

CORKSCREW DEVICE

The invention relates to a corkscrew device comprising a corkscrew spiral, a sleeve which is coaxial with the corkscrew spiral and which is constructed to cooperate with the neck of a bottle, an electric motor and means which are driven by the motor via a reduction gear and which are operable by rotation in one direction to screw the corkscrew spiral into a cork in the neck of the bottle and then to draw the cork from the bottle without the direction of rotation of the drive being reversed.

Such a corkscrew device is disclosed in DE-OS 30 37 785. This known device comprises a d.c. motor powered by replaceable or rechargeable batteries. Since a comparatively high power may be required for removing a cork from a bottle, the batteries are drained fairly rapidly and have to be frequently replaced or recharged, which renders the use of such a corkscrew device rather expensive. Moreover, corkscrew devices should be easy to handle, which means that their dimensions should be as small as possible.

According to the invention there is provided a corkscrew device comprising a corkscrew spiral, a sleeve which is coaxial with the corkscrew spiral and which is constructed to cooperate with the neck of a bottle, an electric motor and means which are driven by the motor via a reduction gear and which are operable by rotation in one direction to screw the corkscrew spiral into a cork in the neck of the bottle and then to draw the cork from the bottle without the direction of rotation of the drive being reversed, wherein the electric motor is a self-starting two-pole single-phase synchronous motor with a diametrically magnetized permanent-magnet rotor whose direction of rotation is determined by a unidirectional latch which is operable to block rotation of the motor in one direction and permit rotation in the other direction, and wherein the reduction gear is constructed to provide a reduction ratio in the range of from 60:1 to 100:1.

The use of a single-phase synchronous motor permits a compact construction of the corkscrew device while at the same time providing a powerful drive for the corkscrew spiral since such a

motor can produce a comparatively high power even if it has small dimensions. The selected reduction ratio of the reduction gear converts this power into the force necessary for a correct removal of a cork from the neck of a bottle. A similar reduction in size cannot be achieved with mains-powered a.c. motors having the same power rating but operating on a different principle, such as, for example, induction motors.

The unidirectional latch which determines the desired direction of rotation of the single-phase synchronous motor may have a construction which is known per se. For example, the unidirectional latch may cooperate directly with the motor shaft and may be constructed to form a unit with the motor. It is found to be very advantageous if the unidirectional latch cooperates with a rotary element of the reduction gear which is arranged to be driven by the motor with an integral reduction ratio. A unidirectional latch which cooperates with an element of the reduction gear may have a simple construction, and its cooperation with an element of the reduction gear which is driven by the motor with an integral reduction ratio ensures in a simple manner that the single-phase synchronous motor always starts from the same predetermined position, which is important since reliable starting of a single-phase synchronous motor is guaranteed only under the starting conditions for which it has been designed.

With the known corkscrew device referred to above a drawn cork can be removed from the corkscrew spiral only by turning the cork by hand. In this respect the use of a single-phase synchronous motor has a further advantage if the unidirectional latch can be set to block rotation of the motor in either direction selectively and permit rotation in the other direction. When the cork has been drawn the unidirectional latch can now be switched over to reverse the direction of rotation of the corkscrew spiral, so that simply by holding the cork the corkscrew spiral can be unscrewed from the cork. In one embodiment of the invention which provides this facility, the unidirectional latch comprises a spring-loaded pawl which is slidably engageable selectively with one or the other of

two tracks which are formed on said rotary element of the reduction gear and of which one is concavely curved about the axis of rotation of said rotary element concentrically therewith and is formed with a radially inwardly projecting stop for cooperation with the pawl and the other is convexly curved about said axis of rotation concentrically therewith and is formed with a radially outwardly projecting stop for cooperation with the pawl, the two stops being so arranged that one stop is cooperable with the pawl to block rotation of said rotary element in one direction and permit rotation in the other direction and the other stop is cooperable with the pawl to block rotation of said rotary element in said other direction and permit rotation in said one direction.

