United States Patent

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[54] **CONTROL FOR SHEET FEEDING APPARATUS**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **200/61.13,** 200/168
[51] **Int. Cl.** **H01h 9/02**
[50] **Field of Search** ..... 200/61.13, 61.14, 153.19, 153.10, 61.41, 172 (A), 166.1, 81.9, 168 (A); 335/188, 187

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ABSTRACT: In a conveyor for feeding sheet material of variable width, a control mechanism for automatically adjusting the conveyor laterally of the sheet in accordance with the width of the sheet. The control mechanism includes an arm engageable with the edge of the sheet to sense its width, a motor for laterally adjusting the conveyor towards or away from the sheet, and a switch mechanism including relays actuated by the control arm for energizing the motor.

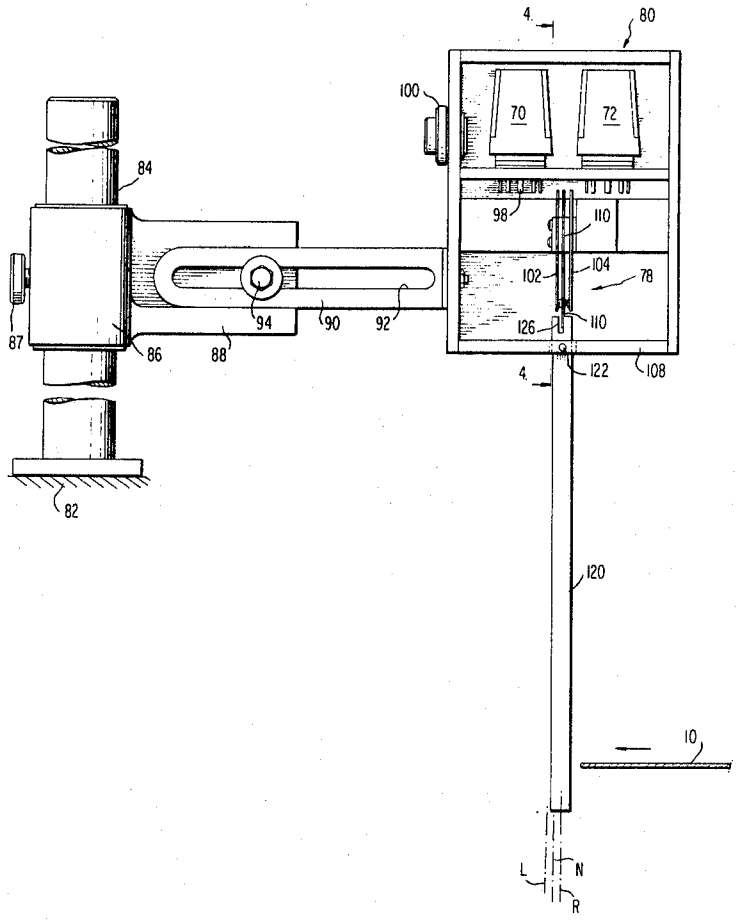


FIG. 1

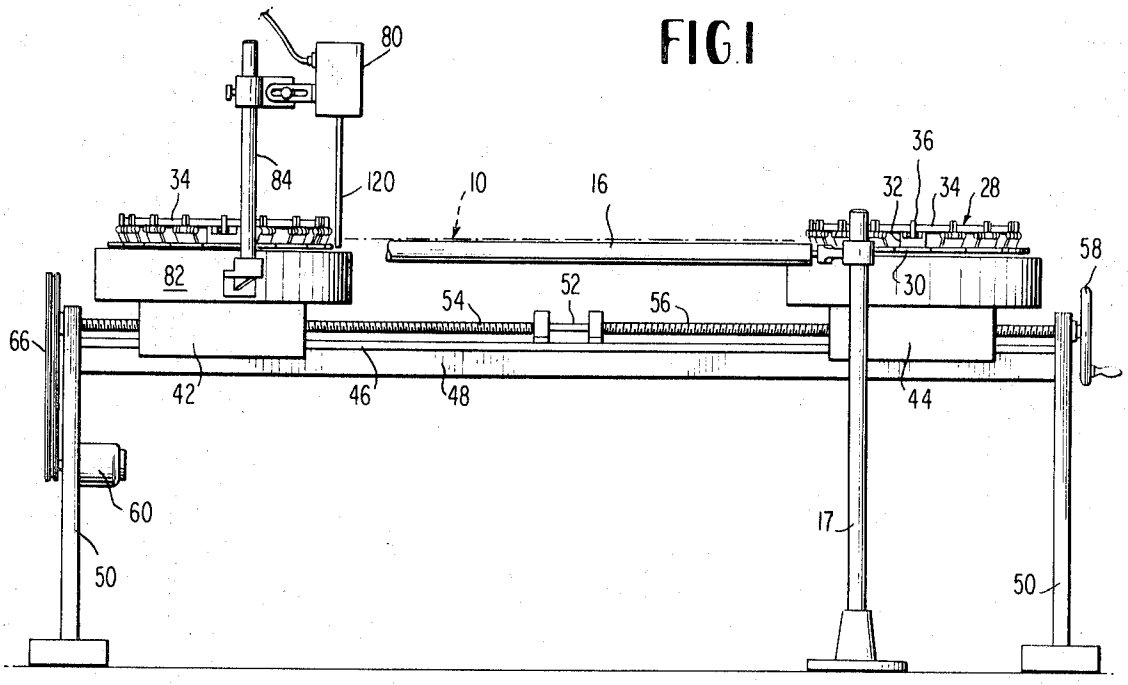


FIG. 2

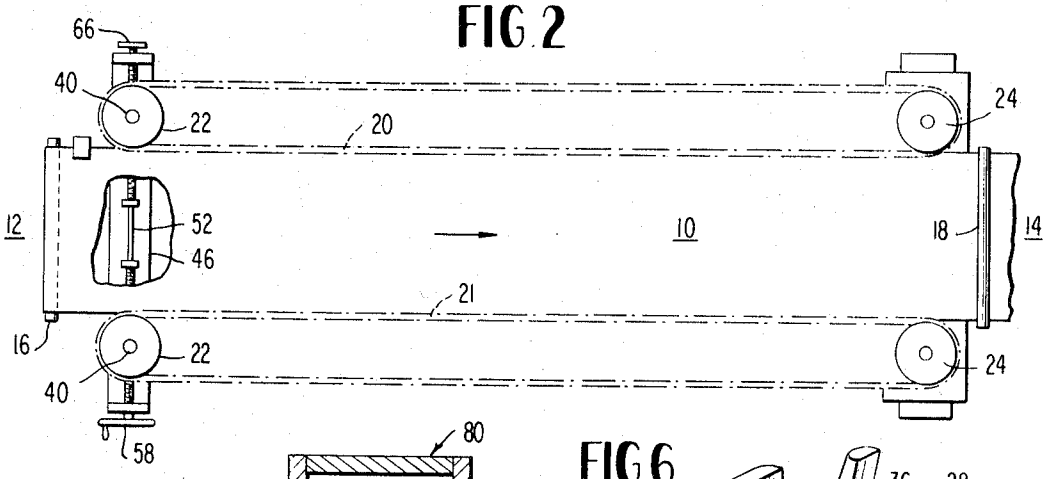


FIG. 4

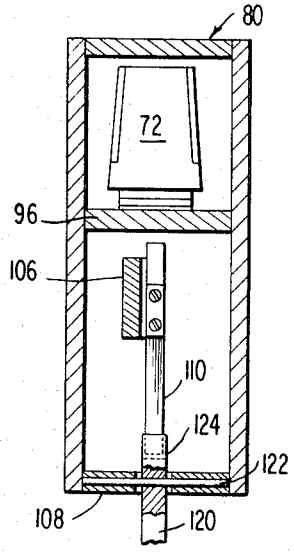
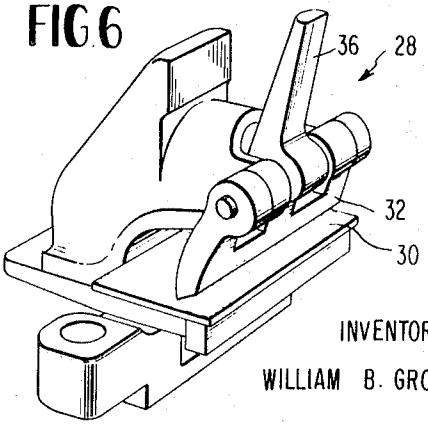


