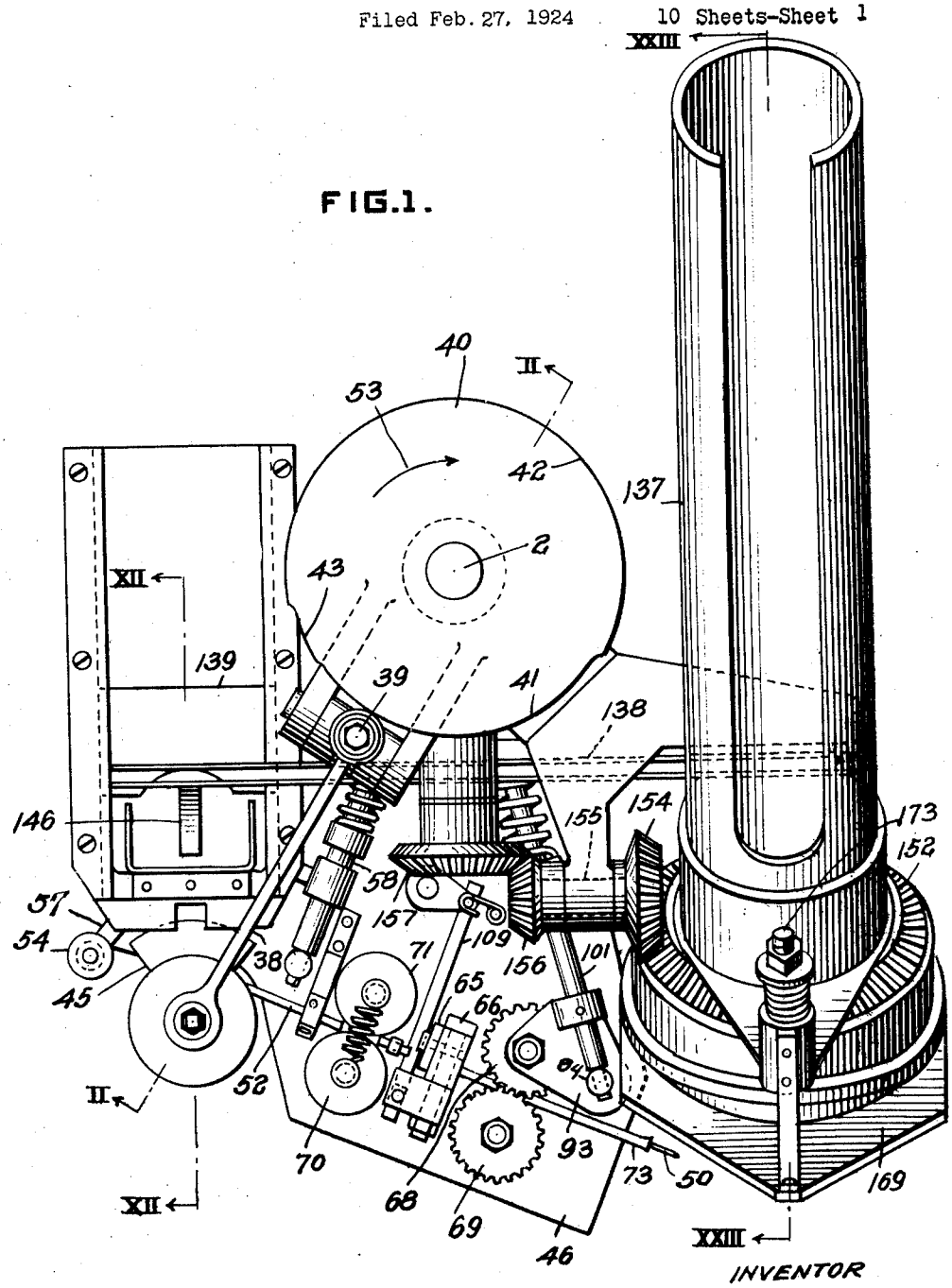
Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

Filed Feb. 27, 1924 10 Sheets-Sheet 1

FIG. 1.



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WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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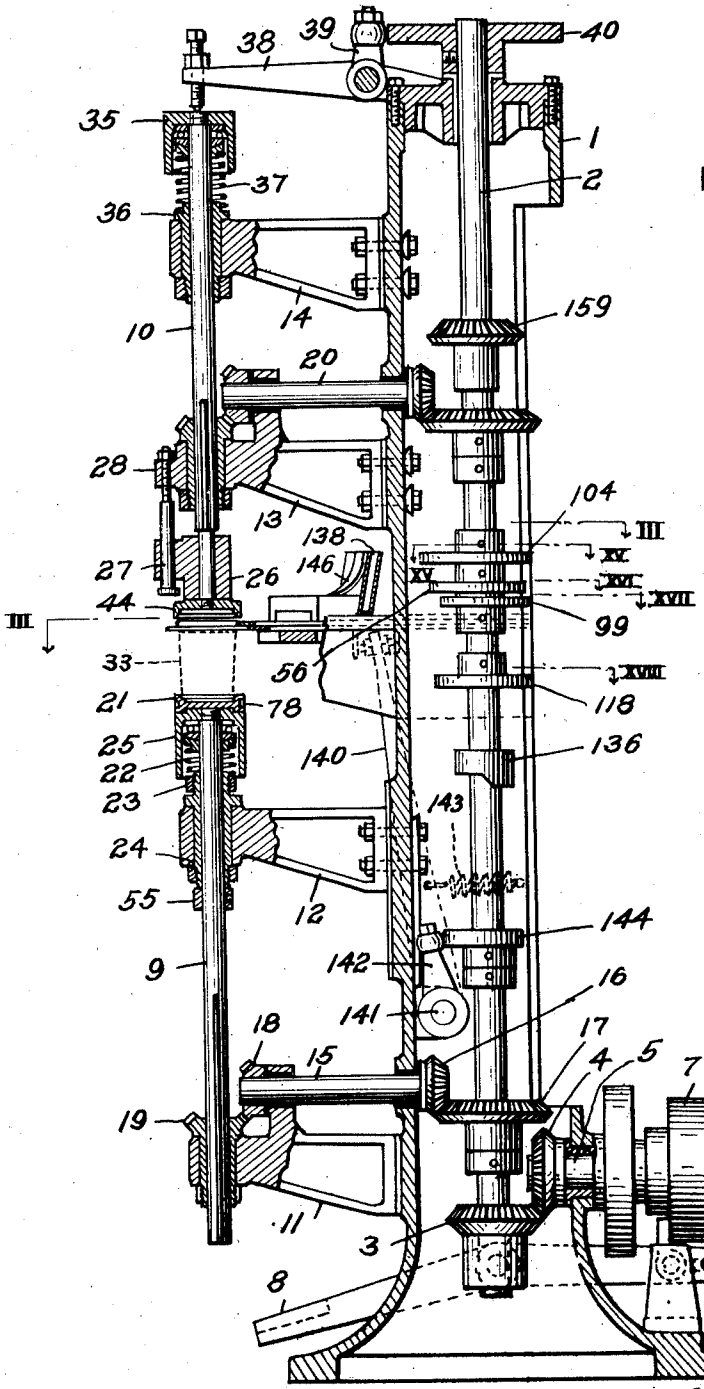


FIG.2.

WITNESSES

J. Hubert Bradley.

INVENTOR

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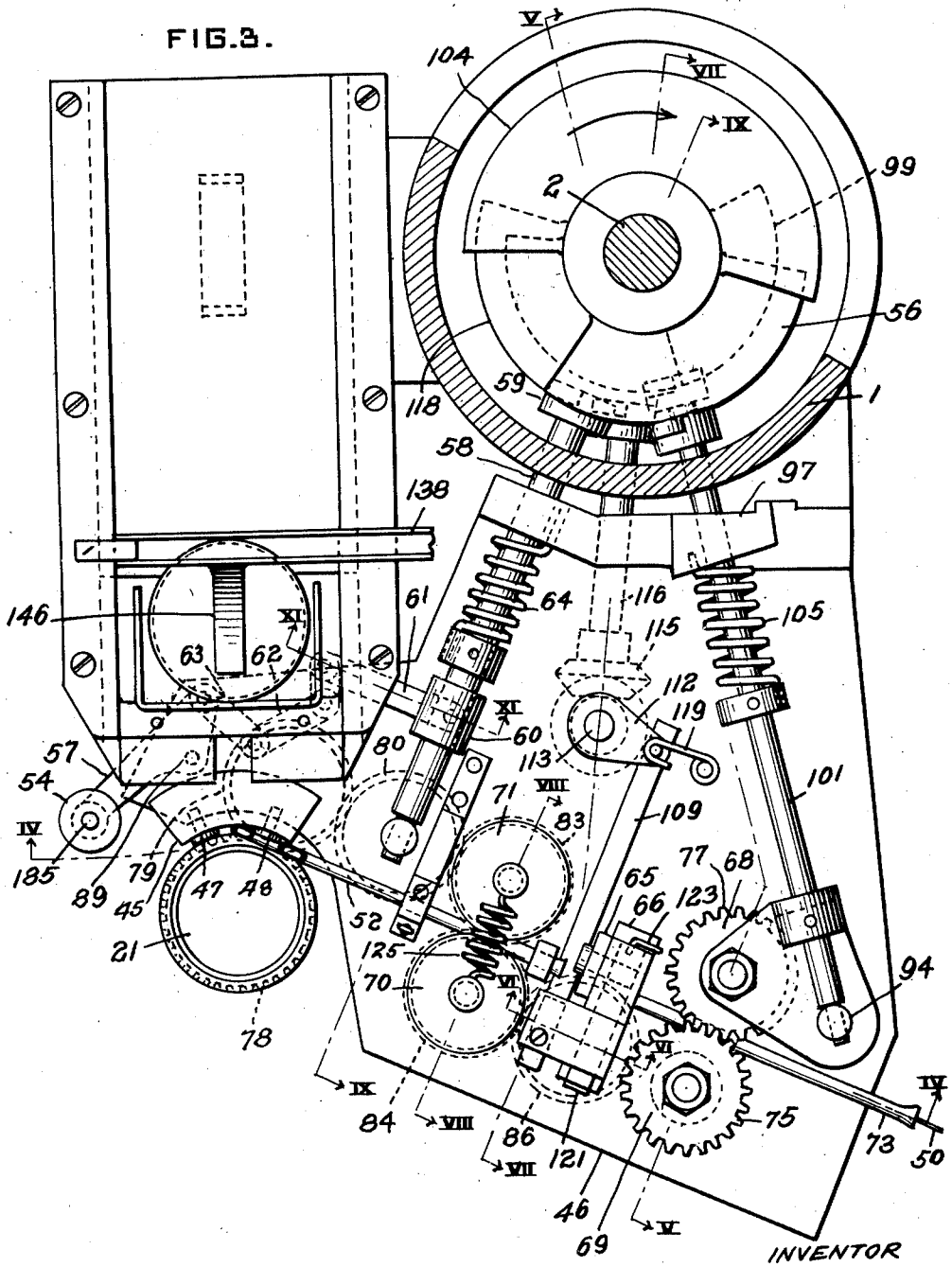
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D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

Filed Feb. 27, 1924 10 Sheets-Sheet 3

FIG. 3.



