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[33] **France**
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[54] **DEVICE FOR GRIPPING AND UNCAPPING BOTTLES AND AUTOMATIC HANDLING MACHINES PROVIDED WITH SUCH DEVICES**
13 Claims, 4 Drawing Figs.

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[50] **Field of Search** ..... 53/381 (A); 81/3.2, 3.47, 3.48, 3.49

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ABSTRACT: Device for automatically gripping and uncapping bottles, comprising gripping members each provided with pressing means to seize the upper end of the neck of a bottle and with a needle movable in translation with respect to the said gripping member so as to penetrate into the bottle neck by passing through the cap and to draw off the said cap when moving out from the said bottle neck.

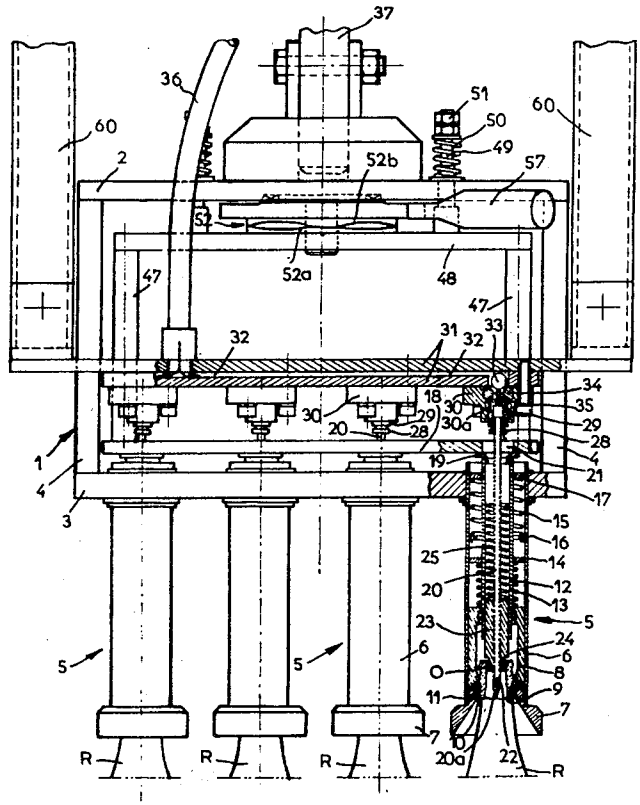

Fig. 1.

