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Rotary Control

The present invention relates to a rotary control, and in particular to a rotary control used in association with apparatus in which control is effected by means of a rotatable spindle. One example of a use
5 to which the invention may be put is as a control in association with the timer or programme-selector mechanism of a washing machine or other domestic electrical apparatus.

According to one aspect of the present invention,
10 a rotary control is arranged to be incorporated in apparatus to be controlled, the control comprising a push-button and a collar axially movable with respect to the push-button and having retracted and extended positions when the control is so incorporated, the
15 collar being caused to move from its retracted to its extended position by pressure on the push-button, and control of the apparatus being effected by manually rotating the collar in its extended position.

Preferably, the control includes a housing, the
20 collar in its retracted position being inside or substantially inside the housing and in its extended position having a portion positioned outside the housing to be grasped manually. Also preferably, the collar is biased to move to its extended position, and
25 is held in its retracted position by a detent; the detent may be released by pressure on a push-button.

According to a second aspect of the invention, a rotary control is arranged to be incorporated in apparatus to be controlled and comprises a push-button,
30 a collar surrounding the push-button and being movable

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with respect to the push button on its axis, the collar
being arranged when the control is so incorporated to
have a retracted position and an operative

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extended position; means for holding the collar in each position and for causing it to move from the retracted to the extended position when the push-button is pressed; and connecting means to connect

5. the rotary control to a spindle, rotation of the collar causing rotation of the spindle.

According to a third aspect of the invention, apparatus including control mechanism which requires rotation by the user for control purposes has an

10. external wall with an aperture therein, a rotary control member in the form of a collar which is connected to the control member and which is positioned for movement within the aperture between retracted and extended positions, in the former of which
15. the collar is substantially or fully withdrawn behind the external face of the external wall and in the latter of which it protrudes forwardly of the external wall to enable it to be manually grasped and rotated by the user, and a user-operable release member
20. operatively connected to the collar for causing movement of the collar from its retracted position to its extended position.

According to a fourth aspect of the invention, apparatus including control mechanism has a shaft

25. which requires rotation by the user for control purposes, the apparatus having an external wall with an aperture therein, a rotary control housing positioned behind the external wall in alignment with the aperture and connected to the shaft, a rotary
30. control collar which is positioned in line with the aperture and within the rotary control housing for movement axially therein between retracted and extended positions in the former of which the collar is substantially or fully withdrawn behind the external

- face of the external wall, and in the latter of which it protrudes forwardly of the external wall to enable it to be manually grasped and rotated by the user, means being provided which rotationally
5. interconnect the control collar and the control housing in at least the extended position of the control collar so that rotation of the collar in at least one direction rotates the control housing and hence the shaft, latching means being
 10. provided which directly or indirectly interconnect the control collar in its retracted position and a push-button lying within the collar and accessible to the user, inward movement of the push-button with respect to the collar causing release of the
 15. latching means and permitting movement of the collar from the retracted position to the extended position.

The invention may be carried into practice in various ways, but one specific embodiment will now

20. be described with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a rotary control according to the invention, as applied to a washing machine, and showing a collar of the control

25. in the retracted position;

Figure 2 is a perspective view of the rotary control of Figure 1 showing the collar in the extended position;

Figure 3 is a perspective exploded view of the

30. rotary control showing the push-button mechanism, the control ring and the housing (with part of the inner wall cut away to show the driving hub);

Figure 4 is a perspective view from the rear of the push-button mechanism;

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Figure 5 is a diametrical cross-section of the rotary control with the collar in the retracted position;

5. Figure 6 is a diametrical cross-section of the rotary control with the collar in an intermediate position;

Figure 7 is a diametrical cross-section of the rotary control with the collar in the extended position;

10. Figure 8 is a perspective view of the housing (with part of the inner wall cut away) showing one possible modification of the ratchet teeth.