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WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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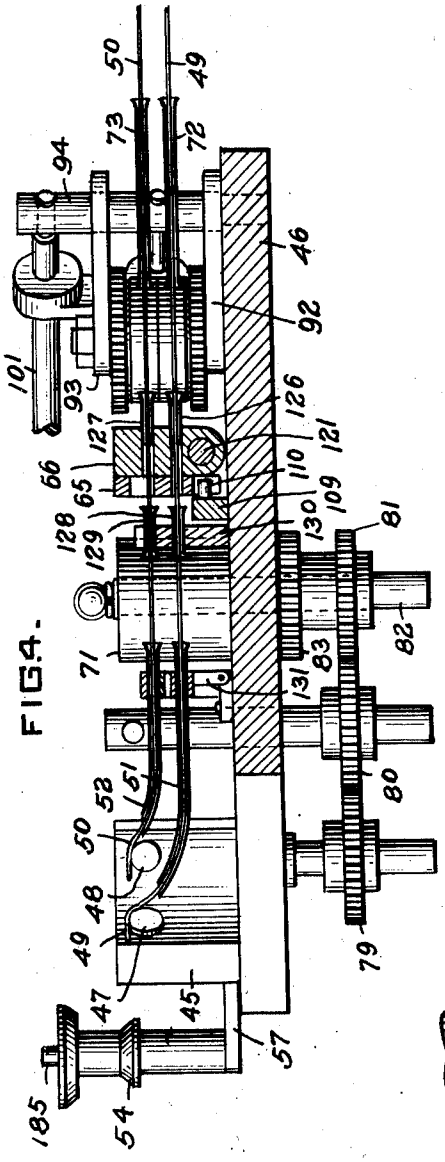


FIG. 4.

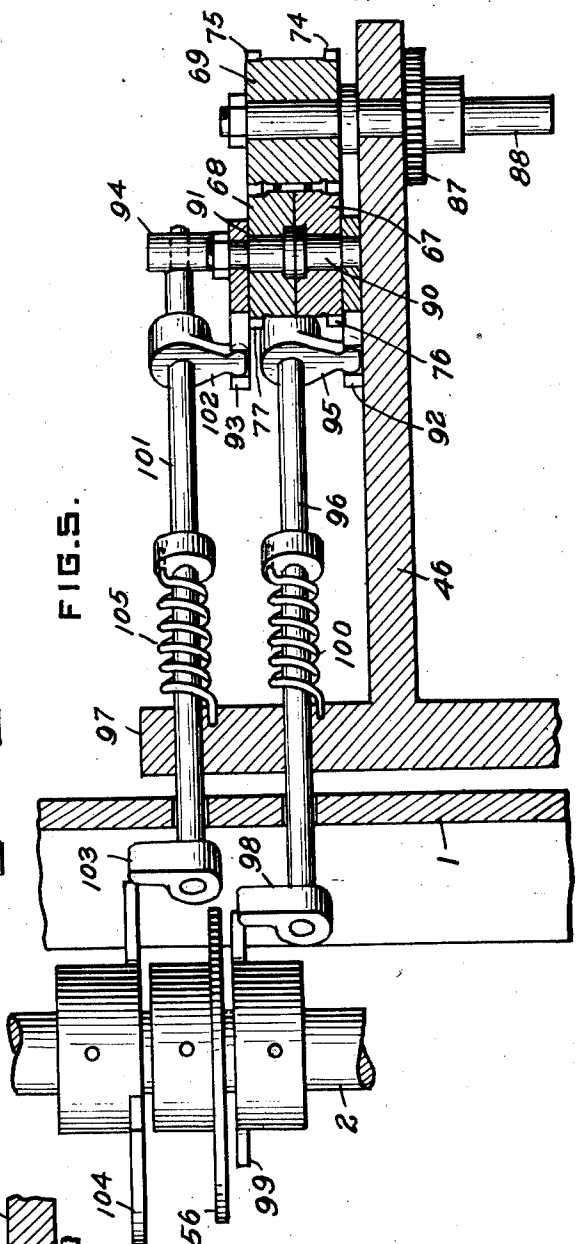


FIG. 5.

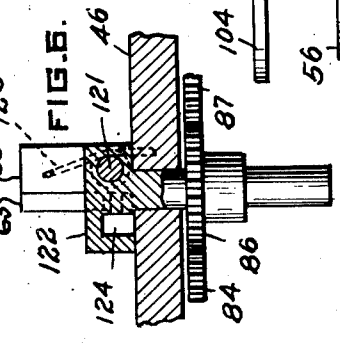


FIG. 6.

WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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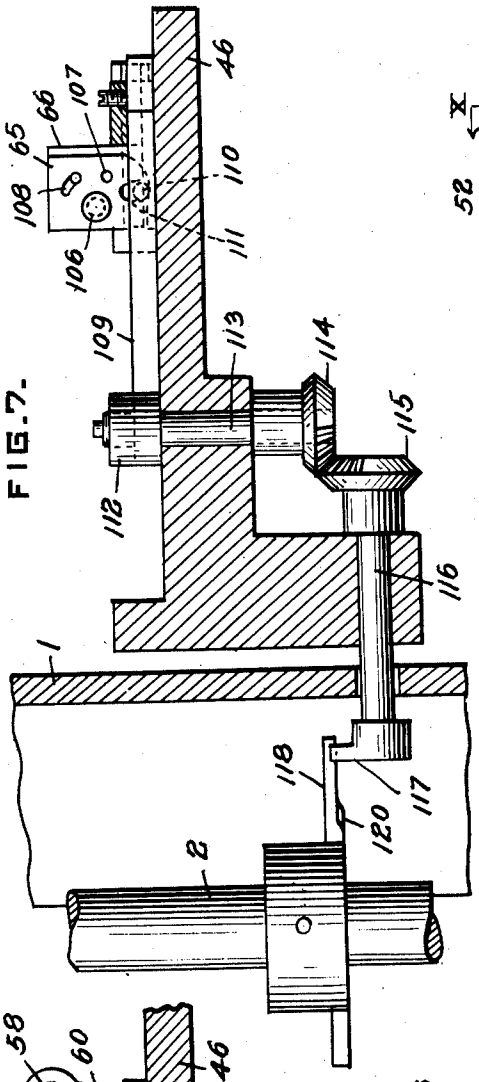


FIG. 7.

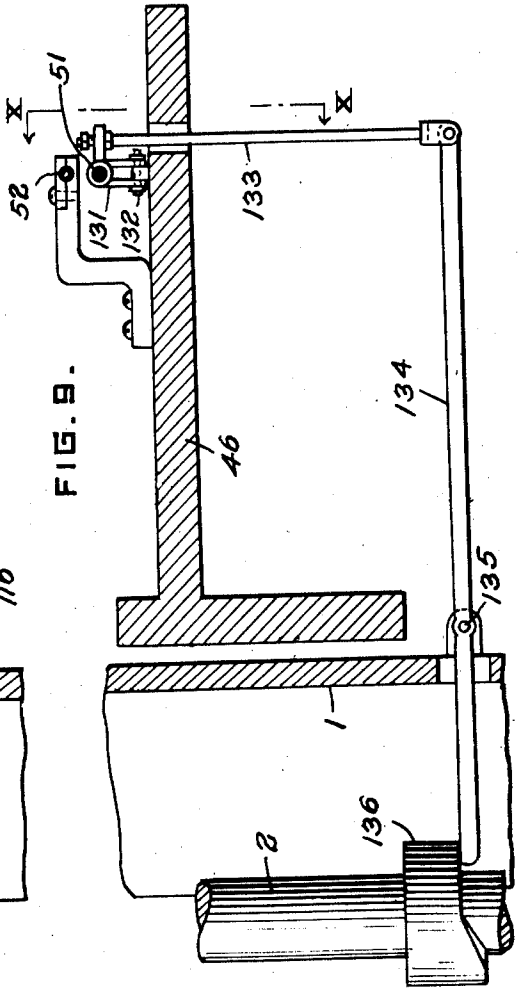


FIG. 9.

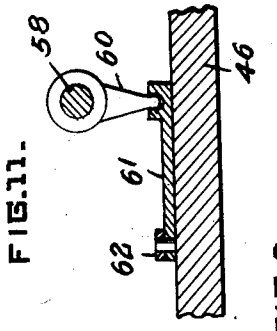


FIG. 11.

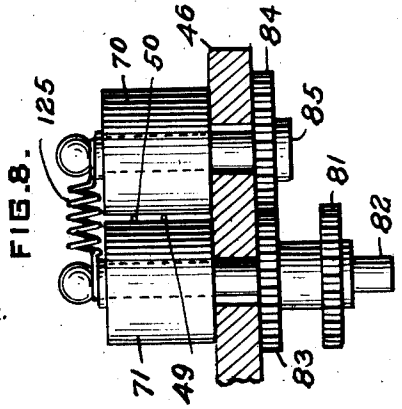


FIG. 8.

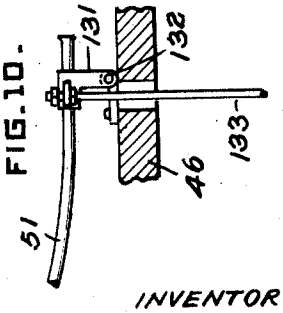


FIG. 10.

WITNESSES

J. Hebel Bradley.

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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FIG. 12.

