

Nov. 26, 1935.

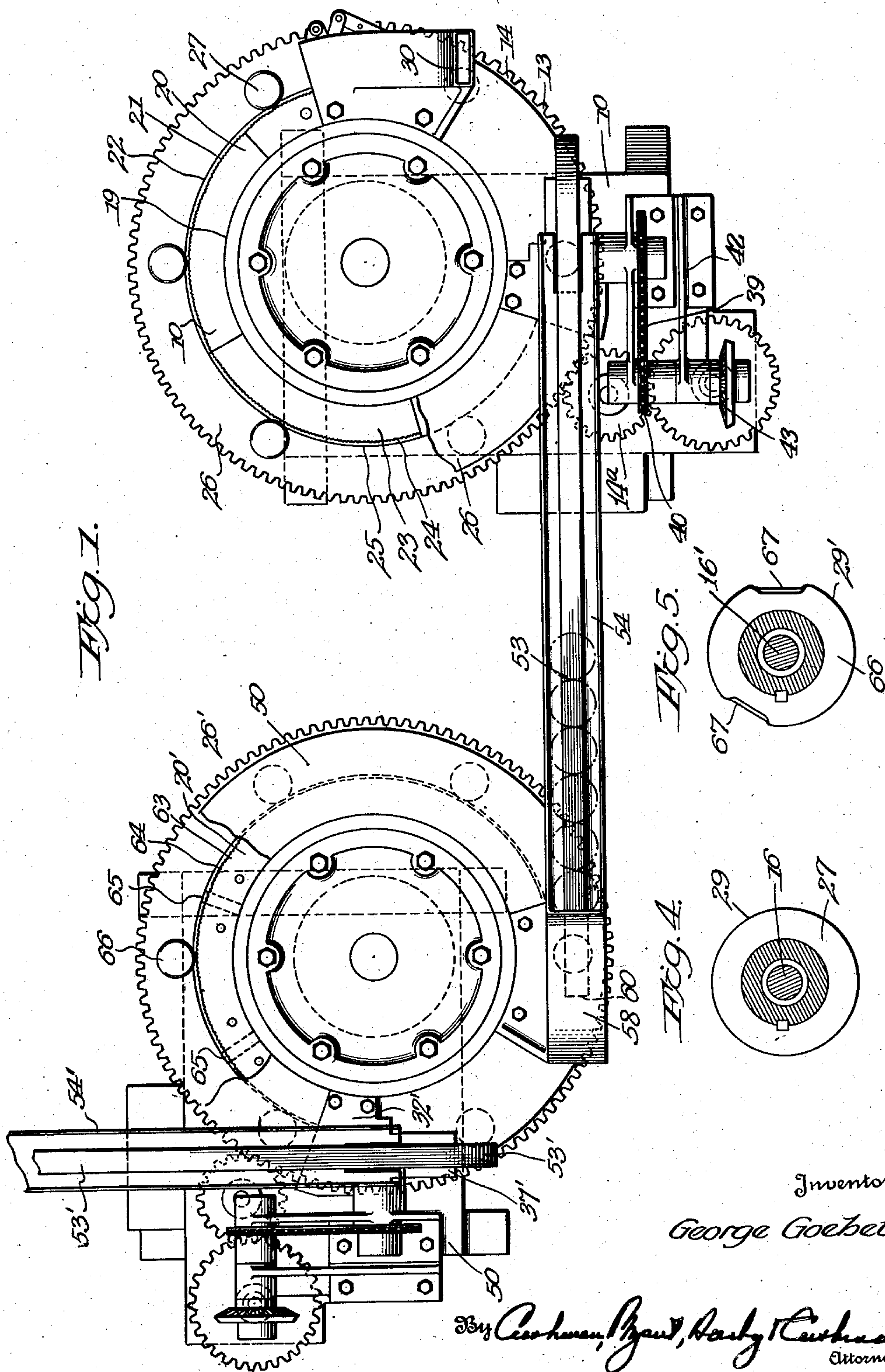
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CAP FORMING APPARATUS AND METHOD

