United States Patent

[11] **3,589,103**

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[33] **Spain**
[31] **355,371 and 367,352**

[54] **MACHINES FOR UNSCREWING CAPS OR STOPPERS FROM CONTAINERS**
15 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **53/381**
[51] **Int. Cl.** **B65b 43/40**
[50] **Field of Search** ..... 53/299, 381, 381 A

[56] **References Cited**

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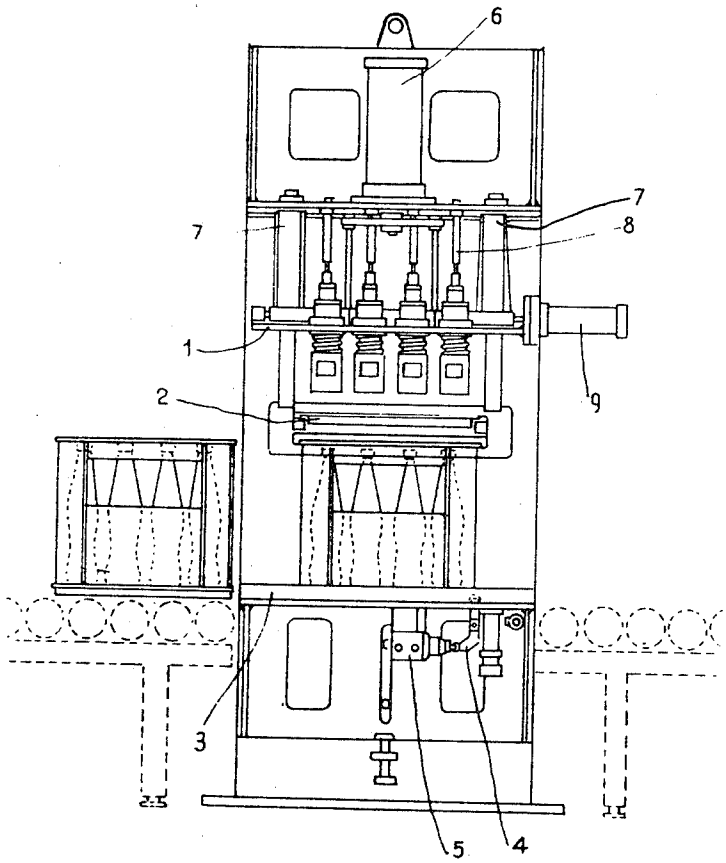
ABSTRACT: This machine includes vertically displaceable guides carrying working heads which in turn carry the unscrewing elements. All elements are automatically correlated by hydraulic or pneumatic means.