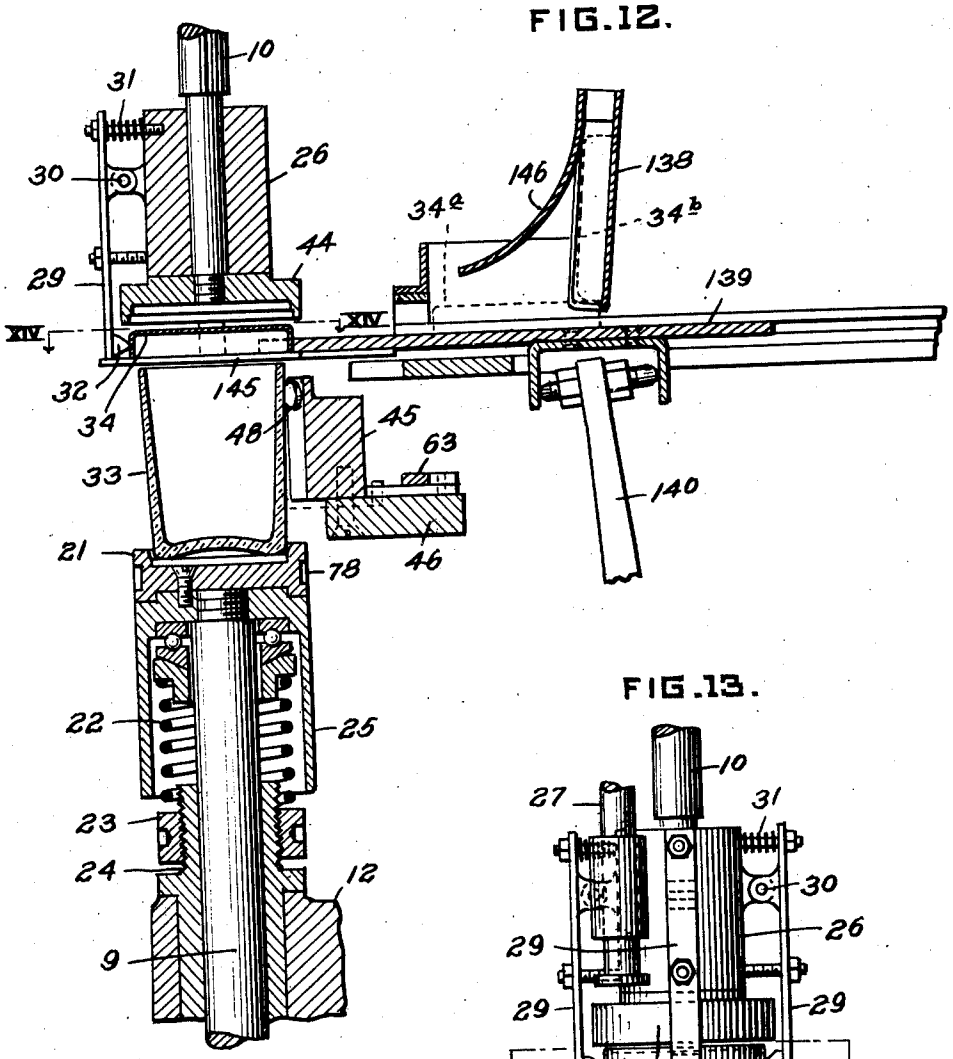
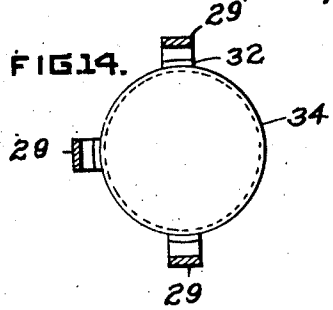


FIG. 13.

FIG. 14.



WITNESSES

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Feb. 14, 1928 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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FIG. 15.

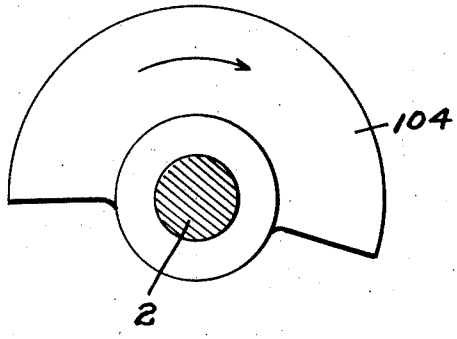


FIG. 16.

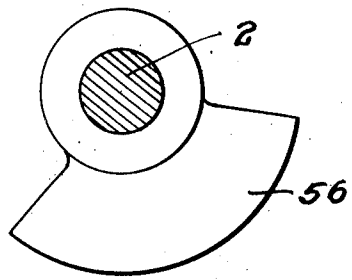


FIG. 17.

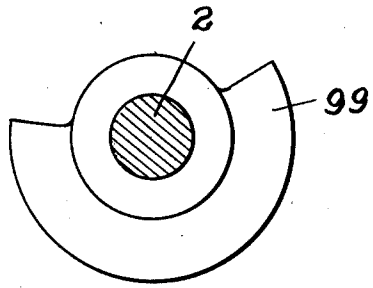
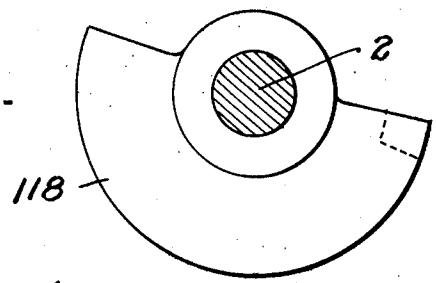


FIG. 18.



WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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FIG. 19.

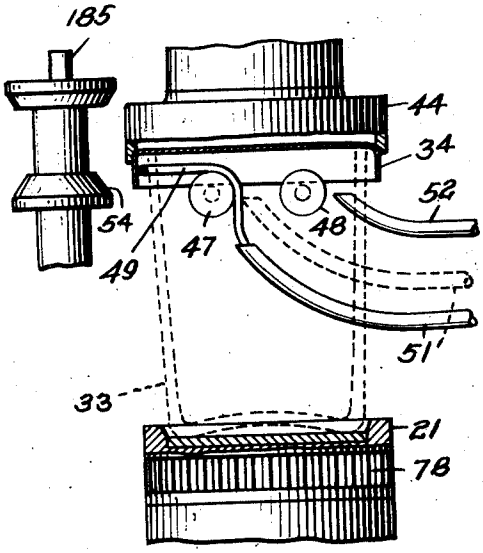


FIG. 20.

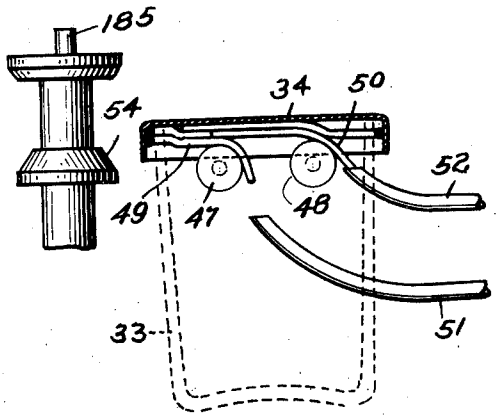


FIG. 21.

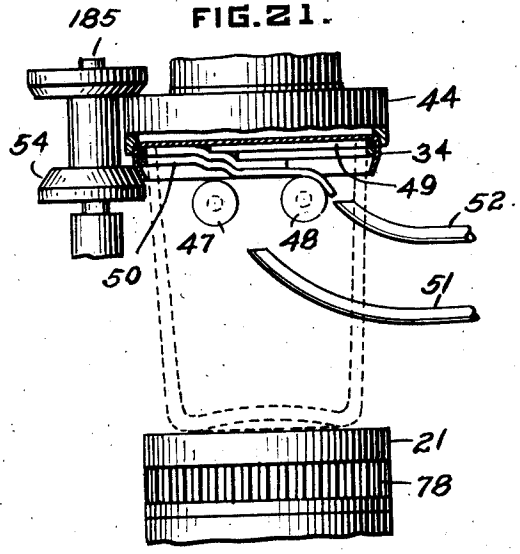
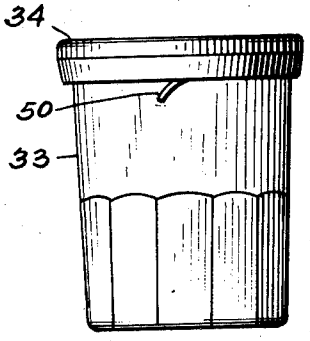


FIG. 22.



WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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FIG. 23.