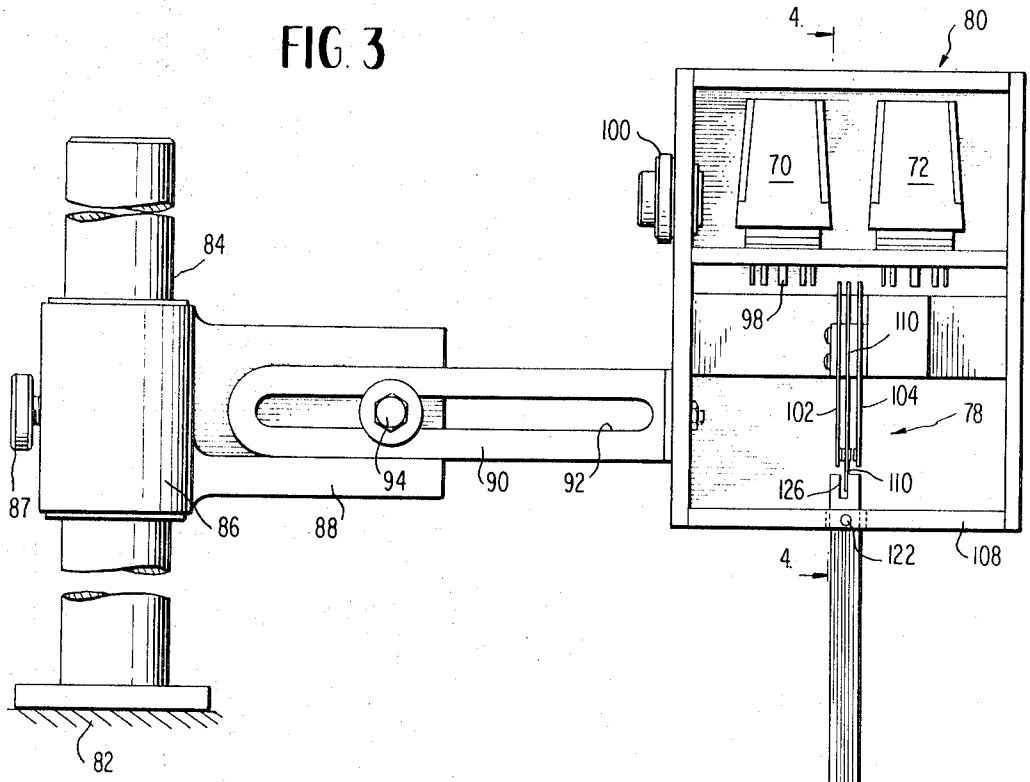
FIG. 6



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FIG. 3



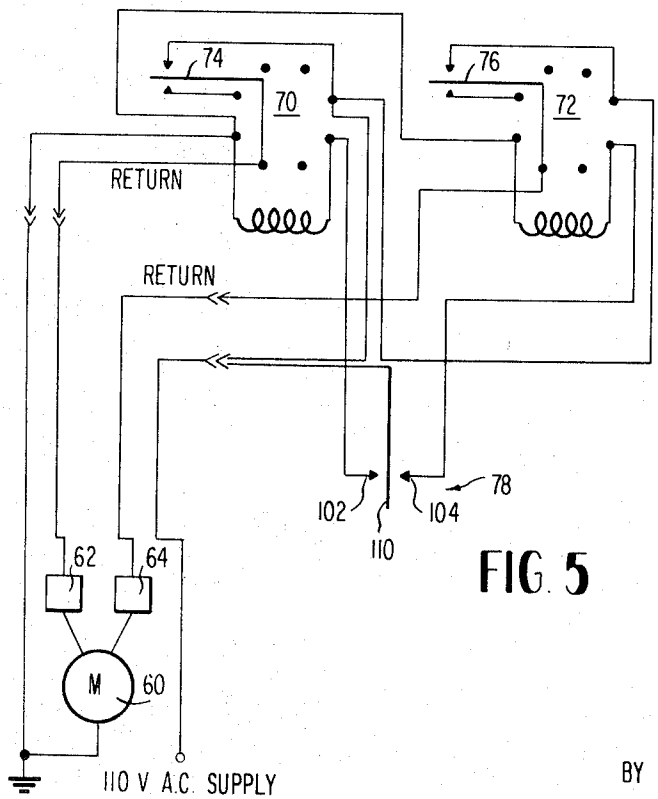


FIG. 5

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CONTROL FOR SHEET FEEDING APPARATUS

SUMMARY OF INVENTION

The present invention generally relates to a conveyor for feeding sheet material along a predetermined path, and more specifically to a new and improved control mechanism for automatically adjusting the conveyor laterally of the path in accordance with the width of the sheet.

Although not limited thereto, the present invention has particularly utility in Tenter Frames employed in the textile industry to convey sheets of textile material which often vary in width. The control mechanism of the present invention will automatically adjust the Tenter Frames to compensate for the variable width of the textile sheet as it is conveyed through the Tenter Frame.

One of the objects of the present invention is to provide a new and improved control mechanism of the aforedescribed type which is both reliable and accurate in operation.

A further object of the present invention is to provide such a control mechanism which incorporates a novel switching mechanism that is extremely durable without replacement of parts and cleaning of contacts despite long periods of continuous use.

A still further object of the present invention is to provide such a control mechanism that may be employed as an attachment to conventional or existing sheet feeding apparatus with minimum cost and with little or no modification to the apparatus. Included herein is the provision of such a control mechanism that may be easily and economically applied to standard Tenter Frames now in use in the textile industry.

Other objects and advantages of the present invention will become apparent from the following more detailed description taken in conjunction with the attached drawings in which:

FIG. 1 is an end elevational view taken at the inlet station of sheet feeding apparatus incorporating the control mechanism of the present invention;