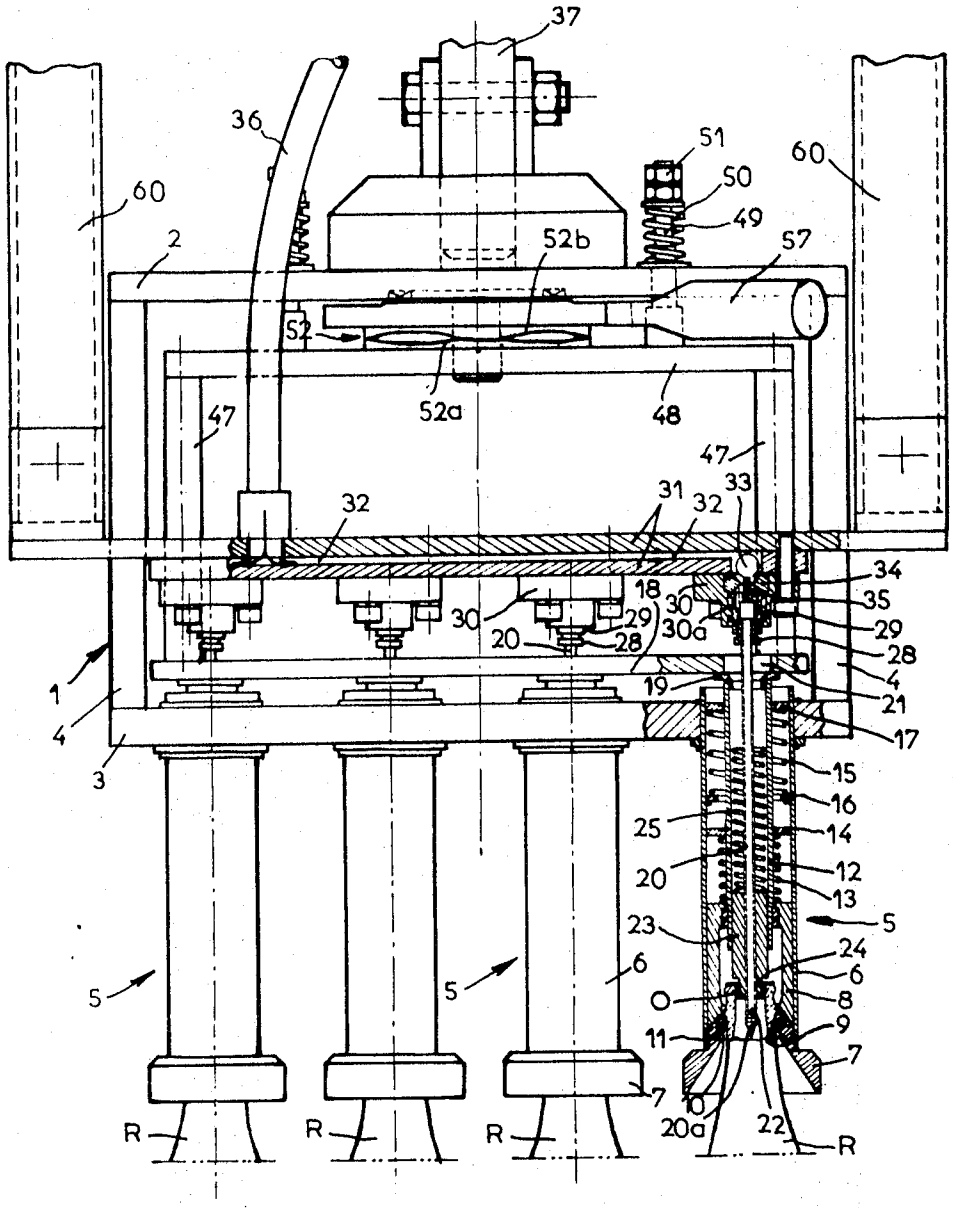

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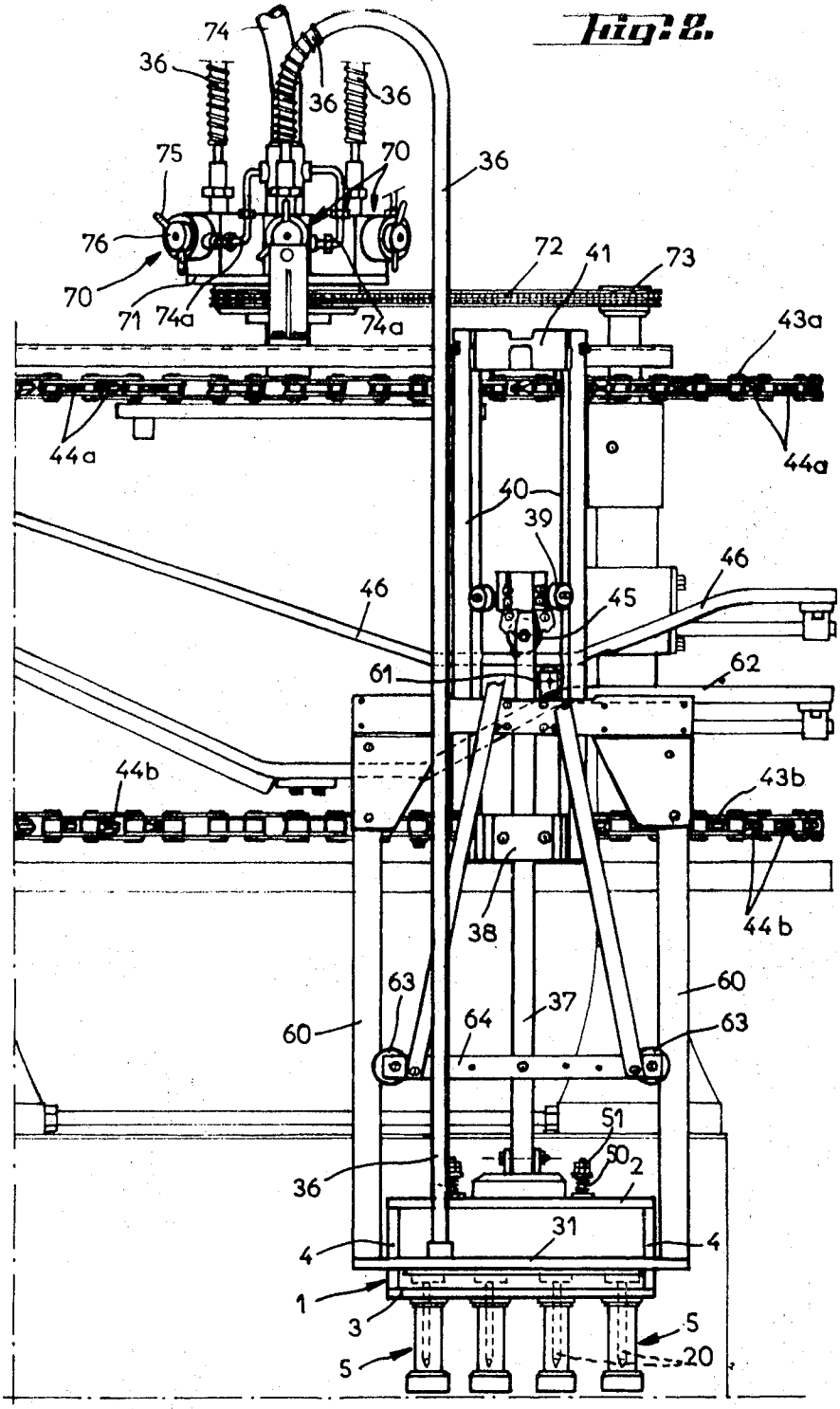