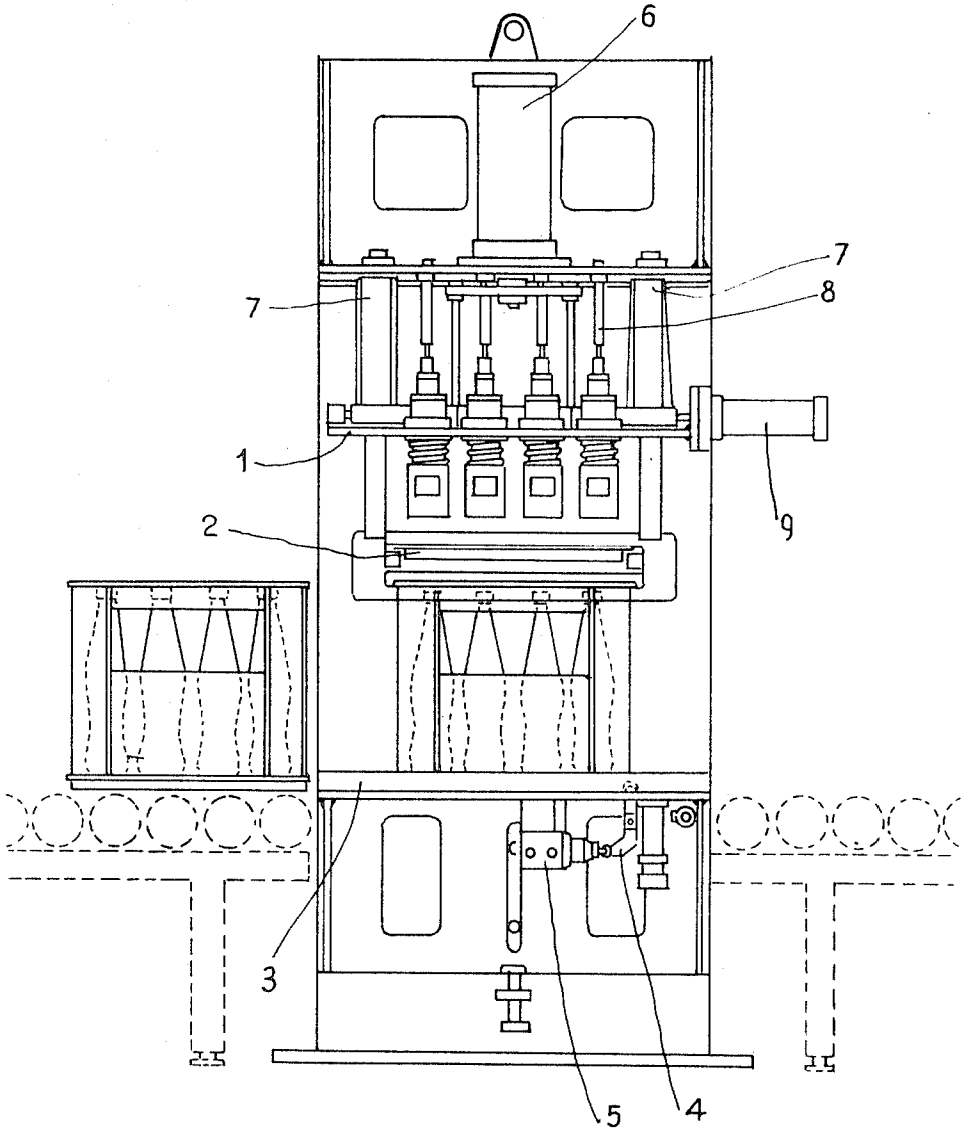


Fig. 1

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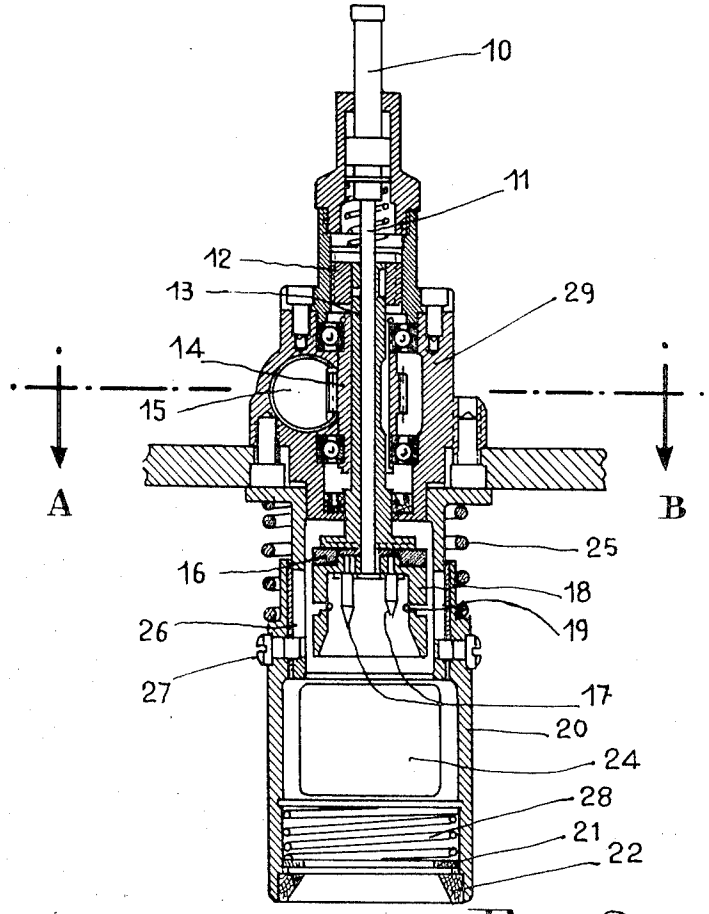

