

Oct. 29, 1957

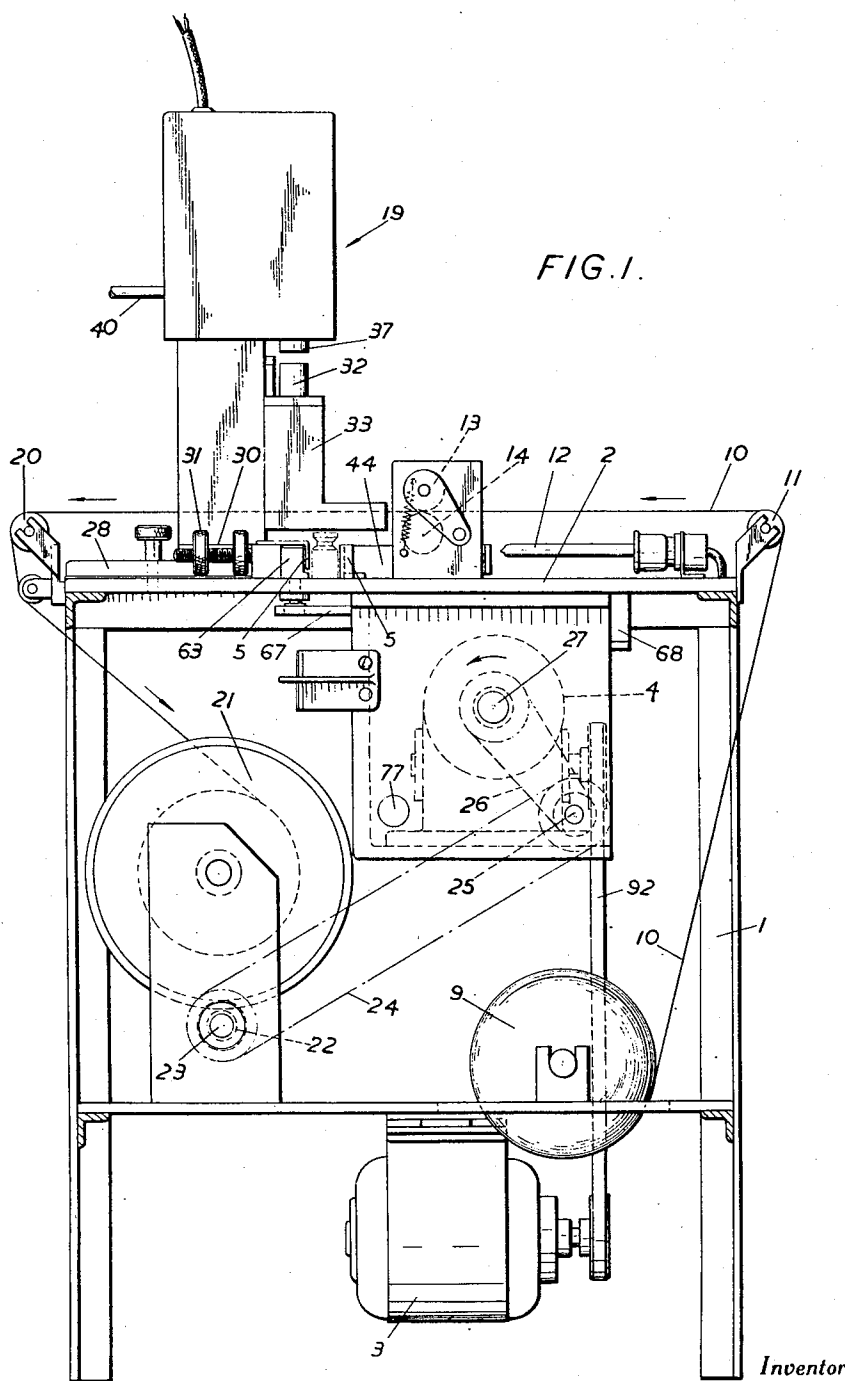
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APPARATUS FOR CAPPING VIALS AND THE LIKE