Filed Feb. 28, 1933

2 Sheets-Sheet 1



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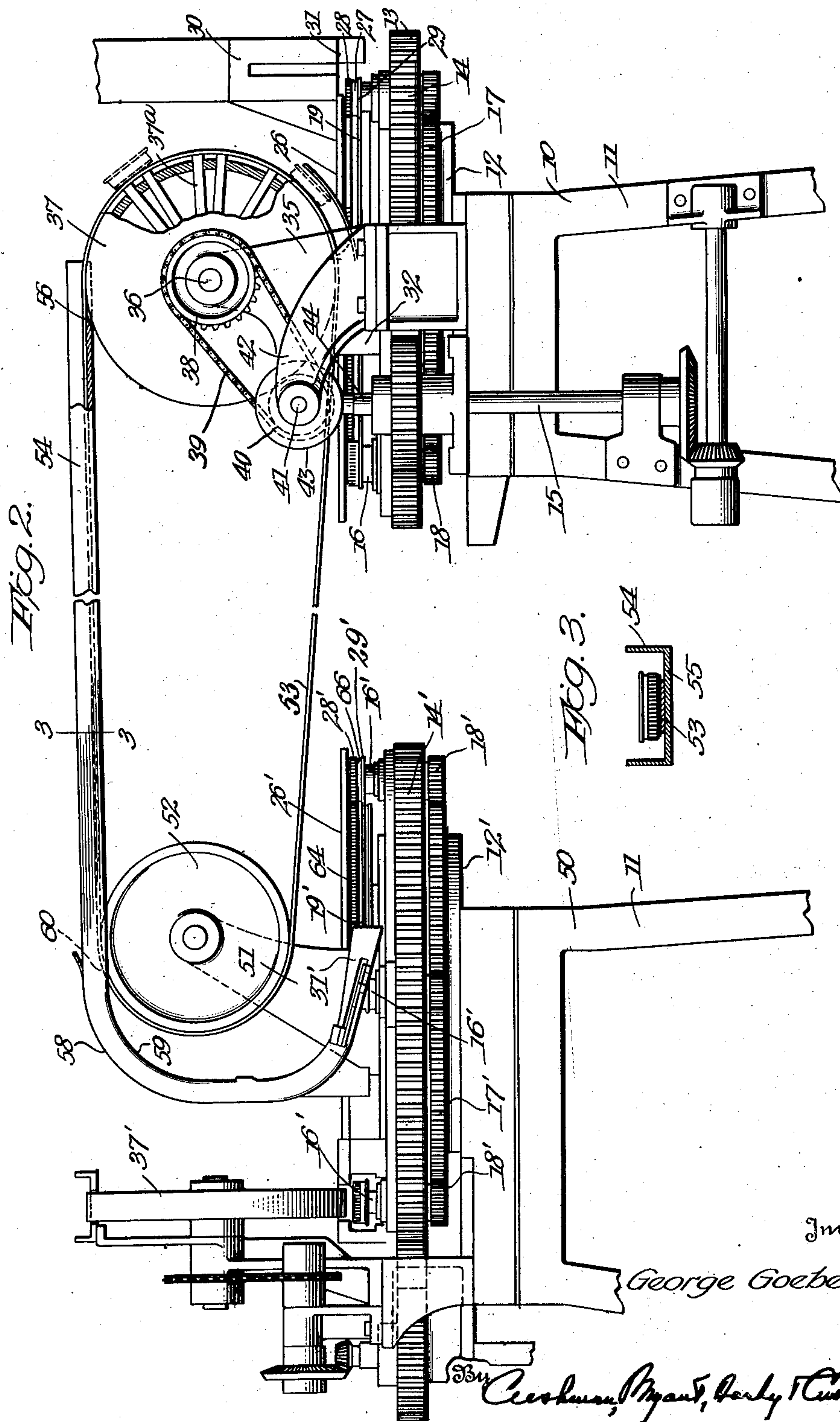
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UNITED STATES PATENT OFFICE

2,022,235

CAP FORMING APPARATUS AND METHOD

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Application February 28, 1933, Serial No. 658,992

21 Claims. (Cl. 153—2)

The present invention relates to a cap forming apparatus and method, and, more particularly, to an apparatus or method for forming lugs caps, the same being an improvement upon the invention disclosed in the patent of Eric B. Kramer, No. 1,900,880, March 7, 1933.

Lug caps for containers are provided with lugs or projections on the inner side of the depending flange of the cap, these lugs being adapted to pass between and/or underneath separated ribs upon the exterior of the mouth of the container. Such lug caps are usually formed by positioning a hat-shaped cap blank upon a moving chuck or die head which carries the cap blank longitudinally with respect to a fixed die. During its movement along the fixed die, the moving chuck or die head rotates and the cap blank is thereby rotated in contact with the fixed die with the result that the chuck and the fixed die cooperate to form the cap blank to its proper finished shape. The fixed die usually comprises a first knurling and wiring die element, a second knurling and wiring die element and a lug forming die element, past which the chuck carries the cap blank in the order named.

The moving chuck or die head customarily used is of a configuration corresponding to the interior configuration of the cap to be completed thereon but is of less overall diameter than the internal diameter of the completed cap and is provided with spaced indentations on its lower edge which exactly correspond in size to the inwardly projecting lugs to be formed in the cap.

The first knurling and wiring die element of the prior art machines knurls the upper portion of the side wall of the cap blank and bends the lateral flange of the hat-shaped blank to form a partial roll in the same, this partial roll being the initial development of the wiring upon the cap blank. The second knurling and wiring die completes the knurling of the upper portion of the side wall of the cap blank and further bends or rolls the partially rolled flange of the cap blank to provide a wiring upon the lower edge of the cap blank. The lug forming die element includes lug forming members or blades spaced along the die element and projecting from the die face of the latter. Since the lug forming members or blades project from the face of the lug forming die element, they force spaced portions of the wired edge of the cap blank or cap device radially inwardly with respect to the cap blank and chuck to form inwardly projecting lugs upon the cap blank. The spaced indentations upon the chuck are aligned with the lug forming blades during the

rotation of the chuck, the indentations permitting the wired edge of the cap blank or cap device to be forced inwardly by the blades.

