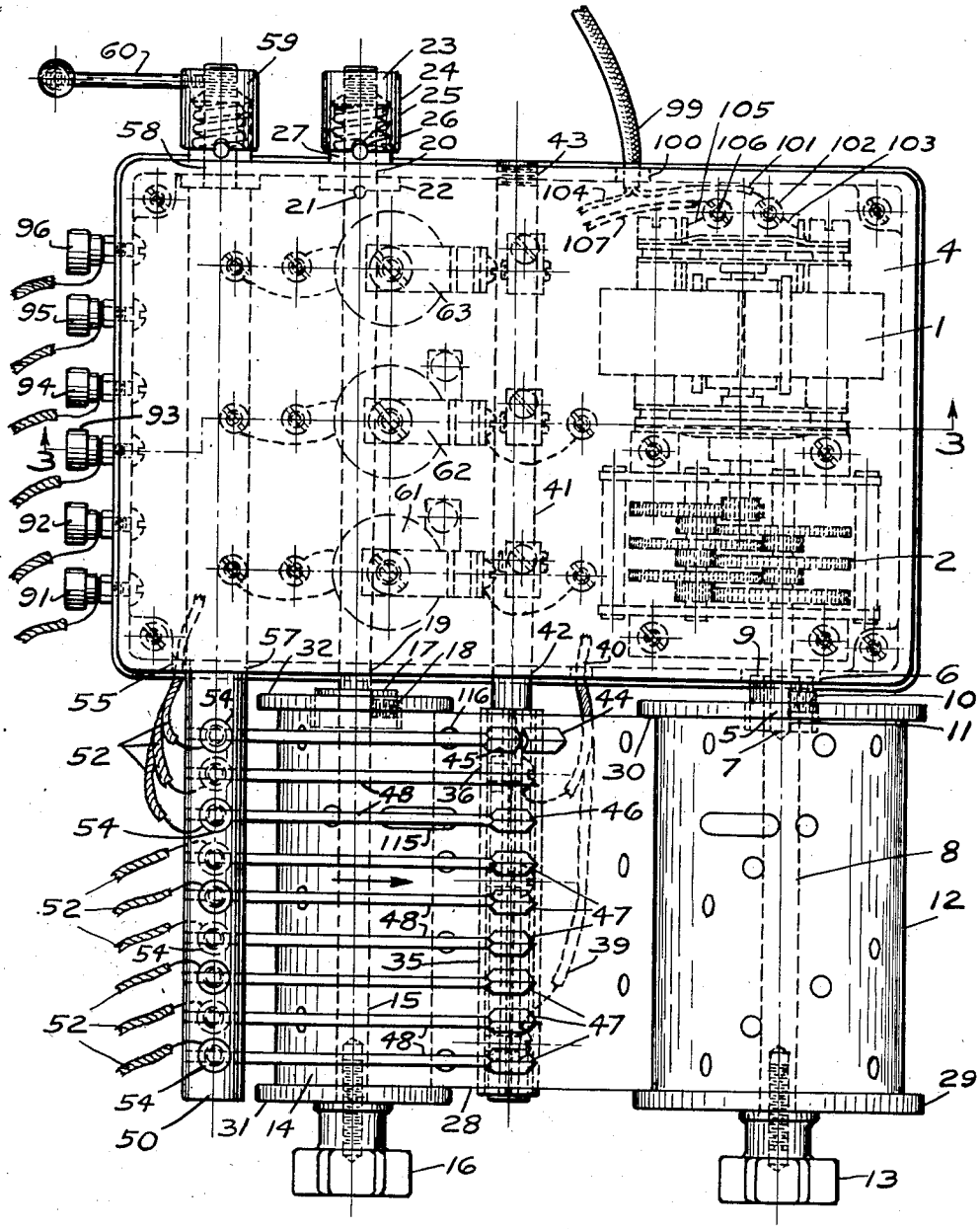
Oct. 16, 1945. W. KLAMP ET AL 2,386,956

PROGRAM TIMER

Filed March 27, 1942 3 Sheets-Sheet 1

Fig. 1.



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PROGRAM TIMER

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Fig. 2.