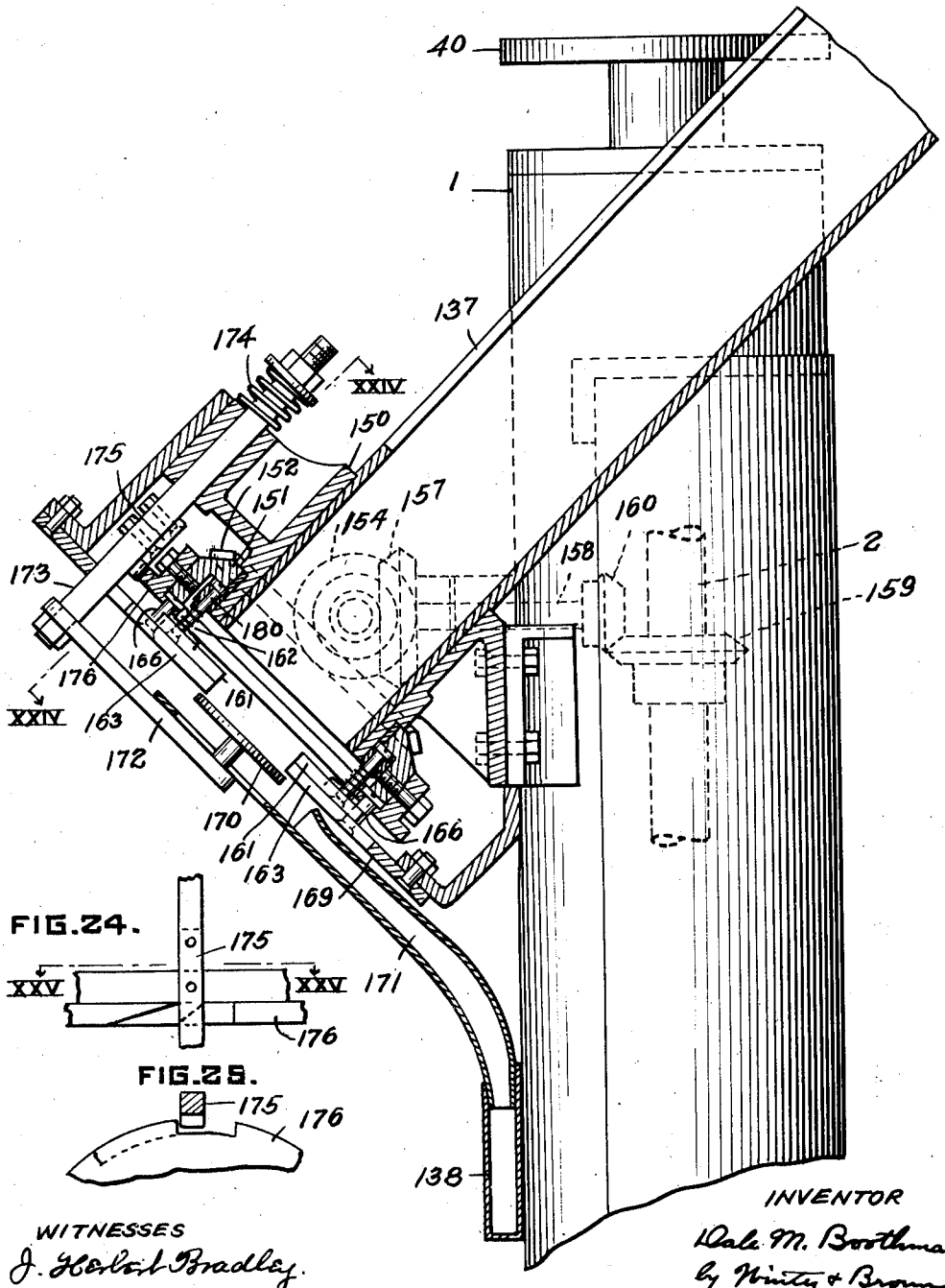


FIG. 24.

FIG. 25.

WITNESSES

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Feb. 14, 1928. 1,659,546

D. M. BOOTHMAN

CONTAINER CLOSING MACHINE

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FIG. 26.

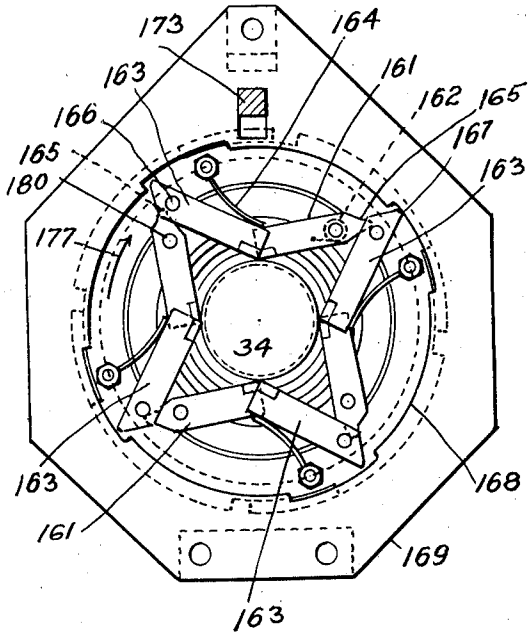


FIG. 27.

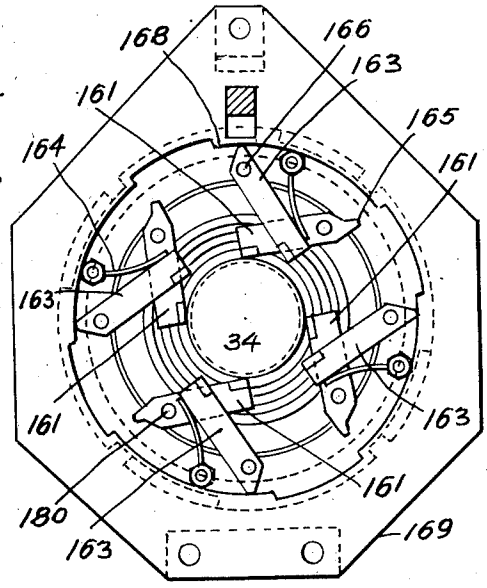
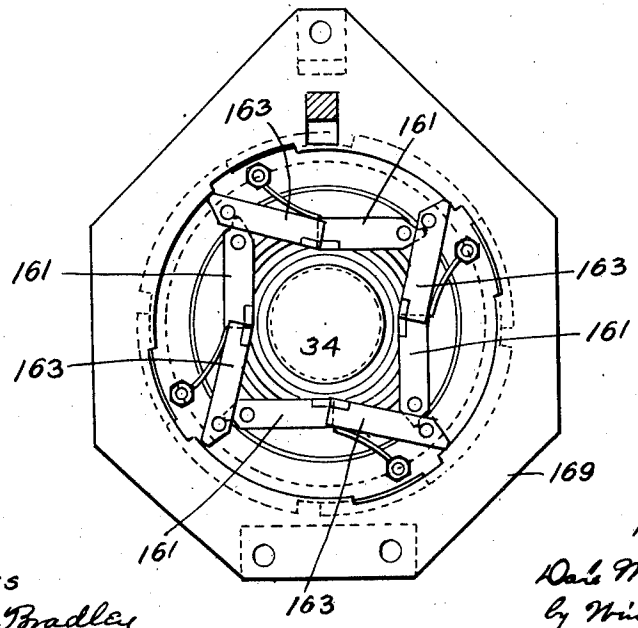


FIG. 28.



WITNESSES

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Patented Feb. 14, 1928. 1,659,546

UNITED STATES PATENT OFFICE.

DALE M. BOOTHMAN, OF OAKMONT, PENNSYLVANIA, ASSIGNOR TO ALUMINUM SEAL COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

CONTAINER-CLOSING MACHINE.

Application filed February 27, 1924. Serial No. 695,598.

In my pending patent application Serial No. 593,791, there is disclosed a seal for closing the mouths of containers such as are used for packing food and like products. The seal comprises a flexible gasket arranged in an annular, preferably wedge-shaped, space between the container and a depending skirt or flange of a cap, and a flexible member arranged in the same annular space below the gasket and pressing upwardly upon it to hold it firmly in sealing position, and pressing outwardly upon the cap skirt to retain the cap upon the container.

The application discloses two forms of gaskets for making the seal, one a continuous ring and the other a strip or string-like member. The retaining member may be a continuation of a string-like gasket, but is preferably a flexible wire which may be formed of aluminum. In the preferred embodiment of the invention in said application a retaining member of wire has its inner end overlapped above the outer end of a string-like gasket, and its outer end protruding below the cap skirt. To break the seal, the retaining wire is first removed by engaging its protruding end and pulling it downwardly, which results in removing the retaining wire and in exposing the outer end of the gasket below the skirt. The exposed end of the gasket is then engaged and the gasket removed, which results in a complete breaking of the seal, leaving the cap in good condition for use as a closure for the container until its contents are removed.

In addition to the convenient manner in which the seal may be broken, it is a further characteristic of the seal that the skirt of the cap is slightly expanded outwardly by the retaining member, and, by reason of its resiliency, the thus expanded skirt continuously presses inwardly upon the wire to hold the cap upon the container and press the gasket in sealing position.

The general object of this invention is to provide a machine for forming closure seals of the type and character disclosed in and contemplated by my said pending patent application.

A specific object is to provide a machine for wedging a sealing gasket, preferably in the form of a strip, between a container and the skirt of a cap after the cap has been applied to the container.

A further specific object is to provide a machine for wedging wire between a container and the skirt of a cap back of a sealing gasket.

A further specific object is to provide mechanism for cutting and delivering to closure forming apparatus, and in coordination with its operation, strips of material used in forming closures.

A further specific object is to provide a container closing machine having coordinated mechanism for applying caps to containers, for successively and progressively wedging sealing strips and closure retaining wires between the containers and skirts of the cap supplied to them, and for delivering proper lengths of sealing strips and retaining wires to the closure forming mechanism.

Other specific objects will appear from the following description of the invention.

The invention is illustrated in the accompanying drawings of which Fig. 1 is a plan view of the machine; Fig. 2 a vertical sectional view thereof, the plane of view being indicated by the line II—II, Fig. 1; Fig. 3 a horizontal sectional view to enlarged scale taken on the line III—III, Fig. 2, the cap-hopper shown in Fig. 1 being omitted; Fig. 4 a vertical sectional view taken on the broken line IV—IV, Fig. 3, showing a train of mechanism for shearing strips and feeding them to seal-forming position; Fig. 5 a vertical sectional view taken on the broken line V—V, Fig. 3, showing strip and wire delivering rolls and mechanism for controlling their operation; Fig. 6 a sectional view taken on the line VI—VI, Fig. 3, showing the details of construction of a shear; Fig. 7 a vertical sectional view taken on the broken line VII—VII, Fig. 3, showing further details of construction of the shear and mechanism for operating it; Fig. 8 a vertical sectional view taken on the line VIII—VIII, Fig. 3, showing strip and wire feeding rolls; Fig. 9 a sectional view taken on the line IX—IX, Fig. 3, showing mechanism for controlling the position of a strip feeding tube; Fig. 10 a vertical sectional view taken on the line X—X, Fig. 9; Fig. 11 a vertical sectional view taken on the line XI—XI, Fig. 3, showing connections for controlling the position of a crimper; Fig. 12 a vertical sectional view taken on the line XII—XII, Fig. 1, showing cap feeding

mechanism and a support for a container and cap; Fig. 13 an elevation of the upper left hand portion of the mechanism shown in Fig. 12; Fig. 14 a horizontal sectional view taken on the line XIV—XIV, Fig. 13; Figs. 15, 16, 17 and 18 horizontal sectional views to enlarged scale taken on the lines XV—XV, XVI, XVII, and XVIII, Fig. 2, showing several cams attached to an operating shaft in substantially their proper relative positions; Fig. 19 a schematic view showing the initial stage of a sealing operation; Fig. 20 a similar view showing a subsequent stage of the sealing operation; Fig. 21 a similar view showing the final stage of the sealing operation; Fig. 22 an elevation of a container with the seal applied to it; Fig. 23 a vertical sectional view of a cap hopper and mechanism for serially discharging caps from it; Fig. 24 a detail view taken on the line XXIV—XXIV, Fig. 23; Fig. 25 a sectional view taken on the line XXV—XXV, Fig. 24; Fig. 26 a face view of the lower end of the cap hopper showing one of the relative positions of mechanism for serially discharging caps from the hopper; and Figs. 27 and 28 views corresponding to Fig. 26 showing succeeding relative positions of the mechanism for discharging caps from the hopper.