FIG. 2 is a schematic plan view of the apparatus in FIG. 1;

FIG. 3 is an enlarged, elevational view of a relay and switching assembly included in the control mechanism;

FIG. 4 is a cross-sectional view, with portions broken away, taken generally along lines 4–4 of FIG. 3;

FIG. 5 is a schematic view of a circuit included in the control mechanism; and

FIG. 6 is a perspective view of a clip included in the sheet feeding apparatus.

Referring now to the drawings in detail, the control mechanism of the present invention is shown as being incorporated in a conveyor such as a Tenter Frame employed to feed sheet material generally designated 10 between an inlet station 12 and a discharge station 14. At the inlet station, a feed roll 16 extends across the conveyor and is supported in any suitable manner such as by vertical stands 17 (only one shown). At the outlet station 14, a roll 18, which may be a guide or feed roll, extends across the sheet as it leaves the conveyor.

In the specific form shown, the conveyor includes a pair of parallel, coplanar, endless chains 20 and 21 laterally spaced to receive sheet 10 therebetween for conveyance between the inlet and discharge stations. Chains 20 and 21 are trained about end sprockets 22 and 24, one set of sprockets being driven through suitable gearing and a motor (not shown) in any conventional manner.

Referring to FIG. 6, the opposite longitudinal edges of the sheet are engaged or gripped by clips 28 secured to the chains in series so as to be movable with the chains. Clips 28 may be of the type such as used in standard or conventional Tenter Frames, such clips including a stationary horizontal jaw or plate 30 and a pivotal jaw 32 movable between an open position (shown in FIG. 1) for receiving the edge of the sheet on the stationary jaw 30 and a closed position overlying stationary jaw 30 for clamping therebetween the edge of the sheet. Movement of jaw 32 into the open position for receiving the edges of the sheet in the shown embodiment, is effected