Fig: 2

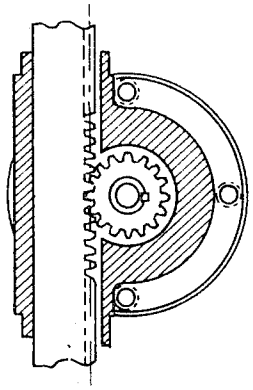

Fig: 3

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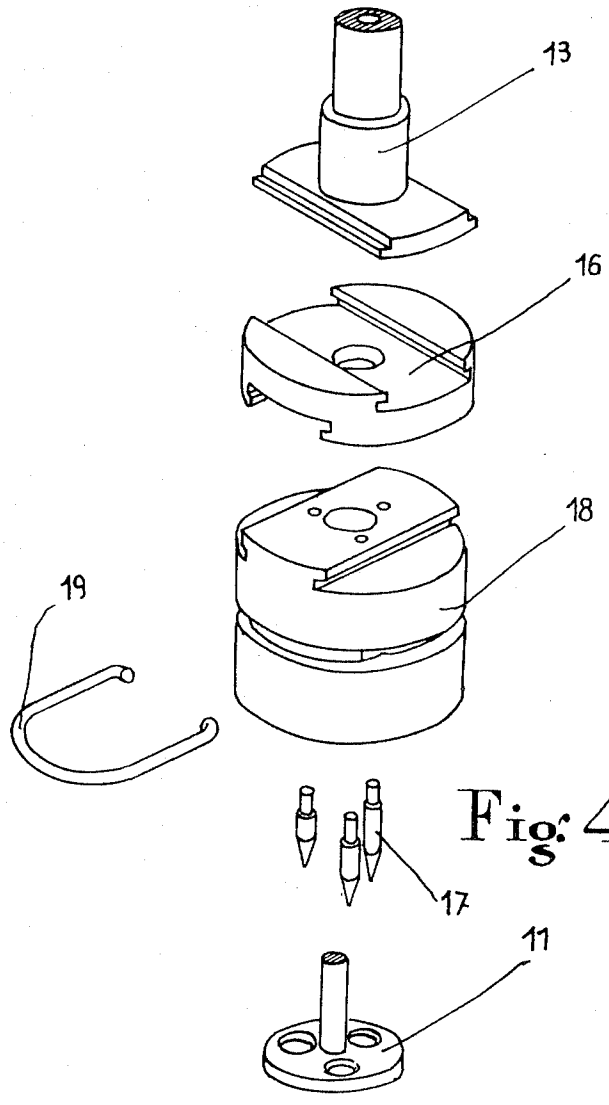

