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PROGRAMMING DEVICE

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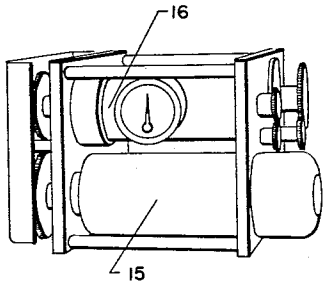



FIG. 5

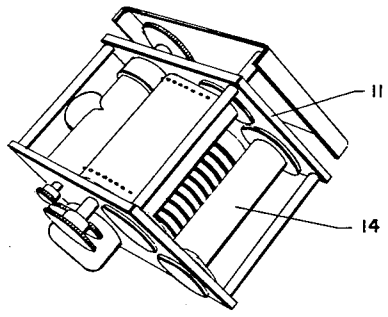



FIG. 3

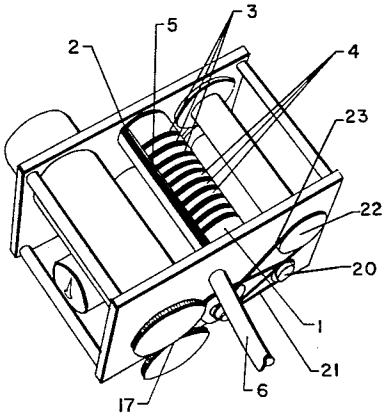



FIG. 1

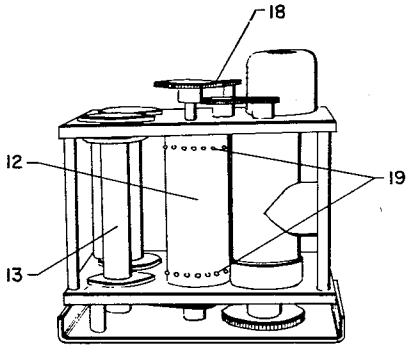



FIG. 4

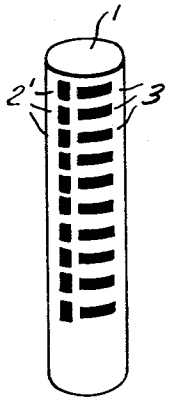



FIG. 6

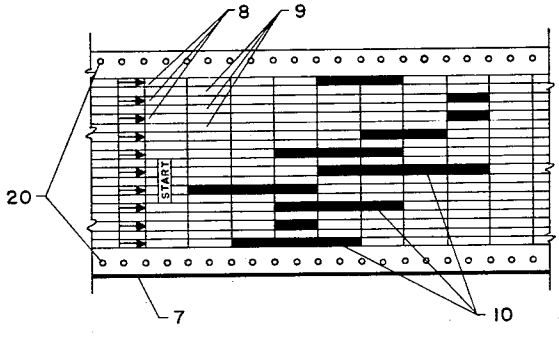



FIG. 2

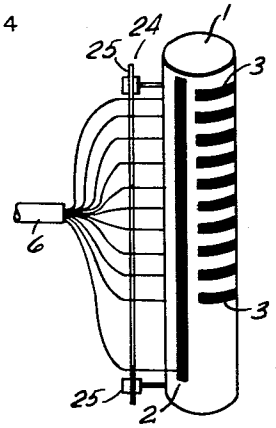



FIG. 7

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# PROGRAMMING DEVICE

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12 Claims. (Cl. 200—46)

Our invention relates to automatic control systems and more particularly relates to programmers for use in such systems.

It is often necessary in systems of this type to control the operation of the apparatus acted upon by these systems in accordance with a predetermined pattern and sequence of events; i. e., the program. In executing a program it is necessary to have devices which will respond to a program to derive control signals therefrom. These signals are used to actuate portions of the control system to eventually control the aforesaid apparatus. Such a device is defined as a programmer.

Due to the complexity of control systems now in use, most programmers include a large number of complex electronic or electromechanical components. Therefore, these programmers are bulky, unwieldy and expensive. Moreover, such programmers are difficult to manufacture and present serious servicing and maintenance problems.

We have invented a programmer which requires only a few simple electromechanical components. It can be easily and inexpensively manufactured. Furthermore, this programmer is small, compact and portable and requires little servicing and maintenance after installation. It is readily adaptable for many different types of systems.

