

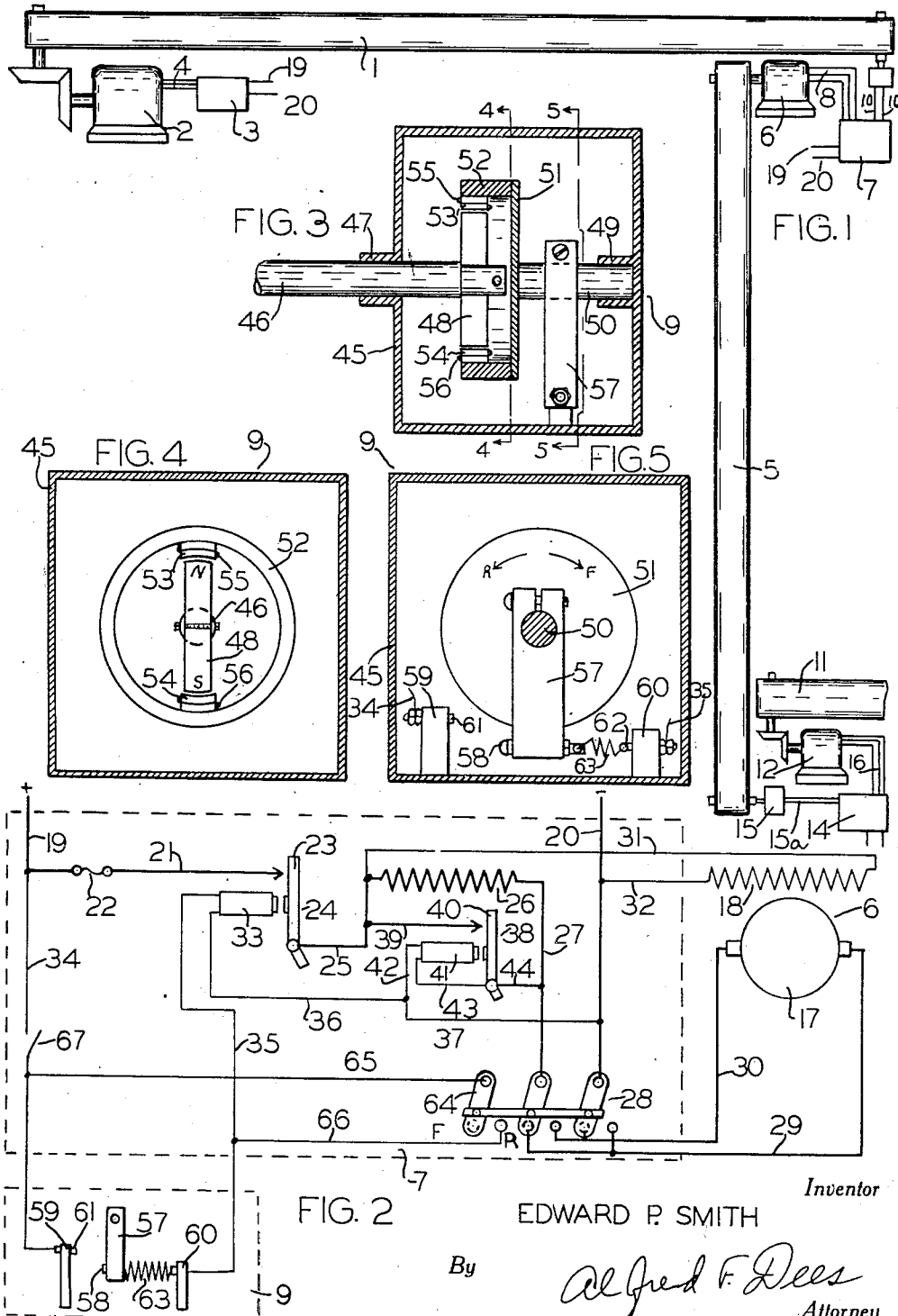
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E. P. SMITH

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CONVEYER CONTROL

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Inventor
EDWARD P. SMITH
By *Alfred F. Dees*
Attorney

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CONVEYER CONTROL

Edward P. Smith, Mansfield, Ohio, assignor to
The Ohio Brass Company, Mansfield, Ohio, a
corporation of New Jersey

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This invention relates to a control between two successive conveyers and in its more specific aspects is directed to a connection between them in which the motion of one conveyer is governed by the speed and direction of motion in the other conveyer.