It has been customary to use a single machine of the type disclosed in the patent of Eric B. Kramer, referred to above, to perform the three die forming operations just described, all three of the fixed die elements being included in the machine. Such an arrangement leads to difficulties in producing an accurately formed cap. More particularly, these difficulties result from the fact that, as stated above, the moving chuck or die head is provided with spaced indentations adapted to be aligned with the lug forming blades to permit lugs to be pressed inwardly upon the wired edge of the cap. These indentations provided for the lug forming operation, being opposite the lower edge of the depending flange of the cap blank, which edge is wired prior to the lug forming operation, provide no support behind and within the portion to be wired during the two steps of the wire forming operations respectively produced by the first and second knurling and wiring dies. Therefore, by this prior machine, it is possible that the wiring will not be accurately formed in the portions of the cap blank or cap device opposite these indentations. If the wiring is not properly formed at these points, the lug which is subsequently produced upon the wired edge at substantially the same points will be distorted and not of proper finished shape.

The principal object of the present invention is to provide an apparatus which will produce accurately formed lug caps at maximum speed. In its preferred form, the apparatus comprises two machines or mechanisms, each generally similar to the machine disclosed in the Kramer patent referred to above. One of the machines is provided with fixed first and second knurling and wiring dies and the other machine is provided with a fixed lug forming die. In the first machine, the moving chucks or die heads are not provided with the indentations ordinarily provided for the lug forming operation, but in the second, or lug forming machine, the chucks or die heads are indented, just as is the case in the machine of the Kramer patent. The indentations in the chucks of the second machine cooperate with the lug-forming members or blades of the fixed die of the second machine to form lugs in the partially formed caps or cap devices.

A further object of the invention is to provide a means for transferring the partially formed caps or cap devices from the first or knurling and wiring machine to the second or lug-forming machine.

chine and which transfer or conveyor means is particularly designed to permit the caps to be quickly transferred from one machine to the other. The transfer or conveyor means is also particularly designed to insure that each cap blank or cap device will be properly positioned with respect to the chucks of the second machine.

In operation of machines of the type disclosed in the Kramer patent, it is customary to provide a conveyor mechanism which will receive the caps from the machine, the caps, when received by the conveyor mechanism, being faced downwardly, i. e., with their normally downwardly depending flange projecting downwardly. The conveyor, in its travel, usually inverts the caps, i. e., reverses the position thereof so that the normally downwardly projecting flange will project upwardly. In this position, the caps are moved to a lining machine which affixes a sealing liner to the interior side of the normally top wall or sealing wall of the cap.

In this prior art conveyor mechanism, the caps are dropped from one conveyor surface to another conveying surface during their travel and this dropping sometimes causes the caps to roll, with the result that the caps, instead of being inverted by the conveyor mechanism, are stood upon one edge or turned entirely through an arc of 360°. In either event, the caps will not be properly positioned for the lining operation. It is obvious that if such a conveyor mechanism were used with the present apparatus to transfer the partially formed caps or cap devices from one machine to the other, the caps would not be properly positioned for operation thereupon by the second or lug forming machine.

The conveying mechanism included in my invention for moving the partially completed caps to the second or lug forming machine is, in some respects, generally similar to the prior art conveyor discussed above. However, the conveyor included in the present apparatus is an improvement upon the prior conveyor in that it is so designed that each cap will be turned to inverted position and will therefore be in proper position to be received by the second machine.

The conveyor included in the present invention differs from other prior art conveyors in that it includes a rotating member or wheel which is so constructed that the cap blanks or lug caps will be caused to adhere thereto in surface to surface contact during rotation of the member and without the necessity of any mechanical gripping or holding means. The mechanical gripping or holding means customarily used for such purposes must be moved to their respective gripping or non-gripping positions by some actuating mechanism. The construction of the present invention eliminates the necessity of such gripping means as well as actuating mechanism therefor, and is obviously much simpler and less subject to wear of moving parts.

Another object of the invention is to provide a conveyor mechanism adapted to transfer caps to a lining machine and which conveyor is also designed to insure that the caps will be delivered to the latter machine in proper position. This latter conveyor mechanism may be used with a machine of the type disclosed in the Kramer patent to move caps to the lining machine.