Fig. 2.



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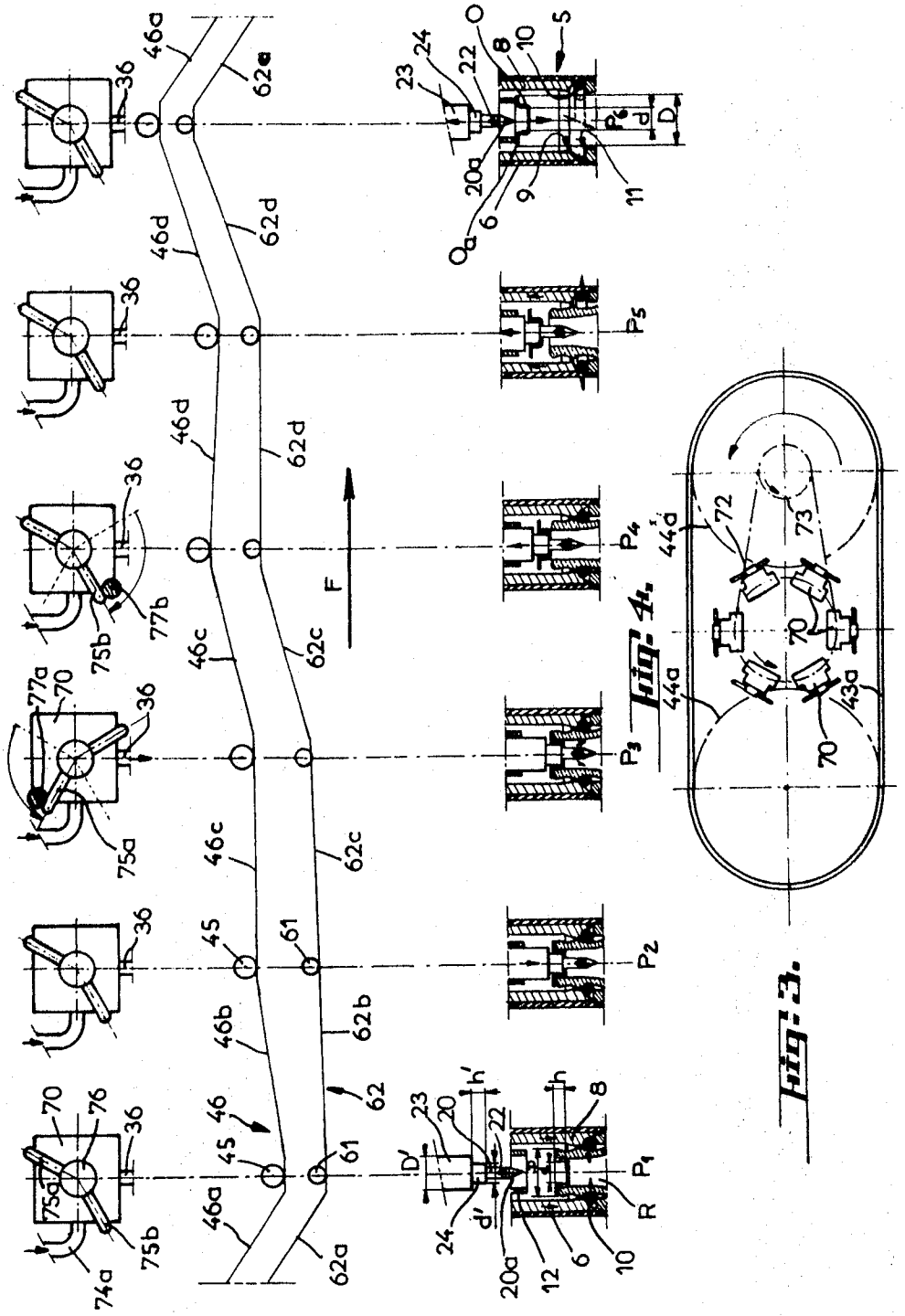

