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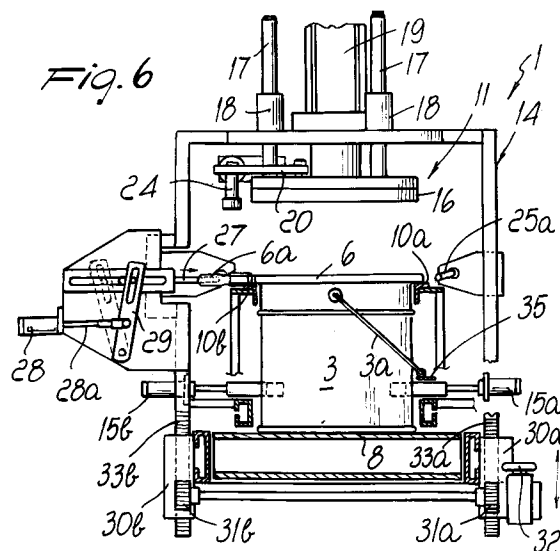
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I-20123 Milano (IT)(54) **Machine for closing drums with a lid and a lever-operated closing ring or the like.**

(57) Machine for closing drums with a lid and a lever-operated closing ring, or the like, which comprises means (8) for moving the drums along an advancement direction (4) and means (10a,10b) for supporting a lever-operated closing ring (6) in open position around a lid (7) which rests on the upper edge of one of the drums (3) on which the movement means (8) act. Along the advancement direction (4) there is a closing station (11) comprising means for stopping one of the drums (3) in the closing station (11) and means (25a,25b) for locking the closing ring. The station (11) also includes closing means (16) which can engage, when actuated, the lever (6a) of the closing ring (6) to move it from the open position to the closed position, in which the closing ring (6) engages around the lid and around the upper edge of the drum (3).

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The present invention relates to a machine for closing drums with a lid and a lever-operated closing ring or the like.

Drums are known which have a substantially cylindrical body open at its top flat surface and have, at this open flat surface, a flanged edge on which the edge of a lid rests, with the possible interposition of a sealing gasket. These drums are generally closed by using a lever-operated ring having a circular body with a substantially C-shaped radial cross-section, so as to engage below the flanged edge of the drum and above the edge of the lid. These closing rings have a discontinuity along their circumferential extension, and at this discontinuity the two portions of the ring are mutually superimposed and can slide inside one another. The end of a lever is also pivoted to one of these portions at this discontinuity, said lever being connected to the other portion by means of a link or of a pair of links, one end of which is pivoted to an intermediate portion of the lever while the opposite end is pivoted to the other portion of the ring. In open position, the lever is orientated along a direction substantially radial with respect to the ring, and its oscillation toward the ring portion to which it is pivoted is allowed only in one direction, due to the link or pair of links connecting it to the other portion, and causes the circumferential sliding of this portion along the other portion and consequently a reduction in the total diameter of the ring which closes the ring around the upper edge of the drum, rigidly coupling the lid thereto.

Drums which use a lever-operated closing ring are currently closed manually in onerous working conditions for the operators, who must keep the pace of modern filling lines in order to avoid excessively penalizing the productivity of these facilities.

The problem of fatigue combines with the problem of safety, since manual closing of the levers can cause accidental injuries to the operators.

The aim of the present invention is to solve the problems described above by providing a machine which can automatically close drums with a lid and a lever-operated closing ring, or the like.

Another object of the present invention is to provide a machine which can close drums at a working rate which allows to fully exploit the productivity of modern filling machines.

Another object of the invention is to provide a machine highly reliable in operation.

A further object of the invention is to provide a machine which can close drums having different capacities and heights.

With these and other objects in view, there is provided, according to the present invention, a machine for closing drums with a lid and a lever-operated closing ring or the like, comprising:

means for moving the drums along an advancement direction; means for supporting a closing ring in an open position around a lid which rests on the upper edge of one of the drums; a closing station comprising means for stopping one of the two drums in said closing station; means for locking said closing ring; closing means which can engage, when actuated, the lever of said closing ring to move it from the open position to said closed position, in which said closing ring engages around said lid and around the upper edge of said drum.

Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figures 1 and 2 are perspective views respectively of a drum with a lid and of a lever-operated closing ring, for which the machine according to the present invention can be used; figure 3 is a schematic lateral elevation view of the machine according to the invention; figure 4 is a partially cutout top plan view of the machine according to the invention proximate to the closing station; figure 5 is a top plan view of the machine according to the invention in the closing station, in which the closing means have been removed to illustrate the placement of a drum with its lid and closing ring in the closing station; figure 6 is a partially sectional front elevation view of the machine according to the invention, with the closing means in inactive position; figure 7 is a schematic front elevation view of the machine according to the invention, with the closing means in active position; figures 8 and 9 are schematic top plan views of the machine according to the invention, illustrating the action of the closing means on the lever of the drum closing ring.

With reference to the above figures, the machine according to the present invention, generally designated by the reference numeral 1, comprises a supporting structure 2 which supports means for moving a drum 3 along an advancement direction 4 and means 5 for supporting a closing ring 6 in open position around a lid 7 which rests on the upper edge of one of the drums 3.

More particularly, the movement means are constituted by a conveyor belt 8 which winds around rollers 9 having horizontal and mutually parallel axes and supported by the supporting structure 2. At least one of the rollers 9 is actuated so that it rotates about its own axis by virtue of known actuation means, to cause the advancement of the upper portion of the conveyor belt 8, on which the drums 3 rest, along the advancement direction 4.

The means for supporting the closing ring 6 are substantially constituted by a pair of guides 10a and 10b supported by the supporting structure 2, parallel to the advancement direction 4 and mutually spaced so that the drums 3 can advance between them. The guides 10a and 10b are arranged at a vertical level which substantially matches the level of the upper edge of the drums 3 arranged on the conveyor belt 8, so that the ring 6 arranged on said guides is correctly positioned vertically with respect to the related drum 3 and to the lid 7 which closes the drum at the top. The guides 10a and 10b extend for a certain length along the conveyor belt 8, upstream of and at a closing station, designated by the reference numeral 11, located along the conveyor belt 8.

At the closing station 11 there are means 12 for stopping the drums 3 that advance along the conveyor belt 8. Said stop means comprise two abutments 13a and 13b arranged mutually opposite along a direction which is transverse to the advancement direction 4 and can move, when actuated, along said transverse direction to engage two lateral regions of the drum 3, arranged in each instance at the closing station 11 by advancement along the direction 4, and disengage therefrom in a cyclic manner. Said abutments 13a and 13b are supported by a frame 14 and are actuated by means of a pair of fluid-driven actuators 15a and 15b, such as for example known pneumatic cylinders.

At the closing station 11 there are closing means which can engage, when actuated, the lever 6a of the closing ring 6 to move it from the open position to the closed position, in which said closing ring 6 engages around the lid 7 and around the upper edge of the drum 3.

Said closing means comprise a presser element 16 which is substantially disk-like and is supported by vertical posts 17 slideable within bushes 18 which are rigidly coupled to the frame 14 to allow the presser element 16 to pass from an inactive position, in which it is spaced upward from the lid 7 which rests on the upper edge of the drum 3 in the closing station 11, to an active position in which it acts, with a preset pressure, on the lid 7 in the direction of the underlying drum 3.

In order to move the presser element 16 from the inactive position to the active position there is a fluid-driven actuator 19, for example a pneumatic cylinder, arranged so that its axis is vertical, i.e. parallel to the extension of the guides 17, and acts on the presser element 16 with the stem of its piston.

The closing means, located at the closing station 11, also comprise an arm 20 which is pivoted, with one of its ends, to the upper face of the presser element 16 and extends, with its other end,

beyond the space occupied by the presser element 16, coaxial to the drum 3 when said drum 3 is located in the closing station 11.

The arm 20 is pivoted to the presser element 16 about an axis 21 which is parallel and spaced with respect to the axis 16a of the presser element, which as mentioned substantially coincides with the axis of the drum 3 located in the closing station 11; said pivoting axis 21 is arranged in a lateral region of the presser element with respect to the advancement direction 4. The stem 22a of a fluid-driven actuator 22, for example a pneumatic cylinder, is hinged to the other end of the arm 20 and is supported by the presser element 16 by means of an L-shaped bracket 23. The fluid-driven cylinder 22 is orientated so that its axis is parallel to the advancement direction 4, so that the actuation of said fluid-driven cylinder causes the oscillation of the arm 20 about the axis 21. On its lower face, the arm 20 has a pivot 24 which extends toward the underlying conveyor belt 8 and can engage the lever 6a of the ring 6 to move said lever from the open position to the closed position, as will become apparent hereinafter.