The spring-loading of the pawl may be provided by a leaf spring of which one end is connected to the pawl near the pivotal axis thereof and the other end bears against a stationary part of the corkscrew device, and the pawl may be rotatable by means of an actuating member between a position in which it slidably engages one of the tracks on said rotary element and a position in which it slidably engages the other track, the actuating member comprising a slide which is movable from a rest position to an operating position and during this movement presses against said other end of the leaf spring to rotate the pawl from one of said positions to the other.

The pawl and the leaf spring may be formed integrally from a plastics material.

Preferably, the pawl is resilient in a direction passing through the pivotal axis of the pawl and through a part of the pawl with which the pawl cooperates with said stops. This ensures that the reduction gear is not subjected to excessive shocks by the operation of the unidirectional latch.

There are various ways of obtaining this resilience of the pawl. In one simple and reliable construction the pawl consists of an endless strip having approximately the shape of a figure eight. A pawl of this shape can be manufactured as a plastics component.

In order to minimize the power consumption of the single-phase

synchronous motor the manner in which the corkscrew spiral is driven is very important. In this respect it is found to be very advantageous if the means which are driven by the motor via the reduction gear comprise a lead-screw which is connected at one end to the corkscrew spiral coaxially therewith and on which a lead-screw nut is arranged, the direction of the thread of the lead-screw being opposite to the direction of the corkscrew spiral, and said sleeve being slidably axially on the lead-screw and the ends of the sleeve and the lead-screw nut which face one another having cooperating abutment surfaces through which, when the sleeve is cooperating with the neck of the bottle and the lead-screw is rotating in said one direction and has screwed the corkscrew spiral into the cork in the neck of the bottle, the nut is held by means of the sleeve against rotation so that by reaction from the nut the rotating lead-screw is moved axially away from the neck of the bottle to draw the cork from the bottle.

Preferably, one of the two abutment surfaces is provided with a friction coating. As a result of this, an improved frictional engagement between the two surfaces is obtained to hold the lead-screw nut against rotation with the lead-screw when the corkscrew spiral has been screwed into the cork. In this respect it is also found to be advantageous if the other of the two of the two abutment surfaces is profiled. This further improves the frictional cooperation between the sleeve and the lead-screw nut. Various profiles are suitable, for example, ribbed profiles.

The two abutment surfaces may be frusto-conical, preferably with an apical angle in the region of 120° , one surface having a concave curvature and the other a convex curvature about the axis of the lead-screw nut and the sleeve. This further ensures a reliable cooperation between the sleeve and the lead-screw nut. The sleeve may be provided with a ring of an elastomeric material for cooperation with the neck of the bottle. The resulting increase in friction between the sleeve and bottle neck ensures that the sleeve and hence the lead-screw nut cannot rotate when the axial movement of the lead-screw is required for pulling the cork from the

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bottle.

5 The thread of the lead-screw may comprise two or more turns and have a pitch of from 6 mm to 10 mm. This will produce the necessary axial movement of the lead-screw to pull the cork from the neck of the bottle and furthermore requires minimal power for this operation.

10 In one embodiment of the invention a helical spring which is coaxial with and surrounds the lead-screw urges the lead-screw nut towards a stop which is situated at that end of the lead-screw which is remote from the corkscrew spiral. When the cork has been drawn from the bottle the lead-screw nut returns to its initial position under the influence of the helical spring.

15 Preferably, a helical spring which is arranged between the sleeve and the lead-screw nut and which is coaxial with and surrounds the lead-screw urges the sleeve towards the corkscrew spiral. This ensures that the sleeve has a well-defined initial position in which it surrounds the corkscrew spiral to protect it from damage.

20 The sleeve may be made of a transparent material. Since the sleeve surrounds the corkscrew spiral in the initial position the use of a transparent sleeve makes it easier to centre the tip of the corkscrew spiral on a cork and also enables the user to observe the spiral as it is being screwed into the cork.

25 The power of the single-phase synchronous motor may be reduced if a disengageable coupling is arranged between the corkscrew spiral and the lead-screw to transmit the rotation of the lead-screw to the corkscrew spiral, which coupling is disengaged automatically by the axial movement of the lead-screw to draw the cork from the bottle. Since the corkscrew spiral thus ceases to be rotated when the cork is being drawn from the bottle, the cork is not rotated inside the neck of the bottle, which would require a substantial amount of power, which is thus saved.