Filed Feb. 17, 1955

6 Sheets-Sheet 1



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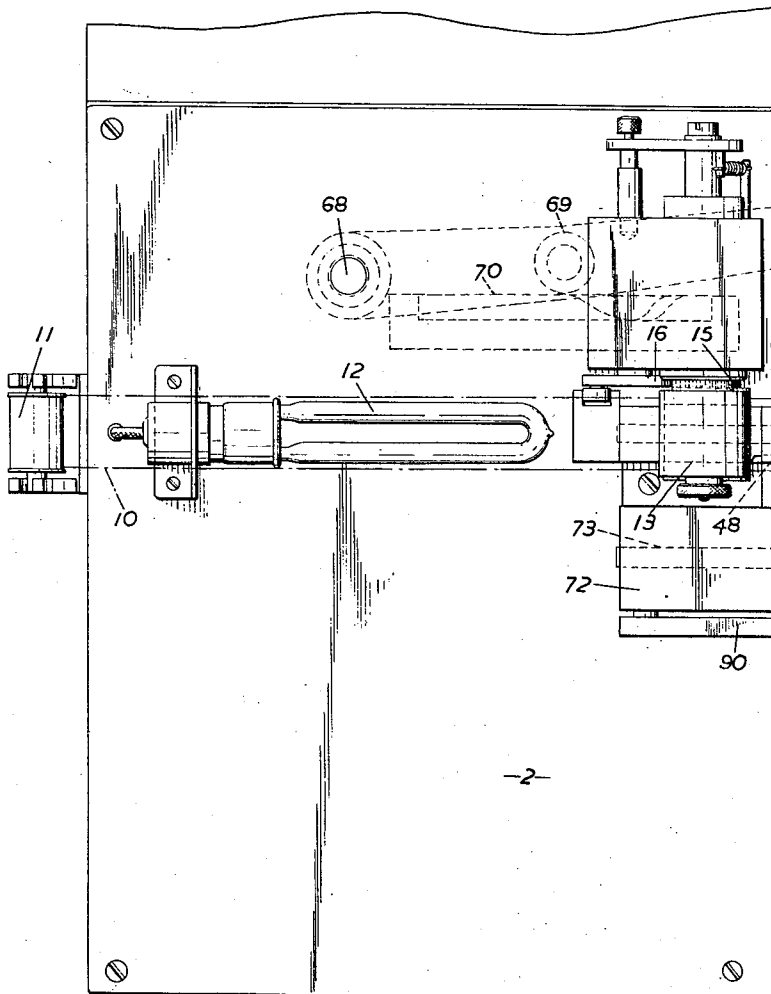
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FIG. 2



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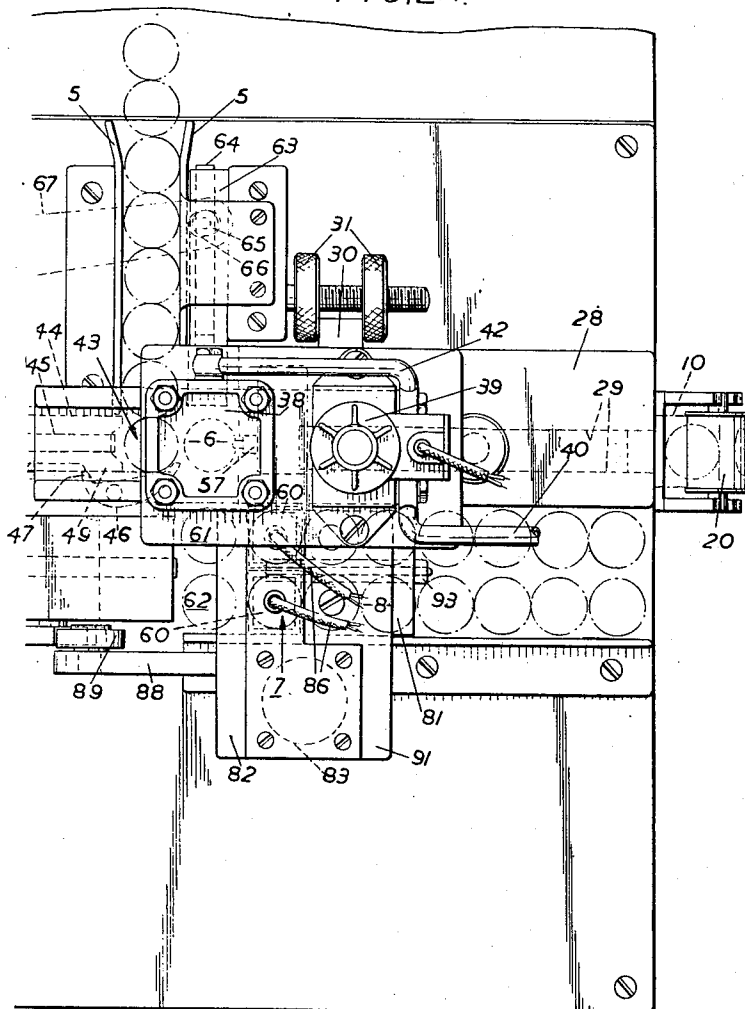
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FIG. 2A.