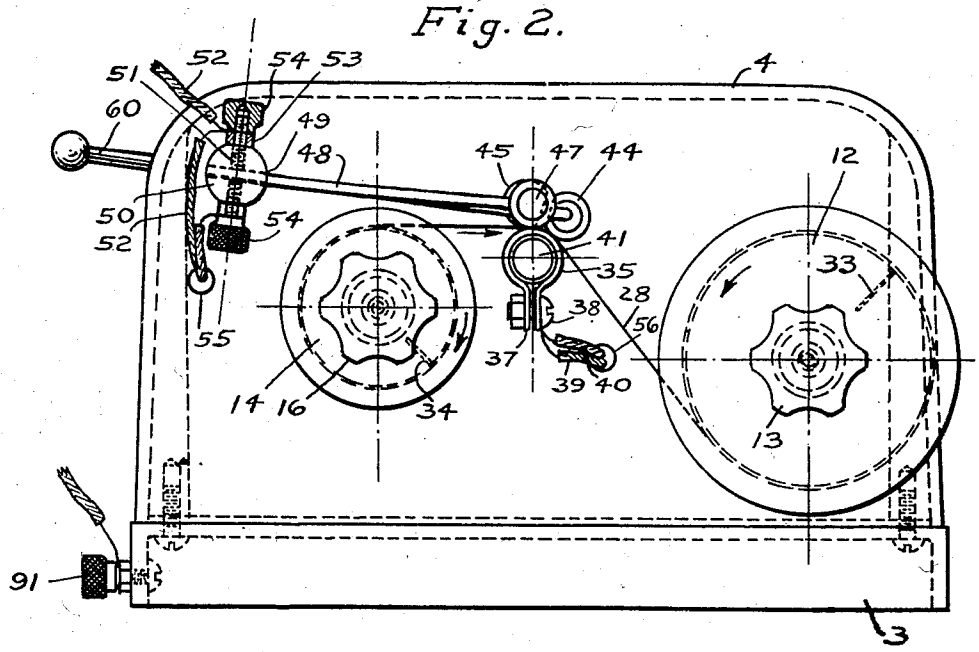
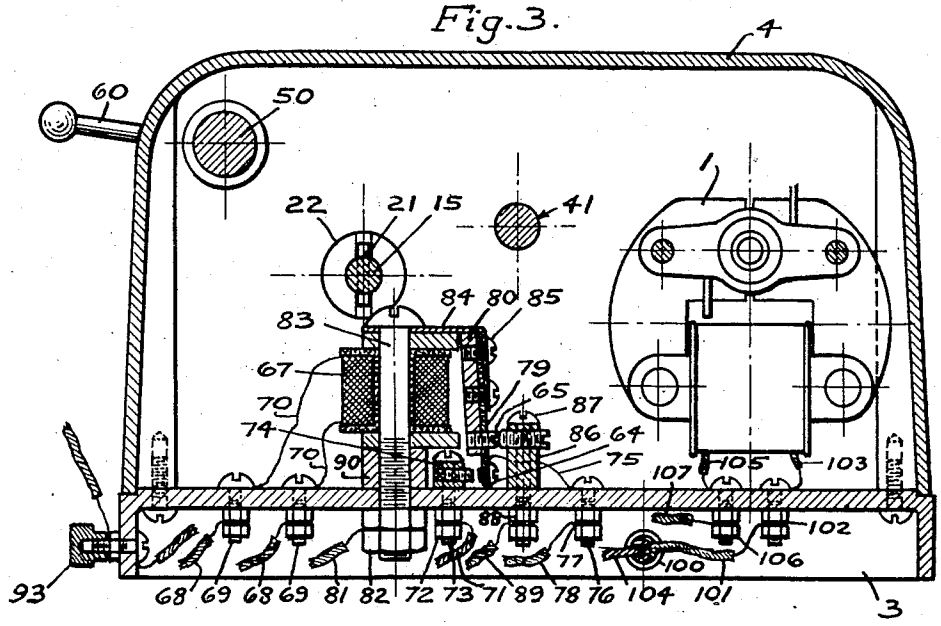


Fig. 3.