30 Various forms of coupling which are known per se may be used. In one embodiment of the invention the corkscrew spiral has a cylindrical shank which is capable of limited sliding movement in

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an axial bore in the lead-screw and which is acted on by a helical spring in the bore to urge the corkscrew spiral axially towards the lead-screw, and the disengageable coupling comprises radial projections on the shank of the corkscrew spiral and radial grooves in the end face of the lead-screw which is adjacent the corkscrew spiral, the projections being engageable in the grooves under the action of said helical spring on the shank of the corkscrew spiral so as to couple the spiral to the lead-screw for rotation therewith, and being disengageable from the grooves by said axial displacement of the lead-screw.

To facilitate the engagement of the projections in the grooves, the grooves preferably have inclined side walls which converge towards the bottoms of the grooves.

Embodiments of the invention will now be described in more detail, by way of example, with reference to the accompanying drawings in which

Fig. 1 is a longitudinal sectional view of a corkscrew device according to one embodiment of the invention, and

Fig. 2 is a transverse sectional view of another embodiment having a reversible unidirectional latch.

In the corkscrew device shown in Fig. 1 two mounting plates 2 and 3 are spaced from each other inside a housing 1. One side of the mounting plate 2 carries a self-starting two-pole single-phase synchronous motor 4 which in the customary manner comprises a U-shaped stator 6 provided with an exciter coil 5 and a cylindrical rotor 7. This diametrically magnetized rotor 7 is made of a permanent magnet material and is arranged between the end portions of the two limbs of the stator 6, which end portions constitute polepieces, for which purpose the motor shaft 8, which is connected to the rotor, is journaled in two bearing plates 9 and 10, the free end of the motor shaft 8 extending through a hole in the mounting plate 2. Such a single-phase synchronous motor of comparatively small dimensions is capable of delivering a comparatively high power, so that it is very suitable for driving a corkscrew.

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A reduction gear 11, which in the present case is constructed as a four-stage gearbox, is arranged between the two mounting plates 2 and 3. This gearbox comprises a first pinion 12 which is fixed on the free end of the motor shaft and which meshes with a first gear wheel 13 which is journaled on a shaft 14 supported in the two mounting plates 2 and 3 and which is rigidly connected to a second pinion 15. This second pinion 15 meshes with a second gear wheel 16 which is journaled on a second shaft 17 which in turn is mounted for rotation in the mounting plates 2 and 3. The second gear wheel 16 is rigidly connected to a third pinion 18 which meshes with a third gear wheel 19 which is journaled on the shaft 14 and which is rigidly connected to a fourth pinion 20. This fourth pinion meshes with a fourth gear wheel 21 which is fixed on the shaft 17. In this way the motor 4 drives the shaft 17 with a reduction ratio determined by the reduction gear 11. It is obvious that the reduction gear may be constructed differently, for example as a planetary gearbox or as a combination of different gear mechanisms.

Since a single-phase synchronous motor starts in a random direction of rotation, a unidirectional latch 22, which ensures that the motor rotates in only one of the two directions, is arranged at the output side of the motor. Such unidirectional latches are known in many different versions and may, for example, cooperate directly with the motor shaft. In the present example the unidirectional latch cooperates with an element of the reduction gear 11, namely with the first gear wheel 13 which for this purpose comprises an eccentric projection 23. The unidirectional latch itself comprises a pawl 24 which is pivotally mounted on a fixed shaft 25 supported in the mounting plates 2 and 3 and which is urged against a stop by means of a spring. The spring and the stop are not shown in the drawing. In the desired direction of rotation the pawl 24 is lifted off the stop against the action of the spring by the projection 23 on the gear wheel 13 so that the projection 23 can move past the pawl 24, whilst in the other direction of rotation the pawl 24 held by the stop and acts as an abutment for the projection 23 so that the latter cannot move

past the pawl 24 and the gear wheel 13 is prohibited from further movement in this direction of rotation, as a result of which the motor 4 automatically reverses to start in the desired direction of rotation. The reduction ratio obtained between the pinion 12 and the gear wheel 13 is an integral ratio, for example 5:1, which ensures that the unidirectional latch 22 always causes the rotor 7 to stop in the same position relative to the stator, which position has been so selected that starting is guaranteed, which is generally achieved by a suitable construction of the stator polepieces which surround the rotor. In this way it is ensured that the motor 4 is always started in the desired direction of rotation.

