

[72] Inventors **Guenther Etter**
Sissach Ich, Switzerland;
William G. Pestalozzi, Carlisle, Mass.
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 [73] Assignee **Sybron Corporation**
Rochester, N.Y.

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Primary Examiner—Arthur L. LaPoint
 Assistant Examiner—George H. Libman
 Attorney—Kenway, Jenney and Hildreth

[54] **AUTOMATIC CONVEYOR BLOCK SYSTEM**
3 Claims, 4 Drawing Figs.

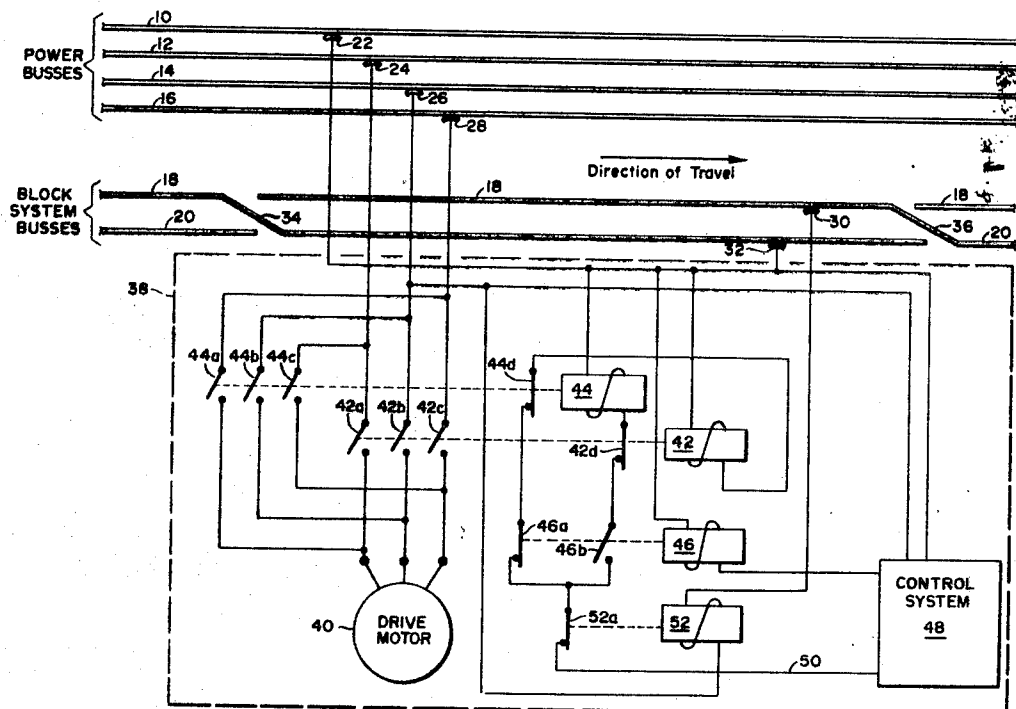
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56, 51, 187 C, 75, 48, 246

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ABSTRACT: A drive and automatic block system for use with electrically driven conveyors which move along a trackway in a single direction. Power is supplied to the conveyor drive motor through switching means mounted on the conveyor from a plurality of electrical busses mounted beside the trackway, the conveyor having brushes to engage the power busses. Two additional busses are provided beside the trackway. These are divided into electrically insulated sections of a length equal to a block section. A conveyor as it moves along the track supplies a ground signal to the block section which is in the uptrack direction from its present location. Additionally the second block bus in any section is continuously tested for electrical ground and if a ground signal is present, by reason of a conveyor being present in the next downtrack block, the ground signal will operate the conveyor switching means to remove power from the conveyor drive motor.