Accordingly, it is an object of the present invention to provide a novel programmer of the character indicated.

It is a further object to provide a programmer which makes use of an insulator strip, one surface of which has a coating of electrically conductive material covering selected areas thereof.

It is another object to provide a programmer which makes use of an insulated cylindrical member which has a plurality of metal segments imbedded in its external surface.

Yet a further object is to provide a programmer in which a plurality of switching elements are actuated and deactuated either simultaneously or in sequence in accordance with a predetermined program and which incorporates an insulated cylindrical member and an insulated strip.

Yet another object is to provide a programmer which can be used as a switching commutator.

Still another object is to provide a programmer which makes use of a tape of paper or other material which can be reused indefinitely.

Still a further object is to provide a versatile programmer which will execute a very wide range of program without the use of cams or similar devices.

These and other objects of the invention will be explained or will become apparent to those skilled in the art when this specification is read in conjunction with the accompanying drawings wherein:

Figure 1 shows a cylindrical insulator, in the external surface of which are imbedded a plurality of metal segments;

Figure 2 shows a programmer tape upon which the program is applied in the form of an electrically conductive coating to selected areas of the tape;

Figure 3 shows, in operative relationship, the programmer tape with associated take-up and supply spools;

Figure 4 shows, in operative relationship, the take-up and supply spools and the sprocket drive spools;

Figure 5 shows, in operative relationship, the motor drive and speed changer;

Figure 6 shows a modified cylindrical insulator; and

Figure 7 shows a cylindrical insulator complete with electrical connections and terminal strip.

Briefly stated, our invention contemplates an insulator member having imbedded in its external surface a plurality of electrically conductive elements. One of these segments may be designated as a common element and extends in a first direction along the surface; each of the remaining elements may be designated as a channel and extends in a second direction along this surface. The invention further includes an insulator strip, one surface of which includes a plurality of subdivisions equal in number to the channels and extending in said second direction. Selected areas of these sections are covered with an electrically conductive coating. A structure supports the insulator member and is provided with apparatus for maintaining the strip in such physical relation to the member that a selected portion of the strip surface covered with the coating is brought into intimate physical contact with the plurality of elements and a portion of each section is brought into registration with the corresponding channel. If this portion of each channel is coated with the electrically conductive coating, an electrical connection is established between the corresponding channel and the common element.

The supporting structure may include strip feeding means for automatically moving the strip across the channels and thus sequentially establish and break electrical connections between the channels and the common element, in accordance with the position of the electrically conductive coating on the tape.

Effectively, therefore, each channel forms with the common element a switch which is closed and opened in accordance with the pattern of coated and uncoated areas on the strip as the strip is moved across the channels. This pattern represents the program. The duration of a programmed action is determined by the length of the strip and its travel speed.

Referring now to the drawings, an insulator member which may be shaped in the form of a cylinder is identified generally as 1. An electrically conductive element, which may be a metallic segment 2, is imbedded in the external surface of the cylinder 1 and extends in a direction parallel to the axis of the cylinder. Segment 2 is designated as a common element or segment. An additional member of metallic segments 3 are imbedded in the surface of the cylinder and are designated as channels. Segments 3 are curved around the circumference of cylinder 1 and are equally separated in the axial direction by insulated areas 4 on the surface of the cylinder. The ends of segments 3 adjacent to segment 2 are equally separated therefrom by an insulated area 5 on the surface of the cylinder.

A lead in cable 6 is connected to the cylinder. This cable contains a plurality of electrical conductors. One of these conductors is connected to segment 2. The remaining conductors are respectively connected to corresponding segments 3. The connection between the segments and the conductors may be made in a variety of conventional arrangements; for example, each segment may be electrically connected to a terminal strip 24 to which the cable 6 is also connected. Strip 24 is attached to cylinder 1, for example, by securing means 25.

An insulated strip which may be a paper strip or roll is

identified generally at 7. One surface of this strip is divided into a plurality of parallel subdivisions 8, which are equally spaced for each other by means of insulated areas 9 on the strip. The plurality of subdivisions 8 is equal in number to the segments 3.

A program is prepared by covering appropriate portions 10 of sub-divisions 8 with a very low resistance electrically conductive coating such as a metallic silver, in a liquid, air drying, acetate type vehicle.

