries the mandrel 42 with it, as will be apparent, for reasons to be brought out more clearly hereinafter.

A grooved collar 96 is slidably mounted on the end 50 of mandrel 42 between the apertured forming portion of the mandrel and supporting arm 40. Lever 98 is pivotally mounted at 100 on a bracket 102 constituting a portion of arm 40. One end of lever 98 carries a pin 104 which rides in the groove of collar 96, and the other end of the lever carries a cam roller 106 which bears against the side of cam 90. Cam 90 is mounted on shaft 24 by means of a collar 108 and on its face opposite collar 108 is a cam surface 110 which is adapted to actuate lever 98 to slide collar 96 along the end 50 of the mandrel for purposes more clearly to be described hereinafter.

Slidably mounted (see Fig. 6I) in bracket 112, which may be integral with arm 114 secured to shaft 22, is an actuating arm 116 carrying a roller 118 at its inner end which is yieldably urged by the bias of a spring, not shown, against the periphery of cam 120, which cam is mounted on shaft 24 to revolve with it. The other end of arm 116 carries a block 122 in which is mounted a heat seal iron 124 impressed with a desired voltage through cable 126. Spring 119 cushions the sealing action of the iron.

Arm 128 is secured to shaft 22 and its opposite end provides a sleeve 130 forming a continuation of stack tube 132, lying between the end of the stack tube and the closed end of mandrel 42. A lever 134 is pivotally secured at 136 to bracket 138 which may be integral with arm 128. One end of lever 134 is provided with a pin 140 which engages in the groove of a collar 142 slidably mounted on the end of stack tube 132. The other end of lever 134 engages in the groove 144 in the periphery of cam 146 which is secured to shaft 24 to rotate therewith.

Spring nesting fingers 148 are secured to collar 142 and extend axially therefrom into sleeve 130. The inside diameter of sleeve 130 is substantially the same as the inside diameter of tube 132 and spring fingers 148 lie in keyways which have been cut in sleeve 130 to a depth which will allow the fingers 148 to lie in substantially a straight-line position against the bottom of the keyway cut in sleeve 130. Each of the spring fingers 148 at its free end carries a hook portion 150, the outer face of each of which normally engages the beveled or flared surface 152 of a keyway in sleeve 130. As the collar 142 is moved away from the mandrel by the action of cam 146, the spring fingers 148 are pulled with it, thus causing the hook portions 150 to move radially inwardly as they cross the cam surface 152. This accomplishes an important phase of the complete operation and will be described more fully hereinafter.

A suitable support for blanks, broadly indicated by the numeral 154, holds a stack of blanks 156 by means of the toed-in end portions or stops 157 of guide rods 158 and is mounted on an adjustable block assembly broadly designated by the numeral 160 which may be moved vertically and transversely by means of hand wheels 162 and 164. The stops protrude only a short distance over the bottom edge of the stack and, while they very effectively restrain movement of the stack past them, it is very easy to snap past them a single label from the bottom of the stack. If two or three labels tend to stick together, which is sometimes caused by static electricity or offset of printing inks, the rather sharp edges of these stops effectively separate the bottom label from those adhered above it as it is snapped past the stops. These stops are adjustable and their interference with movement of the stack can be increased or decreased as demanded by the weight and character of the sheet material being formed. When the support is arranged approximately vertical, as here shown, the labels progress from top to bottom via their own weight, i. e., gravity. However, in some instances one might wish to arrange the stack at some other angle, in which case it would be necessary to supplement or replace the gravity feed by a mechanical substitute such as springs, weights, compressed air cylinder, etc.

When the clutch lever 38 is thrown in and shaft 24 with its cam units is revolving, the automatic sequential operation of the machine is as follows: Arm 56 is actuated by cam 90 to move the picker valve 54 upwardly until it seats the mandrel in groove 60, as clearly illustrated

in Fig. 6B, and continues its movement until it reaches its upward limit, at which point it comes into very close proximity with or touches (Fig. 6C) the outermost blank 156 on the underside of the stack contained in holder 154.