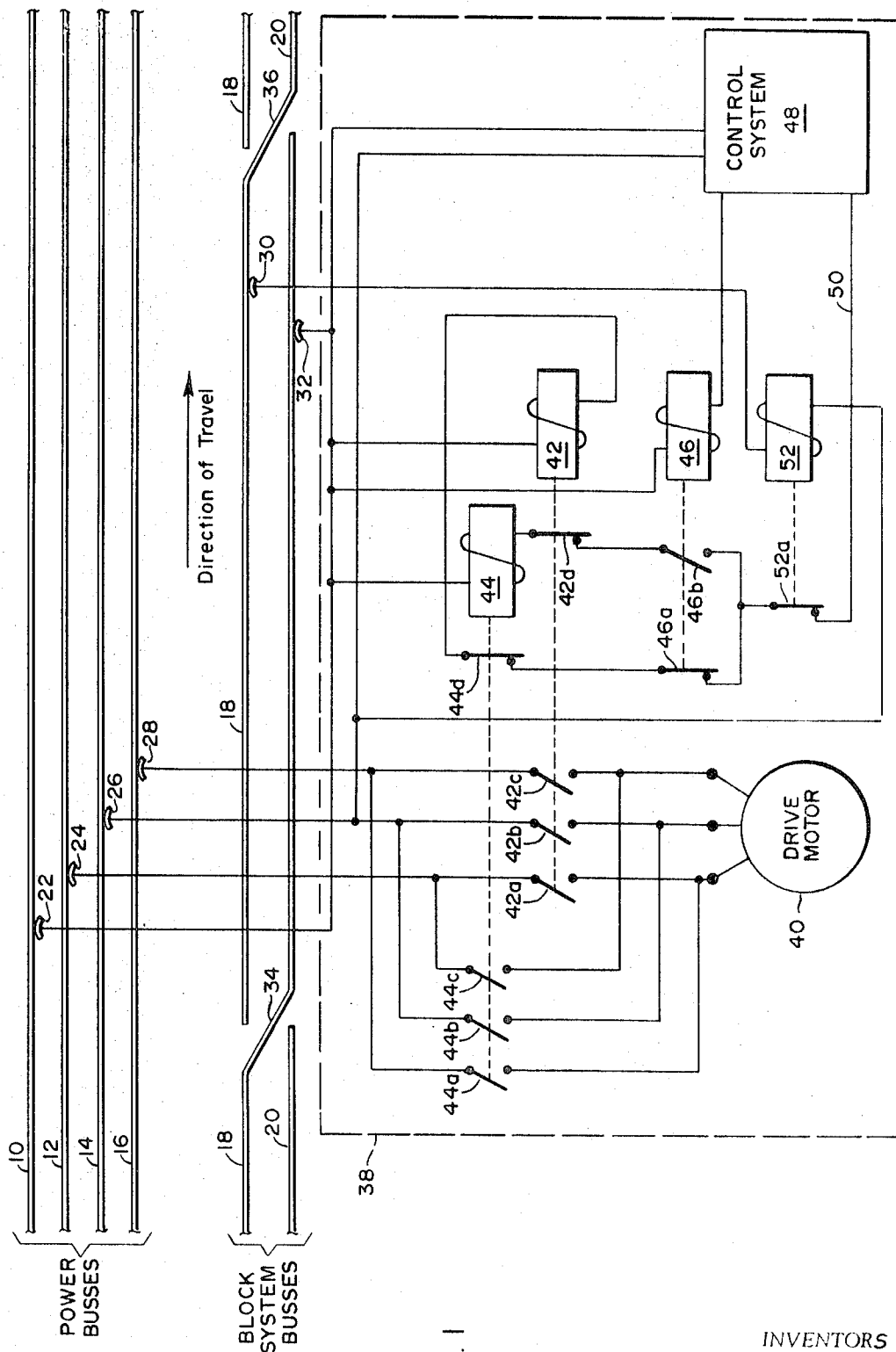
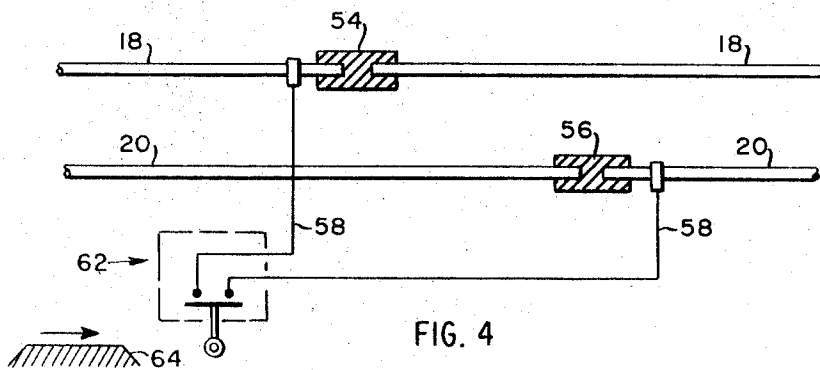
