

Mar. 3, 1925.

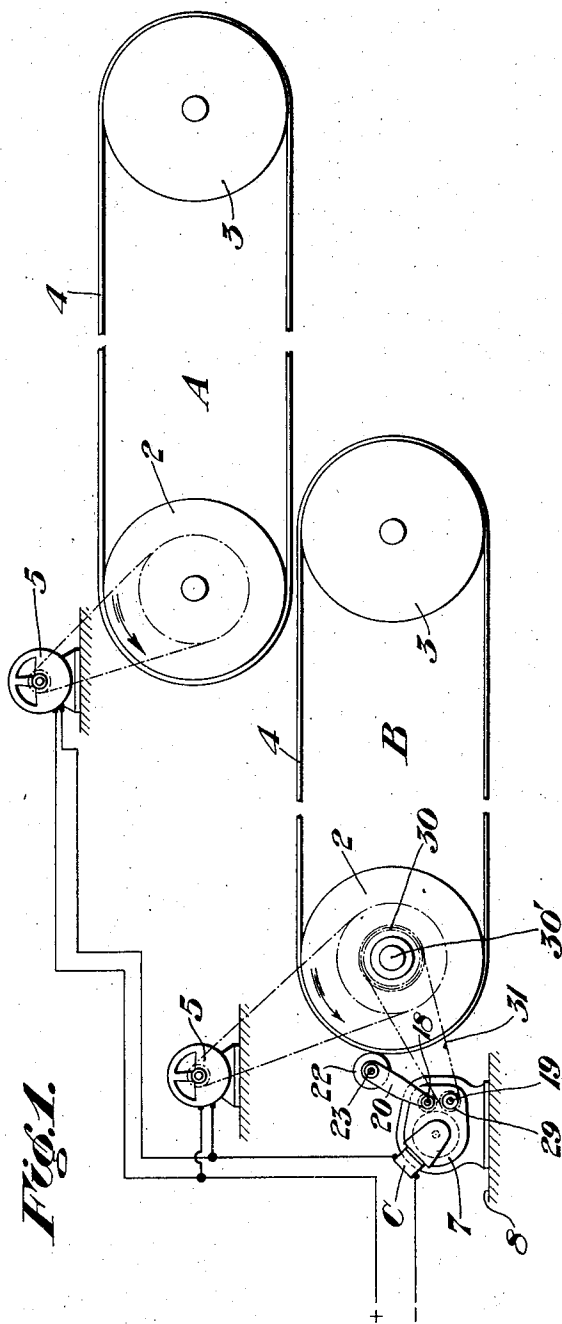
1,528,030

F. E. SMITH

CONVEYER SPEED CONTROL MECHANISM

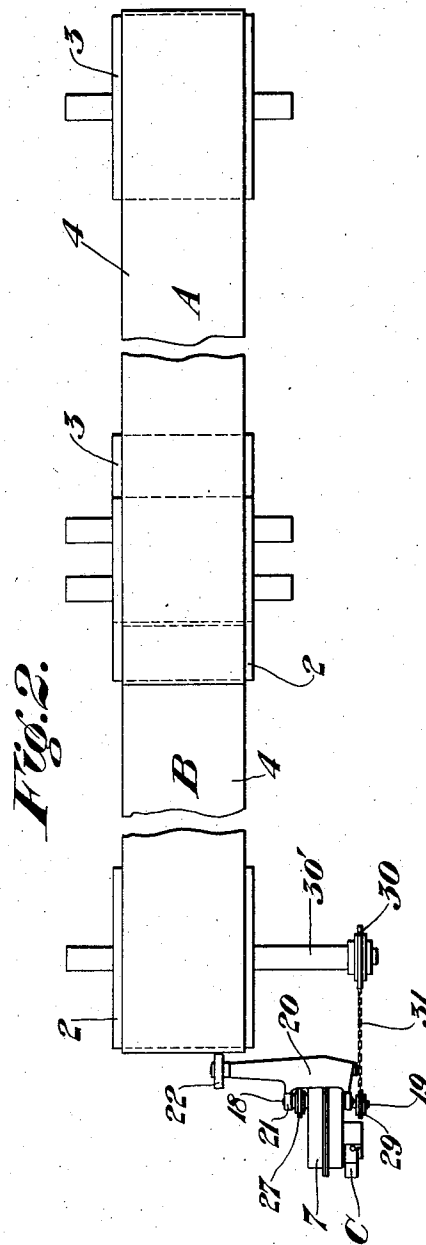
Filed June 16, 1924

4 Sheets-Sheet 1



Witnesses:

Edwin T. Webb



Inventor:

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Mar. 3, 1925.