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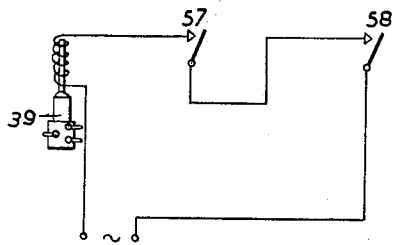
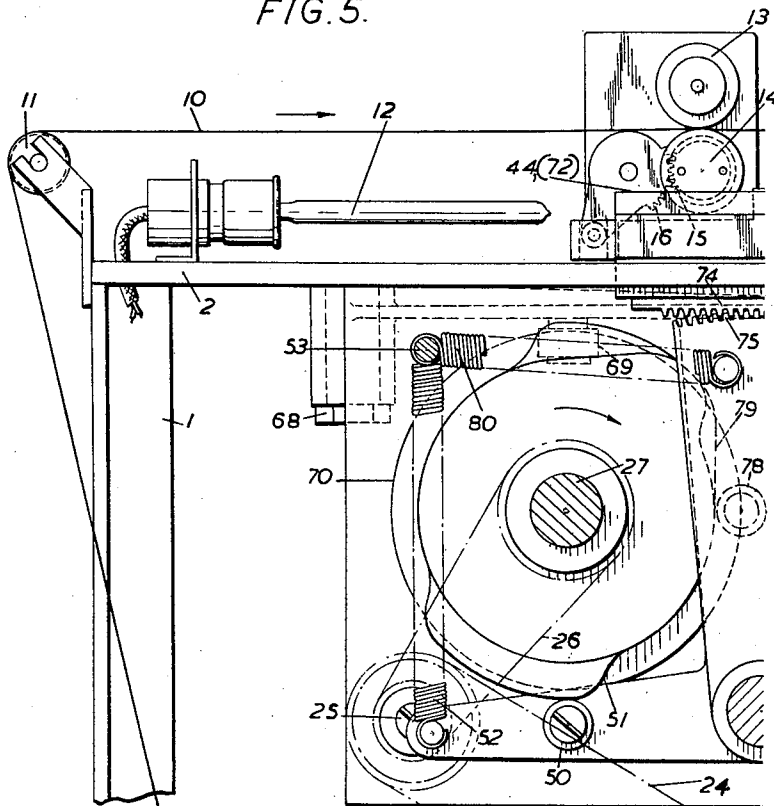


FIG. 3.

FIG. 5.



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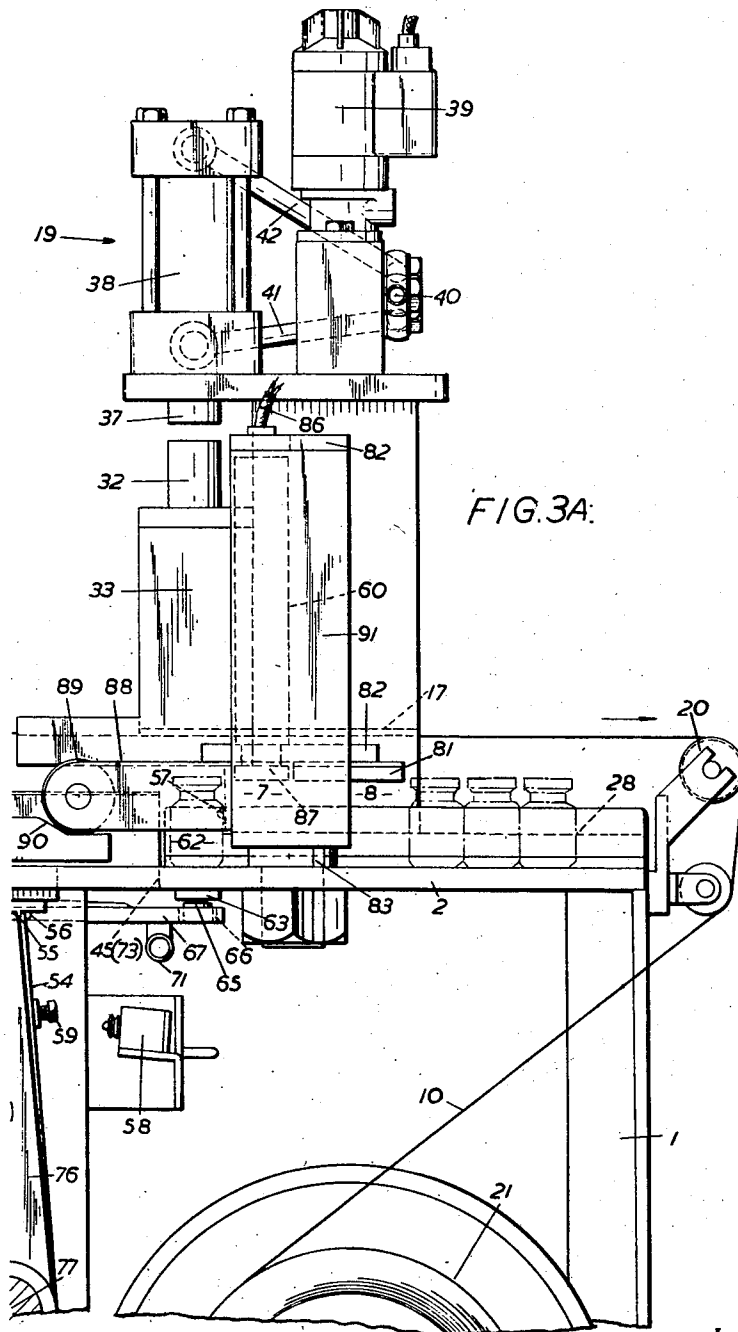
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6 Sheets-Sheet 5