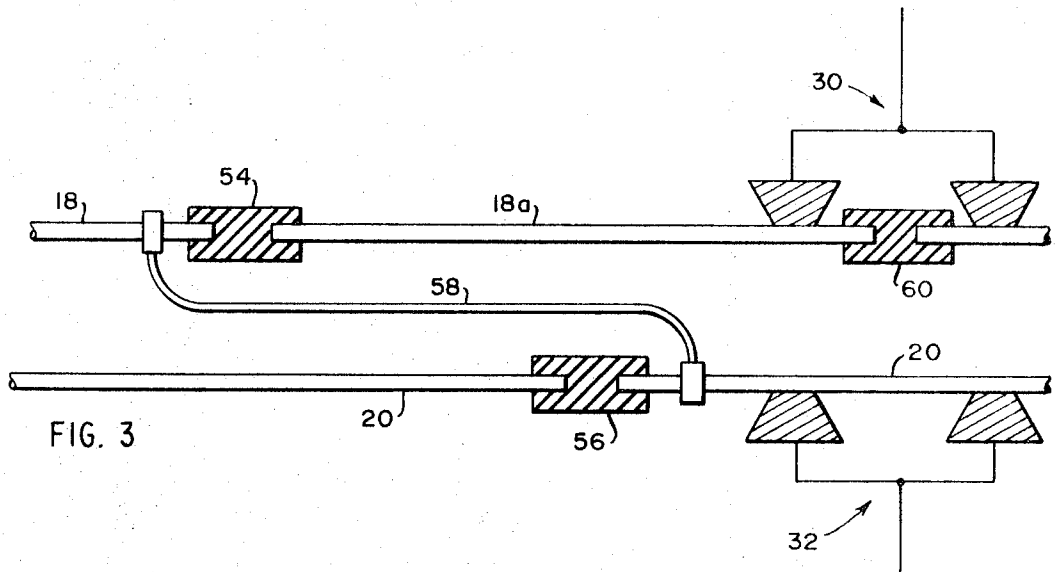
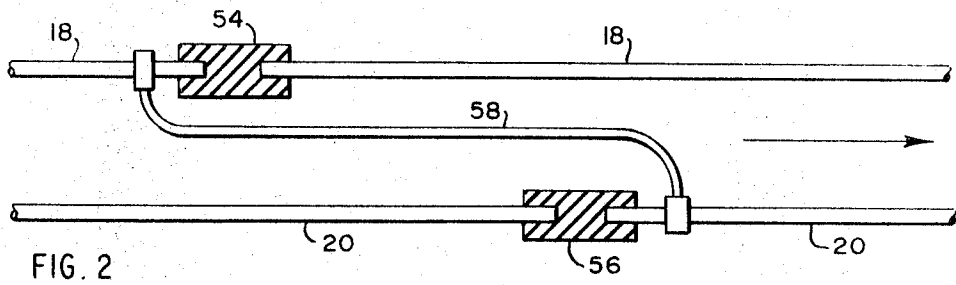