The object of this invention is to provide a control between successive conveyers that will prevent forward motion in any preceding conveyer when the succeeding conveyer or the one into which the preceding one discharges is stopped or is reversed in its direction of motion.

Another object of the invention is to provide a control between electrically connected successive conveyers that will permit any conveyer to be reversely operated without regard to direction of motion or lack of motion in the succeeding conveyers.

A further object of the invention is to provide for a sequential starting and control thereof between successive conveyers.

Another object of the invention is to prevent a clogging or choking of the discharge end of the preceding conveyer when the motion of the succeeding conveyer, or the one into which the preceding conveyer discharges, is stopped or reversed.

A still further object of the invention is to provide an electrical connection between succeeding conveyers in which a device operated by the succeeding conveyer de-energizes the starter of the preceding conveyer whenever the succeeding conveyer has its motion reversed or arrested.

Another and still further object of the invention is to provide for the neutralization of the control in the succeeding conveyer when the preceding conveyer is reversely operated.

A still further object of the invention is to provide for a control between two motor driven devices in which the load, the absence of load, or motion in one motor will determine whether the other motor may be operated on the same direction as the other.

A still further object of the invention is to provide a simple, compact and convenient mechanism connecting successive conveyers or other mechanism requiring a minimum of attention and giving a maximum of service such that one conveyer discharging material on or into a second conveyer will provide against the possibility of clogging or interfering with the operation of the second conveyer by stopping the first conveyer when the second conveyer is stopped or reversed.

Other and further objects of the invention will

occur to those skilled in the arts to which this invention pertains as the description proceeds which taken in connection with the accompanying drawing sets forth a preferred embodiment of the invention but such disclosure is not to be construed as a limitation of the invention which is limited only by the appended claims and any and all modifications, alterations and variations of structure coming within the spirit and scope thereof are deemed to be included herein.

In the drawing:

Fig. 1 shows a schematic plan view of a conveyer system embodying the invention.

Fig. 2 shows a wiring diagram of the essential operating mechanism.

Fig. 3 is a section view of the speed and direction responsive control device.

Fig. 4 is a section view of the speed and direction responsive control device taken along the line 4—4 of Fig. 3.

Fig. 5 is a section view of the speed and direction responsive control device taken along the line 5—5 of Fig. 3.

Mine conveyer systems may consist of a main conveyer of considerable length sometimes amounting to several thousand feet which receives material from a plurality of lateral conveyers disposed transversely to the main conveyer and of somewhat shorter length than the main conveyer. Each of these lateral conveyers is supplied by at least two room conveyers usually only a few hundred feet or less in length each of which is moved to a succeeding room after exhaustion of the particular room in which it is located.

In the operation of the conveyer system, the main conveyer discharges into a mine car adjacent its discharge end or into some other appropriate conveyance. It is essential that the main conveyer be stopped while changing cars or conveyances and it is further necessary that when the main conveyer is stopped that the lateral and room conveyers be stopped as well to prevent a choking or clogging at the discharge ends of the lateral and room conveyers.

It is also desirable that the conveyers run reversely at times in order to take into the mines, men and supplies, and it also is necessary during such reverse operation that any preceding conveyers may be at rest and that they may be capable of individual reverse operation. The instant device provides for just such control and in addition thereto provides for a sequential forward starting of all conveyers once the main conveyer has started operating. The sequential

operation of the several conveyers is inoperative for the reverse operation of the conveyers. Such reverse operation is entirely manually controlled. The control of the instant device is speed and direction responsive, therefore, affording a successive starting of each preceding conveyer in sequence at a predetermined speed after the starting of the succeeding conveyer and prevents a forward motion of a preceding conveyer when a succeeding one is operating reversely.

This case differs from my copending case S. N. 500,144, filed August 26, 1943, in at least one particular in that it provides for speed and direction control means directly associated with the conveyers per se and operated by the movement thereof, whereby the operation of a companion conveyer may be controlled. In my copending case there is no speed responsive device actuated by the conveyer.

The foregoing objects and advantages are achieved in a structure and organization shown in the accompanying drawing in which 1 is a main conveyer discharging into a mine car or other conveyance, the left-hand end of the conveyer 1 as shown in Fig. 1 being regarded the discharge end of the device. Conveyer 1 is driven by a reversible motor 2 through appropriate power transmitting devices whose operation is controlled by motor starter 3 diagrammatically shown at 7 in Fig. 2 and connected to motor 2 by appropriate cable 4.