Another difficulty experienced in the use of a single machine of the type disclosed in the patent of Eric B. Kramer resides in the fact that where all three die forming operations are per-

formed on the cap blank in a single machine, the production of finished caps is not usually sufficient to keep pace with the capacity of the lining machine to which the caps are passed from the cap forming machine. This naturally necessitates that the lining machine must be intermittently operated and, in actual practice, the operation of the lining machine is not commenced until the die forming machine has formed a sufficient number of caps to entirely fill the capacity of the conveyor between the cap forming machine and the lining machine. The lining machine is then operated until the stock of caps in the conveyor has been exhausted and its further operation is held in abeyance until another supply of caps is placed upon the conveyor.

By the present invention, because the steps followed in forming the cap devices are divided between two machines or mechanisms, each of the two machines may be operated at a relatively high rate of production, with the result that cap devices are delivered from the second or lug forming machine at a rate which is substantially equal to the capacity of the lining machine. It is therefore possible to keep the lining machine in continuous operation and synchronism with the cap forming apparatus.

It will be understood that the conveyor mechanisms included in the present invention may be used on cap forming machines adapted to form caps of other types than lug caps.

Other objects and advantages of the invention will be apparent from the accompanying description and drawings wherein:

Figure 1 is a plan view of the apparatus, with portions broken away.

Figure 2 is a side elevation of the apparatus, portions of the machine being broken away.

Figure 3 is a detailed sectional view taken on the line 3-3 of Figure 2.

Figure 4 is a horizontal sectional view through the moving chuck or die head used in the knurling and wiring machine or mechanism of the present apparatus, and

Figure 5 is a horizontal sectional view through the moving chuck or die head used in the lug forming machine or mechanism of the present apparatus.

The numeral 10 designates a cap forming machine or mechanism generally similar to that disclosed in the patent of Eric B. Kramer, No. 1,900,880, issued March 7, 1933. The machine 10 is the knurling and wiring mechanism of the present apparatus and is mounted upon a support or base 11 which is provided at its upper end with a stationary supporting frame 12 upon which a carrier element 13 is journaled to rotate in a horizontal plane. The carrier element 13 is provided with gear teeth 14 with which a pinion 14a fixed to an intermediate shaft driven by a driving shaft 15 meshes. The driving shaft 15 may be driven from any suitable source of power, rotation of the driving shaft 15 causing the carrier frame 13 to rotate upon the stationary supporting frame 12.

A plurality of vertically disposed mandrels 16 are circumferentially spaced about the carrier element 13, the mandrels being mounted for rotation in the element. A stationary sun gear 17 is fixed to the supporting frame 12 and pinions 18 fixed to the lower ends of the mandrels 16 mesh with the sun gear 17 with the result that rotation of the carrier element 13 with respect to the supporting frame 12 will cause the mandrels 16 to

move about the sun gear and to bodily rotate during such movement.

A ring or plate 19 is fixed to the supporting element 12 and, as shown in Figure 1, a stationary first knurling and wiring die element 20 including a toothed knurling member 21 and a grooved wiring element 22 is fixed to the plate 19. A second knurling and wiring die element 23 is fixed to the plate 19 adjacent the die element 20, the element 23 including a toothed knurling member 24 and a grooved wiring element 25. The two knurling and wiring die elements are fixed to the periphery of the plate 19 and beneath a hold-down plate 26.

Moving chucks or die heads 27 carried at the upper ends of the mandrels 16 are positioned opposite the fixed die elements 20 and 23 and cooperate with the fixed die elements to form hat-shaped cap blanks to the desired configuration. Each chuck or die head 27 has a toothed or knurled upper portion 28, arranged in the same plane as the knurling members 21 and 24 of the fixed die elements. A horizontally projecting annular shoulder 29 is provided on the chuck 27, slightly spaced beneath the knurled portion 28, this shoulder being adapted to move in the plane of the fixed wiring members 22 and 25. As is best shown in Figure 4, the wiring shoulder 29 on the chuck 27 is annular, as stated above, and is provided with no indentations about its periphery.

The overall diameter of the chucks 27 is less than the smallest internal diameter of the cap devices to be formed thereon, just as is the case with respect to the chucks or die heads illustrated in the machine of the Kramer patent. By this arrangement, the hat-shaped cap blanks may readily be positioned upon the chucks 27, and after they have been formed to the desired shape, may be readily lifted from the chucks.

In operation of the structure described above, hat-shaped cap blanks are supplied to the die heads 27 from a chute or other suitable means of supply 30, the blanks being positioned upon the chucks by a cap feeding device 31 as the chucks move, while rotating, beneath the latter mechanism. The cap feeding mechanism 31 may be of the type used in the machine of the Kramer patent referred to above. The chucks are shown as moving about the machine in a counter-clockwise direction (Figure 1). The rotation of a chuck carrying a cap blank thereon past the first knurling and wiring die element 20 will cause the upper portion of the depending flange of the cap blank to be engaged between the teeth 28 on the upper end of the chuck and the teeth on the knurling member 20 of the first knurling and wiring die element 20. At the same time the wiring groove of the wiring element 22 of the fixed die 20 will act upon the laterally projecting annular flange of the hat-shaped cap blank to partially bend the latter upwardly. Since the shoulder 29 on the chuck 27 within the hat-shaped cap blank is opposite the inner edge of this flange, this portion of the cap blank will be supported during the wiring operation so that the fixed wiring element 22 may properly perform its function. Also, because of the fact that the wiring shoulder 29 of the chuck 27 has no indentations about its edge, the stationary wiring member and the wiring shoulder of the die head will cooperate to form a partially wired flange which is of the desired configuration throughout its entire circumference.