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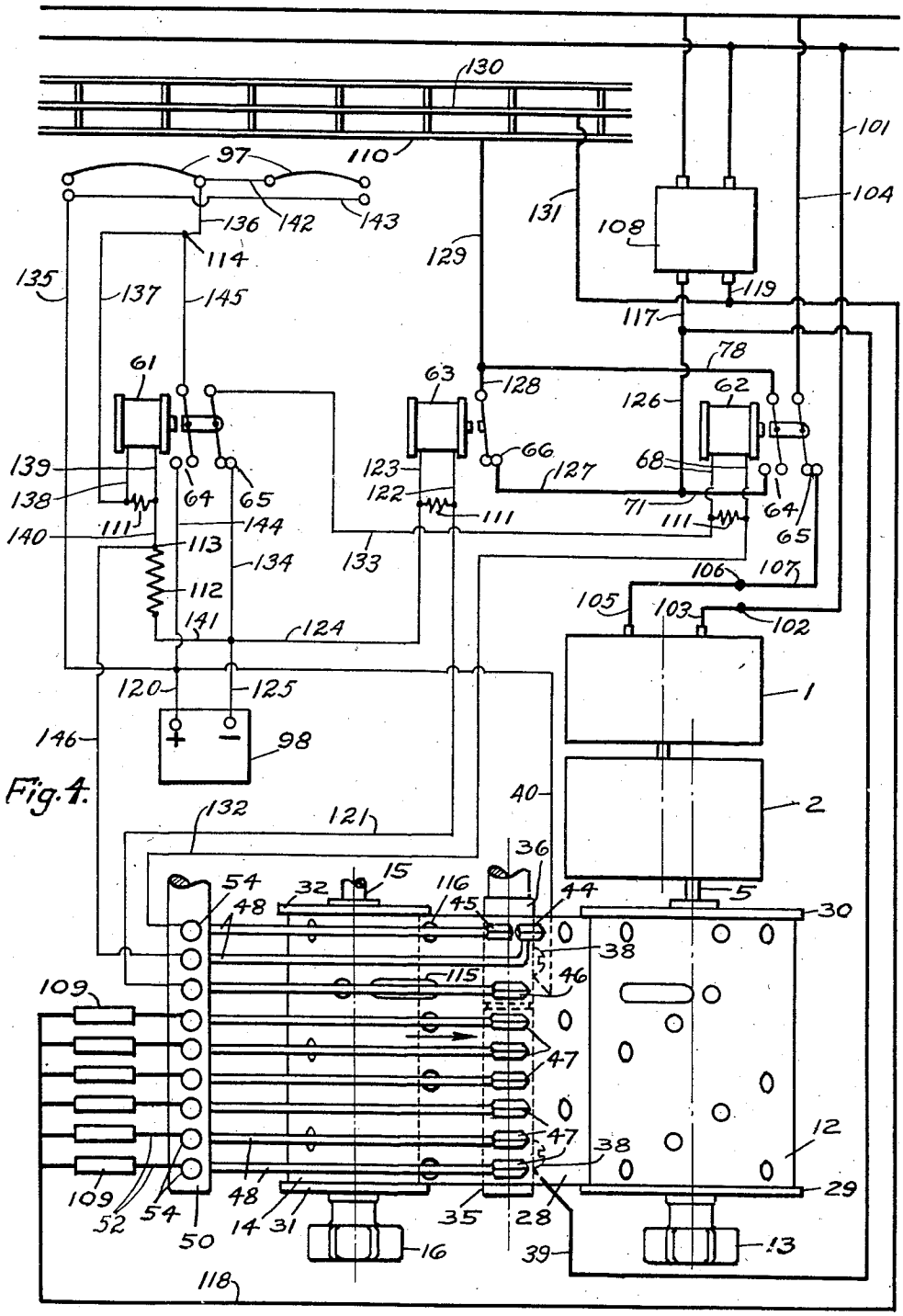


Fig. 4.

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2,386,956

UNITED STATES PATENT OFFICE

2,386,956

PROGRAM TIMER

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East Canton, Ohio

Application March 27, 1942, Serial No. 436,394

9 Claims. (Cl. 104—149)

Our invention relates to program timers, intended particularly for the automatic control of toy trains and accessories. The program timer is, however, suitable for other applications, where operating requirements resemble those in toy train systems.

The present invention has for its principal objects, first, to provide an apparatus that will automatically control the operation of toy trains and accessories; second, to provide automatic synchronization of the train movements with the correctly timed operation of all accessories; third, to provide for the possibility of making a complete change of the operating schedule without a single change of the electric wiring; fourth, to provide a simple means for setting up any desired operating schedule of a continuously changing character, without repetition of uniform cycles; and fifth, to centralize the control of the train and accessories into one unit.