Fig. 4

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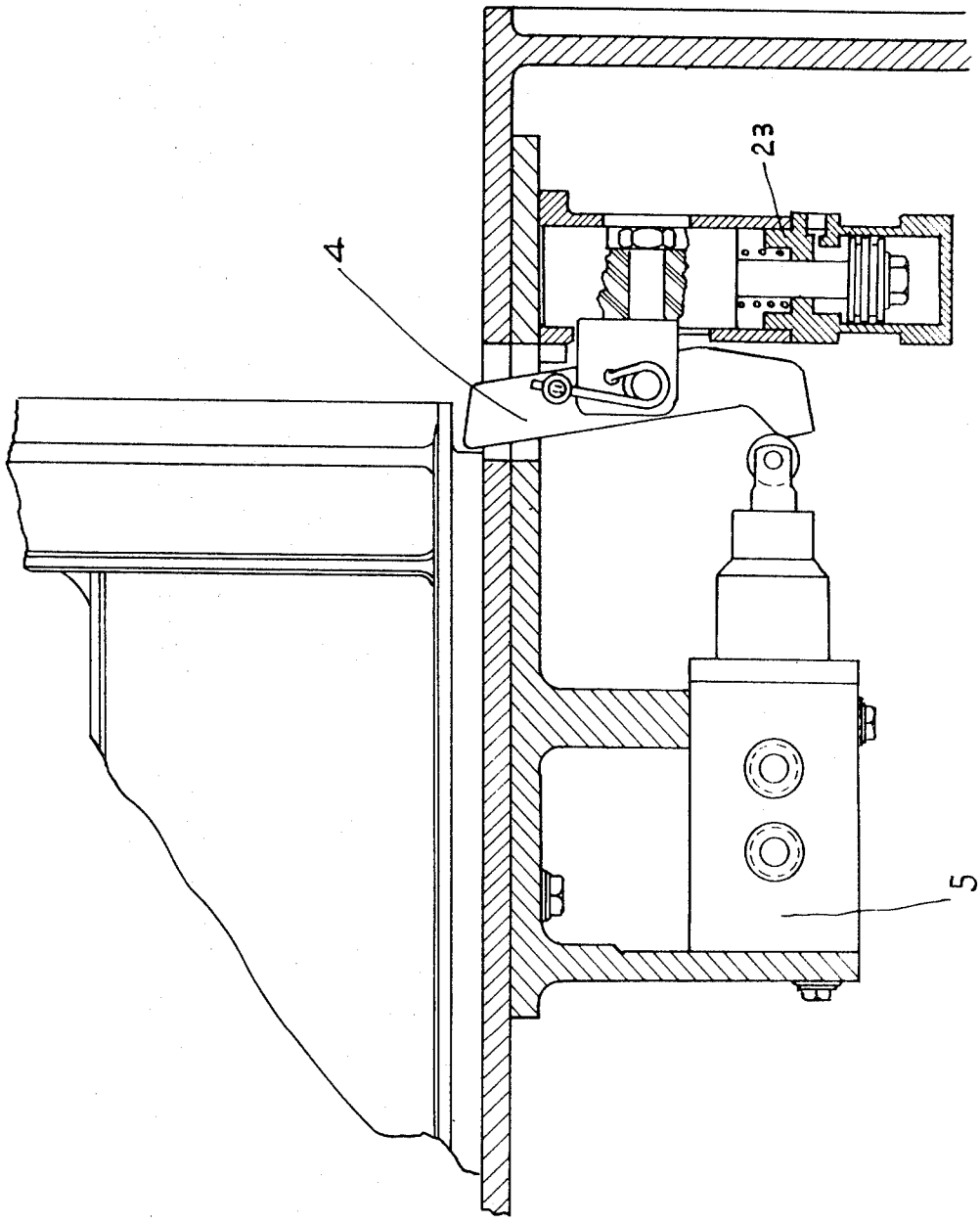

Fig. 5

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MACHINES FOR UNSCREWING CAPS OR STOPPERS FROM CONTAINERS

The present invention relates to a machine for fitting (or extracting) the screw-threaded caps or stoppers of containers, by means of a combination of two simple movements, one linear and vertical, to position and fix the container (and, in turn, its cap or stopper) and the other horizontal, this causing, inside the machine, a rotary movement of a certain number of shafts, which, guided by screw-threaded control elements equal in number to that of the containers, perform the function of fitting the caps or stoppers in the containers (or extracting them therefrom). All this takes place in this machine by means of an appropriate combination of mechanical and pneumatic elements.

The invention can be applied in fitting the caps and stoppers in or removing them from containers of various sizes, shapes etc., and any number of containers placed in a packing case can be dealt with, the same number of simultaneous operations being carried out as there are containers in the case.