15. Figures 1 and 2 show the rotary control as it will be seen by the user. The control is set into a bezel 2 of a washing machine. Protruding through a circular hole in the bezel is a generally cylindrical collar 4 within which is mounted a push-button 6. When the machine is not in use, the collar 4 will normally remain in the retracted position shown in Figure 1, in which its front edge remains almost flush with the bezel 2. When the user wishes to operate the machine, the push-button 6 is pressed and the collar 4 pops out into its operative position, shown in Figure 2. In this position the collar can be
20. grasped and turned to activate the mechanism to which the control is attached. In the example of a washing machine, this may be a timer mechanism or a programme-selector mechanism. Many timer mechanisms will suffer damage if the user attempts to turn them
25. backwards, and in this example the control is provided with a ratchet mechanism (to be described) so that, while the collar 4 may be turned in either direction, only rotation in the clockwise direction
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affects the setting of the timer. The actual setting is visible by means of a scale (not shown) which moves behind a perspex window 8. After use, the collar 4 is simply pushed back into its original retracted position of Figure 1.

The construction of the control will now be described in greater detail. The control consists of three main components, each of which is conveniently moulded as a single unit from a suitable plastics material. The three components are shown in exploded front perspective view in Figure 3. They are housing 10, a control ring 12 (which includes the collar 4), and a button mechanism 14 (which includes the push-button 6). Each will now be described in turn.

The housing 10 includes a generally cylindrical outer wall 16 which is connected to a co-axial generally cylindrical inner wall 18 by a rear wall 20. As shown in Figures 5, 6 and 7 the centre of the rear wall is formed with a rearwardly-extending annular trough 36 which surrounds the rear end of the inner wall 18.

The forward end of the wall 18 (i.e. that part forward of the trough 36) is divided longitudinally into three equal sections by three longitudinally-extending slots 48, one of which is seen in each of Figures 5, 6 and 7. These slots 48 extend rearwardly almost to the rear wall 20. At the rearmost end of each slot 48, the region of the inner wall 18 between the end of the slot 48 and the rear wall is locally built up to form an inwardly-sloping shoulder 50. Centrally placed in each of the three equal sections of the wall 18 is an inwardly-facing, longi-

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- tudinal channel 52 (best seen in Figure 3). This channel 52 extends from the forward end of the wall 18 to the rear wall 20. Centrally moulded within the inner wall 18 is a generally cylindrical driving
5. hub 54. This extends forwardly only a part of the length of the wall 18, but also extends rearwardly through the rear wall 20 for some distance. This wall forms a passageway open at both ends, and is provided with fixing-means (not shown) for the
 10. attachment of a timer spindle 30 (see figure 5). The forward end of the driving hub 54 has three spaced, outwardly extending and rearwardly-facing hub latches 56. These hub latches 56 are positioned so that each latch lies diametrically opposite one of the channels
 15. 52 in the inner wall 18. As best seen in Figure 3 the forward end of the outer wall 16 carries a series of inwardly-facing driven ratchet teeth 22. These comprise a series of a sloping surfaces 58 which lie parallel to the axis of the cylinder outer wall 16,
 20. and corresponding driven surfaces 60 which lie parallel to the axis and also lie in an axial plane. The forward edge of the outer wall 16 also carries, on its outer surface, an angled bevel 78 on which is marked a scale (not shown). The control ring 12 comprises the
 25. collar 4 and a rearwardly-extending open cylindrical hub portion 24 which is co-axial of the collar 4, the two being connected by a rear wall 26. Facing outwardly from the rear end of the collar 4 are a second series of driving ratchet teeth 28 adapted to
 30. act in co-operation with the first set of driven teeth 22. In this case the teeth 28 comprise triangular-shaped driving faces 62 each lying in an axial plane and forwardly-facing and axially-extending sloping camming surfaces 64 which lie in neither an
 35. axial nor a radial plane. The exact size and shape of

the teeth 28 is not critical provided that they fit within, and can act in co-operation with, the driven teeth 22 on the housing 10. The fit need not be exact, to allow for manufacturing tolerances. The rear faces of the driving teeth 28 (not seen in Figure 3) lie in a radial plane and serve no driving function.