We attain these objects by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of the apparatus; Figure 2, a front view; Figure 3, a vertical section on the line 3—3 in Figure 1; and Figure 4, a wiring diagram showing the electrical connections between internal components of the apparatus, as well as between the terminals of the apparatus and the toy train system.

Like numerals refer to like parts throughout the several views.

A motor 1 with a built-in gear reduction 2 is fastened to a case bottom 3 and enclosed in a case 4. Both, case bottom and case, are preferably made of moulded plastics and are held together by four screws. The slow speed shaft extension 5 of said geared motor turns counter clockwise at a speed of about one to three revolutions per minute and extends through a hole 6 in the front of said case and fits into the central bore 7 of a reel shaft 8 on the rear end of which a collar 9 is pressed. A set screw 10 extends through said collar and through the wall of the reel shaft 8 to engage a flat 11 on the gear motor shaft extension 5. A reel 12, made of wood or sheet metal, is placed on reel shaft 8 and secured in place by means of a knob 13, so that it will revolve slowly when the motor runs. The rear end of said reel is provided with a counter bore into which the front end of collar 9 extends, so as to bring the reel close up to case 4. In a similar manner, a second reel 14 is placed on a shaft 15 and held between a knob 16 and a collar 17 which is held by a set screw 18 on shaft 15 which extends backwards, fitting closely in bores 19 and 20 of case 4, said bores serving as bearings. A pin 21 is driven into said shaft and fits into a groove cut in a washer 22, so as to cause this washer to turn with said shaft when the latter revolves. The rear end of shaft 15 is threaded to receive a cap 23 which encloses a helical compression spring 24 and is provided with a slot 25 to engage a pin 26, driven into the periphery of a washer 27, thus forcing said washer to turn when shaft 15 and washer 22 revolve, and also causing said washers to be pressed against the wall of case 4, in order to provide a predetermined friction, so as to produce a slight tension in a perforated timing band 28 of thin insulating material such as paper or vellum, which is wound up on reel 12 and unwound from reel 14 when motor 1 is running, as indicated in Figure 2.

Said timing band fits exactly between flanges 29 and 30 of reel 12 and between flanges 31 and 32 of reel 14, while the ends of the timing band are held in radial slots 33 and 34 in the reels 12 and 14, respectively. Between said reels, the timing band 28 is placed over two copper sleeves 35 and 36 which have downwardly extending flanges 37 that are pulled together by screws 38 which serve as terminals for the electrical wires 39 and 40 and also are holding said copper sleeves tightly on a metal rod 41, while an insulation is placed between each of said sleeves and rod 41. The adjoining ends of sleeves 35 and 36 are separated far enough to keep them insulated from each other. The metal rod 41 is placed through a hole 42 in the front wall of case 4 and is screwed tightly into a tapped hole 43 in the rear wall of said case.

A series of copper contactors 44 to 47 are riding on the timing band 28 where the latter slides over the copper sleeves 35 and 36, said contactors being mounted on brass rods 48 which are placed in holes 49 in a contactor holder 50, consisting of a rod of insulating material, and are held in place by means of set screws 51 which extend out of said contactor holder to form terminals for wires 52 which are held between washers 53 and thumb screws 54. These terminals are arranged alternately upwards and downwards, in order to provide more space for making the wire connections. Three of these wire leads connect to the inside of case 4, passing through hole 55, while the two wires from the terminals on the copper sleeves 35 and 36 also lead to the inside of case 4, passing through hole 56. The contactor holder 50 is supported in two bored holes 57 and 58 in case 4 and is provided with a fric-

tion device 59 which is constructed similar to the friction device at the rear end of shaft 15 and is provided with a handle 60, by means of which the contactors 44 to 47 can be lifted off from the timing band 28, to permit removal of the latter, and can be pushed down again when a new band has been placed on the reels. The friction device 59 serves to hold the copper contactors 44 to 47 against the timing band with a moderate pressure, so that the brass rods 48 will be bent slightly, thus causing all copper contactors to be bearing against said timing band with equal pressure.