FIG. 1

INVENTORS
 GUENTER ETTER
 WILLIAM G. PESTALOZZI
 BY
Kennedy Kenney & Wilder
 ATTORNEYS

SHEET 2 OF 2



INVENTORS
 GUENTER ETTER
 WILLIAM G. PESTALOZZI
 BY
Kenway Jenney & Hildreth
 ATTORNEYS

AUTOMATIC CONVEYOR BLOCK SYSTEM

FIELD OF THE INVENTION

Our invention relates to an automatic block system for use with electrical conveyors which traverse a trackway in a single direction. It is particularly useful in connection with the operation of monorail conveyors which are randomly dispatched over a complex track system.

Monorail conveyor systems of this nature have, in recent years found increasing use in hospitals where they are used to convey laundry, meals, supplies etc. from the laundry, kitchen, or supply room to and from the various floors on which patients are located. Typically at the time of dispatch, each conveyor is supplied with a stored address code and this code is recognized at the appropriate destination where a container carried by the conveyor is removed and emptied and then dispatched at a later time.

It is apparent that with a number of such conveyors traveling in a single direction over a trackway which includes multiple loops and stations and with multiple dispatch locations that the problem of one of the conveyors colliding with another is substantial. This problem has heretofore been recognized and to solve it various types of block systems have been proposed. One of these provided two sets of busses which were located adjacent the trackway. These busses were divided by electrical insulators into sections whose length was equal to the desired length of a given block section. The insulators in each section were in registry i.e. the corresponding insulators were located at the same location along the track for each bus. As the conveyor moved along the track brushes engaged each of the busses. One of the brushes connected a first of the busses to ground and when the bus was grounded a relay connected to the bus was operated. Operation of the relay applied a ground signal to the second bus of the pair of busses in the uptrack direction. A second brush carried by the conveyor sensed whether the second bus in the block section being traversed was grounded (which indicated that a conveyor was in the next downtrack block section) and if so operated a relay to stop the conveyor. In this fashion a conveyor could not move in one block section if the next downtrack section was occupied.

While a system such as that described above operated quite satisfactorily it was expensive in equipment and installation in that each block section required a separate relay and electrical connection of that relay to the bus in question.

In the block system of our invention we provide a relay on each conveyor which responds to the presence of a signal on one of the two block system busses. Additionally a brush on each conveyor provides a signal to the switching means on the conveyor and prevents it from traveling on the trackway if the signal is present.

Accordingly, it is a principal object of our invention to provide an improved automatic block system for use with conveyors which traverse a trackway in a single direction. Another object of our invention is to provide a system of the type described which is automatic in operation and is relatively inexpensive both in the costs of materials and installation as compared with systems heretofore devised. Other and further objects and features of our invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements and the arrangement of parts which will be exemplified in the constructions hereinafter described, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of our invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is an electrical schematic drawing of the block system of our invention;

FIG. 2 is a schematic illustration of the manner in which the sections may be insulated from one another; and

FIG. 3 is an illustration similar to FIG. 2 showing an alternative construction which may be used.

FIG. 4 is a schematic illustration similar to FIG. 2 showing a modification of the circuit of the block system for stopping the conveyor at a specific location.

SPECIFIC DESCRIPTION

FIG. 1 shows, in schematic form, the busses associated with a conveyor together with the electrical apparatus on the conveyor itself used in conjunction with the block system. As shown, four power busses are used to provide three phase power to operate the drive motor on the conveyor. These busses are indicated by the reference characters 10, 12, 14, and 16. As shown in the drawings, the bus 10 is the neutral bus for the three phase system.

Additionally, a pair of block section busses are provided, the upper of these busses being identified by the reference character 18 and the lower by the reference character 20. Brushes 22, 24, 26 and 28 ride on the power busses 10-16 to supply power to the conveyor. The brush 30 rides on the bus 18 and the brush 32 rides on the bus 20. It will be observed that the bus 18 and the bus 20, the block section busses, are interrupted by insulating sections and that at these insulation sections a connection is made from the bus 20 to the bus 18 as indicated at 34 and 36.

The conveyor itself, whose illustrated circuitry is enclosed within the dotted line 38 includes a drive motor 40 which is connected through the contacts of a pair of relays 42 and 44 to the busses 12, 14 and 16. When the relay 42 is operated the contacts 42a, 42b and 42c are closed to cause the motor to drive in a first direction. If the relay 44 is operated then the contacts 44a, 44b and 44c are closed to cause the motor to drive in a direction opposite to that in which it turns when the relay 42 is operated. Each of the relays 42 and 44 includes a contact 44d and 42d which is in series with the operating circuit for the other relay. Thus, if the relay 42 is operated, the relay 44 cannot operate and the reverse is also true. A direction control relay 46 is also provided having two contacts, contact 46a being normally closed and 46b being normally open. This is a latching type relay and is operated from the conveyor control system generally indicated at 48 when it is desired to have the transporter reverse direction.