According to this invention provision is made for wedging a flexible sealing gasket, which may be a ring or a strip, between a container and a cap after the cap has been applied to the mouth of the container. This is preferably effected progressively by causing relative rotation between a wedging member or tucker and a container having a cap applied to it, the rotation being on or around the common axis of the container and cap. While either the container or tucker may be rotated, the tucker is preferably held stationary and the container and cap caused to revolve. When the sealing gasket is in the form of a strip, provision is made for feeding strips of required lengths to seal-forming position, the strips being fed one after another, that is to say, serially, in coordination with the seal forming mechanism.

As an adjunct to the strip-feeding mechanism, means are also preferably provided for shearing strips of required uniform lengths from a continuous length or strand thereof. When it is desired to form seals of the preferred type shown in my said patent application, that is to say seals each formed of and by a strip of flexible sealing material and adjacent to it a cap-retaining wire, the machine may, and preferably does, include means for alternately shearing from continuous strands required lengths of sealing strips and wires and means for delivering the sheared lengths alternately and successively to seal-forming position, all in coordination with the seal-forming mechanism.

To render the machine completely automatic it may be provided with mechanism coordinated with the sealing means for serially delivering containers to seal-forming position, and with mechanism for serially delivering caps to, and positioning them upon, containers, although it will be understood that, as far as concerns some features of the invention, mechanism of this sort need not be used.

The machine shown herein for the purpose of illustrating the invention is constructed and coordinated to automatically shear proper lengths of sealing strips and wires, deliver them alternately and successively to seal-forming position, and to feed caps upon containers. It may conveniently be considered as including four units, a support for holding a container and cap placed on it, mechanism for forming a seal, mechanism for delivering closure-forming strips in position to be wedged between each container and cap, and mechanism for serially delivering caps to containers on the support. In the further description of the invention these several units and parts associated with them will be explained in the order stated, after first describing the general organization of the illustrated machine.

Referring to the drawings, and particularly to Fig. 2, the entire machine may be supported by a housing 1, which is preferably of cylindrical form. Within the housing, and protected by it, there is an operating shaft 2 which carries various cams and driving elements presently to be explained, and to which rotation may be imparted in any desired manner. As shown, the lower end of shaft 2 is provided with a bevelled pinion 3 meshing with a bevelled pinion 4 secured to a driven shaft 5 adapted to be connected to a driving shaft 6 through a suitable clutch 7 which may be operated by a treadle 8.

Container support.

This unit preferably includes two rotatable and longitudinally movable shafts 9 and 10, the shaft 9 being supported by brackets 11 and 12, and shaft 10 by brackets 13 and 14, all secured to housing 1. Rotation may be imparted to shaft 9 by means of a countershaft 15 provided at one end with a bevelled pinion 16 meshing with a bevelled pinion 17 attached to operating shaft 2, and provided at its other end with a bevelled pinion 18 meshing with a bevelled pinion 19 feathered on shaft 9. In a similar manner rotation may be imparted to shaft 10 by a countershaft 20 connected to operating shaft 2 and shaft 10 by bevelled pinions the same as those just explained with reference to shaft 9. As seen in Figs. 2 and 12, the upper end

of shaft 9 is provided with a container supporting plate 21, and may be urged yieldingly upwardly by means of a spring 22 acting between the lower portion of plate 21 and a tension-adjusting nut 23 secured to a bushing 24 mounted in bracket 12, such upward movement being limited by a collar 55 attached to the shaft and adapted to abut against the lower end of bushing 24. Shaft 9 may be moved downwardly against the resistance of spring 22, and in so moving it slides within bushing 24 and bevelled pinion 19 to which it is feathered. As a protection for spring 22, container supporting plate 21 may be provided with a depending sleeve 25 enclosing the spring.

The lower end of shaft 10 is provided with means for receiving a cap and momentarily holding it above a container, after which this shaft is moved downwardly to position the cap upon a container and to simultaneously grip the inner end of a sealing strip between the cap and container. For receiving and positioning a cap above a container, the lower end of shaft 10 is preferably provided with a collar 26 held against rotation with the shaft by means of a pin 27 (Fig. 2) extending through the collar and through a lug 28 formed on the outer end of bracket 13. As seen in Figs. 12, 13 and 14, collar 26 may have a series of levers 29 pivotally attached to it as at 30, the upper ends of the fingers being urged outwardly by means of springs 31, and their lower ends being provided with cap-engaging fingers 32 which may be curved to conform to the periphery of a cap flange or skirt. In the illustrative embodiment of the invention collar 26 is provided with three cap-engaging levers 29 arranged at intervals of 90°, thus leaving an open side for laterally moving a cap into position to be engaged by fingers 32. In Fig. 12 a container 33 is shown resting upon plate 21 and a cap 34 as being engaged by fingers 32 and held in a position above the container. This figure also shows some of the mechanism for serially delivering caps to the support, which mechanism will presently be explained.

The upper end of shaft 10 may be provided with an inverted cup-shaped cap 35 (Fig. 2), between which and a bushing 36 carried by bracket 14 there is arranged a spring 37 which yieldingly urges shaft 10 upwardly. For moving shaft 10 downwardly against the resistance of spring 37, a bell-crank lever 38, 39 may be pivotally mounted on the upper end of housing 1, with arm 38 resting upon the upper end of shaft 10 and arm 39 upon the periphery of a cam 40 attached to the upper end of shaft 2. As shown in Fig. 1 cam 40 has three peripheral arc-shaped sections, a section 41 of smallest radius permitting shaft 10 to rise to its highest position under the pressure of spring 37, a section 42 of largest radius which causes the shaft to move to its lowermost position, and a short section 43 of a radius between those of sections 41 and 42 for causing this shaft to occupy an intermediate position during the last period of a sealing operation for properly positioning a sealed container to crimp inwardly the lower edge of the cap in a manner presently to be explained. To the lower end of shaft 10 a cap-receiving plate 44 is attached for rotation and longitudinal movements with the shaft.

Seal forming mechanism.

As previously explained, the sealing of a container is, in the illustrative embodiment of the invention, effected by a tucker which progressively wedges a sealing strip between the container and the skirt of a cap applied to it while the container and cap are caused to revolve on their common axis. While the tucker may be variously constructed, it preferably consists of one or more idle rollers mounted on a block 45 (Fig. 12) supported by a bracket or shelf 46 attached to housing 1. Preferably two rollers 47 and 48 are used (Figs. 4 and 19), roller 47 for tucking a strip 49 of sealing gasket between the container and cap skirt, and roller 48 for tucking a wire 50 between the container and cap skirt below the sealing strip. Roller 48 additionally acts to hold the cap skirt away from the side of a container while sealing strip 49 is being introduced, and therefore it is advantageous to provide two rollers when a continuous length of sealing strip is used both for the purpose of effecting a seal and retaining a cap upon a container.

The manner of making the seal by tucker 47, 48 and the rotation and longitudinal movement of shafts 9 and 10 will now be explained, omitting for the present reference to the strip shearing and delivering mechanism, it being sufficient to note that sealing strips 49 may be delivered to tucker roll 47 through a tube 51, and cap-retaining wires 50 (Fig. 20) to tucker roll 48 through a tube 52. Operating shaft 2 is normally rotated continuously in a right hand direction as indicated by an arrow 53 (Fig. 1) placed on cam 40, and during each complete revolution of this shaft a container is sealed. With the container supporting shafts 9 and 10 in the positions shown in Figs. 2 and 12 a container 33 is placed upon its supporting plate 21 at the upper end of shaft 9. The containers may be so positioned serially by hand, or suitable conveying mechanism, of which various forms are well known to those skilled in the art, may be used for this purpose. Closure caps 34 may also be placed in engagement with fingers 32 at the ends of

levers 29 either by hand or by cap delivering mechanism presently to be explained.

With a container placed on plate 21 and a cap engaged by fingers 32, the first step in the operation is a downward movement of shaft 10 to position the cap upon the container and to press shafts 9 and 10 and their supported cap and container downwardly so that the upper edges of tucker rolls 47 and 48 lie inside and above the lower edge of the cap. This downward movement of shaft 10 is effected by the off-set in cam 40 between its sections 41 and 42, and at the time this is being effected the leading end of a sealing strip 49 is delivered to a position slightly beyond tucker roll 47 so that the downward movement of the closure cap causes the end of the sealing strip to be engaged by and between the container and cap skirt. The continued rotation of shafts 9 and 10 causes tucker roll 47 to progressively wedge the sealing strip between the container and cap skirt as indicated in Fig. 19.

Before the tail end of strip 49 reaches tucker roll 47 the leading end of a wire 50 (Fig. 20) is delivered through tube 52 above tucker roll 48 so that such end lies above the tail end of a strip 49. The further continued rotation of shafts 9 and 10 causes tucker rolls 47 and 48 to firmly wedge wire 50 below the sealing strip, and such positioning of the wire simultaneously causes the previously positioned strip 49 to be pressed upwardly to the position shown in Figs. 20 and 21. In other words, the sealing strip 49 is preferably not initially pressed by tucker roll 47 to its final sealing position but is wedged into such position by the wire when it is introduced and wedged between the container and cap skirt. As the tail end of wire 50 approaches tucker roll 48, shafts 9 and 10 are permitted to rise sufficiently to cause the upper edges of the tucker rolls to lie below the lower edge of the cap skirt so that the tail end of the wire may protrude below the skirt. This movement of the shafts is effected by springs 22 and 37 when the off-set between sections 42 and 43 of cam 40 reaches arm 39 of bell-crank lever 38, 39. Both before the shafts rise, and while they are held in this intermediate position by cam section 43, a crimping roller 54 (Fig. 21), the construction and complete operation of which will presently be explained, engages the lower edge of the cap skirt to bend it inwardly as the container support continues to revolve. After the crimping operation is completed, arm 39 of the bell-crank lever moves inwardly upon section 41 of cam 40 to permit shaft 10 to rise to its uppermost position so that the sealed container may be removed, it being understood that upward movement of shaft 9 is at this time prevented by collar 55 abutting against the lower end of bushing 24. The appearance of the sealed container is shown in Fig. 22.