After the cap blank has been moved past the first knurling and wiring element 20, it will next

be moved opposite the second knurling and wiring die element 23. The teeth of the fixed knurling member 24 will intermesh with the partially indented knurling already formed upon the cap blank and in the inner surface of which the knurling teeth 28 of the chuck are engaged. The teeth of the second knurling member 24 extend radially outwardly somewhat further than the teeth of the knurling member 21 and will coact with the teeth of the knurling portion 28 of the chuck to deepen and complete the knurling upon the cap blank. The groove of the wiring member 25 of the stationary element 23 will cooperate with the shoulder 29 upon the chuck 27 to bend the partially knurled wiring to finished shape. The hold-down plate 26 extends out over the path of movement of the chucks past the stationary die elements to prevent the cap blanks from being raised with respect to the chucks.

After passing the second knurling and wiring die element 23, the chuck 27 will move beneath a cap removing mechanism 32 which will lift the cap blank or cap device from the chuck. The cap removing mechanism 32 may be of the type disclosed in the Kramer patent and wherein the caps are lifted to alignment with an out-feed chute by means of cam actuated lifting blocks. If preferred, the cap removing mechanism may be similar to that disclosed in the application of Frank S. Bell, Serial No. 654,750, filed February 1, 1933. In the apparatus of the Bell application, the moving die heads pass into an inverted U-shaped channel member the outer end of which serves to center the cap devices with respect to the chuck. Inwardly projecting horizontal flanges are provided on the depending arms of the U-shaped channel member, which flanges extend inwardly beneath the cap device. The channel member is upwardly inclined from its entrance and since the cap devices are oversized with respect to the chuck as the chuck moves through the channel member they will slide up along the inwardly projecting flanges.

A pair of spaced upstanding arms 35 project upwardly from the cap removing mechanism 32 and a horizontal shaft 36 journaled in the upstanding arms has a rotary member or wheel 37 fixed thereto between the arms. The shaft 36 is provided with a pulley or sprocket 38 which is driven by a belt or chain 39 passing about a driving sprocket or pulley 40 carried by a shaft 41 journaled in lateral extensions 42 of the arms 35. The shaft 41 is provided with a beveled ring gear 43 which meshes with and is driven by a beveled gear fixed to an extension 44 of the drive shaft 15. The rotary member or wheel 37 carries a plurality of radially arranged electro-magnets 37a, the polarized ends of which extend to the periphery of the wheel.

A second cap forming machine or mechanism 50 is positioned adjacent the first machine or mechanism 10, the second machine being identical in construction with the machine first described, except as hereinafter pointed out. In general, elements of the machine 50 which are identical with elements of the machine 10 are designated by primed numerals corresponding to those used for the same elements of the machine 10. The machine 50 is the lug forming mechanism of the present apparatus and is provided with die members which form lugs in the cap blanks or cap devices formed on the machine 10.

The machine 50 is provided with spaced upstanding arms 51 having an idler pulley 52 journaled between them at their upper ends. An

endless conveyor belt 53 passes about the idler pulley 52 and the rotating member or wheel 37 of the machine 10. The upper run of the conveyor 53 moves in a substantially U-shaped trough or chute 54, the end of the trough adjacent the machine 10 being supported on vertical extensions of the arms 35. The other end of the chute 54 extends downwardly as shown at 58, the lower end of the downwardly extending portion being connected to a cap feeding mechanism 31' provided on the machine 50.

As is shown in Figure 1, the bottom wall 55 of the trough 54 is cut back as indicated at 56, the edge of the cut out portion being closely adjacent the periphery of the rotating member or wheel 37. At the point where the trough 54 passes about the upper portion of the idler pulley 52 of the machine 50, the bottom wall of the trough is cut out to permit the conveyor belt 53 to pass downwardly and about the pulley. The downwardly extending portion 58 of the trough 54 is of tubular construction so that all four sides thereof will be closed. The inner wall 59 of the downward extension 58, as shown at 60, has its upper edge positioned closely adjacent the surface of the conveyor belt passing down about the pulley 52.