When a selected area of the tape 7 is urged into a plane of contact with the cylinder 1 in a manner in which the subdivisions 8 are brought into registration with segments 3 (the mechanism for establishing this plane of contact will be described below), the painted portions 10 of subdivisions 8 which are contained in this plane electrically bridge the insulated gaps between the channels corresponding to these subdivisions and the common segment 2 and establish an electrical connection therebetween. The unpainted portions of subdivisions 8 cannot bridge these gaps because of the insulating properties of the tape 7 and cylinder 1.

Thus, as the entire surface of the tape 7 is moved through this plane of contact in the manner described below, electrical connections are established and broken in a sequence which is determined by the program.

The cylinder 1 is rigidly mounted in a housing 11. A driving spool 12, a supply spool 13 on which tape 7 is initially wound and a take-up spool 14 are all supported within housing 11 through bearings so that each spool is constrained to be rotatable about its cylindrical axis. The housing 11 also supports a fracitonal horsepower motor 15 and an adjustable speed changer 16. Motor 15 drives the speed changer 16 through gears 17. The speed changer 16 drives the driving spool 12 through gears 18.

Sprockets 19 on the driving spool 12 engage perforations 20 on tape 7. As the motor 15 turns, the speed changer causes the driving spool to rotate, and this rotation unwinds the tape 7 from supply spool 13 on to take-up spool 14. The cylinder 1 is interposed in the path of tape travel between the driving spool and the take-up spool so that a plane of contact is established between the tape 7 and the cylinder 1. Cylinder 1 is so positioned in the path of tape travel that the plane of contact includes both the common segment and the channels. The alignment of all of the spools and the cylinder is such that the portions of the sub-divisions that are included in the plane of contact are brought into registration with the corresponding channels.

The supply spool 13 is connected through pulley 20 and spring belt 21 gears 17. The take-up spool 14 is connected through pulley 22 and spring belt 23 to gears 17. These belts slip-drive the take-up spool at a faster rate and the supply spool at a slower rate than the tape driving spool to keep the tape taut.

It will be apparent that our arrangement can be easily modified and used with any of the well known endless tape systems to repeat or recycle any program for an indefinite period.

Speed changer 16 is adjustable through a wide range of paper tape speeds; in this example the range falls between ⅛ inch per second to 6 inches per second.

A tape once programmed may be reused many times and, as indicated above, at different speeds to vary the rate of the program action.

In this embodiment, the programmer functions as a switching device or commutator which includes a plurality of single pole single throw switches which have one pole in common (i. e., the common segment) and one pole not in common (i. e., the channels) and which are opened and closed in accordance with the program. It will be apparent to one skilled in the art that by interconnecting the channels in various ways at the terminal strip and connecting the cable to the cylinder or at some other convenient location, various series and parallel switch connections can be established. Moreover, by increasing the number of common segments or by dividing the common segment into smaller sub-segments, for example as shown in Fig. 6 wherein these sub-segments are identified at 2', the switches can be so connected that they have a smaller number of poles in common, or may have no poles in common.

While we have shown and described and pointed out the fundamental novel features of the invention as applied to perferred embodiments, it will be understood that various omissions, substitutions and changes in the form and details of these embodiments may be made by those skilled in the art without departing from the spirit of the invention. It is our intention, therefore, to be limited only as indicated by the scope of the claims that follow.

We claim:

1. In combination, an insulator member provided with a first plurality of physically and insulatedly separated electrically conductive elements imbedded in the external surface thereof, one of said elements being designated as a common element and extending in a first direction along said surface, the remaining elements being designated as channels and extending in a second direction along said surface; an insulator strip, one surface of which includes a second plurality of physically and insulatedly separated parallel subdivisions equal in number to said channels, a selected area of at least one of said subdivisions being covered with an electrically conductive coating; and a supporting structure for said member, said structure including apparatus for urging a particular portion of said strip into a physical contact with said elements at which corresponding portions of said subdivisions are positioned in registration with said channels and said selected area electrically bridges the insulated separation between its associated channel and said common element.

2. The combination as set forth in claim 1 wherein said supporting structure is provided with a strip feeding mechanism for automatically moving said strip past said channels to sequentially establish said physical contact with adjacent portions of said strip.