Reference has been made to crimper roller 54 for bending inwardly the lower edge of a cap skirt at the end of a sealing operation. This roller is mounted on a spindle 185, on which it may rotate and move longitudinally, and which is carried on an arm 57 pivoted at 89 to bracket 46 (Fig. 3). The movement of arm 57 to bring roller 54 to and from crimping position may be controlled and effected by a cam 56 (Figs. 2 and 16) attached to shaft 2, and suitable connections extending between such cam and arm. Rotatably mounted on and supported by this bracket there is a rod 58 provided at its inner end with a finger 59 lying in the path of movement of cam 56, and provided at its outer end with a finger 60 (Figs. 3 and 11) which engages an end of a link 61, the other end of which link is connected by means of a lever 62 and link 63 to pivoted arm 57 on which crimping roller 54 is mounted. A spring 64, which may be coiled around rod 58, acts between this rod and bracket 46 to normally throw finger 60 to the left as viewed in Fig. 11, and in consequence thereof to hold crimping roller 54 in inoperative position, that is to say outwardly of a container cap. Rod 58 is rotated by the engagement of arm 59 with cam 56 to cause finger 60 to move to the right to bring the crimping roller into engagement with a cap and to hold it there during the crimping operation. Cam 56 is preferably so constructed and positioned on shaft 2 that after the leading end of wire 50 has been wedged between a container and cap, and while shafts 9 and 10 are in their lowermost position, roller 54 is moved inwardly so that its lower flange bears upon the lower edge of the cap skirt and crimps it inwardly. When moved to crimping position the upper flange of the roller overhangs the top of cap-receiving plate 44, as seen in Fig. 21, and as a consequence thereof the roller moves longitudinally upwardly on its spindle 185 when shafts 9 and 10 rise to their intermediate position. Thus the crimping roller acts on a cap skirt in both the lowermost and intermediate positions of shafts 9 and 10, and not only turn the cap skirt inwardly, but also presses the outer protruding end of wire 50 against the container.

Strip shearing and delivering mechanism.

As shown in Figs. 3, 4 and 5, this unit preferably comprises a shear 65, 66 for cutting lengths of sealing strips and wires from continuous strands of them, cooperating rolls 67, 68 and 69 for delivering continuous lengths of sealing strip and wire to the shears, a pair of rolls 70 and 71 for feeding the sheared lengths of sealing strip and wire to seal-forming position, a series of

tubes through which the sealing strips and wires pass, and driving connections for controlling and operating these elements.

Continuous lengths of a sealing strip 49 and a wire 50, from reels or any other suitable source of supply, pass through tubes 72 and 73, respectively, to delivering rolls 67, 68 and 69, tube 72 being arranged to feed sealing strip 49 between rolls 67 and 69, and tube 73 to feed wire 50 between rolls 68 and 69. Roll 69 is preferably continuously driven and is provided on its lower and upper edges with teeth 74 and 75 which continuously mesh with teeth 76 and 77 formed on rolls 67 and 68, respectively. The driving of roll 69 may be effected by a train of gears extending from container-supporting shaft 9. In the illustrative embodiment of the invention container supporting plate 21 is provided with peripheral teeth 78 (Fig. 3) which mesh with a pinion 79 rotatably mounted on the lower side of bracket 46. From pinion 79 to roll 69 driving connections for the latter are established through pinion 80, pinion 81 (Fig. 8) mounted on a shaft 82 to which feeding roll 71 is attached, pinion 83 also mounted on shaft 82, pinion 84 mounted on a shaft 85 to which feeding roll 70 is attached, pinion 86, (Fig. 3) and pinion 87 (Fig. 5) mounted on a shaft 88 to which roll 69 is attached. That the sealing strip and wire may be delivered to seal-forming position at the proper rate of speed for making a seal, the feeding and delivering rolls and their driving connections are so constructed, proportioned and coordinated that the surface velocity of the rolls is equal to the velocity of the center line of the sealing strip and wire while they are being wound about the container.

That the delivering rolls 67, 68 and 69 may deliver the continuous strands of sealing strip 49 and wire 50 through the shear at the required time to feed sheared lengths of them successively to seal-forming position, provision is made for moving rolls 67 and 68 to and from positions in which they cooperate with roll 69 to advance the sealing strip and wire. For this purpose, rolls 67 and 68 are preferably mounted on separate shafts 90 and 91 (Fig. 5) carried by arms 92 and 93, respectively, which arms are pivotally mounted on a post 94 attached to bracket 46. Arm 92 is engaged by means of a finger 95 attached to a rod 96 which is supported at one end by post 94 and at an intermediate point by a flange 97 extending upwardly from and forming a part of bracket 46. The inner end of rod 96 is provided with a finger 98 lying in the path of a cam 99 (Figs. 5 and 17) attached to operating shaft 2. Surrounding rod 96 there is a spring 100, one end of which engages this rod and the other end bracket flange 97, the arrangement being such that this spring normally holds shaft 96 in such position that its inner finger 95 holds bracket 92 inwardly and in consequence thereof holds roll 67 in cooperative relationship with roll 69. When finger 98 is engaged by cam 99, arm 92 is rotated and carries roll 67 away from roll 69 far enough to release the sealing member from driving or delivering engagement with the rolls, but not far enough to disengage gear 76 from gear 74.

In a similar manner the position of roll 68 with relation to roll 69 for delivering wire to the shears is controlled by a rod 101 provided with a finger 102 engaging arm 93, a finger 103 adapted to be engaged by a cam 104 (Figs. 5 and 15) attached to shaft 2, and a spring 105 acting between shaft 101 and bracket flange 97. The timing of the movements of rolls 67 and 68 will be generally explained in the description of the operation of the machine.

The construction and operation of the wire and strip cutting shears will now be explained. Various forms of shears may be used. They preferably comprise a shear block 66 (Figs. 3, 4, 6 and 7) and a shear blade 65 pivoted at 106 to the shear block. The shear block is provided with suitable openings through which the sealing strip and wire pass, and the shear blade with a round opening 107, through which the sealing strip passes, and with an arc-shaped slot 108, through which the wire passes. The blade is normally held in position to cause both of its openings 107 and 108 to register with the corresponding openings of block 66.

For intermittently moving the blade to shear, first the sealing strip and then the wire, suitable shear operating connections extend between the shear blade and operating shaft 2. These connections preferably include a bar 109 provided with a pin 110 engaged by a slot 111 formed in the lower edge of the shear blade. The inner end of bar 109 is engaged by the outer end of an arm 112 connected to a shaft 113, which shaft extends through bracket 46 and is provided below the bracket with a bevelled pinion 114 meshing with a bevelled pinion 115 attached to shaft 116, which shaft is provided with a finger 117 adapted to be engaged by a cam 118 (Figs. 7 and 18) attached to shaft 2. A spring 119 (Fig. 3) may be attached to arm 112 for holding it in the position indicated in this figure, in which position the openings in shear blade 65 register with those in shear block 66. When the leading edge of cam 118 engages finger 117, shaft 116 is turned to cause, through the connections just explained, shear blade 65 to swing sufficiently to cut the sealing strip then passing through shear blade opening 107. Near the end of cam 118 its lower face is provided with a thickened portion 120 which causes a further

turning of shaft 116 to swing the shear blade sufficiently to cut the wire then passing through its arc-shaped opening 118.

Provision is preferably made for permitting the shear to move with the strip and wire in the manner of a flying shear when they are being cut. To such end the base of shear block 66 may be attached to a pin 121 extending transversely of the lines of advance of the sealing strip and wire and rotatably mounted in a block 122 (Fig. 6) attached to bracket 46. The shear block is normally held in its indicated upright position by means of a suitable spring 123 which permits the block to move sufficiently to effect flying cuts. As seen in Fig. 6, block 122 is provided with an opening 124 in which the outer end of bar 109 is slidably mounted.

As previously indicated, feeding rolls 70 and 71 are mounted on shafts 85 and 82 (Fig. 8) respectively, and are rotated by the driving connections extending between container supporting shaft 9 and delivering roll 69. These feeding rolls are therefore continuously rotated, but it will be understood that they feed sealing strips and wires to seal-forming position only when such strips and wires are delivered to them by the delivering rolls. Feeding rolls 70 and 71 may be held yieldingly towards each other to grip sealing strips and wires between them by means of a spring 125 engaging the upper ends of shafts 82 and 85 which are mounted for slight lateral movements in slotted openings formed in bracket 46.

It has been noted that the sealing strip and wire are carried to delivering rolls 67, 68 and 69 through tubes 72 and 73, and that they are delivered from feeding rolls 70 and 71 to the tucker or wedging rolls 47 and 48 through tubes 51 and 52, respectively. Between the delivering rolls and shear block 66 the sealing strip and wire pass through tubes 126 and 127 (Fig. 4) which may be attached to shear block 66, and between the shear and feeding rolls they may pass through tubes 128 and 129, which may be supported by a plate 130.

In forming a seal it has been found to be advantageous to move seal strip feeding tube 51 downwardly just after the leading end of a sealing strip has been engaged by and between a container and cap. In Fig. 4 the position of this tube for delivering the leading end of a sealing strip to tucker roll 47 is indicated in full lines, while in Figs. 19, 20 and 21 tube 51 is shown in full lines in its lowered position. For thus moving tube 51 it may be supported by an arm 131 (Figs. 4, 9 and 10) pivoted as at 132 to a support attached to bracket 46, and arm 131 may be attached to the upper end of a rod 133 extending downwardly through bracket 46 and pivotally connected at its lower end to a lever 134 pivoted at 135 to housing 1 and having its other end lying in the path of a cam 136 attached to operating shaft 2. The weight of tube 51 and rod 133 acting on the outer end of lever 134 urges its inner end upwardly into contact with cam 136, the lower face of which is formed to rock lever 134 to cause the desired movements of tube 51 at the stated periods in the cycle of operation of the machine.

