

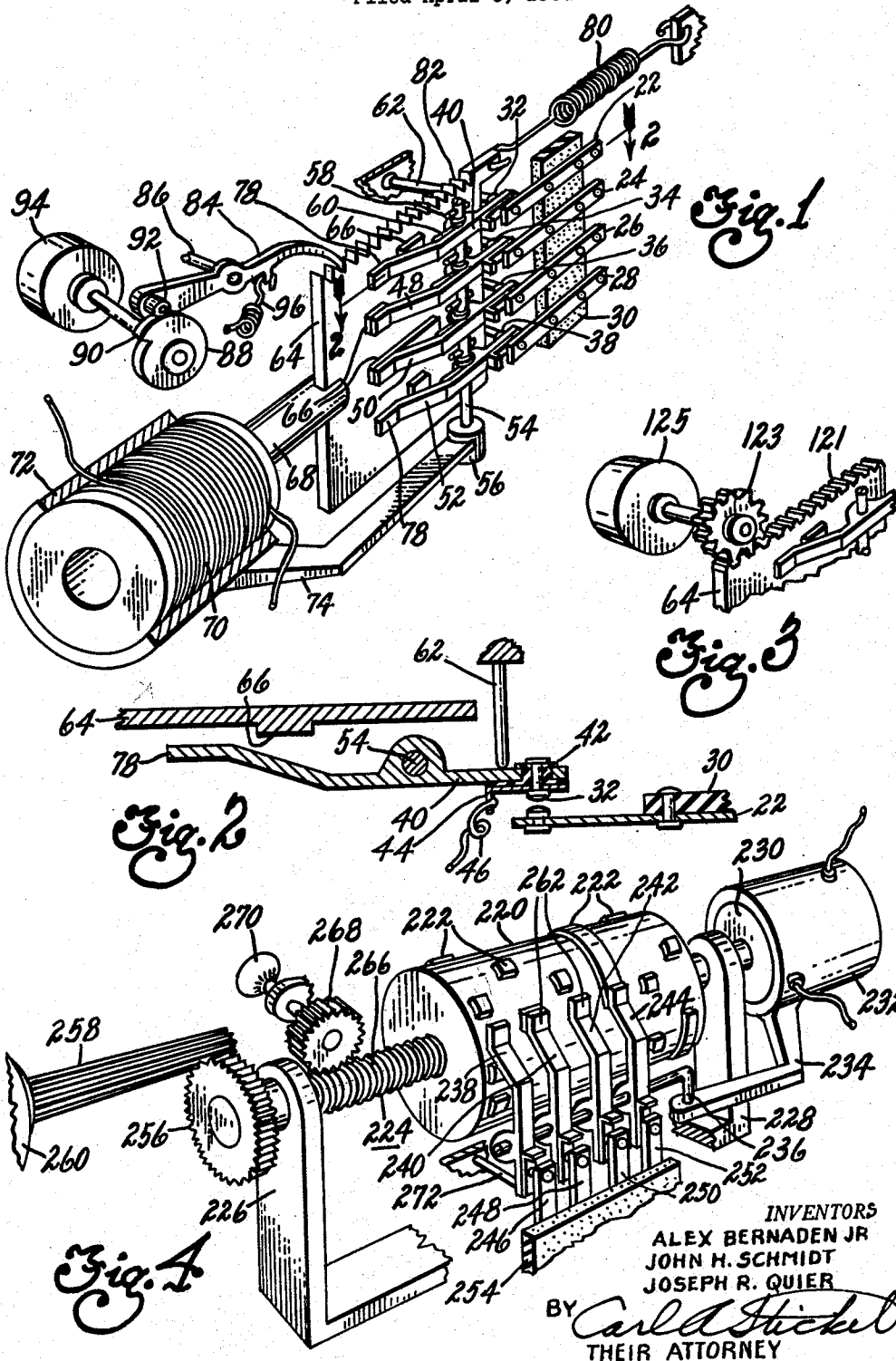
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MAGNETICALLY OPERABLE PROGRAM CONTROLLER

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3,114,084 MAGNETICALLY OPERABLE PROGRAM CONTROLLER

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This invention relates to a magnetically operated program control and more particularly to a magnetically operable program controller, such as may be used on an automatic washer and similar applications in which cycles of several different variations can be readily obtained.