Conveyer 1 receives material from lateral conveyer 5 a plurality of which are provided which discharge onto conveyer 1. Only one such conveyer is illustrated since that is sufficient for the purposes of the instant disclosure. Conveyer 5 is likewise driven by a reversible motor 6 controlled by a starter 7 connected to the motor 6 by appropriate cable 8.

The illustration shows conveyer 5 as disposed adjacent the end of conveyer 1 but this location is not material to the functioning of the device. The connection between starter 7 and conveyer 1 is illustrated as originating in the terminal or return roller of conveyer 1 but in reality it may be associated with any one of the customary conveyer rollers of conveyer 1. The indicated terminal roller drives a speed and direction of movement responsive device 9 which is connected to starter 7 by suitable conductors 10. The speed responsive or zero speed control as it is more frequently designated is detailed at length later in this specification.

A room conveyer 11, only a portion of which is shown discharging onto conveyer 5, is likewise driven by a reversible motor 12 operatively connected to conveyer 11 by appropriate power transmitting means. Motor 12 is governed by starter 14 connected to motor 12 by suitable conductors 16. Speed and direction responsive device 15 identical with device 9 is connected to the starter 14 by cable 15a. While device 9 is shown associated with the terminal roller in conveyer 5 it can and may be associated with any one of the customary rollers distributed along the line of travel of conveyer 5.

It should be apparent from the foregoing that the speed responsive devices and their connection with the several starters may be duplicated and employed whenever an interconnection between two successive devices is desired. These devices are identical in construction and operation and therefore a detailed discussion of the interconnection between devices 9 and 15 and controllers 7 and 14 will suffice for all other devices em-

ployed at any time between succeeding conveyers.

The interconnection between conveyer and starter is set forth in Fig. 2 in which the small dotted rectangle shows the apparatus comprising the speed and direction responsive device 9 and the apparatus shown in the larger rectangle is that within starter 7.

Motor 6 is shown as comprising armature 17 and shunt field 18. These are supplied from 10 power lines 19 and 20, common to all motors shown. Conductor 19 is connected to the motor through conductor 21 in which a fuse element 22 is inserted. Power is then transmitted through the pivoted element 23 of electrically operated switch or contactor 24 and thence by means of conductor 25 through starting resistance 26, conductor 27, through one side of reversing switch 28, conductor 29, armature 17, conductor 30, and through the other side of reversing switch 28 to line 20.

Field 18 is connected to line 19 by means of conductor 31 and fuse 22, pivoted element 23 of contactor 24 and conductor 25. The other side of the field is connected to line 20 by means of conductor 32.

When reversing switch 28 is shifted to the right the middle element thereof is connected to conductor 30 and the right-hand element is connected to conductor 29 thereby reversing the flow of current through the armature 17, thus reversing its direction of rotation. It is assumed that when the switch 28 is in the position shown that motor 6 will cause conveyer 5 to run forwardly and when shifted to the right the conveyer will run reversely, as indicated by letters F and R in Fig. 2.

The circuit for holding coil 33 of the electrically operated switch 24 originates in conductor 34 connected to incoming conductor 19 and a manual control switch 67 is interposed in the conductor which leads to one side of zero speed switch 9 or as designated above a speed responsive and direction control switch. Conductor 35 connects the other side of switch 9 with coil 33 and conductors 36 and 37 connect coil 33 with line conductor 20. Switch 9 is normally open and when conveyer 1 has come up to a predetermined speed it closes thereby completing the circuit to the coil 33 causing contactor 24 to close completing the circuit to the motor 6 through starting resistance 26 assuming that switch 67 has been closed.

After the closure of contactor 24 and after the motor 6 has come up to a certain speed contactor 38 is closed by the energization of its holding coil 41 connected across the armature of motor 6 and shunts the starting resistance 26 by connecting conductor 39, the pivoted element 40 of contactor 38 and conductor 44 in parallel with starting resistance 26 and in series with the motor armature 17. The coil 41 relies upon motor counterelectromotive force of armature 17 for its energization by being connected to conductor 44 through contactor element 38, conductor 43, coil 41 and conductors 42, 43 to the line conductor 20, it being observed that this connection places the circuit squarely across the armature 17 terminals. Closure of contactor 38 imposes a full line voltage across the motor 6.

The zero speed switch 9 or speed responsive and direction control switch details of construction are set forth in Figs. 3, 4 and 5, which shows the device as having a housing 45 from which a shaft 46 projects connectible to one of the rollers in conveyer 1. Shaft 46 is rotatably supported

in an elongated bushing 47, and on the end within the housing 45, has a bar magnet 48 fixed thereon for rotation therewith.