A series of parallel rows of perforations are punched in the timing band, so that each perforation will produce an electrical contact between one of the copper sleeves 35 or 36 and one of the contactors 44 to 47 when such perforation passes under such contactor. Besides the motor 1 with gear reduction unit 2, there are three magnetic switches 61, 62 and 63 mounted inside case 4, the first two of which being alike and having one normally open contact 64 and one normally closed contact 65, while switch 63 has one normally closed contact 66. A cross section through switch 62 is shown in Figure 3. The current for coil 67 is supplied through wires 68, terminals 69 and wires 70. When the switch is energized, current from wire 71 will flow through terminal 72, screw 73, contact holder 74, contact points 64, flexible wire 75, screw 76 and terminal 77 to wire 78. The movable contact point is mounted in a strip of insulating material 79 which is fastened to the swinging cross bar 80, made of soft steel. When the magnet is deenergized, current from wire 81 flows through terminal 82 which is formed by two nuts that serve to hold the soft steel magnet core 83 in place, and from there through said core to a thin brass strip 84, screws 85, swinging bar 80, contacts 65, contact holder 86, screw 87 and terminal 88 to wire 89. A nut 90 serves to hold two soft steel pole pieces tightly against the coil and holds the magnet in the desired position when nuts 82 are tightened. Magnet switch 63 is of the same construction, except that the normally open contact parts are omitted.

Six terminals 91 to 96 at the left side of case bottom 3 serve to connect the components located inside the case 4 with the transformer which furnishes power for the train system, as well as with a master switch 97 and a small dry cell or an eliminator 98 shown in Figure 4. The power for the motor 1 is obtained through a two-wire cord 99, the end of which carries a standard connector that is plugged into a receptacle. Said cord extends into the space under the case bottom, through a hole 100. One lead 101 is connected to a terminal 102 which connects to the motor through wire 103. The other lead 104 of the cord connects to the magnetic switch 62 in the case. The second wire 105 from the motor connects to a terminal 106 and from there to the same switch 62 through wire 107.

Referring to the wire diagram shown in Figure 4, the copper sleeve 35 is connected to one of the secondary terminals of the transformer 108 by wires 39 and 117, so that current flows to one of the contactors 47 whenever one of the perforations in the slowly moving band 28 passes under such contactor, thus carrying power to one terminal of one of the accessories of the train system which are indicated by the rectangles 109, through one of the corresponding brass rods 48, terminals 54 and wires 52. The second terminal of each of these accessories is connected directly to the other secondary terminal of said transformer through wires 118 and 119. In this manner, as many accessories can be controlled directly by the program timer as contactors 47 are provided.

The train movements are primarily controlled by switch 63 and contactor 46. The latter receives current from the plus pole of dry cell 98 (which is connected to the rear copper sleeve 36 by wires 120 and 40), if a hole in band 28 passes under said contactor, thereby carrying current to the coil of magnet 63 through wires 121 and 122 and from there back to the minus pole of said dry cell through wires 123, 124 and 125, thus energizing said magnet coil. The normally closed contact 66 which permits the transformer current to flow to one of the rails of train tracks 110 through wires 117, 126, 127, 128 and 129, and from there to the engine motor and back to the transformer through the other current carrying rail 130 and wires 131 and 119, will thus be broken, so that the train will stop, provided that the normally open contact 64 of switch 62 is not closed. A resistor 111 is connected in shunt with each of the coils of the magnetic switches 61, 62 and 63 and serves to prevent sparking when the current to the coils is interrupted. Said resistors have a resistance several times as great as that of the corresponding coils and, therefore, will consume but a small amount of current.

With the described arrangement and action of contactors 46 and 47, the train motions, as well as the operation of all accessories, can be controlled. But, further steps must be taken to keep train and accessories in synchronism, so that, for instance, no track switch is thrown while the train is passing over it. It is also necessary to time the operation of crossing gates, signals, uncouplers and other accessories in correct relation to the corresponding train positions. For this reason, provision has been made to interrupt the motion of the timing band 28 frequently by an action of the program timer and start it in motion each time again by a master switch 97 or one of two master switches 97 which is operated by the passing train. This way, both, the train and the perforated band 28, are in a predetermined position whenever said band is started in motion by the train as the latter operates a master switch while passing by. Hence, the program timer which may slightly fall off step with the moving train, due to speed variations of timer and train, is brought back into synchronism at short intervals of time.