Fig. 4.

Fig. 3.

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DEVICE FOR GRIPPING AND UNCAPPING BOTTLES AND AUTOMATIC HANDLING MACHINES PROVIDED WITH SUCH DEVICES

The present invention has essentially for its object a gripping device or seizing head for automatic-handling machines for containers such as bottles or the like, of the type comprising a gripping member or a plurality of gripping members mounted on a support and provided with pressing means for seizing the upper end of the neck of a bottle or the like. Such a gripping device is adapted more particularly to be mounted on machines or installations of he encasing-uncasing type.

It is known that certain bottles are supplied to customers, when full, with a closing cap constituted by a capsule of plastics material or the like, the main advantage of which consists in that it can be readily fitted or removed. When the emptied bottles are returned to the filling workshop in order to be reutilized and remarketed, the said closing caps often happen to have remained on the neck. It is necessary, in order to proceed to the cleaning and then the filling of the bottles, to remove the said caps. This operation has hitherto been carried out manually.

The purpose of the present invention is to render this uncapping operation entirely automatic.

The gripping device according to the invention is remarkable notably in that each gripping member is provided with extracting means for separating from the bottle neck seized by the aforesaid pressing means the cap or the like possibly closing the said neck.

It is thus seen that owing to the said extracting means the uncapping takes place automatically during the operation of gripping of the bottles by the machine.

According to another feature of the invention, the aforesaid extracting means comprise essentially a needle or the like movable in translation with respect to the aforesaid gripping member and pressing means so as to penetrate into the bottle neck by passing through the cap or the like, and to draw off the said cap when moving out from the said neck.

According to another feature of the invention, means are provided to make the interior of a bottle communicate with a circuit of pressurized fluid, the said means being actuated when the said needle passes through the cap.

The creation of pressure in the bottle facilitates the extraction of the cap. On the other hand, the fact that a communication with the circuit of fluid is established when the needle passes through a cap enables to avoid losses of fluid when no cap is present.

The invention is also directed, as novel industrial products, to the automatic-handling machines for bottles or the the like, for instance machines of the encasing-uncasing type, comprising a revolving assembly on which are mounted the aforesaid supports, the said support being movable vertically and actuated by a ramp which is rigid with the machine frame.

According to the invention the machines of the aforementioned type are remarkable notably in that they comprise a ramp or the like at least rigid with the frame for controlling the motion of the needles during the vertical motion of the said supports.