A lead-screw 27 formed with an axial bore 26 is rigidly connected at one end to the shaft 17 and is connected at the other end to a corkscrew spiral 29 via a disengageable coupling 28, the lead-screw and the corkscrew spiral being coaxial with one another. The direction of the thread of the lead-screw is opposite to the direction of the corkscrew spiral. In order to convert the power delivered by the single-phase synchronous motor 4 into a force which ensures a correct removal of a cork from a bottle, for which the lead-screw 27 must be driven at a speed such that the corkscrew spiral 29 is screwed correctly into the cork and the cork is also drawn correctly from the neck of the bottle, the reduction gear 11 is given a reduction ratio in the range from 60:1 to 100:1, for example 70:1, in which case a motor power of approximately 10 W is adequate, enabling a single-phase synchronous motor of comparatively small dimensions to be used.

A lead-screw nut 30 is arranged on the lead-screw 27 and a sleeve 31 which is constructed to cooperate with the neck of a bottle is arranged on the lead-screw, or an extension thereof, in such a way that it cannot become detached from the lead-screw but is freely slidable thereon. The ends of the lead-screw nut 30 and the sleeve 31 which face one another are formed with cooperable abutment surfaces 32 and 33, respectively, the abutment surface 32 of the lead-screw nut 30 being provided with a friction coating 34

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and the abutment surface 33 of the sleeve 31 being profiled, for which purpose the surface 33 comprises a plurality of wedge-shaped radial ribs 35 distributed around the axis of the sleeve. Further, the two abutment surfaces 32 and 33 are frusto-conical with an apical angle in the region of 120° and have a concave curvature and a convex curvature respectively about the axis of the nut 30 and the sleeve 31, which are coaxial with one another. For its cooperation with the neck of a bottle the sleeve 31 is provided at its open end with a ring 36 of an elastomeric material. In order to guarantee a satisfactory power transmission between the lead-screw 27 and the lead-screw nut 30 the thread of the lead-screw suitably comprises a plurality of turns, for example three, with a pitch in the range of from 6 mm to 10 mm, for example 9 mm. For the corkscrew spiral 29 a pitch of approximately 10 mm has been found to be effective with a spiral diameter of approximately 8 mm.

At the end of the lead-screw 27 which is adjacent the reduction gear 11 there is provided a stop 37 constituted by a disc with a hub-like portion with which it is rigidly mounted on the lead-screw 27 and/or the shaft 17. Further, a helical tension spring 38 which is coaxial with and surrounds the lead-screw 27 is connected at one end to the stop 37 and the other end of the lead-screw nut 30 to urge the lead-screw nut 30 towards the stop 37. A helical compression spring 39 which is arranged between the lead-screw nut 30 and the sleeve 31 and which is coaxial with and surrounds the lead-screw 27, urges the sleeve 31 towards the corkscrew spiral 29 to a position in which it bears against a flange 40 connected to the corkscrew spiral 29. In this way the spring 38 biases the lead-screw nut 30 into an initial position on the lead-screw 27 adjacent the end thereof which is remote from the corkscrew spiral 29, and the spring 39 biases the sleeve 31 into an initial position in which it surrounds the corkscrew spiral 29. The sleeve may be made of a transparent material so that the corkscrew spiral 29 is visible when it is being centred on a cork and then when it is being screwed into the cork, but this can also

be achieved by means of cut-outs in the sleeve.