Rotatably mounted on the opposite wall of the housing in which shaft 46 is rotatably arranged is an elongated bush 49, in which a shaft 50 is received. This shaft, 50, has a disk 51 fixed thereon to which a steel ring 52 is secured concentric with the shaft 46. The ring 52 has salient poles 53, 54 arranged therein which may have short-circuited windings 55 and 56 respectively thereon. The windings are not essential to the successful operation of the device but may be provided to increase the efficiency and sensitivity of the device.

Fixed on the shaft 50 for rotation therewith is a bar or bracket element 57 at whose lower end a contact element 58 is arranged, 57 being made of insulating material. Fixed to the lower wall of the housing 45 are fixed a pair of insulating upright bar elements 59 and 60 spaced from bar element 57 and having screw threaded conductor elements 61 and 62 arranged therein which receive conductors 34 and 35 respectively, these conductors in part including conductor 8. Connecting contact 58 and contact 62 is a tension spring element 63 which may be of the phosphor bronze variety since it must conduct current.

Upon rotation of shaft 46 and permanent bar magnet 48 within salient pole magnets 53, 54 and magnetic ring 52 a reaction will be set up within said ring 52 and its attached magnets 53 and 54 by reason of magnetic flux established therein against magnet 48. This generates eddy currents in the said poles and when windings 55 and 56 are employed these currents are increased. The eddy currents set up forces in the magnets 53, 54 in opposition to the rotation of bar magnet 48 that tend to carry the disk 51, shaft 50 and bar 57 along with it. Dependent upon the tension and gage of spring 63, contact 58 and contact 61, will at a predetermined speed of conveyer 1 come into engagement thereby closing the switch 9. If switch 67 has been previously closed, the holding coil 33 circuit is now closed and motor 6 will be started.

During reverse rotation of motor 6, switch 28 is shifted and means are provided operable in conjunction with the switch 28 for short-circuiting switch 9. This consists of a third bar element 64 which connects conductors 65 and 66 across conductors 34 and 35 shunting out switch 9, completing the holding coil 33 circuit. As will be observed bar 64 is mechanically linked to switch 38 and positively assures that the holding coil circuit will be closed. One of the terminals of switch bar 64 is marked for forward (F) and the other for reverse (R) rotation.

When conveyer 1 is reversely operated ring 52 and its associated magnets 53 and 54 will be reversely rotated thereby preventing closure or engagement of contacts 58 and 61 thus preventing motor 6 and conveyer 5 from operating forwardly. Conveyer 5 may, however, be reversely rotated for reasons set forth in the preceding paragraph.

It will thus be observed that a convenient simple and compact interconnecting means has been provided connecting two successive conveyers or other devices which is speed and direction responsive and which provides for the starting of the preceding conveyer when and after the succeeding one has come up to a predetermined speed.

That which is regarded new, novel and useful

and which is sought to be protected by Letters Patent of the United States is as follows.

I claim:

1. In a conveyer control; a first conveyer reversibly operable; a second conveyer discharging onto said first conveyer and a reversible motor for operating same; a starter for said motor including an electrically operated switch, an operating coil for said switch and a circuit for said coil; a speed and direction control device operable by said first conveyer, said device including a switch controllable by the motion of said first conveyer, said switch inserted in said circuit; said control device switch closable when said first conveyer is operating forwardly and at a predetermined speed, thereby closing said circuit; said switch remaining open when said first conveyer is reversely operated; and means to short circuit said switch in said device for reverse operation of said second conveyer.

2. In a conveyer control; a first conveyer reversibly operable; a second conveyer and a reversible motor to drive same; a starter for said motor including a reversing switch, a solenoid operated switch and a circuit for said solenoid; a control device driven by said first conveyer which comprises a movable element and two stationary elements, said movable element disposed between said stationary elements, and means driven by said conveyer reacting with said movable element to close said switch, said switch included in said circuit and closable by said movable element when and after said conveyer comes up to speed when said first conveyer travels in the forward direction by engaging one of said contacts; said movable element urged toward said other contact when said first conveyer moves reversely, thereby holding said circuit open; switch means to short-circuit said switch in said control for reverse operation of said second conveyer; and said switch means connected to said reversing switch to secure a joint operation of said switches.