According to another feature of the invention the aforesaid machines are remarkable notably in that they comprise a plurality of compressed-air distributing valves, each connected to the gripping members of one and the same gripping device.

Other advantages and features of the invention will appear as the following description proceeds with reference to the appended drawings given solely by way of example and wherein:

FIG. 1 is a partial view, partially in section, of a gripping device according to the invention;

FIG. 2 is a partial view of a handling machine according to the invention equipped with a gripping device of the type shown in FIG. 1;

FIG. 3 diagrammatically illustrates the actuation of the compressed-air inlet valves provided in the automatic handling machine shown in FIG. 2;

FIG. 4 diagrammatically illustrates the operation of the machine and of the gripping device according to the invention.

According to the form of embodiment shown in the drawings, the gripping device is constituted essentially by a support denoted generally by reference numeral 1 and comprising an upper plate 2 and a lower plate 3 which are made rigid with one another by means of uprights 4. The lower plate 3 carries a plurality of gripping members, each of which is denoted generally by reference numeral 5.

Each gripping member 5 is constituted by a tubular element 6 of cylindrical shape secured at its upper portion to the plate 3 and provided at its lower portion with a cylindrical body 7 having in section the shape of a funnel and intended to facilitate the engagement of the neck of the containers or bottles R to be handled. Within the cylindrical element 6 and in the lower portion of the latter is slidingly mounted a hollow pusher 8 which is also cylindrical in shape and is provided at its bottom with a bevel 9. A coil spring 10 in the shape of a torus is inserted between the bevel 9 of the pusher 8 and a shoulder 11 of the cylindrical body 7.

The displacement of the pusher 8 is controlled by means of an operating tube 12 which is coaxial with the tubular element 6 and is adapted to be displaced axially with respect to the latter, the actuation of the pusher 8 by the operating tube 12 being ensured through the medium of a spring 13 bearing on the one hand upon the upper face of the pusher and on the other hand upon a washer or ring 14 rigid with the operating tube 12. A spring 15 bearing on the one hand on a washer or ring 16 rigid with the tubular element 6 and on the other hand on a washer or ring 17 rigid with the operating tube 12 tends to push the latter upwards with respect to the tubular element 6 and to apply it on a plate 18. The operating tube is provided at its top with a collar 19 and bears through the medium of the said collar upon the lower face of the plate 18.

Within the tube 12 and coaxially therewith is mounted a hollow needle 20 which passes through an aperture 21 provided in the plate 18. The needle 20 is provided in proximity to its tip 20*a* with radial apertures 22 enabling the interior of the needle to communicate with the exterior. A cylindrical sleeve 23 is secured to the needle 20 in proximity to the lower end of the latter and slides within the tube 12. The outer diameter D' of the sleeve 23 (as well as the inner diameter of the tube 12 wherein it slides) is comprised between the outer diameter D and the inner diameter *d* of the flange O*a* of a cap O closing the neck of the bottle (see FIG. 4). The sleeve 23 is provided at its lower portion adjacent to the tip 20*a* of the needle 20 with a portion 24, the diameter *d'* of which is much smaller than that of the sleeve 23 and slightly inferior to the inner diameter *d* of the flange O*a* of the cap O. This portion 24 of smaller diameter has a height *h'* substantially superior to the height of the hollow portion of the cap O. A helical spring 25 mounted within the tube 12 between the sleeve 23 and the collar 19 constitutes a resilient stop, the function of which will be explained hereafter.

The needle 20 is secured at its upper portion, through the medium of a ring 28, to an endpiece 29 slidingly mounted with an easy fit in a valve body 30 secured to a needle operating plate 31. The plate 31 is provided internally with a plurality of compressed-air intake conduits 32 opening into each valve body 30. The communication between the compressed-air conduit 32 and the valve body 30 is controlled by a ball 33 cooperating with a seat 34 and subjected to the action of a finger or the like 35 rigid with the sliding endpiece 29. When the endpiece 29 occupies its upper position shown in FIG. 1, i.e. when its upper end bears upon the lower face of the seat, the finger 35 moves the ball from the said seat so as to allow the passage of compressed air into the hollow needle 20. On the contrary, when the endpiece 29 is in its lower position, i.e. when its upper portion bears upon the lower shoulder 30*a* of the valve body 30, the ball returns to rest on its seat and cuts the communication between the conduit 32 and the needle 20. A flexible compressed-air supply tube 36 communicates with

the whole of the conduits 32, thus enabling the supply of compressed-air to each of the needles of the gripping device.