In order to form the disengageable coupling 28 the corkscrew spiral 29 is provided with a cylindrical shank 41 which is capable of limited sliding movement in the axial bore 26 in the lead-screw 27. A helical compression spring 42 is arranged in the bore 26, one end of the spring acting against a shoulder in the bore and the other end acting against a nut 43 on the end of the shank 41 remote from the corkscrew spiral 29, so that the spring 42 urges the corkscrew spiral towards the lead-screw. The coupling 28 comprises a pin 44 which extends radially through, and projects from opposite sides of, the shank 41 and which is engageable under the influence of the spring 42 in two diametrically aligned radial grooves 45 in the annular end face of the lead-screw 27 adjacent the corkscrew spiral 29. When the pin 44 is engaged in the grooves 45 the corkscrew spiral 29 is coupled to the lead-screw 27, so that rotation of the lead-screw 27 is transmitted to the corkscrew spiral 29. If the corkscrew spiral 29 is subjected to a force which is directed axially of the spiral towards its free end, the pin 44 is disengaged from the grooves 45 in the lead-screw 27 against the action of the spring 42, so that the coupling is disengaged automatically and rotation of the lead-screw 27 is no longer transmitted to the corkscrew spiral 29. If this force ceases, the helical spring 42 again urges the pin 44 into the grooves 45, so that the coupling is restored. The grooves 45 have inclined side walls which converge towards the bottom of the grooves, i.e., in the upward direction as viewed in Fig. 1, to facilitate the engagement of the pin 44 in the grooves 45.

The corkscrew device operates as follows. The tip of the corkscrew spiral 29 is centred on the cork which is to be drawn, with the ring 36 in the sleeve 31 bearing on the top of the neck of the bottle. The motor 4 is then switched on, so that the lead-screw 27 begins to rotate and its rotation is transmitted by the coupling 28 to the corkscrew spiral 29, which is thereby screwed into the cork. The latch 22 ensures that the motor rotates in a direction such that the corkscrew spiral is screwed in. As

the corkscrew spiral 29 is screwed into the cork the lead-screw nut 30, turning with the lead-screw 27, moves axially with the lead-screw towards the sleeve 31 against the action of the spring 39, the housing 1 at the same time moving down over the sleeve, until the friction coating 34 on the abutment surface 32 of the lead-screw nut 30 engages the ribs 35 on the abutment surface 33 of the sleeve 31, as a result of which the lead-screw nut 30 is held frictionally by the sleeve 31 against rotation. The sleeve 31 itself cannot rotate because of its frictional cooperation with the neck of the bottle via the elastomeric ring 36. Since the lead-screw nut 30 cannot now rotate and the rotation of the lead-screw 27 continues, an axial force is exerted on the lead-screw in the upward direction away from the corkscrew spiral 29, which force is transmitted to the spiral 29 through the spring 42 and the shank 41 so that the corkscrew spiral 29 pulls at the cork. The pin 44 in the shank 41 is now disengaged from the grooves 45 in the end face of the lead-screw 27 against the action of the spring 42 by the reaction force from the cork in the neck of the bottle, so that the coupling 28 is disengaged and rotation is no longer transmitted to the corkscrew spiral 29. As the upward axial force on the lead-screw 27 increases, the lead-screw moves upwards through the lead-screw nut 30 against the action of the helical spring 38, pulling the corkscrew spiral 29 with it to draw the cork from the bottle. When the cork leaves the bottle the force is interrupted. Under the influence of the helical spring 38 was extended by the upward movement of the lead-screw 27 relative to the lead-screw nut 30 and at the same time partially unwound by the rotation of the stop 37 with the lead-screw 27 during the upward movement thereof, the lead-screw nut 30 is returned along the lead-screw 27 to its initial position. Also, the spring 42 pulls the pin 44 in the shank 41 into engagement again with the grooves 45 in the lead-screw 27, so that the coupling 28 between the lead-screw and the corkscrew spiral 29 is restored. After this, the cork can be removed from the corkscrew spiral 29 by hand.