At the closing station 11 there are also means for locking the ring 6, substantially constituted by a pair of presser elements 25a and 25b arranged symmetrically with respect to a median plane of the drum 3 arranged at the closing station 11 and parallel to the advancement direction 4.

More particularly, the pair of presser elements 25a and 25b faces two opposite lateral regions of the half-ring directed toward the advancement direction 4. The pair of presser elements can be moved, when actuated, along directions which are radial with respect to the closing ring 6, so as to apply on said ring two forces orientated toward the axis of the closing ring 6 and with mutually opposite components, so as to lock the rotation of the closing ring 6 and the movement thereof along its plane of arrangement. The pair of presser elements 25a and 25b, too, is actuated by means of fluid-driven actuators, for example pneumatic cylinders 26a and 26b mounted on the frame 14.

Proximate to the closing station 11 there are means for positioning the closing lever 6a of the closing ring 6 in such a position that it can be engaged by the pivot 24 of the arm 20. Said positioning means comprise a rod 27 orientated transversely to the advancement direction 4 and facing the region of the presser element 16 to which the arm 20 is pivoted. The rod 27 is slideably supported along its axis by the frame 14 and can move, when actuated, along its longitudinal axis from an inactive position, in which it does not interfere with the lever 6a of the ring 6, to an active position in which it retains the lever 6a of the closing ring 6 at the arm 20 of the closing means.

Movement of the lever 27 from the inactive position to the active position and vice versa is obtained by virtue of a fluid-driven actuator, for example a pneumatic cylinder 28, which is supported by the frame 14 and acts with the stem 28a of its piston on the rod 27 by means of an oscillating lever 29.

As mentioned above, the closing means, the means for supporting the closing ring and the means for locking the closing ring are associated with a bridge-like frame 14 slideably mounted on a pair of vertical guides 30a and 30b arranged laterally on opposite sides with respect to the conveyor belt 8. The frame 14 can move, when actuated, along the vertical guides 30a and 30b in a per se known manner, for example by means of a pair of gears 31a and 31b supported by the guides 30a and 30b, actuatable by means of an actuation handwheel 32, and meshing with racks 33a and 33b which are rigidly coupled to the uprights of the frame 14 so as to adapt the position of the various elements arranged in the closing station 11 to the height of the drums 3.

For the sake of completeness in description, it should be noted that along the extension of the conveyor belt 8 there is a lateral support 35 for the handle 3a of the drum 3.

The operation of the machine according to the present invention is as follows.

The drums 3, once they exit from a filling machine, are placed on the conveyor belt 8 and advance on said conveyor belt along the direction 4. Upstream of the closing station 11, an operator places the closing ring 6 around the upper edge of the drum 3, which already has the lid 7. The operator rests the closing ring 6 on the two guides 10a and 10b, making sure to arrange the lever 6a in an open position and to orientate it transversely to the advancement direction 4. In practice, the lever 6a is orientated toward the part of the machine provided with the rod 27, moved beforehand into its active position.

The drum 3 advances along the direction 4, moving the closing ring 6 which, by virtue of this advancement, engages against the lever 27 with its lever 6a. The combined action of the lever 27 and of the advancement of the closing ring 6 causes the correct placement of the closing ring 6 around the axis of the drum. When the drum arrives at the closing station 11, the abutments 13a and 13b are actuated, stopping the drum in the correct position with respect to the overlying presser element 16. At this point the pneumatic cylinder 19 is actuated, lowering the presser element 16 onto the lid 7 and applying on said lid a pressure calibrated so that the compound or sealing element interposed between the lid and the drum assumes the correct shape. At the same time, the pair of presser elements 25a and 25b is actuated and, by pressing on

the half of the closing ring 6 which faces the advancement direction 4, prevents the closing ring 6 from rotating about its own axis or from moving in the horizontal plane where it is arranged.