The support 1 is secured to the lower end of a slide 37 slidingly mounted on the revolving assembly of an automatic bottle-handling machine of known type, partially shown in FIG. 2. The said revolving assembly is constituted by two parallel endless chains 43*a*, 43*b* meshing with two pairs of coaxial pinions 44*a*, 44*b*, one of the said pairs being driven in rotation by a motor (not shown). The slide 37 slides in a lug or the like 28 secured to the lower chain 43*b* and is guided, through the medium of rollers 39, by uprights 40 rigid with the lug of the like 38 and with a second lug or the like 41 secured to the upper chain 43*a*. The slide 37 is also provided at its top portion with a roller 45 rolling on an actuating ramp 46 closed on itself and rigid with the machine frame, the said ramp thus controlling, in a manner known per se, the vertical motion of the support 1 during the rotation of the revolving assembly.

The pusher actuating plate 18 (see FIG. 1) is rigid, by means of uprights 47, with a plate 48 mounted on the upper plate 2 of the support 1 through the medium of threaded rods 49 and springs 50 whose tension may be adjusted at will by means of nuts 51. The assembly constituted by the upper plate 48, the uprights 47 and the actuating plate 18 is actuated in vertical translation with respect to the support 1 by means of a cam 52 of known type, constituted by a lower element 52*a* rigid with the plate 48 whose upper edge has a sine-shaped profile and by an upper element 52*b* rotatably mounted on the upper plate 2 of the support 1. This upper element 52*b* is provided with a lower edge whose profile is also sine shaped. A lever 57 rigid with the element 52*b* enables to drive the latter in rotation, the effect of this rotation being, owing to the sine shape of the engaging edges of the two elements 52*a* and 52*b*, to move away from or nearer to one another these two elements and therefore to move the plate 48 away from or nearer to the plate 2, against the action of the return springs 50. The actuation of the lever 57 is ensured in a known manner by stationary stops (not shown) rigid with the machine frame and placed in the path of the said lever. The actuating plate 18 and its associated elements have been omitted in FIG. 2 for the sake of clarity of the drawing.

The plate 31 for the actuation of the needles in translation is secured at its two lateral ends to a frame 60 which is rectangular in shape and is adapted to slide with respect to the support 1. The frame 60 is provided at its top with a roller 61 rolling on an actuating ramp 62 closed on itself and rigid with the machine frame. Rollers 63 secured to both ends of a cross-member 64 rigid with the slide 37 ensure the guiding of the frame 60 during its motion of vertical translation controlled by the ramp 62.

The profile of the needle actuating ramp 62 is designed so as to cause a downwards and then an upwards sliding of the needle actuating plate 31 with respect to the support 1 when the latter is in a position wherein the bottle necks are engaged in the tubular elements 5 and pressed by the toroidal springs 10, i.e. when the gripping device is in its lower position. To this end, the ramp 62 comprises a first portion 62*a* parallel to the corresponding portion 46*a* of the head-actuating ramp 46, a portion 62*b* running progressively away from the corresponding portion 46*b* of the ramp 46, a portion 62*c* which is again parallel to the corresponding portion 46*c* of the ramp 46 and lastly a portion 62*d* running progressively nearer to the corresponding portion 46*d* of the head actuating ramp 46 (see FIG. 4).

The supply of compressed-air to each of the flexible tubes 36 connected to each plate 31 is ensured by a plurality of valves 70 equal in number to the gripping devices, the said valves 70 being mounted on a rotatable support 71 driven in rotation in synchronism with the revolving assembly, this drive being ensured by a transmission chain 72 meshing with a pinion 73 solid in rotation with the driving pinions 44*a*, 44*b* of the chains of the revolving assembly.