The machine consists of a vertical frame which has a base for supporting the packing cases, above which base and at an appropriate distance therefrom, there is vertically displaced a plate-carrying head units and directed by means of guides and actuated by a hydraulic or pneumatic vertical cylinder, the guides and the cylinder being supported in the upper part of the frame.

In this head unit carrier, there can be fitted any desired number of extractor heads depending upon the number of containers placed in the packing case, so that the stoppers can be removed by turning without taking the containers from their cases, this constituting an important feature of this invention since, in the contrary case, if the containers had to be uncapped or unstoppered one at a time, it would be necessary to remove them from their packing cases and to execute a transfer movement from the line of cases in order to bring the containers to the machine for removing the caps or stoppers. To remove the caps or stoppers simultaneously from all the containers in a packing case, the machine can be positioned along the same line as the cases. The guides directing the carrier for the heads also contain air distribution orifices for actuating various elements at the appropriate times, in the manner to be described.

Through the body of each extractor head there extends, in the vertical direction, a hollow shaft which, at its lower end, has an extractor cup, the mouth of which faces downwards to receive the stopper located in the end of the container. At the bottom of this cup are perforating means for perforating the stopper and connecting it firmly to the shaft and extractor cup to enable it to be removed. These means are constituted by at least two rods which are of different length for the purpose of applying the perforation force in a progressive manner.

The hollow shaft of each head has a pinion which meshes with a rack actuated by a pneumatic horizontal cylinder, said rack transmitting the rotary movement of all the shafts of a row of heads parallel with the direction of movement of the packing cases in the line. The number of cylinders equals that of the rows of extractor heads, and the cylinders are actuated by fluid passing through pipes which are connected to a further common pipe, that is to say the cylinders are actuated simultaneously.

The extractor cup is connected to the shaft of the head by means of a coupling system which slides in both horizontal directions perpendicular to the axis of rotation, this enabling the axis of the extractor cup to be radially displaced relatively to the axis of the head when the axis of the container does not coincide with that of the stopper. This prevents the setting up of frictional forces which could adversely affect rotation of the shaft of the head, thus interfering with the operation of the machine.

The hollow shaft of the head contains in its interior a rod which terminates in an enlarged portion at the base of the extractor cup, which rod is moved longitudinally at the appropriate moment to eject the extracted stoppers which have been held in a bowed spring which is fitted in two opposite grooves in the cup and the arms of which project slightly from the interior walls thereof.

Downwardly of, and surrounding, the extractor cup, the head incorporates a centering sleeve having a ring of rubber or other suitable material fitted within its lower edge, which sleeve is applied to the neck of the container to hold it in the required position relatively to the extractor cup. This sleeve is resiliently connected to the body of the head so as to accommodate different lengths of container.

The centering sleeve contains a window for viewing and removing portions of material that may have broken off from the stopper, so that these cannot find their way between the extractor cup and the centering sleeve, thereby interfering with the operation of the machine.

To prevent the containers becoming jammed in the rubber ring in the centering sleeve and being lifted by the sleeve, the latter contains a stop ring which rests on a shoulder located immediately above the centering ring, this stop ring having a diameter slightly less than that of the centering ring and being urged by a spring when said centering sleeve receives the neck of a container, the stop ring pressing the container downwards when the centering sleeve begins to rise.

To enable the invention to be more readily understood, there will now be described, by way of example, an embodiment thereof with reference to the attached drawings; this embodiment is concerned with the removal of stoppers from four empty bottles contained in a case and provided with screw-threaded aluminum stoppers which are used when the bottles are full of beverage, the stoppers requiring to be extracted for washing purposes to enable the bottle to be used again, in accordance with the standards of the Spanish Food Code.

In the drawings:

FIG. 1 is a front view of the complete machine of the invention.

FIG. 2 is an axial section through one of the extractor heads, in a plane perpendicular to the direction along which the bottle cases are moved.