At this point the valve 66 from pump 72 is actuated by cam 86 in such manner that a suction condition arises in hose 52 which is transmitted to the mandrel 42. The throat of chamber 62 communicates with certain of the apertures in mandrel 42 and the suction condition, therefore, exists across the entire apertured surface 64 of the valve as well as across the exposed outer apertures in the mandrel. It should be noted that by reason of the very accurate seating of the mandrel 42 in groove 60, certain of the apertures in the mandrel will be completely blocked and the surface 64 of valve 54 combines with the outer surface of the seated mandrel 42 to form a substantially continuous plane surface across which in its entirety a suction condition exists.

By reason of the suction condition existing across the surface in proximity to the outermost blank, the blank will adhere to said surface at a plurality of spaced points and, when the arm 56 is permitted to begin its return stroke by gravity, freed gradually of the cam force, the outermost blank will be drawn away from the stack as clearly illustrated in Figs. 6D and 6E.

When the mandrel 42 has reached its downward limit of movement through engagement of lug 44 against stop 46, the arm 56 continues its downward movement and begins to unseat the valve 54 from mandrel 42 (Fig. 6E). As this unseating movement continues and the valve 54 drops further down away from mandrel 42, the blank 156 is drawn about the mandrel. As soon as the unseating movement begins the suction condition in chamber 62 is broken because there is no longer direct communication between the openings or apertures in mandrel 42 and the throat of chamber 62. Thus the suction as the unseating movement progresses becomes more and more concentrated in the mandrel only. This condition is clearly illustrated in Fig. 6F. If the suction were not relieved from the face of the valve, it would pull the label out of position on the mandrel as the valve recedes from it. However, the receding valve does break the suction and the label remains in its proper position on the mandrel. In Fig. 6G arm 56 and valve 54 have almost reached the limit of downward movement and have receded from the mandrel to a point where the blank 156 contacts only a small portion of valve surface 64.

In Fig. 6H the arm 56 carrying valve 54 has reached its lower limit of movement and abuts the stop 58. During the final increment of its downward movement, the surface 64 of the valve disengages itself entirely from any contact with the blank and the latter is snapped about the lower surface of mandrel 42. That margin of the blank which was initially in contact with the mandrel during the initial downward movement of the valve has been held in close contact with the mandrel surface during further downward movement of the valve and the final snapping action of the other margin carries it over the upper marginal surface of the blank to form the overlap indicated most clearly in Fig. 6H at 165.

The under face of this overlapped margin 165 of the blank is coated with heat-sealable adhesive and, when the valve 54 has reached its lower limit, cam 120 forces heat sealing iron 124 out into engagement with the overlap to form a seal, being immediately retracted after the sealing operation is complete. This phase is clearly illustrated in Fig. 6I. A protruding tab may be embossed into the overlap by a small die 43 on the mandrel which has its counterpart recessed into the heat sealing iron 124. The tab is embossed into the overlap when the iron moves forward and contacts the overlap to effect a heat seal. Since this tab is formed under heat and pressure of the sealing iron, it might be said that it is not merely embossed but actually molded into the overlap. Because it is molded and because it is formed from the double-ply overlap, the tab possesses the maximum possible strength which can be had. The tab serves to keep the cones from wedging tightly into each other during handling and shipment. Cones kept loosely nested by these tabs speed up their application in the bottling line. Without the tabs, the cones become tightly nested into each other and cause the bottlers no end of trouble in separating them.

Referring now to Figs. 7A–7E, the fully wrapped band, formed and sealed as hitherto described, is illustrated in Fig. 7A as of the moment the heat seal is completed. At this point the air valve operating cam reverses the pump connection and a blast of air is directed through hose 52 into the mandrel 42. Simultaneously with, or just prior to, the change in pressure conditon within the mandrel, the cam surface 110 on cam 90 moves lever 98 to slide collar 96 toward the mandrel. The axial dimension of the formed band is slightly greater than that of the mandrel and on sliding movement, collar 96 engages the projecting portion 167 of the band to loosen it (Fig. 7B). This loosening action permits a component of the air blast through hose 52 and exhausting through the apertures in mandrel 42 to blow the band into the mouth of the stacking tube, sleeve 130. As soon as the band has been blown into the mouth of the stacking tube (Fig. 7C), lever 134 moves collar 142 to the left, carrying with it fingers 148. As the fingers move to the left the outer surfaces of the hook portions are cammed inwardly and the hooks themselves engage the end of the band and pull it into tube 132 (Fig. 7D), thus leaving sleeve 130 free and clear for reception of a subsequently blown band. As soon as the band has been pulled into tube 132, the collar 142 is moved back into the position illustrated in Figs. 7A–7E.