The means for moving partially completed caps or cap devices from the knurling and wiring machine 10 to the lug forming machine 50 operates as follows: The partially completed caps or cap devices which move up through the cap removing mechanism 32 of the machine 10 are picked up and held upon the surface of the conveyor belt 53 passing about the rotary wheel 37 by the action of the magnets 37a, the magnets being of sufficient strength for this purpose. The cap devices will adhere to the belt, by surface to surface contact, while the rotating wheel and the portion of the belt moving thereon carries the cap devices upwardly through an arc of 180°, thereby inverting the cap devices. The caps will move away from the wheel 37 upon the upper run of the conveyor belt 53 through the trough 54, the cap devices remaining in position upon the belt during this movement. At the point 60 where the belt 53 passes downwardly about idler pulley 52 the cap devices will move down through the downward extension 58 of the trough 54 and into the cap feeding mechanism 31' of the lug forming machine 50.

The downward extension 58 of trough 54 being curved as shown, will cause the cap devices to be bodily turned through a further arc of 180° so that they will move down into the cap feeding mechanism 31' in proper position to be received upon the chucks of the lug forming machine 50. In other words, the flange of each cap will project downwardly.

It will be understood that the conveyor mechanism described above is arranged to operate in synchronism with the machines 10 and 50 so that cap devices will be removed from the knurling and wiring machine 10 as rapidly as they are formed thereon and will be transferred to the lug forming machine 50 in accordance with the capacity of the latter machine.

The machine 50 is provided with a lug forming die 63 which is fixed to the periphery of the stationary plate 19' thereof. The lug forming die 63 includes a toothed or knurling member 64 and outwardly projecting lug forming blades 65 positioned beneath the knurling member. The lug forming blades 65 are circumferentially spaced along the lug forming die 63 as shown in

Figure 1 in order to impress lugs at properly circumferentially spaced points upon the partially completed caps or cap devices which move past the lug forming die on the chucks or dies heads 66.

The chucks or die heads 66 carried at the upper ends of the mandrels 16' of the machine 50 are exactly similar to the chucks 27 of the machine 10 with the exception that, as shown in Figure 5, they are provided with circumferentially spaced indentations 67. As shown by the chuck 66 at the right-hand side of the machine 50 in Figure 2, the toothed or knurled upper portion 28' of the chucks 66 is adapted to be horizontally aligned with the toothed member 64 of the die 63 and the shoulder 29' of the chuck is horizontally aligned with the lug forming blades 65 of die element 63. By this arrangement, the partially completed caps or cap devices moving past the fixed die element 63 on the chucks 66 will be caused to rotate along the die element by the intermeshing of the upper knurled portion of the cap device with the teeth 64 of the die element and the teeth 28' of the chuck. The rotation of the cap device will be so timed by the intermeshing action described above and by the timing of the mandrel pinion 18' with the sun gear 17' that the lug forming blades 65 will mesh with the indentations 67 of the chuck to force the wired edge of the cap device inwardly at these points. It will be noted from Figure 5 that the indentations 67 of the chuck are not diametrically opposite. Because the cap device is oversized with respect to the chuck 66, these indentations are so spaced about the chuck that the caps will have the lugs properly positioned thereon in diametrically opposite relation. It will be understood that more than two lugs may be formed in the cap merely by providing more indentations in the portion 29' of the chuck 66 and using a corresponding number of lug forming elements or blades on the fixed die element.

After the cap devices have moved past the lug forming die element 63, they will next be removed from the chucks 66 by a cap removing device 32' which is exactly similar in construction to the corresponding device of the machine 10. A rotating member or wheel 37' having a conveyor belt 53' passing about the same is mounted above the cap removing device 32' and serves to remove the caps from the mechanism 32'. The conveyor belt 53' moves in a trough 54' and may convey the caps to a lining or liner inserting machine, not shown, which will insert sealing discs in the interior of the cap.

The caps are ordinarily fed to the lining machine in inverted position, i. e., with their normally downwardly projecting flanges projecting upwardly. In this event, the caps would not be inverted or passed through a further arc of 180° after moving along the upper run of the conveyor belt 53', but would remain in the inverted position in which they move along that run of the belt. A chute, not shown, may be provided at the out-feed end of the belt 53' to deliver the caps to the lining machine without changing the position of the caps.

It will be observed that by the construction described above, an apparatus and various mechanisms included therein is provided which fulfills all of the objects of the present invention.

It is to be understood that in the claims, the term "cap blank" is used to designate a plain hat-shaped blank or other type of plain blank, as well as a blank which is partially formed to

the configuration of a completed cap. Also, the term "cap device" designates a partially formed cap as well as a completed cap.

It will be understood that the invention is not limited to the details of construction of the apparatus shown in the drawings and that the examples of the use of the apparatus which have been given do not include all of the uses of which it is capable; also, that the phraseology employed in the specification is for the purpose of description and not of limitation.

I claim:

1. The combination in a cap forming apparatus of a plurality of cap forming mechanisms, each comprising a stationary die and a rotatable die head bodily movable with respect to said stationary die, each of said rotatable die heads being adapted to freely support a cap blank, means to remove a cap blank from the die head of one of said mechanisms, convey it to the other of said mechanisms and position it upon the die head of said latter mechanism, and means to drive said mechanisms and means.