through a circular cam 34 which engages a follower 36, projecting from the top of movable jaw 32. Thus as clips 28 move around sprockets 22 at the inlet station, movable jaws 32 will be opened by cams 34 to initially receive the edges of the sheet. As clips 28 continue past cams 34 their followers 36 will be engaged by any suitable means such as an elongated guide member (not shown) overlying the inner runs of chains 20, 21, so that the movable jaws will be pivoted into closed position gripping the edges of the sheet for conveyance to discharge station 14. Instead of a guide member, the clips may be biased closed by gravity with or without a spring assist. The clip structure as well as all of the remaining structure described above is conventional and well known in the Tenter Frame art and textile industry and therefore further description thereof is not believed to be necessary. Moreover, it should be understood that the present invention, as will be apparent, may be employed in connection with other types of conveyors and structures employed to grip or support the sheet material for conveyance.

In order to adjust the lateral distance between chains 20 and 21 at the inlet station 12, vertical shafts 40 of sprockets 22 are supported on carriages 42 and 44 movable along a track 46 which extends transversely below the conveyor. Track 46 is secured or formed on a crossbar or bed 48 whose opposite ends are secured to the vertical frames of the conveyor which are shown as stands 50. Actuation of carriages 42 and 44 for adjusting sprockets 22, is achieved through means of a drive screw 52 whose opposite ends are journaled for rotation in the conveyor frame. The opposite halves of screw 52 have oppositely directed screwthreads 54, 56 which are received in corresponding threads housed in the carriages respectively. Rotation of screw 52 in one direction will cause carriages 42 and 44 to move towards each other to thus lessen the distance between chains 20, 21 while rotation of screw 52 in the opposite direction will cause the carriages to move away from each other to thereby increase the distance between the chains. A conventional hand wheel 58 is connected to one end of screw 52 to obtain a manual adjustment of sprockets 22 prior to initiation of an operation.

In accordance with the present invention, an improved mechanism is provided for automatically operating screw 52 during conveyance of a sheet to adjust the chains towards or away from each other to compensate for variations in the width of the sheet. In the illustrated embodiment, the control mechanism includes a reversible electric motor 60 having forward and reversing starters 62, 64. Motor 60 is operatively connected to one end of screw 52 by means of a pulley and belt assembly generally designated 66.

Energization and deenergization of motor 60 is controlled by means of two circuits shown in FIG. 5 respectively including normally open electromagnetic relays 70 and 72 having normally open contacts 74 and 76. The circuits are adapted to be connected to opposite sides of motor 60 through the starters 62 and 64. A dual switch mechanism generally designated 78 is provided for controlling energization and deenergization of the circuits and motor 60.

Referring to FIGS. 3 and 4, relays 70, 72 and switch mechanism 78 are housed in a boxlike casing 80 that is mounted, in the shown embodiment, to the housing 82 of one of the sprockets 22 by means of an upright post 84. Slidably received on post 84 is a sleeve 86 having a slotted bracket arm 88 to which is adjustably secured a mounting arm 90 that projects from one side of casing 80. Mounting arm 90 has an elongated slot 92 which receives bolt 94 that extends through bracket 88 and is fastened thereto by a nut (not shown). Sleeve 86 may be adjusted along post 84 and secured in position by means of a set screw 87.

Relays 70, 72 are mounted in the upper portion of casing 80 on a horizontal partition 96 which has sockets receiving pins 98 of the relays as shown in FIG. 3. Electrical input and return lines are connected to the relays and switch mechanism by means of any suitable electrical connector 100 mounted in the upper portion of the casing sidewall.

Switch mechanism 78 in the shown embodiment, includes a pair of elongated fixed contacts 102, 104 which are flexible and resilient and have their upper ends suitably secured and insulated in vertical crossmember 106 extending between the sides of casing 80 below partition 96. Fixed contacts 102, 104 extend downwardly in casing 80 and terminate adjacent the bottom wall 108. Between the fixed contacts there is similarly mounted what will be termed a "movable contact" 110 that projects below the extremities of the fixed contacts so as to be operable into and out of engagement with the fixed contacts.

As will be seen from FIG. 5, one fixed contact 102 is connected to one of the relays 70 while the other fixed contact 104 is connected to the other relay 72. When movable contact 110 is engaged with one fixed contact, the associated relay will be energized and motor 60 will operate in one direction to actuate screw 52 in one direction, while the other fixed contact and its associated relay remain in open position. When movable contact 110 engages the other fixed contact, the opposite effect will result to drive motor 60 and screw 52 in the opposite direction.