The interruptions of the motion of the timing band 28 are produced by the contactor 45 whenever a perforation in said timing band moves under said contactor, thereby energizing magnetic switch 62, since current will now flow from the plus pole of the dry cell 98 to copper sleeve 36 through wires 120 and 40 and to contactor 45, and through the brass rod holding said contactor, to the terminal at the left end of said brass rod and then to the coil of switch 62 through wire 132 and the right hand wire 68, and from there back to the minus pole of said dry cell, through the left hand wire 68, wire 133, the normally closed contact 65 of magnetic switch 61 and wires 134 and 125. As the coil of switch 62 is energized, the normally closed contact 65 of said switch is opened, so that the current which was passing through wire 101, terminal 102 and wire 103 to motor 1 and back through wire 105, terminal 106, wire 107, contactor 65 and wire 104,

is interrupted, thus stopping the motion of timing band 28. Due to the very slow motion of the latter, it comes to a stop before the perforation under contactor 45 has passed said contactor, thus keeping the coil of switch 62 energized until a suitable lug fastened to the engine, closes one of the master switches 97 in passing. This will make current flow from the plus pole of dry cell 98 to said master switch and from there through the coil of magnetic switch 61 through wires 136, 137 and 138 and through wires 139 and 140 a resistor 112 and wires 141 and 125 to the minus pole of said dry cell. If two master switches are used, they are connected by wires 142 and 143 so that either one, if closed by the train, will complete the described circuit. The result is that the coil of switch 61 is energized and contact 65 is broken, thus interrupting the flow of current to the coil of switch 62, so that contact 65 of switch 62 is closed again which will cause the timer motor 1 and the timing band 23 to resume their motions.

When switch 61 is energized by one of the master switches 97, the other contact (64) of said switch 61 is closed. This will keep the latter energized after the momentary closing of this master switch 97 by the passing train engine, since current will flow from the plus pole of dry cell 98 through wires 120 and 144 contact 64 of switch 61, wires 145, 137 and 138, and through the coil of said switch, and from there through wires 139 and 140, resistor 112 and wires 141 and 125 to the minus pole of said dry cell. But, in order to enable contactor 45 to stop the timer motor again when the next perforation moves under said contactor, it is necessary that contact 65 of switch 61 is closed first. This, however, should not take place until the previous perforation has passed contactor 45, so as not to stop the timer motor at this time. For this reason, a contactor 44 is arranged in line with contactor 45, so that said previous perforation, after passing the latter, will move past contactor 44. This will connect the upper terminal 113 of resistor 112 through wire 146, contactor 44, sleeve 36 and wires 40 and 120, with the plus pole of dry cell 98, while the latter also is connected with wire joint 114 through wires 120 and 144 contact 64 of switch 61 and wire 145, so that the two wires 137 and 140 leading to the coil of said switch 61 will show no difference in voltage, thus causing said coil to be de-energized, thereby breaking contact 64 and closing contact 65 of switch 61. As long as contactor 44 makes contact with copper sleeve 36 through a moving perforation, resistor 112 is interposed between the plus and minus pole of dry cell 98, thus preventing a short circuit during such period which otherwise would occur by connecting the plus pole with the minus pole through wires 120, 40, sleeve 36, contactor 44 and wires 146, 141 and 125.

Since it is desirable at times to control the stopping position of the train accurately, master switches 97 can be used for this purpose as described in the following. The normally open contact 64 of switch 62 will be closed whenever contactor 45 energizes said switch which is used for stopping the timer motor by breaking contact 65 of said switch 62. Therefore, whenever the timer motor is stopped, the train is kept running through contact 64 of said switch with the current passing from the transformer through wires 117, 126, 71, contactor 64, wires 78 and 129, rail 110, engine motor, rail 130 and wires 131 and 119 back to the transformer, even if contact 66 of switch 63 is broken. When the leading edge of an elongated perforation 115 in timing band 28 is in line with a perforation 116 and both perforations are approaching contactors 46 and 45, respectively, the latter contactor, being slightly advanced towards the direction from which timing band 28 approaches, will make contact first and stop said timing band and also close contact 64 of switch 62. However, the advance of contactor 45 with relation to contactor 46 is still less than the small amount of coasting of said timing band, so that it will not come to a stop until the elongated perforation 115 has reached contactor 46, thus energizing switch 63 and breaking contact 66. Contact 64 of switch 62 will keep the train in motion now, until the engine closes one of the master switches 97, thereby energizing switch 61, breaking contact 65 of said switch, de-energizing switch 62 and, thus, breaking contact 64 of the latter and stopping the flow of current to the train tracks. But, at the same time, contact 65 of switch 62 is closed, so that the timing band will resume its motion and make it possible to start the train again.