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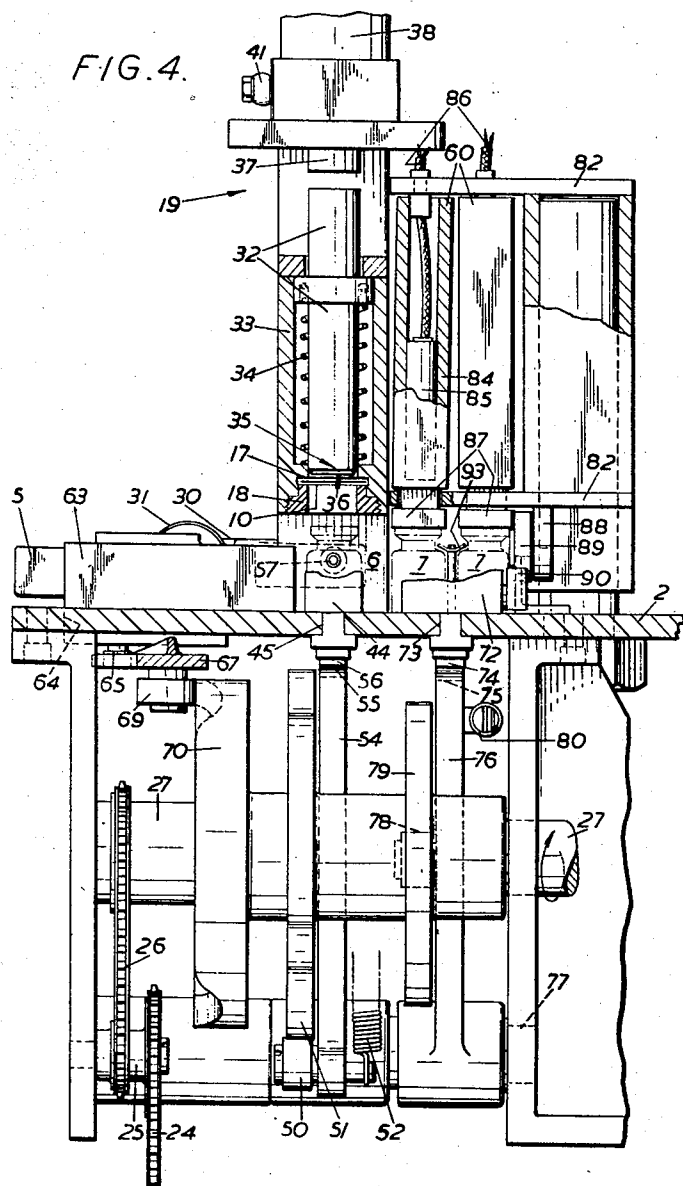
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6 Sheets-Sheet 6



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APPARATUS FOR CAPPING VIALS AND THE LIKE

Edgar David Stanley Baker-Carr, Cheam, England, assignor to Glaxo Laboratories Limited, Greenford, England, a British company

Application February 17, 1955, Serial No. 488,897

Claims priority, application Great Britain March 5, 1954

10 Claims. (Cl. 53—297)

This invention is concerned with improvements in apparatus for applying caps or closures to vials, bottles, jars and like containers, and more particularly with apparatus for applying sealing discs of metallic foil backed with a heat sealing adhesive to glass vials, bottles, jars or other containers where it is of great importance that the resultant closed container should be substantially completely moisture proof.