The timed relation of the sequence of operations hitherto described may be such that a completely formed band is blown into the mouth of the stacking tube as soon as the collar 142 is moved back into position to grasp a subsequent band and repeat its operation of pulling it into the tube proper. As the process continues and more bands are drawn back by the hooks, they emerge out of the end of tube 132 and slide into a trough which may be five or six feet long. An operator can remove a strip of the nested bands from this trough without stopping or interfering with the production of the machine.

The machine described is capable of a high rate of production which is limited only by the rate at which the labels can be properly heat sealed. The valvular action of picking a label off the pile and wrapping it around the mandrel is extremely fast and is limited only by the amount of vacuum applied and by the speed with which the valve can be reciprocated. The machine may be coupled to a multi-stage centrifugal air blower which develops only a two-pound negative pres-

sure, yet the pickup and wrap operation is so fast that one can just barely get a glimpse of the overlap end being whipped around the mandrel. Runs have been made at a rate of over 5,000 bands per hour and there is no apparent reason why, with a more powerful blower, the rate cannot be doubled. The mechanism is extremely simple in that it involves no rotating mandrel, no grippers to grab the label, no mechanism to transfer the label from the pile to the mandrel, and no complicated gearing to operate grippers or a transfer device. Mandrels are simple to make and install since there is no working mechanism contained in them. Indeed, in the simplicity of this mechanism lies its novelty.

This mechanism, however, is not limited to the particular arrangement described. It can equally well form a part of another machine which performs other operations on the band. For example, one might wish to close the tops of the bands. In such a case, one might construct a machine having, for example, six mandrels spaced evenly around the circumference of a turntable, the axis of the mandrels being parallel to the axis of the turntable. The table would be activated by a Geneva motion which would intermittently move the table through a sixth of a revolution and thereby bring successively each mandrel to a pause at the No. 1 position. At the No. 1 position would be the stack rack and mandrel valve which would serve to pick a label from the bottom of the stack and wrap it around the mandrel. This mandrel would then move to position 2 where the wrap would be heat sealed. At positions 3, 4 and 5 other operations would be performed to close and form the top of the band. At position 6 the band would be delivered into the receptacle and pushed out into the delivery trough. Of course, with six mandrels there would be six bands in progress at all times. This illustrates how the same novel ideas described herein may be incorporated in more complex equipment and yet achieve the same net result of simplicity and high-speed production.

Another variation of this mechanism which is very useful and is even more simple is to eliminate reciprocating motion of the mandrel. This may be accomplished by moving the stack so close to the mandrel that no motion of the mandrel to the stack is necessary. The clutch operated by lever 38 is so designed that it will always stop the machine in a position where the mandrel valve 54 and heat sealing iron 124 are farthest from the mandrel 42. This is important because, should the labels become clogged or jammed, the mandrel is then accessible and the jammed labels can be readily removed.

From the foregoing the basic concepts of the invention will have become clear. Utilizing them, it would be a simple matter to construct a machine which would work satisfactorily and yet not have the air passages in the mandrel valve 54 communicating with those in the mandrel 42 through the mandrel valve throat. Such an arrangement is readily obtainable by providing a separate suction hose attached to the mandrel valve and operated by either the same or a different air valve. Some advantage may be derived from an arrangement wherein it is possible to cut off the suction completely in the mandrel valve before it has started to recede from the mandrel itself.

In Fig. 8 is shown a somewhat modified arrangement wherein two pumps 170 and 172 are employed. Pump 170 communicates by appropriate air lines with a four-way valve 174, which is identical in every respect with valve 66 described heretofore, and is operated in the same way by a cam actuated rack arm 176 which rotates valve actuating segment 178 to place pump 170 in either suction or blast communication with mandrel 180.

Pump 172 communicates by appropriate air lines with another four-way valve 182 which is also cam operated in identical fashion, but appropriate sequence, to place the pump 172 in blast or suction communication with mandrel valve 184. Thus the fluid conditions in mandrel 180 and mandrel valve 184 are separately and independently controlled and may be controlled in any desired timed relation to one another.