In this manner, the engine can be stopped as it closes one of the master switches 97, if the timing band perforations are arranged accordingly. Since the coasting distance of the train, after the engine has caused the current flow to the tracks to stop, varies somewhat with the speed of the engine and the number of cars attached, this procedure still will not produce a sufficiently accurate stop for some requirements. In this case, the timing band perforations can be arranged to have the engine engage a master switch 97 and coast to a stop as described, and then back up and engage said master switch again and stop the flow of current to the tracks a second time. This time the train will come to an almost dead stop as soon as said master switch is engaged, due to the fact that the engine has not travelled far enough to gather any appreciable speed. Such a control of the stop is very realistic, resembling the accurate stopping of the train by means of manual control, where the train is liable to overrun the required stopping position and must be backed up a short distance.

In case that more than one accurate stop position on the track system is desired, the two master switches 97 can be placed at the proper points. Normally, both of these will then perform their primary function of keeping timing band and train synchronized. Only when an accurate stop is needed, will said switches serve in their second function of controlling such stop in the described manner.

The timing band is perforated with the aid of a suitable punch board which guides the timing band and has a scale for measuring the needed advance of said timing band after punching one or several holes across the band. Said punch board is not shown on the drawings.

The program timer as described can also be used for the automatic control of the train whistle, by providing one of the whistle control units as they are in use at present, with a magnet which is connected with the program timer in the same manner as the accessories indicated by the rectangles 109 in Figure 4, so that the action of this magnet will replace the manual pushing of the whistle switch button.

The program timer as described can be changed over from automatic to manual control quickly, by removing the timing band and raising the

contactors 44 to 47 slightly above copper sleeves 35 and 36 with handle 60. Now said contactors can be pushed down, one at a time, by means of an insulated rod held between the fingers. Said rod is notched at the bottom, so as to engage one of brass rods 48 near to its right end.

It is obvious that the invention may be embodied in many forms and constructions within the scope of the claims, and we wish it to be understood that the particular form is but one of the many forms. Various modifications and changes being possible, we do not otherwise limit ourselves in any respect thereto.

What we claim is:

1. A program timer for the automatic control of an electrically controlled apparatus comprising a moving timing element, means for moving said timing element, means for intermittently closing and opening a plurality of electrical contacts by said timing element when in motion, said contacts being adapted to control individually the operation of said apparatus,means for intermittently stopping the timing element, at variable time intervals by the action of one of said contacts, means for maintaining the operation of said apparatus during the time said timing element is stopped, and means for restarting the timing band by the action of said apparatus when the latter reaches a predetermined point of its operating schedule.

2. A program timer for the automatic control of an electrically controlled apparatus, comprising a moving timing band, means for moving said timing band, means for closing a plurality of electrical contacts through perforations in said timing band when in motion, said contacts being adapted to control individually the operation of said apparatus, means for intermittently stopping the timing band, at variable time intervals, by the action of one of said contacts, means for maintaining the operation of said apparatus during the time said timing band is stopped, and means for restarting the timing band by said action of the apparatus when the latter reaches a predetermined point of its operating schedule.

3. A program timer for the automatic control of a toy train and electrical accessories comprising a moving timing band, means for moving said timing band, means for intermittently closing and opening a plurality of electrical contacts by said timing band when in motion, said contacts being adapted to control individually the operation of said toy train and electrical accessories, means for intermittently stopping the timing band, at variable time intervals by the action of one of said contacts, means for maintaining the operation of said train during the time said timing band is stopped, and means for restarting the timing band by the action of the toy train as it passes a predetermined point along the train tracks.

4. A program timer for the automatic control of a toy train system comprising a timing band, means for moving said timing band, means for intermittently closing and opening a plurality of electrical contacts by said timing band when in motion, said contacts being adapted to control individually the operation of a toy train and electrical accessories, means for intermittently stopping the timing band, at variable time intervals, by the action of one of said contacts, means for maintaining the operation of said train during the time said timing band is stopped, and means for restarting the timing band by the action of the toy train as it passes a predetermined point along the train tracks, said timing band being adapted to produce different sequences of said electrical contacts during successive periods of motion of the program timer.