Each valve, of a type known per se, is connected on the one hand, through the medium of an individual conduit 74*a*, to a common conduit 74 which is itself connected to a source of pressurized fluid (not shown) and on the other hand to the flexible tube 36 connected to the corresponding gripping device. The opening and closing of each valve is controlled by levers 75 secured to a core or the like 76 rigid with the plug or the like of the valve, the said levers cooperating with stationary stops 77 placed in their path.

The operation of the device is diagrammatically illustrated in FIG. 4 wherein the arrow F denotes the direction of rotation of the revolving assembly. This operation is as follows : during the rotation of the revolving assembly, the support 1 whose vertical motion is controlled by the ramp 46 performs, when the roller 45 travels along the portion 46*a* of the said ramp, a motion of downward translation under the action of gravity, until each gripping member covers the neck of a bottle R. The lever 57 thereafter meets a stationary stop (not shown) placed in its path, thus causing the rotation of the actuating member 52 and therefore a downward sliding of the plate 18 which drives the actuating tubes 12 which in their turn, through the medium of the springs 13, drive the pushers 8. Each pusher 8 sliding downwardly in the tubular element 6 pushes, owing to its bevel 9, the toroidal spring 10 which exerts a pressure on the upper end of the bottle neck and maintains the latter in position. Since the roller 61 runs along the portion 62*a* of the ramp 62 which is parallel to the portion 46*a*, there is no relative motion between the plate 31 and the support 1 and the needle 20 occupies, with respect to the gripping member, the position shown at P1 in FIG. 4.

Immediately after the pressing of the bottle necks, the roller 61 travels along the portion 62*b* of the ramp 62 diverging from the corresponding portion 46*b* of the ramp 46, so the plate 31 performs with respect to the support 1 a motion of downward translation. The plate 31 drives with it the valve body 30 as well as the needle 20, owing to the friction between the endpiece 29 and the valve body. When the tip of the needle contacts the cap O, the resistance offered to it makes the endpiece 29 slide upwardly in the valve body 30, against the frictional resistance, until the said endpiece contacts the valve seat 34 (see FIG. 1). During this relative motion of the endpiece, the finger 35 raises the ball 33 and moves it from its seat, thus enabling the conduit 32 to communicate with the needle 20. As the relative downward motion of the plate 39 continues, the needle perforates the cap and penetrates into the bottle until the sleeve portion 24 of reduced diameter bears upon the bottom of the cap. The needle then occupies the position shown at P2.

The rollers 46 and 61 then travel along the ramp portions 46*c* and 62*c* which are parallel, so that there is no motion of the needle relative to the bottle, but during this travel the arm 75*a* of the valve 70 meets the stationary stop 77*a*, so that pressurized air is admitted into the bottle (as shown at P3). After a period of time enabling the pressure within the bottle to reach the pressure in the circuit of compressed-air, which is about two bars, the lever 75*b* of the valve meets the stationary stop 77*b* (position P4) and the valve closes.

It should be noted that the portion 24 of reduced diameter of the sleeve 23 of the needle 20 maintains the caps on the bottles during the time necessary to create the required pressure.

Simultaneously with the closing of the valve, the needle actuating roller 61 reaches the portion 62*d* of the ramp 62 converging progressively towards the corresponding portion 46*d* of the actuating ramp 46. The frame 60 then slides upwardly with respect to the support 1 and drives with it the plate 31 which in turn drives the needle which frees the bottle (positions P4, P5 and P6). During this upward motion of the plate the cap O remains slipped on the needle until its flange O*a* meets the lower edge of the actuating tube 12. The needle then disengages from the cap (position P6) which falls into a tank or the like (not shown) provided to this end.

The closing of the valve is obtained during the upward motion of the needle-carrying plate by the spring 25 which contacts the collar 19 of the actuating tube 12 and moves the end-

piece 29 back to its lower position with respect to the valve body. The ball 33 returns onto its seat, thus cutting the communication between the conduit 32 and the needle 20.