2. The combination in a cap forming apparatus of a plurality of cap forming mechanisms respectively adapted to perform successive operations upon a cap blank, each mechanism comprising a stationary die and a rotatable die head bodily movable with respect to the stationary die, each of said die heads being adapted to support a cap blank in predetermined position thereon during movement with respect to the corresponding stationary die, means to convey a cap blank from the die head of one of said mechanisms, turn it through an arc of 360° and position it upon the die head of another of said mechanisms, and means to drive said mechanisms and means.

3. The combination in a cap forming apparatus of a pair of cap forming mechanisms respectively adapted to perform successive operations upon a cap blank, each mechanism comprising a stationary die and a rotatable die head bodily movable with respect to the stationary dies, said die heads being adapted to support a cap blank thereon in a predetermined position, means to remove a cap blank from the die head of one of said mechanisms, convey it to the other of said mechanisms, and position it in said predetermined position upon the die head of the other of said mechanisms, and means to drive said mechanisms and means.

4. The combination in a cap forming apparatus of two cap forming mechanisms respectively adapted to perform successive operations upon a cap blank and each comprising a stationary die and a rotatable die head bodily movable with respect to said stationary die, each of said die heads being adapted to support a cap blank in a predetermined position thereon, means to remove a cap blank from the die head of one of said mechanisms, bodily turn the blank through an arc of 180°, convey it to the other of said mechanisms, turn it through a further arc of 180° and position it upon the die head of said latter mechanism, and means to drive said mechanisms and means.

5. The combination in a cap forming apparatus, of a cap forming mechanism comprising a stationary die and a rotatable die bodily movable with respect to said stationary die, said rotatable die being adapted to support a cap device thereon and said dies being adapted to coact to knurl and wire a cap device, a second cap forming mechanism comprising a stationary die and a

rotatable die bodily movable with respect thereto, said last named rotatable die being adapted to support a cap device thereon and the dies of said last named mechanism being arranged to coact to form inwardly projecting lugs upon a cap device, means to transfer cap devices from the rotating dies of the first named mechanism to the rotating dies of the second named mechanism and means to drive said mechanisms and transferring means.

6. The improved method of forming lug caps from hat-shaped blanks which consists in moving the caps bodily and rotationally along a predetermined path and during said movements curling the edge of the blank to form a wired edge, bodily removing the wired blank from said path to a second path and subjecting the wired blank to bodily and rotational movements along said second path and during said last mentioned movements indenting the wired edge to form lugs therein.

7. The improved method of forming lug caps from hat-shaped blanks which consists in moving the caps bodily and rotationally along a predetermined circular path and during said movements curling the edge of the blank to form a wired edge, bodily removing the wired blank from said path to a second path and subjecting the wired blank to bodily and rotational movements along said second circular path and during said last mentioned movements indenting the wired edge to form lugs therein.

8. The combination in a cap forming apparatus of a mechanism to form a cap blank to partially completed condition, a mechanism to complete the partially formed cap, each of said mechanisms including cap blank supporting means, means to remove the cap blank from the supporting means of said first named mechanism, convey it to the said second named mechanism and position the cap blank upon the supporting means of said second mechanism for operation thereupon by said second named mechanism, and means to drive said mechanisms and means.

9. The combination with a plurality of mechanisms for successively operating upon cap blanks to form caps, each of said mechanisms including cap blank supporting means, of means to move cap blanks from one of said mechanisms to another of said mechanisms comprising an endless conveyor adapted to remove cap blanks from the supporting means of one of said mechanisms and retain and bodily turn the same thereupon during movement through an arc of 180°, means to convey the cap blanks from said mechanism to the other of said mechanisms and position the cap blanks upon the supporting means thereof for operation thereon by said last named mechanism, and means to drive said mechanisms and moving means.

10. The combination in a cap forming apparatus of a plurality of cap forming mechanisms, each mechanism including a forming means and a supporting means, means to remove a cap blank from the supporting means of one of said mechanisms, convey it to the other of said mechanisms and position it upon the supporting means of said latter mechanism, and means to drive said mechanisms and means.

11. The combination in a cap forming apparatus of a plurality of cap forming mechanisms respectively adapted to perform successive operations upon a cap blank, each mechanism including a forming means and a supporting means,

means to remove a cap blank from the supporting means of one of said mechanisms, turn it through an arc of 360° and position it upon the supporting means of another of said mechanisms, and means to drive said mechanisms and means.

12. The combination in a cap forming apparatus of a pair of cap forming mechanisms respectfully adapted to perform successive operations upon a cap blank, each mechanism including a forming means and a supporting means, means to remove a cap blank from the supporting means of one of said mechanisms, convey it to the other of said mechanisms and position it in a predetermined position upon the supporting means of said last named mechanism, and means to drive said mechanisms and means.