5. A program timer for the automatic control of an electrically controlled apparatus, comprising a moving timing band, means for moving said timing band, means for intermittently closing and opening a plurality of electrical contacts, said contacts being closed through perforations in the timing band and being arranged in a number of parallel rows disposed in the direction of motion of said timing band, said contacts being opened again when said perforations are moved past said contact means, said contacts being adapted to control the operation of said apparatus, means for intermittently stopping the timing band, at variable time intervals, by the action of an additional electrical contact, said additional contact being closed through additional perforations in said timing band, each time one of said additional perforations in the moving timing band moves up to said additional contact, said additional perforations being arranged in a row parallel to the first mentioned rows of perforations and means for restarting the timing band by the action of the apparatus which is controlled by the program timer when said apparatus reaches a predetermined point of its operating schedule.

6. A program timer for the automatic control of a toy train and electrical accessories, comprising a moving timing band, means for moving said timing band, means for intermittently closing and opening a plurality of electrical contacts by said timing band when in motion, means for intermittently stopping the timing band, at variable time intervals, by the action of one of said contacts, means for maintaining the operation of said train during the time said timing band is stopped, and means for restarting the timing band by the action of the toy train as it passes any one of a plurality of predetermined points along the train tracks, said timing band being adapted to produce different sequences of said electrical contacts during successive periods of motion of the program timer, said periods of motion being normally of short duration, but, occasionally, of widely variable longer duration.

7. A program timer for the automatic control of a toy train and its accessories, comprising a motor and gear reduction unit, a reel driven by said motor and mounted on an extension of the slow speed shaft of said gear reduction unit, a timing band of thin, flexible insulating material, said timing band adapted to be wound up on said reel when the latter is in motion, an idler reel from which the timing band unwinds when said first mentioned reel is rotating, an idler reel shaft holding said idler reel in place, a friction device attached to said idler reel shaft and adapted to maintain a light tension in the timing band, two current carrying copper sleeves over which the timing band slides when in motion, said copper sleeves being mounted in line with each other and with their axes disposed at right angles to the direction of motion of the timing band, the first of said copper sleeves being connected to a source of low voltage alternating current and being insulated from the second of said copper sleeves, the latter being connected to a source of low voltage direct current, a series of alternating current contactors pressing on top of the timing band and disposed so as to make electrical contacts with the first copper sleeve

when suitable perforations in the timing band are passing under said contactors, and three direct current contactors, also pressing on top of the timing band and disposed so as to make electrical contacts with the second copper sleeve when other suitable perforations in the timing band are passing under said contactors with each of said alternating current contactors being adapted to close a circuit through any perforation in one row of perforations in the timing band and, thereby, control the operation of one of said accessories, and with said three direct current contactors consisting of a train control contactor adapted to close a circuit through any perforation in one row of perforations in the timing band and, thereby, control the stopping and starting of the toy train, by means of a magnetic switch, a timer control contactor adapted to close a circuit through any perforation in an additional row of perforations in the timing band and, thereby stop the motion of the timing band, by means of a second magnetic switch, the perforations in said additional row of perforations being unevenly spaced and, therefore, being adapted to stop the motion of the timing band at variable time intervals by the timer control contactor, said timer control contactor being adapted to close an auxiliary circuit supplying current to the train tracks, by means of said second magnetic switch and, therefore, being adapted to maintain the operation of said train during the time said timing band is stopped, a master switch located beside the train tracks and adapted to close a contact when said train passes by, thereby energizing a third magnetic switch and, thereby, breaking the circuit which was closed by said timer control contactor, thus causing the timing band to resume its motion, and a reset contactor adapted to close a circuit through any perforation in said additional row of perforations, thereby de-energizing said third magnetic switch again and, thereby, enabling said timer control contactor to be operative again.

8. A program timer for the automatic control of a toy train and its accessories as claimed in claim 7, comprising means for quickly converting said program timer into a manually operated remote control unit for the centralized control of the toy train and all accessories.

9. A program timer for the automatic control of an electrical toy train and accessories, comprising a moving timing band, means for moving said timing band, means for intermittently stopping the timing band at variable time intervals by the action of an electrical contact which is closed by the timing band, means for restarting the timing band by a master switch, located beside the train tracks and actuated by the passing train, contact means for closing and opening a plurality of electrical contacts by said timing band when in motion, said contacts being adapted to control individually the operation of said electrical toy train and accessories, said contact means being adapted to close and open said electrical contacts in any combination during each variable period of motion of the timing band, said master switch being adapted to either start the motion of the timing band while keeping the train in motion, or to start the motion of the timing band and, simultaneously, stop the motion of the train.

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