Cap delivering mechanism.

This unit of the machine comprises means for serially feeding caps to the cap engaging fingers 32 at the lower end of shaft 10 when this shaft is in its uppermost position. In the illustrative embodiment of this, caps are serially discharged from a hopper 137 (Figs. 1 and 23) by mechanism which will presently be explained into a downwardly inclined trough which terminates with an opening in its bottom above a horizontally movable plate 139 having a plate 145 attached to its outer end (Fig. 12). This plate receives the caps and may be reciprocated laterally for delivering them to fingers 32 by an arm 140, the upper end of which engages the plate in the manner shown in Fig. 12, and the lower end of which is attached to a shaft 141 (Fig. 2) supported by housing 1, and to which there is also attached an arm 142, the end of which is yieldingly urged by a spring 143 into contact with the periphery of a cam 144 attached to operating shaft 2.

In the operation of the cap-delivering mechanism, assuming as a starting point that the parts are in the position shown in Fig. 12, with a cap 34^a resting horizontally upon plate 139, and another cap 34^b in trough 138 with its skirt resting upon cap 34^a, arm 140 is moved to the right until the left edge of plate 139 lies to the right of cap 34^a. The ensuing movement of arm 140 to the left carries cap 34^a, which then rests on plate 145, into engagement with fingers 32 and causes the lower edge of cap 34^b to move to the left so that such cap lies on plate 139. To prevent caps in the position of cap 34^b from being thrown from plate 139 as it is moved to the left, a guide finger 146 may be attached to the open side of trough 138 in the position indicated in Fig. 12. Movement of cap 34^a to the right consequent upon the movement of plate 139 to the right is prevented by the lower edge of trough 138 which lies below the top of cap 34^a. This cycle of operation of cap-feeding plate 139, 145 is, as previously indicated, so coordinated with the operation of the machine as a whole that a cap is delivered into engagement by fingers 32 each time shaft 10 is in its uppermost position.

Referring now to hopper 137 and the mechanism for serially discharging caps

from it into trough 138, the hopper is a cylindrical tube adapted to receive caps telescopically nested one within the other, as they are usually packed for shipment. The hopper is downwardly inclined so that the series of nested caps slide to its lower end as the caps are serially discharged. Rotatably mounted on a frame 150 (Fig. 23) which supports the hopper at its lower end there is a ring 151 on which there is formed a bevelled pinion 152 which meshes with a bevelled pinion 154 attached at one end of a shaft 155, the other end of which shaft is provided with bevelled pinion 156 which meshes with a bevelled pinion 157 attached to a shaft 158. Rotation of shaft 158 is effected by a bevelled pinion 159 attached to operating shaft 2, which pinion meshes with a bevelled pinion 160 attached to the shaft 158. Through this train of driving connections hopper ring 151 is continuously rotated during the operation of the machine.

Pivotally attached by pins 180 to the lower edge of hopper-supporting frame 150 there are a series of fingers 161 (Figs. 26, 27 and 28), the inner ends of which may be yieldingly urged toward the center of hopper 137 by springs 162. These fingers are positioned and arranged to bear upon the flange or skirt of the cap adjacent to that at the lower end of the hopper. Similarly, there are pivotally mounted on pins 166 at the lower edge of a flange 176 attached to rotatable ring 151 a series of fingers 163, the inner ends of which are yieldingly urged toward the center of the hopper by means of springs 164. These fingers are so positioned and arranged that they may bear upon the flange of the lowermost cap in the hopper. The outer ends of fingers 161 are provided with lugs 165 which lie in the path of rotation of the pins 166 on which fingers 163 are pivotally mounted, so that, as ring 151 rotates, these lugs are intermittently engaged. Through such engagement and the rotation of ring 151 the inner ends of fingers 161 are intermittently moved outwardly from engagement with the second cap. In a similar manner the outer ends of fingers 163 are provided with lugs 167 which, during the rotation of ring 151, are intermittently engaged by projections 168 formed on a circular flange 169 which is a part of hopper supporting frame 150. This engagement of lugs 167 by projections 168 causes the inner ends of fingers 163 to move outwardly from engagement with the lowermost cap.

At the lower end of the hopper there is a plate 170 mounted for intermittent movements longitudinally of the hopper axis for alternately supporting the series of caps in the hopper and permitting the end cap to fall into a chute 171 through which it is conducted to the uper end of trough 138. Plate 170 may be attached to one end of an arm 172, the other end of which is attached to a bar 173 mounted for longitudinal sliding movement in frame 150 and normally urged upwardly by means of a spring 174. In the upward position of bar 173, plate 170 is held at the discharge end of the hopper to support the series or column of caps. To intermittently move bar 173 downwardly it may have attached to it a lug 175, the lower end of which engages flange 176. The lower face of this flange is bevelled at the required positions in the manner indicated in Figs. 24 and 25 to cause lug 175 and rod 173 to move downwardly.

The operation of the mechanism for serially discharging caps from the hopper may be understood by reference to Figs. 26, 27 and 28 which show the two series of fingers 161 and 163 in successive relative positions. In the positions shown in Fig. 26 fingers 163 engage the skirt of the lowest cap and fingers 161 the skirt of the adjacent or second cap. The rotation of ring 151 in the direction indicated by arrow 177 causes fingers 163, which are carried with this ring, to turn or twist the lowest cap from its engagement with the next cap which is held, or tends to be held, against rotation by non-rotatable fingers 161 then bearing upon its skirt. In this position of the two series of fingers plate 170 may be in its lower position affording free passage for a cap to fall into chute 171, the column of caps being then supported by the two series of fingers, the lugs 167 of fingers 163 are engaged by projections 168 and the inner ends of these fingers thereby moved outwardly and released from their engagement with the lowest cap, which cap may then fall into chute 171. This position of fingers 163 is shown in Fig. 27, which also shows fingers 161 as being still in engagement with the second cap. By such engagement at this time, fingers 161 continue to support the column of caps. In the next step in the operation fingers 161 are released from their engagement with a cap to permit the entire series of caps to move downwardly, and at this time plate 170 is in its inner position to stop the downward movement of the caps. The throwing outwardly of the inner ends of fingers 161 is effected by the engagement of pivot pins 166 with lugs 165 at the outer ends of fingers 161. This position of the two series of fingers is shown in Fig. 28.

The cycle of operation of the cap discharging mechanism just explained is, in the illustrative embodiment of the invention, repeated four times for each revolution of ring 151, and in each cycle the mechanism is brought to the necessary successive positions for releasing the lowest cap from the series thereof and discharging it into trough 171. Sometimes caps are so firmly wedged

together that it requires several efforts of fingers 163 to twist it loose. Accordingly, it is preferred to so time the operation of the cap-discharging mechanism that provision is made for the operation of the remainder of the machine. In case a cap is released each time fingers 163 engage and act upon one, and as a consequence thereof trough 138 and chute 171 are filled with caps, a released cap merely remains in the hopper until there is room for it to fall in chute 171.

It will be understood that the hopper and cap-discharging mechanism may, as far as concerns some features of the invention, be dispensed with and the caps manually fed to chute 138. Furthermore, other cap-discharging mechanism may be used in place of that disclosed, or that disclosed may be used on other types of closure-forming machines than that contemplated by this application.

Operation.

The operation of each of the several units of the machine has been explained in connection with its description. It remains therefore, to explain the coordinated operation of the machine as a whole in making seals of the specific character for which the machine shown herein is constructed. One sealing operation is effected during each revolution of operating shaft 2. In Figs. 15, 16, 17 and 18 there are illustrated in substantially their proper relative positions several of the cams attached to the operating shaft for moving or controlling various elements of a machine. These are cam 99 (Fig. 17) for controlling the position of roll 67 for delivering the sealing strip to the shear, cam 104 (Fig. 15) for controlling the position of roll 68 for delivering the wire to the shear, cam 118 (Fig. 18) for moving the shear blade 65, and cam 56 (Fig. 16) for moving crimping roll 54.

Assuming the container supporting shafts 9 and 10 to be in the positions indicated in Figs. 2 and 12, the first step in the operation is the delivery of a cap 34 to cap engaging fingers 32 at the lower end of shaft 10. This is effected by the inward movement of cap-supporting plate 139, 145, which is effected by cam 144 acting through arm 142, shaft 141 and arm 140. After the cap-supporting member has moved outwardly from beneath a cap supported by fingers 32, shaft 10 is moved downwardly through bell-crank lever 38, 39 and cam 40, and, coordinated with this, a sealing strip is delivered by delivering rolls 67 and 69 and feeding rolls 70 and 71 so that the inner or leading end of the strip may be engaged between the cap and container as the cap moves downwardly upon the container. The downward movement of shaft 10 also causes a downward movement of shaft 9 so that the upper edges of tucker or wedging rolls 47 and 48 lie inside and above the lower edge of the cap. The continued rotation of the container supporting shafts causes tucker roll 47 to wedge the sealing strip between the container and cap skirt. When the required length of sealing strip has passed through shear 65, 66, blade 65 is moved to cut the strip. Just before this takes place, and in order to have the leading end of the wire overlap the tail end of the sealing strip, delivery roll 68 is permitted to move towards delivery roll 69 to feed the wire through the shear. When the proper length of wire has passed through the shear, blade 65 is moved further to cut the wire. Feeding rolls 70 and 71 feed the wire through tube 52 to a position above tucker roll 48 which wedges it between the container and cap skirt below the sealing strip. While the wire is being thus wedged into position, roll 54 is moved to operative position for crimping inwardly the lower edge of the cap skirt. When the tail end of the wire approaches tucker roll 48, shafts 9 and 10 move upwardly so that the end of the wire protrudes below the cap skirt, and crimping roll 54, which moves upwardly with the shafts, further crimps the cap skirt and presses the protruding end of the wire against the container.

It will be understood that in this complete cycle of operation the movements of the several elements of the machine are so coordinated as to effect the several operations in the manner and order stated. The strip and wire delivering rolls 67 and 68 need be positioned in delivery relationship with roll 69 only for such periods of time as are required to deliver the sealing strip and wire through the shears and into engagement with feeding rolls 70 and 71 which are continuously rotated.