In copending application Serial Number 459,202 of Baker-Carr et al. filed September 29, 1954, now Patent No. 2,799,981, issued July 23, 1957, we have described a method of applying sealing discs of metal foil having a backing of heat sealing adhesive to glass containers, bottles, vials, jars or the like in which a disc of appropriate size is applied cold to the neck or aperture of a container with sufficient impact to cause it to be lightly attached thereto, said disc is then subjected to heat and pressure for a short time sufficient to render the adhesive tacky and to cause it to adhere to the glass without damaging the contents of the container and thereafter final sealing is effected by the application of pressure applied thereto so as to bring the disc into intimate contact with the whole of the upper surface of the neck or aperture of the container.

The said method is particularly advantageous in connection with the manufacture of closures for vials described and claimed in copending application Serial Number 409,173 of Winfield, filed February 9, 1954, now Patent No. 2,783,908, issued March 5, 1957.

In the application of sealing discs as caps or closures for vials and like containers which are required to be substantially moisture proof, whether such containers have stopper members in their necks or are merely sealed with a metallic foil sealing disc, it is important that the adhesive backing to the foil should adhere intimately to the face of the neck of the container over substantially the whole surface in spite of variations in the level of the face of the neck which occur during the manufacture of the containers.

Machines are already known which are capable of stamping out discs of metallic foil and applying these to a container to be closed. As has been set forth in copending application Serial Number 459,202 of Baker-Carr et al. filed September 29, 1954, there are particular difficulties to be overcome in applying adhesively secured discs of metallic foil to vials and other containers which are intended for instance for pharmaceutical preparations due inter alia to the need for sterile operating conditions, and the necessity for avoiding excessive heating to the container or its contents.

It is therefore, an object of this invention to provide an apparatus which is capable of applying at high speed caps or closures to vials, jars, bottles and like containers and which is particularly suitable for applying adhesively backed metallic foil discs to such containers in accordance with the method set forth in said copending application Serial Number 459,202 of Baker-Carr et al. filed September 29, 1954, so as to provide an intimate adhesive

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contact over substantially the whole of the upper surface of the neck of such containers.

According to the present invention there is provided apparatus for the application of sealing discs to vials, jars, bottles and like containers comprising means for applying an adhesive backed sealing disc to the upper surface of the neck of a container to be sealed with sufficient impact to cause it to be lightly attached thereto and heater means adapted to apply heat and pressure to such a sealing disc, said heater means being so mounted that the heat applying surface thereof is free to take up a position substantially parallel to the plane of the upper surface of the neck of a container so as to ensure adhesive attachment of said disc over substantially the whole of said surface.

Apparatus according to the invention comprises a table or base onto which a succession of containers to be capped are fed in any convenient manner. Means are provided for presenting such containers either singly or in groups to a position at which a foil disc is applied to the neck or necks thereof and thereafter to a position where said heater means act on the said foil discs.

We prefer to arrange for the containers to be moved in linear motions from stage to stage and preferably reciprocating slide members actuated in timed relationship with each other from a single cam shaft are provided to effect the various movements. If desired however other movements, e. g., arcuate, might be imparted to the containers during their passage through the apparatus.

The said means for applying sealing discs to the necks of containers is preferably a punching device adapted both to cut out a disc from a strip of material fed thereunder and to implant such disc on the neck with sufficient impact to cause it to adhere lightly to the said neck. We prefer to provide such device in the form of a punch member operable within a die and having a separate punch actuating device normally spaced from the punch so that said actuating device transmits a certain initial momentum to the punch at the beginning of its working stroke. Since in applying discs to the necks of containers there is only a relatively narrow neck to which to attach the disc we prefer to design the face of said punch so that there will be a proud portion beyond the cutting edge which will make contact with the surface of the neck and thus assist the initial light adhesion of the disc to the neck.

The said punching device may for instance be actuated by a double acting plunger operated by compressed air and controlled by a solenoid device. We prefer to incorporate in the punching device or the means by which it is actuated a safety device which serves to prevent operation of the punch when no container is presented for the application of a foil disc. In one embodiment we may incorporate one or more micro switches which are caused to close a circuit to said solenoid only when a container moves into position.

The said heater means which are preferably electrically heated are mounted in a frame member so that their heat applying surface is free to take up any position relative to the face of the neck of the container under the influence of gravity and dependent on the inclination of the said face to the base of the container. If desired said heater member may be mounted in its frame member so as to be free to move laterally, longitudinally, and vertically, or if desired a type of universal joint, ball and socket joint or a spring mounting may be provided for said heat applying surface.

In a preferred embodiment we also provide a rubber padding member which applies pressure to sealed containers after they have been subjected to the action of said heat and pressure member and serves finally to ensure intimate adhesion of the foil over the whole surface

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of the neck of the container. We may if desired mount such rubber padding member and said heater member in a common frame, means being provided for lifting the whole of said frame as containers are fed under each of said members in turn.