The conveyor control system generally indicated at 48 is supplied with energy from the neutral bus 10 and from one of the phase busses, in this case bus 14. In response to other control functions, the control system 48 supplies the phase voltage on the lead 50 to operate either the relay 42 or 44 and to cause the drive motor 40 to rotate. However, before any voltage can be applied through the direction control relay 46 to the relay 42 or 44 to energize the drive motor, it must pass through the normally closed contact 52a of the relay 52. It will be observed that the coil of the relay 52 is connected at all times to the phase voltage supplied by the brush 26 from the bus 14. The other side of the coil of the relay 52 is connected to the brush 30 which rides on the bus 18. The brush 32 is connected to the system neutral supplied by the brush 22 from bus 10. It will be apparent, that if relay 52 is operated neither of the relays 42 or 44 can operate since power from the conveyor control system 48 to these relays will be interrupted by the opening of the contact 52a.

It will also be apparent that relay 52 will be operated at any time that the brush 30 picks up a neutral voltage from the bus 18. Also, it will be noted that the brush 32 is applying a neutral voltage to the bus 20 in the block section in the center of FIG. 1 between the transitions between block sections represented by the leads 34 and 36. It will also be observed that with the brushes of the conveyor in the position shown, the brush 32 will apply a neutral potential to the bus 18 of the block section at the left-hand side of the paper, only a portion of whose busses are shown. Thus, the presence of the transporter in the position shown in FIG. 1 in the block section would cause the operation of a relay corresponding to the relay 52 in a similar conveyor which was in such a location along the track that its

brush corresponding to brush 30 was engaging the bus 18 of the left-hand block section in FIG. 1 and thereby inhibit movement of that conveyor. Thus, with the conveyor in the position shown, the next block section up track i.e. in the direction opposite to the normal direction of travel along the track, would be blocked. For example if the conveyor whose schematic diagram is illustrated in FIG. 1 were positioned as shown and for some reason were stopped, no conveyor could move in the block section partially shown at the left-hand side of the sheet. Similarly, if a conveyor such as that shown in FIG. 1 were in the block section downtrack in the direction of travel, the brush 32 of that conveyor would be applying a neutral potential to the bus 20 which would be carried by the jumper 36 to the bus 18 in the block section illustrated. This neutral would be picked up by the brush 30, operate the relay 52, which would open the normally closed contact 52a and remove power from the drive motor. Accordingly, the presence of a conveyor in a given block section blocks the next preceding section.

Thus, rather than providing a relay associated with each block section, the relay 52 is provided on the conveyor to sense the presence of a neutral on the bus 18. Because the bus 18 in each section serves to inhibit motion of the conveyor if a neutral voltage is present on it, it is termed the "inhibit" bus. Similarly, since the function of the bus 20 is to announce to the up track block section that a conveyor is present in the next down-track section, it is called the "announce" bus. As shown, at each transition between block sections, there is an electrical connection between the announce bus of the downtrack block and the inhibit bus 18 of the next uptrack block section.

FIG. 2 illustrates a typical construction for the transition between block sections. As shown, the two sections of the bus 18 are separated by an electrical insulator 54 and similarly the two sections of the bus 20 are separated by an electrical insulator 56. An electrically conducting jumper wire 58 is interconnected between the downtrack side of the insulator 56 and the uptrack side of the insulator 54.

While the brushes 30 and 32 are shown as staggered along the trackway in FIG. 1, in practice, they usually engage the two busses at the same location along the track. Also, in practice, the brushes are of substantial length as compared to the length of the insulating sections and generally several separate brushes are used in parallel to provide reliable operation.

In operation, as the conveyor moves down the track, the inhibit brushes cross the insulator 54 and engage the bus 18 in the next block section before the announce brushes cross the insulator 56 to engage the next announce bus if the insulators are staggered as shown in FIG. 2. If any of the inhibit brushes are engaging the inhibit bus in the uptrack block section when one of the announce brushes is simultaneously engaging the announce bus in the block section being entered, there will be at least momentary operation of the relay 52 and at least temporarily interruption of the drive motor. If the insulators at a transition between block sections were placed at the same location along the track, a conveyor moving at full speed would probably move through the transition between block sections by reason of the inertia associated with it even though the leading edge of the announce brush caused operation of the inhibit relay and interruption of motor power. However, if a conveyor were stopped across such a transition, it would not be possible to start it.