3. In a conveyer system; a reversible first conveyer and motor to drive the same; a second conveyer and a reversible motor for operating said second conveyer; a starter for said second motor including a reversing switch, an electrically operated switch, a holding coil for said electrically operated switch and a circuit for said coil; a direction control switch operable by said first conveyer to control the operation of said second conveyer; said direction control switch inserted in said circuit and closable by said first conveyer when operated forwardly, said control switch remaining open when said first conveyer is reversely operated; and switch means in said starter operable simultaneously with said reversing switch to shunt said direction control switch whereby the said second conveyer may operate reversely regardless of the direction of movement in said first conveyer.

4. In a conveyer system; a reversibly operable first conveyer and motor to drive same; a reversibly operable second conveyer discharging onto said first conveyer; a reversible motor to drive said second conveyer; a starter for the second said motor which includes a reversing switch, an electrically operated switch, an operating coil for said switch, and a circuit for said switch; means operated by said first conveyer to control the operation of said second conveyer which includes a speed and direction responsive switch inserted in said circuit, said switch closable after said first conveyer reaches a predetermined speed, and remaining open when said first con-

veyer is stopped or reversed, thereby preventing operation of said second conveyer; and means associated with said reversing switch to shunt said speed and direction responsive switch whereby said second conveyer may operate reversely without regard to the direction of operation of the first conveyer.

5. In a conveyer control; a reversibly operable first conveyer; a control means operable by said conveyer; a second conveyer discharging onto said first conveyer and a motor to drive same; a starter for said motor including a reversing switch for said motor, an electrically operated switch, a holding coil for said switch, and a circuit for said holding coil; said control means including a switch inserted in said circuit; said switch closable by the movement of said first conveyer as it is operated forwardly; means to open and hold the last said switch open when the velocity of said first conveyer is reduced below a predetermined value or is operated reversely; and switch means simultaneously operable with said reversing switch to shunt said switch in said control means when said second conveyer is operated reversely.

6. A conveyer system comprising, a main or delivery conveyer unit and a plurality of auxiliary conveyer units so arranged that a preceding conveyer delivers to an immediate succeeding unit, each unit comprising a conveyer and drive means coupled to the conveyer to operate the same forwardly or in reverse and control means to control the starting and stopping of the drive means, the control means for the main conveyer unit being manually operable to drive the same forwardly or in reverse and the drive means for the auxiliary units being automatically operable to energize the drive means to operate the conveyers forwardly, a normally open speed and direction control switch associated with each unit which is preceded by another unit of said system, each said control switch arranged to be operated by some member of that unit with which it is associated whereby the control switch will close when the conveyer of that unit moves forward and reaches a predetermined speed, means electrically connecting each control switch with the automatic control means of the adjacent preceding unit whereby the control means is operated to automatically energize the drive means it controls when the electrically connected control switch closes, each control switch provided with means to effect its opening when the speed of the associated conveyer falls below said predetermined value or is operated in a reverse direction whereby the connected control means of the preceding unit is automatically deprived of current and the conveyer thereof brought to rest, a manually operated switch for each control means whereby the direction of operation of the conveyers may be independently reversed, other switch means simultaneously operable with said manually operable switches other than on the main conveyer unit whereby the connected control switch will be rendered ineffective and the controlled unit operated in reverse without regard to the operation of the succeeding unit.

7. In a conveyer system, in combination, a first unit comprising a conveyer and a reversible motor to drive the same and means to control the forward and reverse operation of the motor, a second unit comprising a conveyer discharging onto the first conveyer and a motor to drive the same and a starter for the second motor including a reversing switch for the motor, an electrically operated switch and operating coil therefor to close said switch and a circuit for said coil, control means operable by the first unit and including a control switch inserted in said circuit and closable when the first unit is operated forwardly, means to open and hold open the control switch when the speed of said first unit is reduced below a predetermined value or is operated reversely, and switch means operable simultaneously with said reversing switch to shunt said control switch in said control means to render same ineffective when said second unit is operated reversely.

7. In a conveyer system, in combination, a first unit comprising a conveyer and a reversible motor to drive the same and means to control the forward and reverse operation of the motor, a second unit comprising a conveyer discharging onto the first conveyer and a motor to drive the same and a starter for the second motor including a reversing switch for the motor, an electrically operated switch and operating coil therefor to close said switch and a circuit for said coil, control means operable by the first unit and including a control switch inserted in said circuit and closable when the first unit is operated forwardly, means to open and hold open the control switch when the speed of said first unit is reduced below a predetermined value or is operated reversely, and switch means operable simultaneously with said reversing switch to shunt said control switch in said control means to render same ineffective when said second unit is operated reversely.

EDWARD P. SMITH.