It will be appreciated that for a correct drawing of a cork

from a bottle it is important that during this operation the lead-screw nut 30 is held correctly by the sleeve 31 in order to ensure that the force required for drawing the cork is built-up correctly. In the present embodiment this is achieved by the shape of the abutment surfaces 32 and 33 on the lead-screw nut 30 and the sleeve 31 respectively, by the friction coating 34 on the abutment surface 32, by the ribs 35 on the abutment surface 33 and by the elastomeric ring 36 in the sleeve 31. The disengageable coupling 28 between the lead-screw 27 and the corkscrew spiral 29 is also important because during the drawing of a cork from a bottle the disengagement of the coupling ensures that rotation of the corkscrew spiral 29 does not continue so that the cork is not rotated inside the neck of the bottle, which saves a substantial amount of power and is therefore important in respect of the dimensioning of the single-phase synchronous motor.

The removal of the drawn cork from the corkscrew spiral can also be effected automatically if the corkscrew spiral can also be driven in a direction opposite to that in which it was driven to screw it into the cork, so that the cork merely has to be held against turning while the corkscrew spiral is unscrewed from the cork. This can be achieved by the use of a unidirectional latch whose blocking direction is reversible. Fig. 2 shows such a reversible unidirectional latch 22, which again cooperates with an element of the reduction gear 11 which has an integral reduction ratio in order to ensure that the rotor of the single-phase synchronous motor 4 is always stopped in the position in which it can start correctly. In Fig. 2 the reduction gear 11 comprises a pinion 12 which cooperates with a gear wheel 13, the pinion 12 being driven by the motor 4 and the rotation being transmitted to a further stage of the reduction gear 11 by the gear wheel 13. This gear wheel 13 cooperates with the unidirectional latch 22. This unidirectional latch is constructed by forming on one side of the gear wheel 13 radially spaced concavely and convexly curved tracks 46 and 47, respectively, which are concentric with the gear wheel 13 and of which the outer track 46 is formed with a radially

inwardly projecting stop 48 and the inner track 47 is formed with a radially outwardly projecting stop 49, the stops being so arranged that one is operative in one direction of the gear wheel 13 and the other stop in the opposite direction. The two curved tracks 46 and 47 may be constituted by the side walls of an annular groove in the side of the gear wheel 13 or by side walls of annular raised portions on the side of the gear wheel 13. The latch further comprises a spring-loaded pawl 51 which is pivotable about a spindle 50 and comprises a projection 52 which lies between the two tracks 46 and 47 and which is slidably engageable selectively with one or the other of the two tracks. In the present example the spring loading of the pawl 51 is provided by a leaf spring 53 of which one end 54 is connected to the pawl 51 near the pivotal axis thereof and the other end 55 bears against a stationary part of the corkscrew device, in the present case the housing 1. In the present example the pawl 51 and the leaf spring 53 are formed integrally as a single plastics component. The leaf spring 53 is arranged to urge the projection 52 on the pawl 51 against the inner curved track 47.

If the gear wheel 13 is driven in a clockwise direction as viewed in Fig. 2, the stop 49 on the track 47 cooperates with the projection 52 of the pawl 51 to prohibit rotation of the gear wheel 13 in this direction, as a result of which the direction of rotation of the single-phase synchronous motor is reversed automatically and the gear wheel 13 is now driven in the anti-clockwise direction. In this direction of rotation the track 47 lifts the projection 52 of the pawl 51 over the stop 49, so that the gear wheel 13 is able to continue rotating in this direction. To absorb any shock which may be produced by the abutment of the stop 49 with the projection 52, the pawl 51 is constructed so as to be resilient in a direction passing through the projection 52 and through the pivotal axis of the pawl. In the embodiment shown the pawl consists of an endless strip 56 having approximately the shape of a figure eight to give the pawl the desired resilience. It is obvious that this resilience can be obtained in another manner, for

example by arranging an elastic intermediate portion in the pawl 51. These steps ensure that the reduction gear is not subjected to excessive shocks through the unidirectional latch 22.