Movable contact 110 is operated between one neutral and two opposite positions by means of a control arm 120 which senses the width, or variation in the width, of sheet 10. Control arm 120 is mounted to pivot about a horizontal axis by means of a pivot pin 122 mounted in bottom wall 108 of casing 80. Externally of casing 80, control arm 120 extends a substantial distance downwardly so as to terminate adjacent the edge of sheet 10 when casing 80 is mounted to the conveyor for operation. The top portion 124 of control arm 120 is employed to actuate movable contact 110, and in the shown embodiment, this top portion is formed with an elongated slot 120 which receives movable contact 110.

In the illustrated form of the invention, movable contact 110 is positioned closer to fixed contact 102 to engage fixed contact 102 when movable contact 110 is free or unstressed. Additionally, pivot pin 122 is positioned such that when control arm 120 is freely suspended from casing 80, slot 126 allows movable contact 110 to engage fixed contact 102 as shown in FIG. 3.

In use, control arm 120 is positioned (by adjusting arm 90 and sleeve 80) so that the edge of sheet 10 will engage control arm 120 and slightly pivot it (clockwise as viewed in FIG. 3) sufficient to move movable contact 110 out of engagement with fixed contact 102 into an intermediate position spaced from both fixed contacts. This position of control arm 120, which is indicated by phantom line N in FIG. 3, is assumed when the width of sheet 10 properly corresponds to the desired spacing between conveyor chains 20, 21. Because movable contact 110 is spaced from both fixed contacts when the control arm 120 is in position N, both relays 70, 72 and motor 60 will be deenergized.

Should sheet 10 increase in width, its edge will cause control arm 120 to pivot further in a clockwise direction (as viewed in FIG. 3) whereby movable contact 110 will be brought into engagement with fixed contact 104. This position of control arm 120 is represented schematically by phantom line L in FIG. 3. Upon engagement between movable contact 110 and fixed contact 104, the circuit through relay 72 will be energized to start motor 60 which will rotate in one direction to drive screw 50 to increase the spacing between chains 20 and 21 in accordance with the variation in the sheet width as sensed by the control arm. Once chains 20, 21 are sufficiently adjusted, control arm 120 will move slightly counterclockwise sufficient to permit return of movable contact 110 to its neutral position spaced from both fixed contacts whereupon motor 60 will be deenergized. In this neutral position of the movable contact, the edge of sheet 10 will engage control arm 120 to maintain it slightly pivoted clockwise in position N to thereby maintain movable contact 110 spaced from both of the fixed contacts.

Assuming now that the width of the sheet decreases, the edge of the sheet will be spaced inwardly from control arm 120 thus allowing the control arm to pivot by gravity into its freely suspended position represented by R in FIG. 3. This will result in engagement of movable contact 110 with fixed contact 102 and energization of the associated relay 70 and motor 60 which will rotate in the opposite direction to drive the screw in the opposite direction to decrease the spacing between conveyor chains 20, 21. Once the conveyor chains are brought into the new adjusted position corresponding to the decreased width in the sheet, the edge of the sheet will again engage control arm 120 to pivot it slightly clockwise to a new neutral position wherein movable contact 110 is spaced from both fixed contacts thereby maintaining motor 60 deenergized.

The initial position of control arm 120, that is, before the conveyor chains are started, may be adjusted by means of slot 92 in arm 90 which allows sufficient room for adjustment. Additionally vertical adjustment of control arm 120 may be easily effected by sleeve 86 and set screw 87.

Control arm 120 along with casing 80 may be mounted on either side of sheet 10. A small adjustable weight (not shown) may also be screwed in the control arm to increase its gravity bias. Moreover, although one reversible motor has been employed in the illustrated embodiment, two motors operating with two separate screws respectively may be employed to carry out the present invention. It should also be understood that the control mechanism of the present invention may be applied to other types of conveyors which may or may not positively grip the edge of the sheet.