In order that the invention may be well understood, a preferred embodiment thereof will now be described with reference to the accompanying drawings in which:

Figure 1 is a side elevation of apparatus according to the invention,

Figures 2 and 2A are complementary portions of a plan view of Figure 1 on an enlarged scale,

Figures 3 and 3A are, respectively, side elevations of Figures 2 and 2A taken from the opposite side to Figure 1.

Figure 4 is a part sectional view taken transversely of Figures 3-3A and showing details of the punch unit, the heater unit and the drive for the apparatus and

Figure 5 is a diagrammatic view of a circuit arrangement which ensures that the punch unit is rendered inoperative when no container for sealing is presented to the apparatus.

In the following description the apparatus will be described as an example only with reference to the application of sealing discs to small vials for pharmaceutical products so as to produce substantially moisture proof vials such as are described and claimed in copending application Serial Number 409,173 of Winfield, filed February 9, 1954, and it will be understood that this apparatus can with appropriate modifications be used for applying sealing discs to other containers than such small vials. The said sealing discs to be applied are preferably of aluminum foil backed with a thermoplastic adhesive sold under the trademark Telstic, although it will be appreciated that sealing discs of other materials can be applied by means of the apparatus.

The apparatus comprises a frame 1 having a base plate 2 upon which the application of sealing discs takes place. Beneath base plate 2 an electric motor 3 is mounted together with a reduction gear 4 and appropriate transmission mechanism to be further described.

Referring to Figure 2 a supply of filled vials ready for the application of sealing discs is fed, by means not shown, on to the base plate 2 between guide rails 5. The continuous supply of such vials feeds each vial forward into the apparatus. Each vial will pass from the rails 5 to a first position generally indicated at 6 where a disc of foil is cut out from a strip thereof and implanted on the top of the neck thereof. From there it will be moved to a second position generally indicated at 7 where heat and pressure is applied to the foil disc whereafter the vial passes to a third position indicated at 8 where further pressure is applied to complete the sealing of the vial.

Mounted beneath the base plate 2 is a supply roll 9 of adhesively backed metallic foil 10 from which sealing discs will be cut out at position 6. The foil 10 is led over a roller 11 across the base plate 2 which carries an ultra violet light sterilising unit 12 serving to sterilise the adhesive surface of the foil 10. Foil 10 is then fed forward by a pair of feeding rollers 13, 14. Roller 14 has a free wheel device incorporated in it and has teeth 15 which cooperate with ratchet 16 to feed the foil 10 forward towards the position 6. The foil 10 passes through a slot 17 formed in the die portion 18 of a punching device 19 and thence passes over a roller 20 to take up reel 21 beneath base plate 2. Take up reel 21 which serves to pull the foil off supply roll 19 is driven by a friction drive wheel 22 on shaft 23, which shaft 23 is driven by a chain drive 24 from lay shaft 25. The lay shaft 25 takes its drive by a chain drive 26 from a main cam shaft 27 driven by motor 3 as will be further described.

The whole punching device 19 which serves to cut out correctly shaped foil discs for each vial is mounted on a plate 28 which is carried in a slotted guide 29 in base

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plate 2. A lug 30 on plate 28 engageable in an adjustable clamping device 31 serves to enable the position of the punching device 19 to be precisely located on base plate 2, and enables device 19 to be readily removed, for maintenance.

Said punching device 19 comprises the die portion 18 and a punch member 32 disposed in a body 33 and operable against the action of spring 34. The face of punch member 32 is formed with a cutting edge portion 35 and a central proud portion 36 the diameter of the proud portion 36 being such that when the punch is actuated a foil disc will be firmly planted upon the upper face of the rim of the neck of a vial presented beneath it.

As will be seen from Figure 3 the punch member 32 in its inoperative position is spaced from an actuating plunger 37 which is driven by means of a double acting piston device 38 controlled by a solenoid actuated valve mechanism 39. Valve mechanism 39 supplies compressed air from inlet 40 via one or other of pipes 41 or 42 to actuate said piston device 38. The punch member 32 is spaced from the actuating plunger 37 so that for each punching stroke of member 32 there will be additional momentum imparted to member 32 in order to ensure that the face 36 of the punch in addition to cutting out a foil disc will impart a sharp impact to it so as to implant it on the face of the neck of a vial and cause it to adhere lightly thereto during movement of the vial from position 6 to position 7.

As has been described above, vials for capping are fed between rails 5 and push each other forward towards position 6. When a vial reaches position 43 it will be moved into position 6 for the operation of punching device 19 by means of a slide member 44 mounted in slotted guide 45 on base plate 2.

