MULTIPLE UNIT SWITCH

Jacob J. Neuman, Jamaica, N. Y.

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8 Claims. (Cl. 200—97)

This invention relates to a multiple unit switch, and has for its general object and purpose to provide a switch of this type in which the several parts of the various units are compactly arranged so that they may be contained within a single housing of comparatively small dimensions, the said parts being constructed, automatically controlled and operated in a positive and reliable manner so that the respective units of the switch will independently function in precisely timed relation to each other, thus enabling my improved switch to be employed successfully in connection with the carrying out of industrial operations or processes which must be very accurately controlled in order to produce a satisfactory commercial product.

One of the important objects of the invention is to provide a motor driven multiple unit type switch, in which electromechanical means is employed for operatively connecting the switch means of each unit with the driving motor.

The subject matter of this application is a division of my pending application for patent on automatic sequence control means, Serial No. 470,995, filed July 26, 1930.

To the above end, it is an important object of my invention to provide an electrical control switch of the multiple unit type, the said units being relatively and independently adjustable and automatically operating to control the duration of the processing cycle, as well as the duration of the several phases or steps thereof in predetermined timed relation.

In the drawings, wherein I have disclosed one practical and efficiently operating embodiment of the invention, and in which similar reference characters designate corresponding parts throughout the several views,—

Figure 1 is a front elevation of one form of the multiple unit switch;

Fig. 2 is an enlarged top plan view thereof with the cover of the switch casing removed, and certain parts shown in section,

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic view of one application of the present invention to an automatic control system for sugar refining centrifugal.

Referring more particularly to the drawings, the various switch parts are operatively mounted and arranged within a single housing or casing generally indicated at 39. Adjacent to the front end of this casing, a transversely positioned shaft 40 is fixed in the opposite side walls thereof and upon this shaft a plurality of large gears 41, 41a and 41b (in the present instance three) are loosely mounted for independent rotation. There is also associated with each of these gears at one side thereof, and likewise loosely mounted on the shaft 40, a dial 42a, 42b and 42c, respectively. 60 The gears are spaced from each other and from the associated dials by suitable spacing sleeves 43 on the rod 40. To one side of each gear, a detent lug 44 is suitably fixed and is adapted for engagement with a stop 45 projecting from the opposed side of the associated dial, thus limiting the rotation of the individual gears to their normal positions under the action of the springs shown at 46.

In spaced relation to the rod 40, a second transverse rod 47 is supported in the opposite sides of the switch case and upon this rod the spaced levers 48a, 48b and 48c are loosely mounted for pivotal rocking movement. Each of these levers has an angular downwardly projecting arm 49A at its pivoted end which is disposed in the path of movement of the detent lug 44 carried by one of the gears 41a, 41b or 41c.

The dials 42a, 42b and 42c are adapted to be independently adjusted relative to the gears with which they are respectively associated to position the respective stops 45 relative to the lever arms 49, and as herein shown, such adjustment may be most conveniently effected by providing each dial with a worm gear 50 engaged by a worm 51 on 55 the inner end of a manually adjustable shaft 52 suitably mounted in the front wall of the switch case 39. Each dial has a peripheral flange suitably graduated and provided with the spaced digits or numerals suitably marked thereon as shown at 53, and which are visible through the respective sight openings 54a, 54b and 54c provided in the front wall of the case 39. In the use of the switch in connection with sugar refining centrifugal, the numerals on the dial 42b indicate the time period or duration of the process cycle, while the dial 42a indicates the number of minutes elapsing after the start of the cycle when the wash period begins, while the dial 42c indicates the quantity or volume of the wash water supplied in each operating cycle, in gallons. The appropriate indicative characterizations may be suitably associated with the respective sight openings of the switch case in any preferred manner.

In the rear end of the case 39 a transverse bar 105 is secured in which the vertical rods 56 are mounted, said rods extending loosely through openings in the rear ends of the levers 49a, 49b and 49c respectively, and supporting the springs 57 yieldingly urging the rear ends of said levers 110.
upwardly to the normal position shown in Fig. 3 of the drawings. Each of these levers is provided with suitable mercury switch tube supporting a single such switch 58 being mounted on the lever 48b, while two mercury switches 59 and 60 respectively, are mounted on the lever 48a, and a single such switch 61 is mounted on the lever 48c. To each of the levers 48a and 48b respectively the core of a solenoid magnet 62, 63 respectively, is connected by a link such as that shown at 64 in Fig. 3 of the drawings. These magnets are not of sufficient strength to pull the levers 48a and 48b downwardly when energized, but are merely holding magnets, which after the lever has been actuated, will hold the same in its actuated position until the magnet has been deenergized.

Rearwardly of the rod 47 and below the same, a shaft 65 is journaled in suitable bearings provided on the walls of the switch case, and is driven by means of an external electric motor shown at 66. Upon this shaft there is fixed the spaced gears 67 and 69, and adjacent each of said gears a lever 68a, 68b and 68c respectively, is loosely mounted on the shaft 65. Each of these levers has an angular end portion 69 extending downwardly below the shaft 65 and upon the same is mounted 70 for transmitting rotation from one of the gears on the shaft 65 to one of the gears 41a, 41b and 41c, as the case may be. For the purpose of driving the gears 41a and 41b, I have shown on each of the levers 68b and 68c, large gears 70 meshing with the two relatively small gears 67 on the shaft 65, and smaller gears 71 on the same axes with the gears 70 which are movable into and out of engagement with the gears 41a and 41b. The other lever 68a carries a single rotation transmitting gear 72 of small diameter in constant mesh with the large diameter gear 67 on shaft 65. The gear elements of the several switch units are of such ratios as to transmit rotation to the several gears 41a, 41b and 41c from the common drive shaft 65 at the proper predetermined relative speeds. The several levers 68a, 68b and 68c are yieldingly held in their normal positions wherein the gears 41a, 41b and 41c are disengaged from the drive shaft 65, by means of the springs 73, 74 and 75 respectively.