It is preferred that casing 80 be formed from transparent material such as plastic or glass and that it be sealed against entry of foreign matter which may contaminate the contacts.

In addition to accurate sensing of the variations in the width of the sheet, the present invention through the use of the relays, reduces the voltage in the circuits and thus avoids pitting and extreme wear on the points of the contacts which often occurs with prior art and conventional devices to cause repeated breakdown in operation. In contrast the control mechanism of the present invention will operate efficiently and accurately over relatively long periods of use and without requiring cleaning or replacement of the contacts. In addition, the control mechanism of the present invention may be economically fabricated from standard parts.

Modifications and adaptations of the present invention readily apparent from the foregoing description and associated drawings, although not specifically mentioned herein, will nevertheless be included within the scope of the present invention as indicated in the appended claims.

I claim:

1. A switch control mechanism comprising in combination; a casing including walls enclosing a chamber, a pair of relays mounted in the casing, a pair of switches mounted in the casing and respectively connected directly to said relays, the switches including two fixed contacts extending downwardly towards the bottom of the casing and a movable contact positioned between the fixed contacts for alternately engaging the fixed contacts to close and open the switches, a control arm for actuating the movable contact in accordance with a condition sensed by the control arm, said control arm having an elongated lower portion freely projecting externally of the casing and an upper portion received and pivoted in the casing to be movable about a horizontal pivot axis, said upper portion including means engageable with said movable contact to pivot the movable contact into or out of engagement with said fixed contacts upon pivotal movement of said control arm.

2. The switch control mechanism defined in claim 1 wherein the movable contact normally engages one of the fixed contacts when the control arm is freely suspended from the casing.

3. The switch control mechanism defined in claim 2 wherein said means on the control arm engageable with the movable contact defines a slot receiving the movable contact and permitting the movable contact to engage the fixed contact when the control arm is freely suspended from the casing.

4. In combination with the switch control mechanism defined in claim 1, a circuit including a power source connected directly to one side of said relays to energize the same upon energization of the relays through said movable contact, and a motor connected to the relays to be energized when the relays are energized through said movable contact.

5. The switch control mechanism defined in claim 1 wherein said casing includes opposite sidewalls and a bottom wall extending between said sidewalls, and wherein said control arm is elongated and has an upper portion pivoted to the bottom wall of the casing and with the upper end of the control arm projecting into the casing, said upper end of the control arm having a slot extending longitudinally therein and receiving said movable contact to actuate the same upon pivotal movement of said control arm.

6. The switch control mechanism defined in claim 5 further including, means in said casing mounting said relays in the upper portion thereof, means in said casing mounting said fixed and movable contacts in an intermediate portion of said casing below said relays, an electrical connector means mounted in one of the walls of the casing adjacent said relays and connected to said relays for supplying input power thereto, and an elongated mounting arm rigidly fixed to one of the sidewalls of the casing and projecting outwardly therefrom and having an elongated slot for mounting the casing relative to a fixed support.

7. The switch control mechanism defined in claim 6 wherein said casing is made of transparent material.

8. A switch control mechanism comprising in combination; a casing including a top wall, opposite sidewalls and a bottom wall enclosing and substantially sealing a chamber, a pair of relays mounted in an upper section of the casing, a pair of switches, mounting means mounting said switches in an intermediate portion of the casing below said relays, said switches including two fixed contacts extending downwardly from said mounting means towards the bottom of the casing and respectively connected to said relays and a movable contact position between the fixed contacts and extending downwardly towards the bottom wall of the casing from said mounting means for alternately engaging the fixed contacts to close and open the switches, an elongated control arm for actuating the movable contact in accordance with a condition sensed by the control arm, said control arm is mounted at its upper portion to the casing for pivotal movement about a horizontal pivot axis and having a lower elongated portion freely depending vertically beyond the bottom wall of the casing for engagement with an object to be sensed, the upper portion of said control arm having an elongated longitudinally extending slot receiving the free end of said movable contact to actuate the same upon pivotal movement of said control arm, and an electrical connector means mounted in one of the walls of the casing adjacent said relays and being connected directly to said relays for supplying input power thereto.