For switching over the unidirectional latch there is provided an actuating member 57, which in the present example is constructed as a slide 59 which is movable from a rest position to an operating position against the action of a spring 58. In the rest position of the slide 59 shown in Fig. 2 a free end 60 of this slide faces the free end 55 of the leaf spring 53. When the slide 59 is moved in the direction indicated by the arrow 61, its free end 60 presses against the free end 55 of the leaf spring 53 and moves this spring also in the direction indicated by the arrow 61, thereby stressing the leaf spring 53 so that the pawl 51 is pivoted clockwise (as viewed in Fig. 2) about the spindle 50 until the projection 52 of the pawl engages the outer curved track 46. If the gear wheel 13 is now rotated in the anti-clockwise direction the stop 48 on the track 46 will cooperate with the projection 52 to block rotation of the gear wheel 13 in this direction, so that the direction of rotation of the single-phase synchronous motor is again automatically reversed to drive the gear wheel 13 in the clockwise direction. In this direction the projection 52 is lifted over the stop 49 by the curved track 46, as a result of which the single-phase synchronous motor can continue to drive the gear wheel 13 in this direction.

As the slide 59 returns to its rest position the leaf spring 53 can relax and also resumes its original position, so that the pawl 51 is pivoted towards the inner curved track 47 to bring the projection 52 into engagement with this track so that rotation of the gear wheel 13 in the clockwise direction is blocked again.

In the present embodiment the actuating member 57 can be actuated manually, for which purpose the portion 62 of the actuating member 57 which projects from the housing 1 is pushed inwards. However, it is found to be very effective if the actuating member 57 can be actuated directly by the switch for switching on and off the single-phase synchronous motor, in which

case this switch may be constructed as a three-position tumbler switch, so that if this switch is toggled out of its rest position in one direction the corkscrew spiral is driven in one direction of rotation in which it is screwed into a cork and if the tumbler switch is toggled in the other direction the unidirectional latch is switched over and the corkscrew spiral is driven in the opposite direction of rotation to withdraw from the cork.



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CLAIMS:

1. A corkscrew device comprising a corkscrew spiral, a sleeve which is coaxial with the corkscrew spiral and which is constructed to cooperate with the neck of a bottle, an electric motor and means which are driven by the motor via a reduction gear and which are operable by rotation in one direction to screw the corkscrew spiral into a cork in the neck of the bottle and then to draw the cork from the bottle without the direction of rotation of the drive being reversed, wherein the electric motor is a self-starting two-pole single-phase synchronous motor with a diametrically magnetized permanent-magnet rotor whose direction of rotation is determined by a unidirectional latch which is operable to block rotation of the motor in one direction and permit rotation in the other direction, and wherein the reduction gear is constructed to provide a reduction ratio in the range of from 60:1 to 100:1.

2. A corkscrew device as claimed in Claim 1, wherein the unidirectional latch cooperates with a rotary element of the reduction gear which is arranged to be driven by the motor with an integral reduction ratio.

3. A corkscrew device as claimed in Claim 1 or 2, wherein the unidirectional latch can be set to block rotation of the motor in either direction selectively and permit rotation in the other direction.

4. A corkscrew device as claimed in Claim 3, wherein the unidirectional latch comprises a spring-loaded pawl which is slidably engageable selectively with one or the other of two tracks which are formed on said rotary element of the reduction gear and of which one is concavely curved about the axis of rotation of said rotary element concentrically therewith and is formed with a radially inwardly projecting stop for cooperation with the pawl and the other is convexly curved about said axis of rotation concentrically therewith and is formed with a radially outwardly projecting stop for cooperation with the pawl, the two stops being so arranged that one stop is cooperable with the pawl to block rotation of said rotary element in one direction and permit



rotation in the other direction and the other stop is cooperable with the pawl to block rotation of said rotary element in said other direction and permit rotation in said one direction.

5 5. A corkscrew device as claimed in Claim 4, wherein the spring-loading of the pawl is provided by a leaf spring of which one end is connected to the pawl near the pivotal axis thereof and the other end bears against a stationary part of the corkscrew device, and wherein the pawl is rotatable by means of an actuating member between a position in which it slidably engages one of the
10 tracks on said rotary element and a position in which it slidably engages the other track, the actuating member comprising a slide which is movable from a rest position to an operating position and during this movement presses against said other end of the leaf spring to rotate the pawl from one of said positions to the other.