To avoid unnecessary relay operation and to insure operation of the conveyor it is desirable to stagger the insulators as shown in FIG. 2 by a distance such that the brushes engaging the inhibit bus are in fact all engaging the inhibit bus in the downtrack block section before the announce brushes first engage that announce bus in the new section.

It is also desirable that a conveyor when stopped on entering a particular block section, prevent entrance only into the next uptrack block of the system. For example, and referring to FIG. 2, if a conveyor crossed the insulated transition provided by the insulator 54 and the brushes 32 associated with that

conveyor picked up a signal from the bus 18 in the right-hand block section of FIG. 2, the conveyor would come to a halt. If it came to a halt in the position such that the "announce" brushes were across the transition provided by the insulator 56, then the brushes on the right-hand side of the transition 56 would block the next uptrack block section by reason of the neutral supplied through the jumper wire 58 as previously described. However, the neutral carried by these brushes would also be applied to the uptrack announce bus 20 in FIG. 2 and this in turn would block the second uptrack block section. Thus in this situation, the presence of a conveyor stopped at the entrance to the block section on the downtrack side of FIG. 2 would prevent entry by another conveyor into two uptrack block sections. This is undesirable, particularly where conveyors are to be "parked" in adjacent block sections.

To prevent the foregoing, we provide the arrangement shown in FIG. 3. As there indicated, an additional insulator 60 is provided in the inhibit bus 18 a short distance downtrack from the insulator 54. This insulator 60 completely insulates a short section 18a of the inhibit bus at the entrance to the block section.

In practice, then when the brushes indicated generally at 30 and 32 are proceeding along the busses in the downtrack direction across the transition 54 they do not immediately pick up an inhibit signal. Rather the conveyor proceeds until the brush 30 crosses the transition provided by the insulator 60 and then picks up an inhibit signal which operates the relay 52 and stops the conveyor with the brushes approximately in the position shown. Under these circumstances then, if an inhibit signal is present on the bus 18 as the conveyor enters a block section, it will still proceed to a point sufficiently far into the block section, such that, when stopped, the brushes engaging the announce bus 20 will not bridge the insulator 56 and thereby provide inhibit signals to the next two uptrack block sections. Thus the construction of FIG. 3 insures that only a single uptrack block section is blocked when the conveyor is in the next downtrack section.

As has been pointed out previously, the block system of our invention was designed particularly for use with monorail conveyor systems and more particularly for use with monorail conveyor system adapted for automatic operation. However, it is to be understood, that the invention is not limited to conveyors of this type but is applicable generally to electrically driven conveyors moving in a single direction along a trackway whether it be a monorail, dualrail or etc.

It will also be apparent that if the insulators are provided as shown in FIG. 3, it is only necessary to change the connection of the jumper 58 in order to reverse the direction of the block system. For example, if the jumper were connected from the right-hand side of insulator 60 to the left-hand side of insulator 56 as shown in FIG. 3, the block system would operate as described but for travel in the reverse direction from that shown.

In FIG. 4 we have illustrated a modification of the block system of our invention which is arranged to stop a following conveyor at a particular location within a block section when the next downtrack block is occupied. Such an arrangement is useful in a situation where relatively short block sections are used for purposes of "parking" a number of conveyors,

As shown in FIG. 4, the jumper 58 is connected from the bus 20 on the downtrack side of insulator 56 to the bus 18 on the uptrack side of insulator 54 through the normally open contacts of a switch 62. The switch 62 is mechanically operated by engagement with a cam 64 carried by the conveyor and the mechanical location of the switch 62 along the track may be varied. Assume that the downtrack block is occupied so that a neutral potential is applied to the bus 20 on the downtrack side of the insulator 56 in FIG. 4. As a conveyor approaches the transition shown in FIG. 4, the brush 30 of the conveyor which engages the bus 18 will not pick up this neutral potential and cause the relay 52 to operate until the cam 64 operates the switch 62.