When employing the arrangement disclosed in Fig. 8, the fluid condition within the mandrel valve 184 may be controlled by valve 182 and pump 172 to develop a small volume of air with a high negative pressure so that the label blank will be more firmly held on or to its apertured face. Sucking the label blank around the mandrel requires, on the other hand, a large volume of air at relatively low pressure. Thus it is apparent that the use of two types of pumps separately and independently controlled may prove very beneficial in obtaining high speed operation, particularly when the blanks are formed of relatively stiff material.

Having described certain preferred embodiments of the invention, various modifications will be apparent to those skilled in the art and for that reason I wish to limit myself only within the scope of the appended claims.

What I claim is:

1. In a machine for forming bands from flat blanks of flexible sheet material, the combination of means for supporting a stack of blanks, a tubular mandrel having an apertured wall, a hollow picker valve movable into position to seat the mandrel within said valve with the outermost portion of the mandrel surface substantially aligned with the outer surface of the valve, the apertures in said mandrel wall communicating with the interior of said valve, and means for moving said valve and the mandrel while in seated position therein into spaced engagement with an outermost blank of said stack.

2. In a machine for forming bands from flat blanks of flexible sheet material, the combination of means for supporting a stack of blanks, a tubular mandrel having an apertured wall, a hollow picker valve movable into position to seat the mandrel within said valve with the outermost portion of the mandrel surface substantially aligned with the outer surface of the valve, the apertures in said mandrel wall communicating with the interior of said valve, means for moving said valve and the mandrel while in seated position therein into spaced engagement with an outermost blank of said stack, and means for creating a suction in said mandrel transmitted to said valve whereby withdrawal of the mandrel and valve withdraws said outermost blank from said stack with spaced portions of said blank engaging the mandrel and valve respectively.

3. In a machine for forming bands from flat blanks of flexible sheet material, the combination of means for supporting a stack of blanks, a tubular mandrel having an apertured wall, a hollow picker valve movable into position to seat the mandrel within said valve with the outermost portion of the mandrel surface substantially aligned with the outer surface of the valve, the apertures in said mandrel wall communicating

with the interior of said valve, means for moving said valve and the mandrel while in seated position therein into proximity with an outermost blank of said stack, means for creating a suction in said mandrel transmitted to said valve whereby withdrawal of the mandrel and valve withdraws said outermost blank from said stack with spaced portions of said blank engaging the mandrel and valve respectively, means for terminating the suction in said valve and then withdrawing said valve from said mandrel whereby continued suction through the mandrel wraps the blank thereabout, and means for heat sealing the overlapping margins of said blank in wrapped position to form a band.

4. In a machine adapted to form a band from a single flat blank of sheet material, an apertured mandrel, an apertured valve adapted to move into engagement with said mandrel, seat the same, and move the mandrel with it into engagement with a blank, means for creating a suction in said mandrel and valve, means for withdrawing the valve from the mandrel to permit the suction therein to draw the band about the mandrel wall, and means for heat sealing the overlapped margins of said blank to form a band.

5. In a machine adapted to form a band from a single flat blank of sheet material, an apertured mandrel, an apertured valve adapted to move into engagement with said mandrel, seat the same, and move the mandrel with it into engagement with a blank, means for creating a suction in said mandrel and valve, means for withdrawing the valve from the mandrel to permit the suction therein to draw the band about the mandrel wall, means for heat sealing the overlapped margins of said blank to form a band, and means for automatically changing the suction in said mandrel to a pressure condition for ejecting the formed band from the mandrel.

6. In a band forming machine the combination of a hollow forming mandrel having an apertured wall, and a chambered valve member having a groove conforming to a portion of the surface contour of the mandrel and adapted to seat the same, the chamber of said valve member having an apertured wall forming with the inserted wall portion of the mandrel when seated a substantially continuous apertured surface and a passage from the chamber connecting with certain apertures in the mandrel when the valve is seated.

7. In a band forming machine the combination of a hollow forming mandrel having an apertured wall and a chambered valve member having a groove adapted to seat said mandrel, said valve member embodying means forming a communicating passage between the interior of the mandrel and the valve chamber when the mandrel is seated, and including passages from said chamber communicating with the exterior of the valve member.

8. In a band forming machine the combination of a hollow forming mandrel having an apertured wall, a normally separated chambered valve member having a groove adapted to seat said mandrel, said valve member embodying means forming a communicating passage between the interior of the mandrel and the valve chamber when the mandrel is seated, and including passages from said chamber communicating with the exterior of the valve member, and means for moving said mandrel and valve member into valve seating engagement with each other.