As will be seen from Figure 2 a vial locating pawl 46 is pivotally mounted on base plate 2 and serves to receive a vial at position 43 so as to prevent it from fouling a preceding vial beneath the punch device 19. Portion 47 of pawl 46 is adapted to be urged into recess 48 in slide 44 as the latter moves in a vial feeding direction, and is held against the side portion 49 of slide 44 when the latter has returned to its starting position after feeding a vial beneath punching device 19.

Slide member 44 is driven from the main cam shaft 27. Said cam shaft 27 carries a double throw cam 49 which engages a cam follower roller 50 carried on one arm of a bell crank lever 51. The same arm has a return spring 52 attached thereto said spring being attached at its other end to a pin 53. The other arm 54 of bell crank 51 carries teeth 55 which engage teeth 56 on the underside of slide member 44. Thus cam 49 serves to move slide 44 in a vial feeding direction from position 43 to a position located directly beneath punching device 19.

The apparatus comprises means to ensure that if at any time no vial is present beneath punching device 19 the latter will be rendered inoperative and will not punch out a sealing disc. For this purpose the solenoid actuated valve mechanism 39 is connected in a circuit (Figure 5) with two micro switches. One such switch 57 is so disposed that as a vial is fed into position by slide member 44 it closes the switch 57. Since the closing of this switch alone would lock the vial beneath the punch 32 a further switch 58 in series with switch 57 is provided, this further switch being closed and opened by means of a switch actuating member 59 carried by arm 54 of bell crank lever 51.

Upon completion of the first step of cutting out a foil disc and causing it to be lightly adhered to the face of the neck of a vial at position 6 punch 32 and slide member are retracted by means indicated above and the vial having thereon a foil disc is moved from position 6 towards position 7 where heat and pressure are applied. In the embodiment of the invention shown we have provided two heater units 60 side by side so that the first of a pair of vials moving from position 6 first moves to an

intermediate position 61 whence the second vial of the pair moves said first vial on to position 62. Both vials are then moved together to position 7 beneath the heater units 60 as will be described.

In order to move a vial from position 6 to intermediate position 61 a transverse slide member 63 is mounted in a slotted guide 64 on base plate 2. The said slide member 63 carries a roller member 65 which is disposed in an elongated slot 66 in one end of an actuating lever 67. Lever 67 is pivoted at 68 and carries a cam follower 69 which is maintained in engagement with an internally faced double acting cam 70 by means of a spring 71 (Figure 3). The cam 70 is mounted on the main cam shaft 27 and takes its drive therefrom, so that in properly timed relation to the operation of punching device 19 vials are moved from position 6 via intermediate position 61 into position ready for transfer to position 7 beneath heater units 60.

This transfer of two vials at a time is effected by a third slide member 72 which is mounted in a slotted guide 73 in base plate 2. Slide member 72 has teeth 74 on its underside which are engaged by teeth 75 on the end of a lever 76. Lever 76 is pivoted at 77 and carries a cam follower 78 which is maintained in contact with a cam 79 by means of spring 80 which is connected to lever 76 and to pin 53. Cam 79 is carried by the main cam shaft 27.

At position 7 the vials with foil discs thereon are subjected to heat and pressure sufficient to render the adhesive tacky and to give a good adhesion over the whole of the upper surface of the neck of the vial, thereafter the vials are subjected to a final pressure step where further pressure is applied without heat which serves finally to pad down the foil discs to ensure a uniform adhesion over all the surface of the neck of the vial and thus produces a substantially completely moisture proof seal.

As will be seen from Figure 2 vials in pairs are subjected to heat and pressure at position 7 and after this step the two vials treated are pushed on by the arrival of a subsequent pair of vials to a position beneath a pressure pad 81 to be further described.

A frame member 82 is mounted on a post 83 on the top of base plate 2. Said frame 82 carries the two heater units 60. Each heater comprises a shell like member 84 which for the particular vials and foil here referred to is of approximately one pound weight. The member 84 has an electrical heating element 85 therein supplied by leads 86 and has a face portion 87 of brass or other good conductor. As will be seen from Figure 4 the whole heater unit 60 comprising shell 84, element 85 and face portion 87 is loosely mounted in frame member 82 so that when face portion 87 contacts the neck of a vial the unit 60 is free to take up its own alignment thereon. In Figure 4 one heater element is shown in a horizontal position, whilst the other has taken up a position out of the horizontal as dictated by the plane of the surface of the neck of the vial. This ability of the heater unit to align itself is of particular importance with small vials required to be completely moisture proof in view of the fact that the surfaces of the necks are rarely truly plane surfaces or exactly parallel to the plane of the base and the tolerances in manufacture would otherwise cause only partial contact or uneven contact with the foil disc.