3. In a programmer, an insulator member provided with a plurality of physically and insulatedly separated electrically conductive segments imbedded in the external surface thereof, one of said segments being designated as a common segment and extending in a first direction along said surface, the remaining segments being designated as channels and extending in a second direction along said surface.

4. An insulator member as set forth in claim 3 wherein said segments are metal segments.

5. In combination, an insulator member provided with a plurality of physically and insulatedly separated electrically conductive segments imbedded in the external surface thereof, one of said segments being designated as a common segment and extending in a first direction along said surface, the remaining segments being designated as channels and extending in a second direction along said surface; and a like plurality of electrically conductive wire elements, one of said elements being connected to said common segment, each of the remaining elements being connected to corresponding channels.

6. In a programmer, a cylindrically shaped insulator provided with a plurality of physically and insulatedly separated metallic segments imbedded in the external surface thereof, one of said segments extending in a direction parallel to the cylinder axis, the remaining segments being axially displaced with respect to each other and extending circumferentially about a portion of said cylinder.

7. A programmer comprising a cylindrical insulator provided with a first plurality of metallic segments imbedded in the external surface thereof and insulatedly separated from each other, one of said segments extending in a direction parallel to the cylinder axis, the re-

maining segments extending about the periphery of said cylinder; a tape formed from insulating material, a selected area on one side of said tape being divided into a second plurality of subdivisions equal in number to said remaining segments, said subdivisions being parallel and insulatedly separated from each other, selected portions of said subdivisions being covered with an electrically conductive coating in a predetermined pattern which defines a program; and a frame structure supporting said tape and said insulator in a physical relationship in which a portion of said selected area is urged into a plane of contact with said segments and the sections of said subdivisions contained within said plane are brought into registration with said remaining segments, any of said sections which are covered with said coating electrically bridging the insulated separation between its corresponding remaining segment and said one segment.

8. A programmer as set forth in claim 7 further including a plurality of electrical conductors equal in number to said first plurality, one of said conductors being connected to said one segment, the remaining conductors being respectively connected to corresponding remaining segments.

9. A programmer as set forth in claim 7 further including a tape feeding mechanism for moving said tape past said member to urge adjacent portions of said selected area sequentially into said plane of contact whereby electrical connections between said remaining segments and said one segment are established and broken in accordance with said program.

10. In combination, an insulator member provided with a first plurality of physically and insulatedly separated electrically conductive elements imbedded in the external surface thereof, one of said elements being designated as a common element and extending in a first direction along said surface, said one element including a second plurality of physically and insulatedly separated sub-elements, the remaining elements being designated as channels and extending in a second direction along said surface; an insulator strip, one surface of which includes a plurality of physically and insulatedly separated parallel subdivisions equal in number to said channels, a selected area of at least one of said subdivisions being covered with an electrically conductive coating; and a supporting structure for said member, said structure including apparatus for urging a particular portion of said strip into a physical contact with said elements at which corresponding portions of said subdivisions are positioned in registration with said channels and said selected area electrically bridges the insulated separation between its associated channel and one of said sub-elements.



11. In a programmer, an insulator member provided with a first plurality of physically and insulatedly separated electrically conductive segments imbedded in the external surface thereof, one of said segments being designated as a common segment and extending in a first direction along said surface, said common segment comprising a second plurality of physically and insulatedly separated sub-elements, the remaining segments being designated as channels and extending in a second direction along said surface, each channel corresponding to one of said sub-elements.

12. A programmer comprising a cylindrical insulator provided with a first plurality of metallic segments imbedded in the external surface thereof and insulatedly separated from each other, one of said segments extending in a direction parallel to the cylinder axis and including a second plurality of physically and insulatedly separated sub-elements, the remaining segments extending about the periphery of said cylinder, each of said remaining segments corresponding to one of said sub-elements; a tape formed from insulating material, a selected area on one side of said tape being divided into a plurality of subdivisions equal in number to said remaining segments, said subdivisions being parallel and insulatedly separated from each other, selected portions of said subdivisions being covered with an electrically conductive coating in a predetermined pattern which defines a program; and a frame structure supporting said tape and said insulator in a physical relationship in which a portion of said selected area is urged into a plane of contact with said segments and the sections of said subdivisions contained within said plane are brought into registration with said remaining segments, any of said sections which are covered with said coating electrically bridging the insulated separation between its corresponding remaining segment and the corresponding sub-element.

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