No claim is here made to the process herein disclosed, the process being disclosed and claimed in my copending application Serial No. 742,555 filed October 9, 1924.

According to the provisions of the patent statutes, I have described the principle and operation of my invention, and have illustrated and described a machine which I now consider represents the best embodiment of it. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced by forms of construction other than those shown and described. Particularly, I desire to have it understood that my invention, as far as concerns some features of it, is not limited to all the coordinated units illustrated and described, and that it is not limited to the specific details of construction of the several units. For example, it has already been explained that the cap hopper and delivering mechanism need not be used. By omitting the wire shearing and delivering mechanism, the machine may be used for forming seals

with continuous lengths of sealing strips, the outer portion of the sealing strip being used as a cap-retaining member. Other omissions and changes will be readily understood from the foregoing description of the invention.

I claim as my invention:

1. A container-closing machine, comprising in combination means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for feeding and wedging a sealing strip between the container and cap skirt, and means for effecting relative rotation between the container and strip feeding and wedging means around the axis of the container whereby the strip is progressively wedged between the container and cap skirt.

2. A container-closing machine, comprising in combination means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for revolving the cap and container around their common axis, and means for feeding and wedging a sealing strip between the container and cap skirt while the container and cap are revolving.

3. A container-closing machine, comprising in combination a support for a container, a support for a cap having a depending skirt, means for moving one of said supports toward the other to position a cap upon a container, means for feeding an end of a sealing strip between and into engagement by the container and cap as said support-moving means operates, and subsequently operative means for progressively wedging said strip between the container and cap skirt.

4. A container-closing machine, comprising in combination a support for a container, a support for a cap having a depending skirt, means for moving one of said supports toward the other to position a cap upon a container, means for feeding an end of a sealing strip between and into engagement by the container and cap as said support-moving means operates, and means for rotating the cap and container on their common axis and for progressively wedging said strip between the container and cap skirt.

5. A container-closing machine, comprising in combination of a support for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for rotating said support to cause the cap and container to revolve upon their common axis, means for feeding a sealing gasket between the container and cap skirt, and a tucker arranged at the side of the support for wedging the gasket between the container and cap skirt while they are being rotated.

6. In a container-closing machine, the combination of means for holding a container and cap applied to it, a tucker for wedging a sealing strip between the container and cap, and means for serially feeding sealing strips of substantially uniform lengths to said tucker.

7. In a container-closing machine, the combination of means for holding a container and cap applied to it, a tucker for wedging a sealing strip between the container and cap, and means for serially cutting sealing strips of substantially uniform lengths from a continuous strand thereof and for delivering them to said tucker.

8. In a container-closing machine, the combination of means for holding a container and cap applied to it, a tucker for wedging a sealing strip between the container and cap, a strip shear, means for feeding a continuous strip to the shear, means for delivering sheared lengths of the strip to said tucker, a source of power, and coordinated driving connections therefrom to said shear and feeding and delivering means whereby said sheared lengths of sealing strip are serially delivered to said tucker.

9. In a container-closing machine, the combination of a support for serially holding containers and caps applied to them, means for rotating the support to cause each container and cap to revolve upon their common axis, a tucker for wedging sealing strips between containers and caps, and means for serially feeding sealing strips of substantially uniform lengths to said tucker and each into engagement by and between a container and cap.

10. In a container-closing machine, the combination of a container support, a cap support provided with yielding gripping fingers to receive and hold a cap in spaced relation to the mouth of a container on the container support, means for delivering an end of a sealing strip between the container and cap, means operable simultaneously with said delivering means for causing said cap to be applied to the container whereby the end of the sealing strip is engaged between the cap and container, and means for subsequently tucking the strip between the cap and container.

11. In a container-closing machine, the combination of a container support, a cap support, yielding gripping fingers for receiving and holding a cap in spaced relation to the mouth of a container on the container support, means for rotating said supports to cause the container and cap to revolve on their common axis, means for delivering the end of a sealing strip between the container and cap, means operable simultaneously with said delivering means for moving the cap toward the container support to apply the cap to the container and to engage the leading end of said strip between the cap and container, and a tucker for subsequently

progressively wedging the strip between the cap and container while they are rotated.

12. In a container-closing machine, the combination of a container support, a cap hopper, means for serially discharging caps from said hopper and applying them to containers held serially by said support, means for rotating said support to cause each container and cap applied to it to revolve on their common axis, and means coordinated with said cap applying means for first applying and then wedging a sealing strip between each container held by said support and the skirt of a cap applied to it.

13. A container-closing machine, comprising means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, and means for consecutively and progressively introducing and wedging a sealing strip and a cap-retaining wire between the container and cap skirt.

14. A container-closing machine comprising in combination a support for a container and a cap having a depending skirt, means for consecutively introducing between the container and cap skirt a sealing strip and a cap-retaining member, and means for simultaneously wedging said strip and member into seal forming and maintaining position.

15. A container-closing machine, comprising in combination means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for feeding and wedging first a sealing strip and then a cap-retaining wire between the container and cap skirt, and means for effecting relative rotation between the container and feeding and wedging means around the axis of the container whereby the strip and wire are progressively introduced and wedged between the container and cap skirt.

16. A container-closing machine, comprising in combination means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for revolving the container and cap around their common axis, and means for consecutively and progressively wedging a sealing strip and cap-retaining wire between the container and cap skirt while the container and cap are revolving.

17. A container-closing machine, comprising in combination a support for a container, a support for a cap having a depending skirt, means for moving one of said supports toward the other to position the cap upon a container, and coordinated means for first feeding an end of a sealing strip between and into engagement by the container and cap as said support moving means operates, then progressively wedging said strip between the container and cap skirt, and then progressively introducing and wedging a cap-retaining wire between the container and cap skirt.

18. A container-closing machine, comprising in combination means for holding upon a container a cap having a depending skirt surrounding the outer wall of the container, means for rotating said holding means to cause the cap and container to revolve upon their common axis, a tucker arranged at the side of the support for wedging a sealing strip and cap-retaining wire between the container and cap skirt while they are being rotated, and means for successively feeding a sealing strip and cap-retaining wire to said tucker and between the container and cap skirt.

19. In a container-closing machine, the combination of means for serially holding containers and caps applied to them, a tucker for wedging sealing strips and cap-retaining wires between the container and cap, and means for serially feeding in alternation sealing strips and cap-retaining wires of predetermined lengths to said tucker.

20. In a container-closing machine, the combination of means for holding serially containers and caps applied to them, a tucker for successively wedging a sealing strip and a cap-retaining wire between the container and cap, and means for serially and in alternation cutting sealing strips and cap-retaining wires of predetermined lengths from continuous strands thereof and for feeding them to said tucker.

21. In a container-closing machine, the combination of means for holding upon a container and cap having a depending skirt surrounding the outer wall of the container, means including a tucker for progressively wedging first a sealing strip and then a cap-retaining wire between the container and cap skirt, and means effective at the end of the strip-wedging operation for causing a separation of the tucker from beneath the cap skirt to permit the outer end of said wire to protrude below the cap skirt.

22. In a container-closing machine, the combination of a support for holding a container and cap applied to it, a tucker arranged at the side of said support, means for successively feeding a sealing strip and a cap-retaining wire to said tucker, means for rotating said support to cause the tucker to progressively wedge said strip and wire between the container and cap skirt, and means for moving said support longitudinally at the end of the wedging operation to permit the outer end of said wire to protrude below the cap skirt.

23. In a container-closing machine, the combination of a support for holding a container and a cap with a depending skirt applied to the container, means for rotating said support to cause the container and cap

to revolve on their common axis, means for progressively wedging a sealing strip and cap-retaining wire between the container and cap skirt, and means for subsequently crimping inwardly the lower edge of the cap skirt.

24. In a container-closing machine, the combination of a rotatable and vertically movable support for holding a container and a cap with a depending skirt applied to the container, a tucker arranged at a side of said support, means for successively feeding a sealing strip and a cap retaining wire to said tucker, means for moving said support downwardly to bring said tucker between the cap skirt and container, means for rotating the support to cause the tucker to progressively wedge said strip and wire between the cap skirt and container, means for moving said support upwardly at the end of the wedging operation to permit the outer end of the wire to protrude below the cap skirt, and means for crimping inwardly the lower edge of the cap skirt.

25. In a container-closing machine, the combination of a rotatable support for holding a container and a cap with a depending skirt applied to the container, a tucker arranged at the side of the support for successively and progressively wedging between the container and cap skirt a sealing strip and a cap-retaining wire while said support is rotating, a shear, intermittently operating rolls for delivering continuous lengths of sealing strip and cap-retaining wire to and through said shear, rolls for feeding sheared lengths of sealing strip and wire from the shear to said tucker, a driving shaft, and coordinated driving connections therefrom to said delivering rolls and shear to effect the following operations in the order stated: delivery of sealing strip through the shear to the feeding rolls, shearing of the sealing strip, delivery of the wire through the shear to the feeding rolls, and shearing of the wire.

26. A container-closing machine, comprising means for holding upon the mouth of a container a cap having a depending skirt surrounding the outer wall of the container, said holding means permitting lateral outward expansion of the cap skirt, and means effective after the cap is applied to the container for applying and wedging a flexible sealing gasket between the container and cap skirt, whereby the skirt is placed under initial outward tension for maintaining pressure upon the gasket.

27. A container-closing machine, comprising means for holding upon the mouth of a container a cap having a depending skirt surrounding the outer wall of the container, said holding means permitting lateral outward expansion of the cap skirt, and means effective after the cap is applied to the container for progressively applying and wedging a flexible sealing strip between the container and cap skirt, whereby the skirt is placed under initial outward tension for maintaining pressure upon the gasket.

28. A container-closing machine, comprising in combination a container support, means for serially applying caps to containers held serially by said support, and means coordinated with said cap-applying means and effective subsequent to the cap applying means for first applying and then wedging a sealing strip between each container on said support and the skirt of a cap applied to it.

29. In a container-closing machine, the combination of a container support, a cap hopper, means for serially discharging caps from said hopper and applying them to containers held serially by said support, and means coordinated with the cap-applying means and effective subsequent to the cap applying means for first applying and then wedging a sealing strip between each container held by said support, and the skirt of a cap applied to it.

In testimony whereof, I sign my name.

DALE M. BOOTHMAN.