The frame 82 has an arm 88 carrying a roller 89 which roller rides on cam surface 90 which is disposed on the side of slide member 72. Thus each time slide member 72 moves in a vial feeding direction, cam surface 90 causes the whole of frame member 82 to be raised by roller 89 and arm 88 thus allowing vials to pass beneath the heater units 60. As will be seen from Figure 4 a rail member 93 is provided between two vials in position 7 so that said member 93 engages the shoulders of the vials and serves to prevent their adhesion to the surfaces 87. As the face portion 87 of the heater units contact the vials the heater unit automatically aligns itself ac-

cording to the particular vial and heat and pressure exerted by gravity alone is then applied to the foil disc for a predetermined time to cause adhesion of the foil to the vial.

As mentioned above frame member 82 also carries a pressure pad 81. This pressure pad is preferably of silicone rubber and is of such size that it will act on four vials at a time, thus padding them for a time twice as long as their heating time. The said pad 81 is mounted rigidly with frame member 82 and hence the whole weight of the frame 82, which can have additional weights as required applied at 91, is applied to the third or padding step for the sealing discs. After the padding steps the vials are moved along base plate 2 from where they may be removed for packing (or, if required, for the fitting of the known tamper proof caps.

As mentioned above the electric motor 3 drives the whole apparatus. The motor is hingedly slung beneath the frame 1 so that the weight of the motor serves always to tension a belt 92 which transmits drive to the reduction gear 4 and thence to the main cam shaft 27.

It will be seen that an apparatus has been provided according to this invention which is capable of quickly and efficiently applying sealing discs to vials, jars and like containers so as to produce from appropriate foil substantially completely moisture proof closures. It will be understood that only one preferred embodiment of the apparatus has been described above by way of example and that variations and modifications may be made therein without departing from the scope of the invention. Thus for instance instead of moving the vials by linear movements from one position to the next the punching device, and heat and pressure member might be so disposed that vials on a rotary table, or moving in an arcuate path were presented to such devices either singly or in groups in order to have sealing discs applied thereto. Furthermore, it will be appreciated that many alternative mechanical means may be used, in place of those specifically described, to effect the various movements of the vials, the foil and the punching and heat and pressure devices.

What I claim is:

1. In apparatus for cutting and sealing adhesive-surfaced closure discs to the opening of containers and the like; means defining a plurality of stations adapted to sequentially receive containers to be sealed, punch and die members at one of said stations, said punch being mounted for movement past said die sufficiently to engage a container at said station, and means for cyclically moving said punch whereby to cut sealing discs at said die and carry said discs to and impact the same against a container at said station, and heater means at a subsequent station, said heater means having a heating and supporting surface and being mounted for cyclic movement to a position of rest with said surface against the closure disc on a container at said subsequent station, said heater being mounted for limited universal tilting whereby said surface may assume an attitude corresponding to that of the container surface against which said closure is applied.

2. Apparatus as claimed in claim 1 in which said punch has a cutting edge for cooperation with said die and a portion extending beyond the cutting edge in the direction of movement of the punch which portion serves to implant the disc on the surface of the container.

3. Apparatus as claimed in claim 1 in which a movable actuating device for said punch is normally spaced from said punch, and means for moving said actuating device toward said punch whereby to impart an initial momentum to the punch at the beginning of its working stroke.

4. Apparatus as defined in claim 1 including electrical control means for said punch, said control means including a switch at said first station and engageable by a container, said switch being arranged to render said

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punch inoperative in the absence of a container at said first station.

5. Apparatus as claimed in claim 1, including a vertically movable frame at said subsequent station and in which said heater means comprises an electrically heated member loosely mounted on said frame so as to be free to move laterally, longitudinally and vertically relative thereto whereby to enable said heat applying surface to take up a position parallel to the surface of the neck of a container.

6. Apparatus as claimed in claim 5 in which an additional pressure member is provided at a further station and which is arranged to apply pressure to sealed containers, after they have been subjected to the action of said heater means.

7. Apparatus as claimed in claim 1 including a reciprocating slide member arranged to move a container to be sealed out of a line of containers and into position

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at said first station for applying an adhesive backed sealing disc thereto.

8. Apparatus as claimed in claim 7 including a further reciprocating slide member arranged to move a container having a sealing disc implanted thereon into position beneath said heater means at said subsequent station.

9. Apparatus as set forth in claim 1 including means for feeding a supply of adhesive disc material to said punch and die members, and sterilizing means arranged to sterilize the adhesive surface of said material.

10. Apparatus as set forth in claim 9, wherein said sterilizing means comprises an ultraviolet lamp arranged to irradiate said adhesive surface immediately adjacent said punch and die members.

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