The button mechanism 14 is shown in more detail in Figure 4. The mechanism consists of the circular or disc-like push-button 6, to which is centrally moulded a rearwardly-extending generally cylindrical part 38. This part is split into twelve individual fingers by means of twelve axial slots 39 which extend from near the push-button 6 to the far end of the part 38, such that the mechanism 14 has a triad axis of symmetry. Three of the fingers 41 have, near their free ends, inwardly extending latches 40, with their detent surfaces 42 facing forwardly (to the left in Figure 4). Another three fingers 43, those lying equidistant between the first three), have near their free end, outwardly-extending latches 44, with their detent surfaces 46 facing rearwardly. The remaining six fingers 45 are plain and serve no function in this embodiment. The mechanism 14 is conveniently moulded in plastics or some other material that will allow the individual fingers to flex slightly.

The fully-assembled control is shown in axial cross-section in Figures 5 to 7. In these figures, the forward direction is downwards on the page, the bezel-surface (not shown) fitting directly over the forward surface 66 of the housing 10. Considering now Figure 5, it will be seen that the hub 54 of the housing 10 is mounted on the spindle 30 so as to drive it when a setting operation is carried out. The control ring 12 is mounted within the housing 10 so that it is free to move axially, the cylindrical hub portion 24 fitting over the inner

- wall 18 of the housing. The ring 12 is biased in the forward direction by means of a spring 34, which, at one end, is received in the annular trough 36 of the housing rear wall 20, while the other end abuts
5. the control ring rear wall 26. The button mechanism 14 is located coaxially within the collar 4 so that the cylindrical part 38 extends within the housing inner wall 18. The position is such that the three fingers 43 with external latches 44 extend opposite
 10. the three slots 48 in the inner wall 18 (with the latches 44 extending into the slots), while the three fingers 41 with internal latches 40 extend opposite the channels 52. The button mechanism is biased in the forward direction by means of a second
 15. spring 68 which fits over the timer spindle 30 and abuts the forward edge of the hub 54 and the rear of the push-button 6. The spring is held centrally on the push-button by means of a boss 70. In the retracted position of Figure 5 the button mechanism 14 is held in
 20. place by the co-operation of the three hub latches 56 with the three inwardly extending latches 40 on the fingers 41. Again, as shown in Figure 5, the control ring 12 is in turn retained in the retracted position by the button mechanism by means of the
 25. three external latches 44 which engage the forward end of the cylindrical hub portion 24 of the ring 12.

The operation of the control will now be described with reference to Figures 5, 6 and 7. When the user wishes to alter the setting of the timer

30. 32, the push-button 6 is pressed. The button mechanism 14 then moves backwards against the action of the spring 68 until it is stopped by the abutment of the boss 70 against the end of the spindle 30 (see Figure 6). As the mechanism moves backwards,

the ends of the fingers 43 carrying the external latches 44 slide along the inwardly sloping shoulders 50, thus flexing the fingers inwards slightly. This inward flexing frees the hub

5. portion 24 of the control ring 12 from behind the latches 44, and it moves forwards under the action of the spring 34. At this stage, the angular position of the control ring 12 may not be such that, in the extended position, the two sets of ratchet teeth
10. mesh exactly. The spring 34 is, however, strong enough not only to push the control ring 12 forward to its fullest extent (in which it abuts the push-button 6) but also, if the alignment is not exact, to cause the control ring 12 to rotate until it is
15. in alignment as shown in Figure 7. This rotation is caused by the action of the rear edges 74 of the ratchet teeth 22 (see Figure 3) pressing on the sloping camming surfaces 64 of the ratchet teeth 28: the forwardly-acting force is converted into a torque
20. due to the angle of the camming surfaces 64. The push-button, when released, returns to its original position under the action of the spring 68.

In this position, (see Figure 7) the user can now grasp the collar 4, and turn it clockwise.