FIG. 3 is a cross section on the line A–B of FIG. 2.

FIG. 4 is an exploded perspective view of the coupling means which slides between the shaft of the head and the extractor cup.

FIG. 5 is a front view of the air distribution valve system, the means for locating the case, and the pneumatic cylinder for actuating said locating means.

Referring to the drawings, the case of empty bottles, moved along a roller bed automatically or by hand, reaches the receiving platform **3** and is arrested by the locating means **4**. This locating means, loaded by the case, actuates the air distributing valve **5** and this, acting upon the pneumatic cylinder **6**, causes the plate **1** carrying the heads to descend. Upon completion of the downward movement, the centering sleeves **20** center the bottles and hold them in position, and the punches **17** on the rotary shaft **13** of the head enter the stoppers and perforate them. Also, at the end of this movement, the air distributors **7** uncover appropriately situated orifices and pass compressed air to the pneumatic cylinder **9** which pushes the rack **15** and, through the agency of the pinions **14**, cause the rotary shafts to rotate to the left, and, with the punches firmly inserted in the stoppers, these shafts unscrew the stoppers from the bottles.

An annular part **12**, integral with the shaft of the head **13**, has an exterior screw thread of the same pitch as the thread of the stopper to be removed, said first thread meshing with an interior screw thread on a sleeve which surrounds it and which is fixed to the body of the head, constituting a master thread for screwing in or unscrewing the stoppers. During the unscrewing operation, the master element **12**, during rotation of the stopper, causes the rotating shaft **13** of the head to rise at the same rate as that due to the pitch of the thread on the bottle, thus facilitating the extraction operation.

When the stoppers have been unscrewed, the rack **15**, upon completing its movement, actuates a pulsing means (not illustrated) which sends compressed air to the pneumatic cylinder **23**, and the latter causes the means **4** for locating the case to descend, releasing the case for continued movement along the roller bed. When the means **4** for locating the case descends, the air distributing valve **5** which actuates the machine is enabled to return to its initial position and enables said distributor valve to send air to the lower part of the pneumatic vertical cylinder **6**, thereby raising the plate **1** carrying the heads to its initial position again. When this upward movement is completed, the air distributors **7** establish communication between orifices which pass air to the rear end of the horizontal pneumatic cylinder **9**, causing this to retract the rack **15** and causing the latter, in turn, to rotate the spindles **13** to the right, leaving the whole system in position for repeating the cycle.

Also, the rack **15**, when brought back to its initial position, ceases to actuate the air-pulsing means, the latter ceases to discharge air from the pneumatic cylinder **23** and the means **4** for locating the case again moves up into its initial position until it again receives an impulse from another case, at which moment the action of the machine begins afresh.

After having been extracted, the stoppers remain between the extractor cup and are held by the bowed spring **19** until they are expelled by the ejectors **11**, after which they are collected by the collecting tray. The mode of operation of the tray **2** for collecting the stoppers and of the ejectors **11** is as follows:

This tray is moved in and out by a pneumatic cylinder (not illustrated) which is contained inside the body of the machine. Just before completion of the upward movement of the plate **1** carrying the heads, the air distributors **7** pass air to the rear face of said pneumatic cylinder, and this causes the tray **2** to move out; following this, the stops **8** on the ejectors come into contact with the pushers **10** and these, in turn, with the ejectors **11**, the stoppers being thrown on to the tray **2** upon completion of the upward movement of the plate **1** carrying the heads. The machine then comes to a stop having completed the working cycle.

When another bottle case restarts the machine, the flow of air is reversed and air is applied to the rear face of the pneumatic cylinder which actuates the tray **2**, said tray being caused to move back before the plate **1** carrying the heads begins to descend.