Additional solenoid magnets 76, 77 and 78 are arranged in the switch case 39 and have their cores respectively connected to the rear ends of levers 68a, 68b and 68c so that when any one of these magnets is energized, the corresponding lever is rocked on shaft 65 to entrain said drive shaft with one of the gears 41a, 41b and 41c, as the case may be.

In the operation of the invention as above described, the several dials 42a, 42b and 42c are first adjusted by the operation of the shafts 52 to position their stops 45 in proper relation to the ends of the levers 48a, 48b and 48c, as will be indicated by the dial readings. Thus, before starting operations, it will be understood that the springs 46 hold the several detents 44 carried by the gears in contact with these stops. As explained in my copending application above referred to, when current is supplied to the operating motor for shaft 65, the several solenoid magnets are also energized, the energization of certain of these magnets being controlled by the mercury switches. The energization of magnets 76, 77 and 78 will entrain the gears 41a and 41b with the motor driven shaft 65 by pulling the rear ends of the lever 68a and 68b downwardly. The magnets 62, 65, however, being relatively weak, are incapable of disturbing the normal positions of the levers 48a and 48b. As the gear 41b is thus rotated, during the first portion of the operating cycle of the centrifugal or other apparatus, at the end of the predetermined length of time, the detent 44 on said gear comes into contact with the end of lever 48b and moves said lever so as to cause the mercury switches 59 and 60 thereon to make or break the circuits controlled thereby as the case may be. In the application of the switch, as disclosed in my pending application, and as illustrated in Fig. 4 of the drawings, at this time the switch 59 breaks the circuit of electromagnet 77, so that gear 41b is disengaged from the shaft of motor 66 at the same time the other mercury switches 58 through the normally closed mercury switch on the lever 48a, thus entraining the gear 41a of the other switch unit with the shaft 65. The opening and closing of the mercury switches may also electrically control various other operations, which it is not necessary to elaborate upon in the present specification. Also, it is evident that insofar as the novel features of the present invention is concerned, it may be employed in various other industrial operations in which the same gearing is utilized to energize the several control solenoid magnets for the switch units.

When the detent 44 on the gear 41a strikes the end of the lever 48a, magnet 78 is deenergized so that the said gear is disengaged from the motor driving shaft 65. The holding magnet 62, 63 will continue to retain levers 48a and 48b in their operated positions until the detent on gear 41a comes into contact with levers 48a to close a circuit through the mercury switch 58, which circuit in turn controls suitable switch means which will operate to open the circuit for the motor of the centrifugal machine or other apparatus. The holding magnets 62, 63 are of course thereby also deenergized so that the levers 48a and 48b as well as the lever 48c return to their normal positions.

It will be appreciated that a multiple unit switch of the construction above described is capable of easy and quick adjustment and will be sensitive and reliable in operation to insure the inauguration and discontinuance of the several steps of the process cycle with a high degree of accuracy and at the proper times in accordance with the predetermined requirements of the particular process. The parts of this switch are also of comparatively simple form and compact in their arrangement, so that the entire switch apparatus may be contained in an outer housing of small dimensions which will occupy comparatively little space.

While I have herein shown and described one simple and satisfactory embodiment of the invention, it will be understood that with respect to the particular construction and arrangement of the various parts thereof, the essential features of my present improvement are susceptible of embodiment in various other structural forms. Accordingly, the privilege is reserved of resorting to all such legitimate variations therein as may be fairly embodied within the spirit and scope of the invention as claimed.

I claim:

1. In a multiple unit switch, a plurality of individual switch operating units and a common operating motor therefor, each gearing for each unit, electrically controlled means for independently actuating the entraining gear-
5. In an electric switch, a switch operating lever, actuating means therefor including a movable member to directly engage and actuate said lever, electrically controlled means for establishing an operative connection between said actuating means and a source of power, and additional means for holding said lever in its actuated position independently of said actuating means.

6. In an electric switch, a switch operating lever, actuating means therefor including a movable member to directly engage and actuate said lever, means for establishing an operative connection with said actuating means and a source of power, and additional electrically controlled means for holding said switch operating lever in its actuated position independently of said actuating means.

7. In a multiple unit switch, a plurality of individual switch operating units and a common operating motor therefor, electrically controlled means associated with each of said units for independently effecting an operative connection between said units and the motor, and a switch actuated to closed position by one of said units for energizing a circuit for the electrically controlled means of another of said units.

8. In a multiple unit switch, a plurality of individual switch operating units and a common operating motor therefor, electrically controlled means associated with each of said units for independently effecting an operative connection between said units and the motor, and separate switches independently operable by the individual units and jointly controlling a circuit for the electrically controlled means of one of said units.

JACOB J. NEUMAN.