Present tendencies to require controls to be more completely automatic is causing program controllers to be more complex. This makes them costly and more liable to failure. Contact difficulties are increased and more powerful drive motors are required.

It is an object of this invention to provide a complex program controller in which friction is minimized and the power requirements are lowered.

It is another object of this invention to provide a complex program controller in which wear and contact difficulties are minimized.

It is another object of this invention to provide a complex program controller in which a number of different cycles may be readily selected.

It is another object of this invention to provide a magnetic program controller in which a plurality of contact members are magnetically actuated at desired times according to a preselected program by a single electromagnet.

These and other objects are attained in the form shown in the drawings in which a program plate or drum of magnetic material is provided with raised portions and by the pull of a magnet or by an electric motor these raised portions are moved through the vicinity of magnetic actuators of contact members. When one of these raised portions is adjacent the magnetic actuator, an electromagnet associated with the plate or drum causes a magnetic circuit to be completed between the raised portions and the magnetic actuators. The completion of the magnetic circuit through the raised portions and actuators at various times close the contacts at such times or operate the contacts in various ways according to the program set forth to close various circuits. The single electromagnet through the magnetic circuit connecting with the raised portions provides all of the attractive force required for the actuation of the contacts. The raised portions and the magnetic material associated with them may be shifted laterally of the path of movement to provide different programs.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a perspective view partly diagrammatic of a magnetic program controller embodying one form of our invention;

FIGURE 2 is a fragmentary sectional view taken along the lines 2-2 of FIGURE 1 showing the contact mechanism;

FIGURE 3 is a fragmentary view showing a different form of power for the movement of the magnetic card; and

FIGURE 4 is a perspective view partly diagrammatic of a magnetic type of drum controller embodying another form of our invention.

Referring now more particularly to FIGURE 1, there are shown four stationary contact members 22, 24, 26 and 28 which preferably are connected into four separate control circuits of the device to be controlled, such as an automatic washing machine. These stationary contacts are all fixed to a support 30 of electrical insulating material. Four movable contacts 32, 34, 36 and 38 cooperate respectively with the contacts 22 to 28 inclusive. These contacts are each in the form of a rivet which is mounted within electrical insulation upon a contact member of soft iron in a similar manner for all the movable contacts. This rivet contact 32 is insulated from the contact member 40 by the insulation 42. It is electrically connected by an L-shaped conductor strip 44 to a pigtail connection 46 providing the second connection for connecting with the circuit to be controlled. The contact member 40 as well as the remaining contact members 48, 50 and 52 are all of soft iron and are all pivotally mounted upon the rod 54 also of soft iron or steel. The rod 54 is preferably fixed at both ends to a symmetrical support 56 of magnetic material, such as soft iron or steel. The rod 54 is also provided with transverse pins 58 adjacent each of the contact members. A torsion spring 60 extends between the transverse pin 58 and the contact member 40 so as to normally urge the contact member 40 to the open circuit position. This is, of course, counterclockwise in the direction viewed in FIGURES 1 and 2. A stop pin 62 is provided for each of the contact members to limit their opening movement. All of the contacts and contact members are identical in construction and arrangement and are each provided with a torsion spring connected to one of the transverse pins 58.

To control the contact members according to a predetermined program, there is provided a card or plate 64 of magnetic material having raised portions 66 at various locations of various lengths to cooperate with the magnetic actuating end portions 78 of the contact members 40, 48, 50 and 52. The card is connected directly to the armature 68 of an electromagnet coil 70. The energization of the electromagnet 70 not only attracts the armature 68 but also magnetizes the card 64 and particularly the raised portions 66 so that the contact members 40, 48, 50 and 52 are attracted toward the raised portions 66 to close their respective contacts. The magnet coil 70 is enclosed by a housing 72 of soft iron which is connected by an extension 74 of magnetic material with the one end 56 of the rod 54. An identical arm (not shown) may be provided for the opposite end of the rod. The energization of the electromagnet coil 70 therefore sets up an efficient magnetic actuating circuit whenever any of the raised portions passes through the vicinity of the actuating end portions 78 of the contact members.