25. The engagement of the driving surfaces 62 with the driven surface 60 causes the whole unit to rotate, and this rotation is thus transmitted to the timer spindle 30. The position of the housing 10, and thus of the spindle 30, can be read off the scale which
30. is marked on the surface of the bevel 78. This is viewed by means of the window 8 in the bezel 2 (see figures 1 and 2). Should the user attempt to turn the collar 14 in the anticlockwise direction, however, the edges 74 will simply slide over the surfaces 64, as

explained above, and the rotation will not be transmitted to the timer. Such a rotation will, of course, cause small forward-backward movements of the control ring 12; these will be taken up by the

5. spring 34. The control could also be constructed so that clockwise turning was inoperative. When the user has made a programme selection or has set the timer he simply pushes on the collar 4, which moves backwards from the Figure 7 position against the spring 34, the

10. cylindrical hub portion 24 pushing the latch 44 aside as it passes. When the latch reaches the foremost edge of the hub 24 it springs outward again and holds the control ring once more in the retracted position shown in Figure 5.

15. One possible modification of the housing 10 is shown in Figure 8. In this example the ratchet teeth have been modified by the removal of the square edge 74. This produces a similarly sloping face 76 to that 64 on the teeth of the control ring. When the

20. collar 4 is turned clockwise, the driving faces 62 contact the (now triangular) driven faces 60 exactly as before. When the collar 4 is turned anticlockwise, however, the sloping surfaces 76 on the housing 10 and those 64 on the control ring 12 move against each other (instead of the

25. edge 74 and the face 58). The effect is similar.

Other modifications of the ratchet teeth could of course be envisaged, or even the possibility that the control ring 12 and housing 10 are permanently keyed together, rotation being active in both directions.

30. The example given here is extremely cheap to construct since each part can be moulded in one-piece plastic. It is also easy to assembly, the steps being as follows:

(a) The housing 10 is attached to the timer spindle 30

35. (b) The spring 34 is placed in position, with the

control ring 12 inside it.

(c) The spring 68 is placed in position, and the button mechanism simply snapped into place over it. As will be seen from Figure 5, 5. for example, as the button mechanism is being slid into place the latches 40 will slide over the rear surface of the latches 56, bending the corresponding fingers outwards slightly, and into the channels 52. These provide sufficient space for 10. the two latches to pass each other.

(d) The whole assembly, timer and control, is then fixed to the washing machine in the usual way.

The rotary control of the example provides an extremely compact unit, the several parts being 15. telescoped together in such a way as to take up very little space, both on the surface of the bezel and internally. The control also has the advantage of a tamper-proof element: when the timer is not actually being set, the control rests in the inoperative retracted 20. position such that the timer is protected from being accidentally reset. The flush, retracted position also discourages children from accidentally resetting the timer.



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Claims

1. A rotary control arranged to be incorporated in apparatus to be controlled, the control comprising a push-button and a collar axially movable with respect to the push-button and having retracted and extended positions when the control is so incorporated, the collar being caused to move from its retracted to its extended position by pressure on the push-button, and control of the apparatus being effected by manually rotating the collar in its extended position.
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- 10 2. A rotary control as claimed in claim 1 which includes a housing, the collar in its retracted position being inside or substantially inside the housing and in its extended position having a portion
15 positioned outside the housing to be grasped manually.
3. A rotary control as claimed in claim 1 or claim 2 in which the collar is biased to move to its extended position, and is held in its retracted position by a
20 detent.
4. A rotary control as claimed in claim 3 in which the detent is released by pressure on the push-button.
- 25 5. A rotary control as claimed in any one of the preceding claims in which the push-button lies within the collar.
- 30 6. A rotary control as claimed in claim 4 or claim 5 in which the collar is held in its retracted position directly by the push-button.