However, upon operation of the switch 62, the relay 52 will be immediately operated, removing power from the conveyor drive motor. It will be apparent that by adjusting the location of the switch 62 along the trackway, the location at which the conveyor stops may be precisely determined. Further such location can be selected so that the problem discussed in connection with FIG. 3 will be obviated.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and since certain changes may be made in the above constructions without departing from the scope of our invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of our invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A drive and block system for use with electrically driven conveyors operating in one direction along an elongated trackway comprising in combination, a plurality of busses for carrying electrical energy located beside said trackway, a plurality of brushes mounted on said conveyor and adapted to engage said busses, an electric drive motor on said conveyor adapted when energized to drive said conveyor along said trackways, switch means operable to electrically connect said brushes and said drive motor, a second pair of busses mounted beside said trackway, each of said second pair of busses being interrupted by electrical insulators to form separated electrically insulated sections of a length equal to the desired block length, means electrically connecting the downtrack side of each insulated section of said first bus and the uptrack side of each insulated section of said second bus across corresponding sets of insulators, brush ensembles mounted on said conveyor and engaging each of said second pair of busses, the brush ensemble engaging said first bus supplying an electrical signal thereto and the brush ensemble engaging said second bus supplying an electrical signal received therefrom to said motor switching means to thereby control movement of said conveyor each of said second busses of said second pair of busses being interrupted by at least one pair of electrical insulators having a section of said bus therebetween, said pair of insulators being relatively closely spaced along said trackway as compared to the length of a block section, and the downtrack insulator of said pair of insulators being farther downtrack than the corresponding insulator in the first bus of said second pair of busses.

2. A drive and block system for use with electrically driven conveyors operating in one direction along an elongated trackway comprising in combination, a plurality of busses for carrying electrical energy located beside said trackway, a plu-

ality of brushes mounted on said conveyor and adapted to engage said busses, an electric drive motor on said conveyor adapted when energized to drive said conveyor along said trackway, switch means operable to electrically connect said brushes and said drive motor, a second pair of busses mounted beside said trackway, each of said second pair of busses being interrupted by electrical insulators to form separated electrically insulated sections of a length equal to the desired block length the insulators in said busses at each transition between block section being staggered along said trackway with respect to each other, whereby all the insulators in the first of said busses are positioned farther down the trackway than the corresponding insulators in the second of said busses, means electrically connecting the downtrack side of each insulated section of said first bus and uptrack side of each insulated section of the second bus across the insulators at each transition, brushes mounted on said conveyor and engaging each of said busses, the brushes engaging said first bus supplying an electrical signal thereto and the brush engaging said second bus supplying an electrical signal received therefrom to operate said switching means, and a third insulator in said second bus at each of said transitions between block sections, said third insulator being spaced farther downtrack than the first insulator in said second bus and also being farther downtrack than the insulator in said first bus.

3. A drive and block system for use with electrically driven conveyors operating in one direction along an elongated trackway comprising in combination, a plurality of busses for carrying electrical energy located beside said trackway, a plurality of brushes mounted on said conveyor and adapted to engage said busses, an electric drive motor on said conveyor adapted when energized to drive said conveyor along said trackway, switch means operable to electrically connect said brushes and said drive motor, a second pair of busses mounted beside said trackway, each of said second pair of busses being interrupted by electrical insulators to form separated electrically insulated sections of a length equal to the desired block length, means electrically connecting the downtrack side of each insulated section of said first bus and the uptrack side of each insulated section of said second bus across corresponding sets of insulators, brush ensembles mounted on said conveyor and engaging each of said second pair of busses, the brush ensemble engaging said first bus supplying an electrical signal thereto and the brush ensemble engaging said second bus supplying an electrical signal received therefrom to said motor switching means to thereby control movement of said conveyor means electrically connecting the downtrack side of each insulated section of said first bus and the uptrack side of each insulated section of said second bus of said second pair of busses including a mechanically operated switch having normally open contacts, said contacts being connected in series with said connecting means, and a cam carried by said conveyor for operating said switch when said conveyor is at a predetermined location along said trackway.

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