The metal card 64 is returned to its initial position by the return spring 80. The movement from the initial position toward the electromagnet coil 70 under the attraction of the electromagnet coil 70 for the armature 68 is controlled by providing ratchet teeth 82 upon the upper edge of the card 64. A pawl 84 pivoted upon the pin 86 engages the ratchet teeth 82. The card is permitted to move intermittently toward the electromagnet coil 70 by a cam 88 having a single rise and falling step 90 in its periphery cooperating with roller follower 92 on the adjacent end of the pawl 84. The cam 88 is rotated at a relatively slow speed by an electric motor 94 which may be suitably geared for this purpose. For example, the pawl may be actuated every thirty seconds or every sixty seconds by the cam 88 to permit it to release the card 64 for movement a distance of one of the ratchet teeth 82. The pawl 84 is provided with a spring 96 for keeping its chisel-shaped end into engagement with the ratchet teeth 82. Different programs may be ob-

tained by putting in different cards in place of the magnetic card 64.

This form operates as follows. The magnetic card 64 provides a magnetic connection between the armature 68 and the raised portions 66 which upon energization of the magnet coil 70 magnetizes the raised portions 66 sufficiently that, when they move into a predetermined adjacent relationship with the actuating ends 78 of the contact members 40, 48, 50 and 52, these adjacent ends are attracted to close the magnetic circuits so as to also close the electrical contacts 32, 22 and 34, 24 and 36, 26 and 38, 28 at the times corresponding to the relative location of the raised portions. The card 64 advances toward the coil 70 intermittently at a slow speed. The actuating portions 78 remain separated from the raised portions 66 at all times so that there is no friction. The contact members operate instantaneously so that there is substantially no arcing at the contacts and, hence, the contacts have a long life. The friction therefore is low so that the power requirements are low and inexpensive. The electromagnet 70 is used to provide the magnetic attraction for all the raised portions and contact members and, in addition, provides the power requirement for moving the metal card through the cycle.

In FIGURE 3 is a modification in which the card 64 is driven independently of the power of the solenoid 70. In this particular form, the upper edge of the card 64 is provided with rack teeth 121. The card 64 is driven through the rack teeth 121 by a small pinion 123 which is driven at a slow speed by a small motor 125 which may operate either intermittently or continuously at a slow speed. The magnetic circuit is the same as in FIGURE 1 and the operation is otherwise similar.

In FIGURE 4, the magnetic card is formed into a drum 220 having raised portions 222 upon its surface. The drum is provided with a drum shaft 224 which is both slidably and rotatably mounted in the bearings 226 and 228. The drum 220, the raised portions 222 and the drum shaft 224 extending from both ends of the drum 220 are all of soft iron or other suitable magnetic material. The drum shaft at one end projects into a magnet coil 230 which surrounds it and magnetizes the drum 220 and the raised portions 222. The magnet coil 230 is enclosed in a housing 232 of soft iron or other magnetic material connected by an arm 234 to a rod 236 upon which are mounted the contact members 238, 240, 242 and 244. These contacts as well as the rod 236 and the arm 234 are all of magnetic material, such as soft iron. The contact members 238 to 244 inclusive include insulated electrical conductor strips and contact buttons similar to those shown for FIGURE 1. Pigtail connections are also provided in a similar way as shown in FIGURE 2. The stationary contacts are also similar and are designated by reference characters 246, 248, 250 and 252. They are all supported upon the insulating member 254.

The drum shaft 224 is provided with a gear 256 which meshes with a long pinion 258 driven by an electric motor 260 at a slow speed. If desired, the pinion 258 may be operated intermittently, such as every thirty or sixty seconds. The electromagnet coil 230 through the magnetic circuit composed of the housing 232, the arm 234, the rod 236 and the contact members 238 to 244 inclusive and the raised portions 222 of the drum 220 as well as the drum shaft 224 sets up a magnetic circuit which will cause the contact members 238 to 244 inclusive to be attracted and operated to closed position when the raised portions 222 come into closely adjacent relation with the upper actuating end portions 262 of the contact members 238 to 244. This provides an efficient magnetic circuit which causes a powerful attraction between the raised portions 222 and the actuating portions 262 at the particular times set forth by a program as provided by the locations of the various raised portions 222.