FIG. **4** shows details of the sliding coupling between the shaft of the head **13** and the extractor cup **18**, use being made of an intermediate member or bridge **16** which consists of a relatively short cylinder, the upper and lower faces of which contain diametral grooves of T-shape in cross section, these grooves being disposed at an angle of 90° to each other; in these grooves move slides of complementary shape to that of the grooves, said slides being integral with the shaft of the head **13** and the extractor cup **18** respectively. The parts constituting this coupling system are made of suitable wear-resisting materials. Also in FIG. **4** can be seen the lower end of an ejector **11**, the thrust plate of which contains three orifices through which pass the pins **17** which are fitted in the base of the extractor cup. The ejector rod passes through axial orifices in the extractor cup **18** and in the bridge and over the entire length of the bore of the shaft of the head. Naturally, these axial orifices in the bridge and the extractor cup are of greater diameter than the ejector rod so as to enable these elements to be displaced radially to a small extent. For the same reason, the orifices in the ejector thrust plate are of greater diameter than the pins **17** which pass therethrough.

FIG. **2** shows the arrangement of the centering sleeve **20** in the body of the head **29**. Said body has, towards the top, a sleeve which surrounds the extractor cup and on which can be slidably adjusted the upper reduced portion of the centering sleeve **20**; surrounding the two sleeves is a spring **25** which is supported on shoulders on the body of the head and on the centering sleeve respectively, and which biases these elements away from each other. The upward and downward movements of the centering sleeve are limited by the upper and lower parts respectively of two opposite slots **26** in each of which slides a pin **27** fitted on the centering sleeve, these pins acting as stops to limit said movements.

The sleeve **20** also contains a window **24** for viewing and removing fragments which may become detached from the lower part of the stopper.

The lower part of the said sleeve **20** accommodates a stop ring **21** which, loaded by the spring **28**, pushes out the bottles upon commencement of the upward movement of the centering sleeve.

Although only one embodiment of the invention has been described, this has been done simply by way of example, and various modifications can be made to the subject matter of the invention. For example, if it is required to use the machine for fitting caps or stoppers in containers, this can be done by removing the above-mentioned punch means and replacing the ejector system and the extractor cup plus its perforating means by another system which would comprise a suitable tube within the shaft of the head and a screwing-in cup fitted thereto, a suction action on the stopper being applied through these parts for the purpose of providing the force required for the screw-in action; alternatively, a suitable resilient lining could be fitted inside the screwing-in cup, the stopper being forced into this lining under a certain pressure; finally, the extractor system could be replaced by a suitable gripper arrangement.

I claim:

1. Machine for unscrewing caps or stoppers from containers, characterized in that it comprises a plate for carrying heads and mounted, in two guides, in a manner enabling it to be vertically displaced, in which head carrier are mounted a number of working heads which, when the machine is operating, are simultaneously applied to the tops of all the containers in a packing case, without the need for removing the containers from the case, so as to disconnect the caps or stoppers therefrom, which heads each comprise a centering sleeve for facilitating their fitting to the stopper or cap, punch means located in the base of an extractor cup, open at the bottom, for attaching said stoppers or caps firmly to a mechanically actuated rotating shaft, which is contained in the interior of each head, and ejection means in the form of a longitudinally displaceable rod adapted to eject the cap or stopper when separated from the container, the machine also comprising a tray for receiving the caps or stoppers and automatically positioned below the heads when the head carrier is in its highest position, and, in the vertical guides, a hydraulic or pneumatic distributor means which correlates the movements of all the elements mentioned, actuated by hydraulic or pneumatic means, as well as automatic means for controlling the distribution of fluids, and a device for locating the packing cases in which the containers are located in a position in register with the heads.

2. Machine according to the preceding claim, characterized in that the head carrier, mounted in vertical guides, is connected to the piston rod of a vertical pneumatic cylinder which moves the head carrier from a top position to the operating position and vice versa.

3. Machine according to claim **1**, characterized in that, integral with the shaft of each head, is a pinion which meshes with a horizontal transversely positioned rack which engages the pinion of each of all the heads in a row so that the rotary movements of said shafts and punches take place simultaneously.