It is thus seen that if the bottle has no cap thereon, the needle during its downward motion meets no resistance, so that the endpiece 29 does not contact the valve body and therefore the finger 35 does not raise the ball 33 from its seat. The admission of air into the needles is therefore controlled by the cap itself, and this enables to avoid a loss of air when no cap is present.

Of course, the invention is by no means limited to the forms of embodiment described and represented which have been given by way of example only. In particular, it comprises all the means constituting technical equivalents to the means described as well as their combinations, if the latter are carried out according to the spirit of the invention.

We claim:

1. A device for automatically gripping miscellaneous containers such as bottles having a closing cap formed with a lower hollow having a bottom wall and adapted for penetrating into the neck of the bottle and an upper annular flange member radially projecting from said hollow portion and adapted for abutting against the upper edge of said neck, comprising a support, a series of gripping members adapted to cap the necks of the bottles, each gripping member comprising a tubular element secured to said support, a resiliently deformable ring in said tubular element, said resiliently deformable ring being engageable by the neck of a bottle, a movable member overlying said ring and adapted to exert thereon a pressure causing a reduction of its diameter and extracting means for separating from a bottle neck seized by said ring the cap closing said bottle neck, said extracting means comprising a needle arranged within said tubular element and movable in translation with respect to the latter so as to penetrate into the bottle neck and to draw off said cap when moving out from said bottle neck.

2. A device according to claim 1, wherein said needle is formed with a lower tip and is provided, in proximity to said tip, with a sleeve secured to said needle and comprising at its lower end a portion whose diameter is substantially inferior to the inner diameter of said annular flange of said cap, so that the said end portion bears upon said bottom wall of the said cap during the motion of the needle towards the bottle.

3. A device according to claim 2, wherein said movable member comprises a hollow annular pusher slidably mounted in said tubular member and an actuating tube coaxial with the said tubular element and having an opened lower end, said needle and said sleeve being mounted within said actuating tube.

4. A device according to claim 3, wherein said actuating tube has an inner diameter substantially inferior to the outer diameter of said annular flange of said cap so that when the said cap driven upwardly by the said needle meets said lower edge of said actuating tube, it is stopped and therefore disengaged from the said needle.

5. A device according to claim 1, wherein the said needle is supported by a needle-carrying plate movable in translation on the said support.

6. A device according to claim 5, wherein said needle is constituted by a hollow stem, connected to a pressurized-fluid supply conduit through the medium of a valve whose opening is controlled by the position of said needle-carrying plate with respect to the said support.

7. A device according to claim 6, wherein said valve comprises a body secured to said plate and provided internally with a seat and a ball cooperating with said seat, an endpiece carrying said needle, being slidingly mounted in said valve body and being provided with a finger, said finger moving said ball from said seat when the resistance offered to the needle tip contacting the cap causes said endpiece to slide with respect to the said valve body.

8. A device according to claim 7, wherein a return spring is provided to move automatically the needle back to the position wherein the said finger frees said ball.

9. A device according to claim 5, wherein said needle-carrying plate is rigid with a frame mounted slidingly with respect to the said support.

10. An automatic handling machine for containers such as bottles comprising a frame structure, a revolving assembly supported on said frame structure, a plurality of gripping devices supported on said revolving assembly, each gripping device comprising a support secured to a slide member having a first roller, a series of gripping members adapted to cap the necks of the bottles and secured to said support, a plate secured to a frame member movable in translation on said support and having a second roller, a series of hollow needles supported on said plate, each one of said needles being mounted within each one of said gripping members, a support actuating ramp and a needle actuating ramp both mounted on said frame structure and engaged by said first and second rollers respectively, said ramp controlling the vertical motion of said support with respect to said revolving assembly and the motion of said needles with respect to said gripping members respectively.

11. A machine according to claim 10, wherein said needle actuation ramp is provided to control the downward motion of said needles while said support occupies its lower position in which said gripping members cap said bottle necks.

12. A machine according to claim 10, further comprising a plurality of compressed-air distributing valves, each connected to the gripping members of one and the same gripping device.

13. A machine according to claim 12, wherein said valves are mounted on a rotatable frame driven in synchronism with said revolving assembly.