These raised portions 222 are arranged in rows around

the drum 220 so that each row normally actuates one of the contact members at various times. However, the drum 220 may also be provided with additional rows of raised portions 222 and, in order to make use of these additional rows, the drum shaft 224 is provided with threads or gear teeth 266 which extend annularly around the shaft 224. To move the drum 220 laterally, there is provided a pinion 268 in engagement with the annular gear teeth 266 which may be rotated by a suitable knob 270 so that the drum 220 and the drum shaft 224 are moved laterally relative to the bearings 226 and 228. This makes it possible to shift the additional rows of raised portions into alignment with different contact members, such as the contact members 242 and 244 in order to provide a different program. The actuating ends of the contact members 238 to 244 never actually touch the raised portions 222 so that there is a minimum of friction and only a small amount of power is required for the motor 260 to drive the drum 220. The single electromagnet can readily be made sufficiently powerful to provide quick actuation of the contact members so as to minimize arcing and deterioration of the contacts. The contact members 238 to 244 are each provided with a stop pin 272 for limiting their opening movement in the manner illustrated in FIGURE 3. The contact members 238 to 244 are also provided with torsion springs similar to those illustrated in FIGURE 1 connected to transverse pins on the rod 236 so as to yieldingly hold the contact members into contact with the stop pins. This arrangement provides a drum-type magnetic control employing only a single electromagnet for operating a number of contacts. This provides an excellent control for complex operations.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A controller including a plurality of segments of magnetic material arranged in a pattern, an electromagnet, magnetic material connecting each of said segments with said electromagnet, a control device having an actuating means of magnetic material, said electromagnet being also associated in attracting relationship with said magnetic material to move said segments into and out of magnetic relationship with said actuating means to operate said control device.
2. A controller including a plurality of segments of magnetic material arranged in a pattern, an electromagnet, magnetic material connecting each of said segments with said electromagnet, a control device having an actuating means of magnetic material, said electromagnet being also associated in attracting relationship with said magnetic material to move said segments into and out of magnetic relationship with said actuating means to operate said control device, and a ratcheting device cooperating with said magnetic material for controlling the movement of the segments relative to the control device.
3. A controller including a member having a magnetic material provided with discontinuous raised portions arranged in parallel rows, control devices provided with actuating means of magnetic material, means for moving said member and said control devices relative to each other parallel to said rows, said actuating means being located out of the path of but adjacent to the path of relative movement of the raised portions, and a single electromagnet associated with said movable member for magnetizing said magnetic material and all of said raised portions of said movable member to attract said actuating means of said control devices when any of said raised portions is adjacent.
4. A controller including a movable member having magnetic material provided with raised portions, control devices provided with actuating means of magnetic material, means for moving said member and said control devices relative to each other, said actuating means being

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located out of the path of but adjacent to the path of relative movement of the raised portions, an electromagnet associated with said movable member for magnetizing said magnetic material and said raised portions of said movable member to attract said actuating means of said control devices when any of said raised portions is adjacent, and means for shifting the control devices and the movable member laterally relative to each other and to their relative paths of movement to place the relative paths of movement of the raised portions in different lateral relationship to said actuating means.

5. A controller including a member having magnetic material provided with raised portions, control devices provided with actuating means of magnetic material, means for moving said member and said control devices relative to each other, said actuating means being located out of the path of but adjacent to the path of relative movement of the raised portions, an electromagnet associated with said member in attracting and magnetizing relationship for magnetizing said raised portions and moving said member relatively to said control devices and to move said raised portions into and out of magnetic relationship with said actuating means to operate said control devices.

6. A controller including first means provided with areas having magnetic properties arranged discontinuously in parallel rows, a plurality of control devices having individual actuating means individually associated in magnetic relationship with different parallel rows of said first

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means, and means for moving said first means parallel to said rows to present said rows to said actuating means and for creating a magnetic field between said rows and said actuating means including a single electromagnet and magnetic material extending from said electromagnet to each of said areas having magnetic properties.

7. A controller including first means provided with areas having magnetic properties arranged discontinuously in parallel rows, a plurality of control devices having individual actuating means individually associated in magnetic relationship with different parallel rows of said first means, means for moving said first means parallel to said rows to present said rows to said actuating means and for creating a magnetic field between said rows and said actuating means including a single electromagnet and magnetic material extending from said electromagnet to each of said areas having magnetic properties, and manual selector means for moving perpendicularly to said rows said first means relative to said actuating means to position different rows in actuating relationship with said actuating means.

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