15 6. A corkscrew device as claimed in Claim 5, wherein the pawl and the leaf spring are formed integrally from a plastics material.

20 7. A corkscrew device as claimed in any of Claims 4 to 6, wherein the pawl is resilient in a direction passing through the pivotal axis of the pawl and through apart of the pawl with which the pawl cooperates with said stops.

8. A corkscrew device as claimed in Claim 7, wherein the pawl consists of an endless strip having approximately the shape of a figure eight.

25 9. A corkscrew device as claimed in any of the preceding claims, wherein the means which are driven by the motor via the reduction gear comprise a lead-screw which is connected at one end
30 of the corkscrew spiral coaxially therewith and on which a lead-screw nut is arranged, the direction of the thread of the lead-screw being opposite to the direction of the corkscrew spiral, and said sleeve being slidably axially on the lead-screw and the ends of the sleeve and the lead-screw nut which face one another having cooperable abutment surfaces through which, when the sleeve is cooperating with the neck of the bottle and the lead-screw is
35 rotating in said one direction and has screwed the corkscrew spiral



into the cork in the neck of the bottle, the nut is held by means of the sleeve against rotation so that by reaction from the nut the rotating lead-screw is moved axially away from the neck of the bottle to draw the cork from the bottle.

5 10. A corkscrew device as claimed in Claim 9, wherein one of the two abutment surfaces is provided with a friction coating.

11. A corkscrew device as claimed in Claim 10, wherein the other of the two abutment surfaces is profiled.

10 12. A corkscrew device as claimed in any of Claims 9 to 11, wherein the two abutment surfaces are frusto-conical, one having a concave curvature and the other a convex curvature about the axis of the lead-screw nut and the sleeve.

15 13. A corkscrew device as claimed in any of Claims 9 to 12, wherein the sleeve is provided with a ring of an elastomeric material for cooperation with the neck of the bottle.

14. A corkscrew device as claimed in any of Claims 9 to 13, wherein the thread of the lead-screw comprises two or more turns and has a pitch of from 6 mm to 10 mm.

20 15. A corkscrew device as claimed in any of Claims 9 to 14, wherein a helical spring which is coaxial with and surrounds the lead-screw urges the lead-screw nut towards a stop which is situated at that end of the lead screw which is remote from the corkscrew spiral.

25 16. A corkscrew device as claimed in any of Claims 9 to 15, wherein a helical spring which is arranged between the sleeve and the lead-screw nut and which is coaxial with and surrounds the lead-screw urges the sleeve towards the corkscrew spiral.

30 17. A corkscrew device as claimed in any of Claims 9 to 16, wherein a disengageable coupling is arranged between the corkscrew spiral and the lead screw to transmit the rotation of the lead-screw to the corkscrew spiral, which coupling is disengaged automatically by the axial movement of the lead-screw to draw the cork from the bottle.

35 18. A corkscrew device as claimed in Claim 17, wherein the corkscrew spiral has a cylindrical shank which is capable of

(2)



5 limited sliding movement in an axial bore in the lead-screw and
which is acted on by a helical spring in the bore to urge the
corkscrew spiral axially towards the lead-screw, and wherein the
disengageable coupling comprises radial projections on the shank of
the corkscrew spiral and radial grooves in the end face of the
lead-screw which is adjacent the corkscrew spiral, the projections
being engageable in the grooves under the action of said helical
spring on the shank of the corkscrew spiral so as to couple the
spiral to the lead-screw for rotation therewith, and being
10 disengageable from the grooves by said axial displacement of the
lead-screw.

19. A corkscrew device as claimed in Claim 18, wherein the
grooves have inclined side walls which converge towards the bottom
of the grooves.

15 20. A corkscrew device as claimed in any of the preceding
claims, wherein the sleeve is made of a transparent material.

21. A corkscrew device substantially as herein described with
reference to Figure 1 or 2 of the accompanying drawings.

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