4. Machine according to claim **3**, characterized in that the shafts of the heads, fitted with punch means, each have at their extremities a screw-threaded part linked to a control screw fixed in the upper part of each head in such manner that when said shafts rotate, an upward or downward displacement also takes place which enables the cap or stopper to be moved away from or towards the container, according to the pitch of their screw-threaded link.

5. Machine according to claim 3, characterized in that each rack for actuating the shafts of the heads is connected to the piston rod of a horizontal pneumatic cylinder which automatically operates when its circuit is connected to the distributor means fitted in the guides of the head carrier and moving therewith, there being as many pneumatic cylinders as there are rows of heads in the head carrier, said pneumatic cylinders being connected to a common fluid supply pipe whereby they are simultaneously actuated.

6. Machine according to claim 3, characterized in that the shaft of each head is tubular and houses and acts as a guide for a rod actuated by a pneumatic means in a movement coordinated by the distributor means located in the guides of the head carrier, which rod, when downwardly displaced, ejects the cap or stopper held by the punch means.

7. Machine according to claim 1, characterized in that it comprises a tray for collecting the ejected stoppers or caps, which tray, when the head carrier reaches its highest position, is automatically located below the centering sleeves, moved by the distributor means of the guides of the head carrier.

8. Machine according to claim 1, characterized in that the guides for the linear vertical movement contain appropriately disposed orifices and passages for compressed air, so that, depending upon the position of the head carrier, the remaining movable elements are actuated in a coordinated manner when the pneumatic circuit for feeding the actuating elements is established through said distributor elements and in such manner that incorrect movements cannot occur since each of the movements depends upon the foregoing one.

9. Machine according to claim 1, characterized in that the extractor cup, which carries the punch means, can rotate eccentrically relatively to the axis of the shaft of the head, by means of a sliding link constituted by an intermediate part which consists of a vertical cylinder of relatively small length, in the upper and lower faces of which are diametral grooves of T-shaped cross section, these being opposed and forming an angle of 90° with each other and in which can move slides of complementary form to that of the grooves and solidly connected respectively to the shaft of the head and to the extractor cup.

10. Machine according to claim 1, characterized in that the

centering sleeve surrounds the lower cylindrical part of the body of the head and is telescopically slidable thereover, a spring being held between the sleeve and the body of the head, which spring biases these parts away from each other and is compressed when they move downwards, to suit possible variations in the height of the bottles.

11. Machine according to claim 1, characterized in that the centering sleeve contains in its lower inner portion a stop spring, fixed at its upper end to said sleeve and carrying at its lower end a stop ring which comes into contact with the base of the neck of the container and is compressed when the head descends, applying force to the spring, and is extended when the head moves upwards, the container being pressed downwards and prevented from being lifted.

12. Machine according to claim 1, characterized in that the centering sleeve contains a window facing the operator and enabling him to introduce his fingers to remove any fragments that may become separated from the stopper.

13. Machine according to claim 1, characterized in that the punch means consist of at least two rods of different length to enable the pressure to be applied progressively.

14. Machine according to claim 1, characterized in that the extractor cup incorporates a bowed spring which embraces the stopper and prevents it from falling, so that it may be ejected at the appropriate moment.

15. Machine according to claim 1, characterized in that it incorporates a pneumatic or hydraulic system which starts and stops the machine automatically upon commencement and completion of each working cycle, which system comprises: a receiving table; a stop for locating the packing case and situated on the receiving table; an actuating fluid distributing valve positioned below the receiving table and actuated by the above-mentioned locating stop when this is pushed by the said packing case, which distributing valve starts up the various elements of the machine, initiating the working cycle, by way of said distributor means; a pnuematic or hydraulic cylinder which contains a piston, the rod of which is connected to said locating stop and which is actuated upon completion of the working cycle so as to retract said locating stop, thereby releasing the packing case and permitting it to act upon the distributor valve, so stopping the machine.