13. The combination in a cap forming apparatus of two cap forming mechanisms respectfully adapted to perform successive operations upon a cap blank, each mechanism including a forming means and a supporting means, said supporting means being adapted to support cap blanks in a predetermined position thereon, means to remove a cap blank from the supporting means of one of said mechanisms, bodily turning the blank through an arc of 180°, convey it to the other of said mechanisms, turn it through a further arc of 180° and position it upon the supporting means of said last named mechanism, and means to drive said mechanisms and means.

14. The combination in a cap forming apparatus of a cap forming mechanism comprising a forming means and supporting means, said means being adapted to coact to knurl and wire a cap device, a second cap forming mechanism comprising a forming means and a supporting means, said means being adapted to coact to form inwardly projecting lugs upon a cap device, means to transfer cap devices from the supporting means of the first named mechanism to the supporting means of the second named mechanism, and means to drive said mechanisms and transferring means.

15. In combination, a plurality of mechanisms for successively operating upon a cap blank to form a cap device, each mechanism including a cap blank supporting die member, and means for removing a cap blank from operative relation with one of said mechanisms and positioning the same in operative relation with another of said mechanisms, consisting of an endless conveyor for removing a cap blank from the die member of one of said mechanisms, said endless conveyor including means to cause the cap blank to adhere thereto in surface to surface contact during rotation thereof to bodily turn the blank through an arc of 180°, and means to bodily turn the blank through a further arc of 180° and position the same upon the die member of another of said mechanisms.

16. In combination, a plurality of mechanisms for successively operating upon a cap blank to form a cap device, each mechanism including a cap blank supporting die member, and means for removing a cap blank from operative relation with one of said mechanisms and positioning the same in operative relation with another of said mechanisms, consisting of a rotating member, an endless conveyor, said rotating member including means to lift a cap blank from the die member of one of said mechanisms and retain the blank thereon and bodily turn the same through an arc of 180°, said conveyor being adapted to move the blank from said rotating member, means to conduct the blank

from said conveyor to another of said mechanisms, further turn the blank bodily through an arc of 180° and position the same upon the die member of said last-named mechanism.

17. In combination, a plurality of mechanisms for successively operating upon a cap blank to form a cap device, each mechanism including a cap blank supporting die member, and means for removing a cap blank from operative relation with one of said mechanisms and positioning the same in operative relation with another of said mechanisms, consisting of a rotating member, an endless conveyor, said rotating member having a magnetized periphery to lift a cap blank from the die member of one of said mechanisms and retain the blank thereon and bodily turn the same through an arc of 180°, said conveyor being adapted to move the blank from said rotating member, means to conduct the blank from said conveyor to another of said mechanisms, further turn the blank bodily through an arc of 180° and position the same upon the die member of said last-named mechanism.

18. In combination, a plurality of mechanisms for successively operating upon a cap blank to form a cap device, each mechanism including a cap blank supporting die member, and means for removing a cap blank from operative relation with one of said mechanisms and positioning the same in operative relation with another of said mechanisms, consisting of a rotary member, an endless conveyor movable about said rotary member, said rotary member being provided with means to lift a blank from the die member of one of said mechanisms and to hold the blank upon said conveyor during travel by the blank through an arc of 180° upon said conveyor, means to conduct the blank from said conveyor to the other of said mechanisms, bodily turn the blank through a further arc of 180° during such movement and to position the same upon the die member of said last named mechanism.

19. In combination, a plurality of mechanisms for successively operating upon a cap blank to form a cap device, each mechanism including a cap blank supporting die member, and means for removing a cap blank from operative relation with one of said mechanisms and positioning the same in operative relation with another of said mechanisms, consisting of a rotary member, an endless conveyor movable about said rotary member, said rotary member having a magnetized periphery and being arranged to lift a blank from the die member of one of said mechanisms and to hold the blank upon said conveyor during travel by the blank through an arc of 180° upon said conveyor, means to conduct the blank from said conveyor to another of said mechanisms, bodily turn the blank through a further arc of 180° during such movement and to position the same upon the die member of said last-named mechanism.

20. In combination, a cap forming machine including a cap blank supporting die member, a lining machine, and means for removing a cap device from operative relation with said cap forming machine and positioning the same in operative relation with said lining machine, consisting of a rotary member mounted on the forming machine, a conveyor belt moving about said rotary member, said rotary member including means to lift a cap device from the die member of said forming machine and bodily turn the

same through an arc of 180°, said conveyor belt being adapted to thereafter move the cap device from said rotary member to operative relation with said lining machine.

- 5 21. In combination, a cap forming machine including a cap blank supporting die member, a lining machine, and means for removing a cap device from operative relation with said cap forming machine and positioning the same in
10 operative relation with said lining machine, consisting of a rotary member mounted on the form-

ing machine, a conveyor belt, said rotary member having a magnetized periphery about which said conveyor belt moves, said rotary member being adapted to lift a cap device from the die member of said forming machine and bodily
5 turn the same through an arc of 180°, said conveyor belt being adapted to thereafter move the cap device from said rotary member to operative relation with said lining machine.

GEORGE GOEBEL. 10