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7. A rotary control as claimed in any preceding claim in which the control is ineffective if the collar is rotated backwards.
- 5 8. A rotary control as claimed in any one of claims 2 to 7 in which, in its extended position, the collar is arranged with respect to the housing so as to cause the two to rotate together.
- 10 9. A rotary control arranged to be incorporated in apparatus to be controlled comprising a push-button, a collar surrounding the push-button and being movable with respect to the push-button on its axis, the collar being arranged when the control is so incorporated to
15 have a retracted position and an operative extended position; means for holding the collar in each position and for causing it to move from the retracted to the extended position when the push-button is pressed; and connecting means to connect the rotary control to a
20 spindle, rotation of the collar causing rotation of the spindle.
10. Apparatus including control mechanism which requires rotation by the user for control purposes, the
25 apparatus having an external wall with an aperture therein, a rotary control member in the form of a collar which is connected to the control member and which is positioned for movement within the aperture between retracted and extended positions, in the former
30 of which the collar is substantially or fully withdrawn behind the external face of the external wall and in the latter of which it protrudes forwardly of the external



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wall to enable it to be manually grasped and rotated by the user, and a user-operable release member operatively connected to the collar for causing movement of the collar from its retracted position to
5 its extended position.

11. Apparatus as claimed in claim 10 in which the user-operable member comprises a push-button the forward face of which normally lies substantially in
10 the same plane as the front of the external wall of the apparatus.

12. Apparatus as claimed in claim 11 in which the push-button lies within the collar and is axially
15 movable inwardly with respect thereto to cause the movement of the collar from the retracted position to the extended position.

13. Apparatus including control mechanism having a
20 shaft which requires rotation by the user for control purposes, the apparatus having an external wall with an aperture therein, a rotary control housing positioned behind the external wall in alignment with the aperture and connected to the shaft, a rotary control collar
25 which is positioned in line with the aperture and within the rotary control housing for movement axially therein between retracted and extended positions in the former of which the collar is substantially or fully withdrawn behind the external face of the external
30 wall, and in the latter of which it protrudes forwardly of the external wall to enable it to be manually grasped and rotated by the user, means being provided which



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rotationally interconnect the control collar and the control housing in at least the extended position of the control collar so that rotation of the collar in at least one direction rotates the control housing and
5 hence the shaft, latching means being provided which directly or indirectly interconnect the control collar in its retracted position, and a push-button lying within the collar and accessible to the user, inward movement of the push-button with respect to the collar
10 causing release of the latching means and permitting movement of the collar from the retracted position to the extended position.

14. Apparatus as claimed in claim 13 in which the
15 push-button has a front face which lies substantially in line with the front of the control collar in its retracted position.

15. Apparatus as claimed in claim 13 or claim 14 in
20 which the means which rotationally interconnect the control collar and the control housing comprise inter-engaging sets of drive teeth on the control collar and the control housing which are arranged to be drivingly engaged when the control collar is in its
25 extended position.

16. Apparatus as claimed in claim 15 in which the control collar is spring-biased to its extended position and camming means is provided to cause such
30 rotary movement of the control collar (upon its movement to the extended position) as is necessary to ensure full engagement of the sets of drive teeth.



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17. Apparatus as claimed in claim 15 or 16 in which the drive teeth comprise a driving set of teeth carried on the external circumference of the rear of the collar and a driven set of drive teeth carried on an inner
5 wall of the housing at the front end thereof.

18. Apparatus as claimed in any one of claims 13 to 17 in which the push-button has, to the rear thereof, guide means which cooperate with guide means located on
10 the control housing to enable axial movement of the push-button with respect to the housing between a forward position which is limited by abutment of shoulders on the push-button and control housing, and a rearward release position which is limited by abutment
15 of a rearward part of the push-button and the control housing.

19. Apparatus as claimed in any one of claims 13 to 18 in which the latching means comprises at least one
20 resilient latching member carried by the push-button and normally positioned in radial alignment with a latching abutment on the control collar to prevent its movement to the extended position, camming means being provided between the resilient latching member and the
25 control housing to cause the latching member, on rearward movement of the push-button, to move out of radial alignment with said latching abutment on the control collar.

30 20. Apparatus as claimed in any one of claims 13 to 17 including spring biasing means reacting between the control housing and the control collar and tending to bias the control collar to its extended position.



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21. Apparatus as claimed in any one of claim 13 to 20 including biasing means reacting between the control housing and the push-button and normally biasing the push-button outwardly.

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22. A rotary control substantially as specifically described herein with reference to figure 1 to 7 of the accompanying drawings, with or without the modification shown in figure 8.

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