9. In a band forming machine the combination of a hollow forming mandrel having an apertured wall, a normally separated chambered valve member having a groove adapted to seat said mandrel, said valve member embodying means forming a communicating passage between the interior of the mandrel and the valve chamber when the mandrel is seated, and including passages from said chamber communicating with the exterior of the valve member, means for moving said mandrel and valve member into valve seating engagement with each other, a pump connected with the interior of said mandrel, and means for placing said interior in communication with the intake or exhaust of said pump.

10. A process for forming bands from blanks of flexible sheet material about a perforated tubular mandrel which comprises the steps of moving a suction element into alignment with the tubular mandrel, then simultaneously moving the suction element and mandrel into proximity with a stack of the blanks, then terminating suction in said suction element and withdrawing such element while maintaining suction in the tubular mandrel to wrap the withdrawn blank therearound with edges of the blank overlapping, then heat-sealing the overlapped edges while still on the mandrel, then releasing suction in the mandrel, and then forcing fluid under pressure through the mandrel to eject the formed band therefrom.

11. In a machine adapted to form a band from a single flat blank of sheet material, an apertured mandrel bodily movable in a fixed path, a support movable along the path of said mandrel, means for moving the support into engagement with said mandrel and moving the mandrel with it into engagement with a blank, means for creating a suction in said mandrel, and means for withdrawing the support from the mandrel to permit the suction therein to draw the band about the mandrel wall.

12. In a machine adapted to form a band from a single flat blank of sheet material, an apertured mandrel bodily movable in a fixed path, a support movable along the path of said mandrel, means for moving the support into engagement with said mandrel and moving the mandrel with it into engagement with a blank, means for creating a suction in said mandrel, means for withdrawing the support from the mandrel to permit the suction therein to draw the band about the mandrel wall, and means for heat sealing the overlapped margins of said blank to form a band.

13. In a machine adapted to form a band from a single flat blank of sheet material, an apertured mandrel bodily movable in a fixed path, a support movable along the path of said mandrel, means for moving the support into engagement with said mandrel and moving the mandrel with it into engagement with a blank, means for creating a suction in said mandrel, means for withdrawing the support from the mandrel to permit the suction therein to draw the band about the mandrel wall, means for heat sealing the overlapped margins of said blank to form a band, and means for automatically changing the suction in said mandrel to a pressure condition for ejecting the formed band from the mandrel.

14. In a machine for forming bands from a stack of flat blanks, the combination of a perforated tubular mandrel movable toward and away from said stack, means for creating a suction condition inside the mandrel, a support movable into position adjacent said mandrel, means for simultaneously moving the mandrel and sup-

port into proximity with said stack while the mandrel is under suction to thereby withdraw the outermost blank from said stack, means for simultaneously moving said mandrel and support away from said stack while maintaining suction in the mandrel, and means for stopping the return movement of the mandrel ahead of that of said support, whereby the withdrawn blank is sucked away from said support and wrapped around said mandrel.

15. In a machine for forming bands from a stack of flat blanks, the combination of a perforated tubular mandrel movable toward and away from said stack, means for creating a suction condition inside the mandrel, a support movable into position adjacent said mandrel, means for simultaneously moving the mandrel and support into proximity with said stack while the mandrel is under suction to thereby withdraw the outermost blank from said stack, means for simultaneously moving said mandrel and support away from said stack while maintaining suction in the mandrel, means for stopping the return movement of the mandrel ahead of that of said support, whereby the withdrawn blank is sucked away from said support and wrapped around said mandrel with overlapping margins, means for securing the overlapping margins together, means for terminating the suction in said mandrel, and means for forcibly ejecting the formed band from the mandrel while the suction is terminated.

16. In a machine adapted to form a band from a single flat blank of sheet material, the combination of a mandrel having spaced holes spread over its entire forming surface, first means connected to said mandrel for producing through said holes predetermined pressure conditions over the entire forming surface of said mandrel, support means for supporting said blank in proximity to said mandrel, picker valve means, means connected to said picker valve means for moving the picker valve means into pick-up relationship with said blank and into proximity with said mandrel to enable transfer of said blank to said mandrel, and second means connected to said mandrel for producing predetermined pressure conditions in the picker valve means.

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