At this point, the rod 27 is disengaged from the closing lever 6a and the pneumatic cylinder 22 is actuated, causing the oscillation of the arm 20 about the axis 21. Due to this oscillation, the pivot 24 engages against the outer side of the lever 6a and follows a curved path which progressively approaches the perimeter of the closing ring 6, closing the lever 6a against the ring 6. Closure of the lever 6a reduces the total diameter of the closing ring 6 and thus closes the ring 6 around the upper edge of the drum 3 and around the lid 7.

The arm 20 is then returned to its initial position, and the presser element 16 is raised above the closed drum, whereas the pair of abutments 13a and 13b is disengaged from the drum and the pair 25a and 25b is disengaged from the ring 6, which is by then closed, so that the drum 3 can continue its advancement toward a downstream packaging station.

At this point the closing cycle resumes for a subsequent drum.

In practice it has been observed that the machine according to the present invention fully achieves the intended aim, since by eliminating direct manual intervention on the lever of the closing ring it makes the working conditions less onerous for the operators and at the same time allows to achieve significantly higher production rates than those allowed by a manual closure of the ring.

The machine thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements and the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Machine for closing drums with a lid and a lever-operated closing ring or the like, comprising: means (8,9) for moving the drums (3) along an advancement direction (4); means (10a,10b) for supporting a closing ring (6) in an open position around a lid (7) which rests on

the upper edge of one of the drums (3); a closing station (11) comprising means (12) for stopping one of said drums (3) in said closing station (11); means (25a,25b) for locking said closing ring (6); and closing means (16) which can engage, when actuated, the lever (6a) of said closing ring (6) to move it from the open position to the closed position, in which said closing ring (6) engages around said lid (7) and around the upper edge of said drum (3).

2. Machine according to claim 1, characterized in that said closing means comprise a presser element (16) which can move, when actuated, along a substantially vertical direction from an inactive position, in which said presser element (16) is spaced upward from the lid (7) which rests on the upper edge of the drum (3), to an active position, in which said presser element (16) acts with a preset pressure on said lid (7) in the direction of the underlying drum (3).

3. Machine according to claims 1 and 2, characterized in that said closing means comprise an arm (20) which is pivoted, with one of its ends, to said presser element (16) about an axis substantially parallel to, and spaced from, the axis of said drum (3) located in said closing station (11), said arm (20) protruding with its other end laterally beyond the space occupied by said closing ring (6) and being able to oscillate, when actuated, about its pivoting axis with respect to said presser element (16) to act, with one of its portions, on the lever (6a) of said closing ring (6) to move it from the open position to the closed position.

4. Machine according to one or more of the preceding claims, characterized in that said stopping means (12) comprise two oppositely arranged abutments (13a,13b) which can move, when actuated, transversely to said advancement direction (4) to engage against two portions of the lateral surface of the drum (3).

5. Machine according to one or more of the preceding claims, characterized in that said locking means comprise at least one pair of presser elements (25a,25b) which are arranged laterally to said closing ring (6) and can engage, when actuated, two portions of said closing ring (6) mutually spaced around the axis of the closing ring (6), said pair of presser elements (25a,25b) acting on said closing ring (6) with forces directed toward the axis of said closing ring (6) and with mutually opposite components to lock the rotation and translatory motion of said closing ring (6) in its plane of

arrangement.

6. Machine according to one or more of the preceding claims, characterized in that it comprises means (27) for arranging the closing lever (6a) of said closing ring (6) in a position suitable to be engaged by said arm (20) of the closing means (16), said positioning means (27) being controllably disengageable from said closing lever (6a) when said arm (20) is actuated.

7. Machine according to one or more of the preceding claims, characterized in that said positioning means (27) comprise a rod which is arranged substantially transversely to said advancement direction (4) and can move, when actuated, along its longitudinal axis from an inactive position, in which it does not interfere with the lever (6a) of said closing ring (6), to an active position, in which it retains said lever (6a) of the closing ring (6) at said arm (20) of the closing means (16).

8. Machine according to one or more of the preceding claims, characterized in that said closing means (16), said means (10a,10b) for supporting the closing ring (6) and said means (25a,25b) for locking the closing ring (6) can be adjusted along a substantially vertical direction according to the height of the drum (3).

9. Machine according to one or more of the preceding claims, characterized in that said means (8) for moving the drums are constituted by a conveyor belt.