1,528,030

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CONVEYER SPEED CONTROL MECHANISM

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4 Sheets-Sheet 2

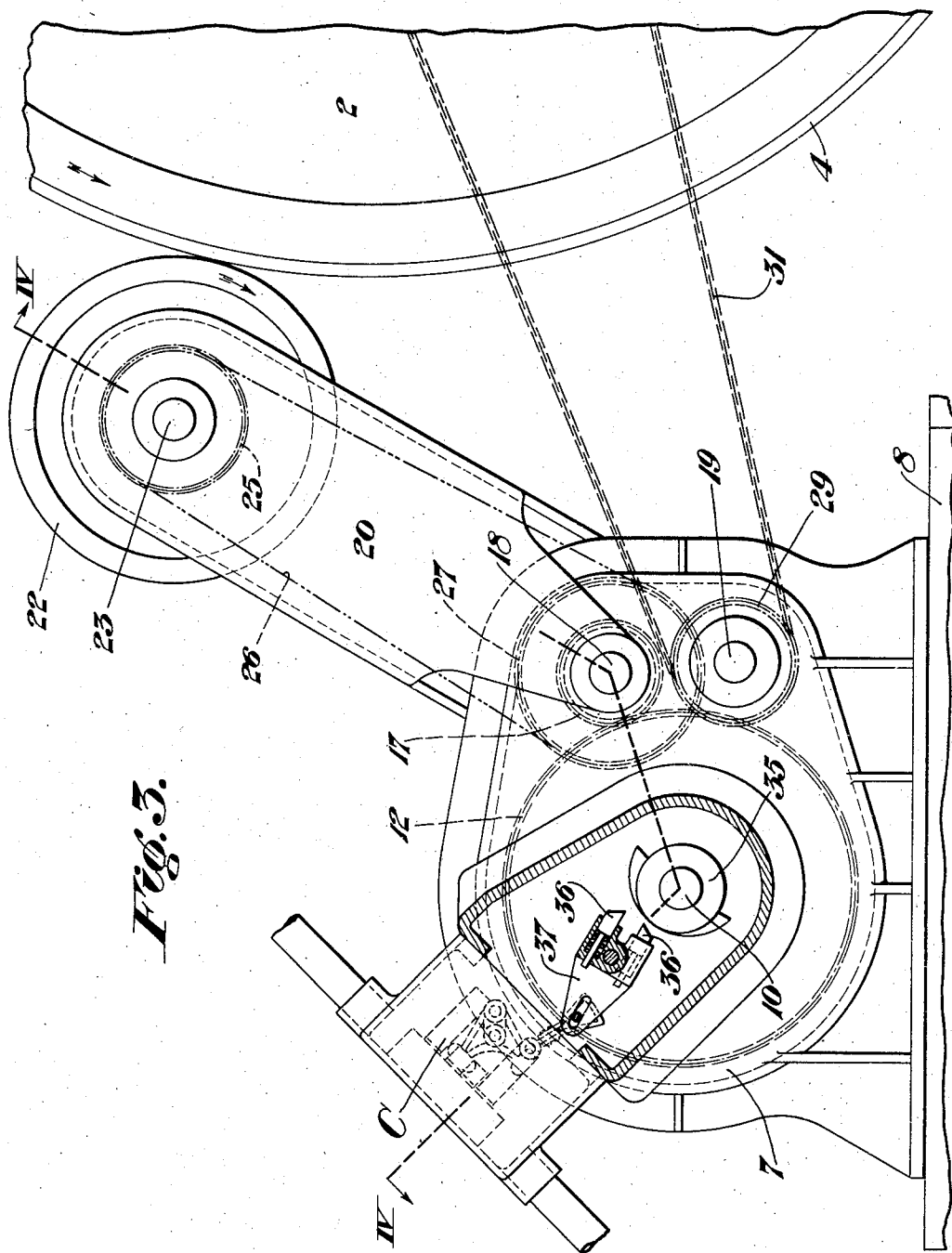


Fig. 3.

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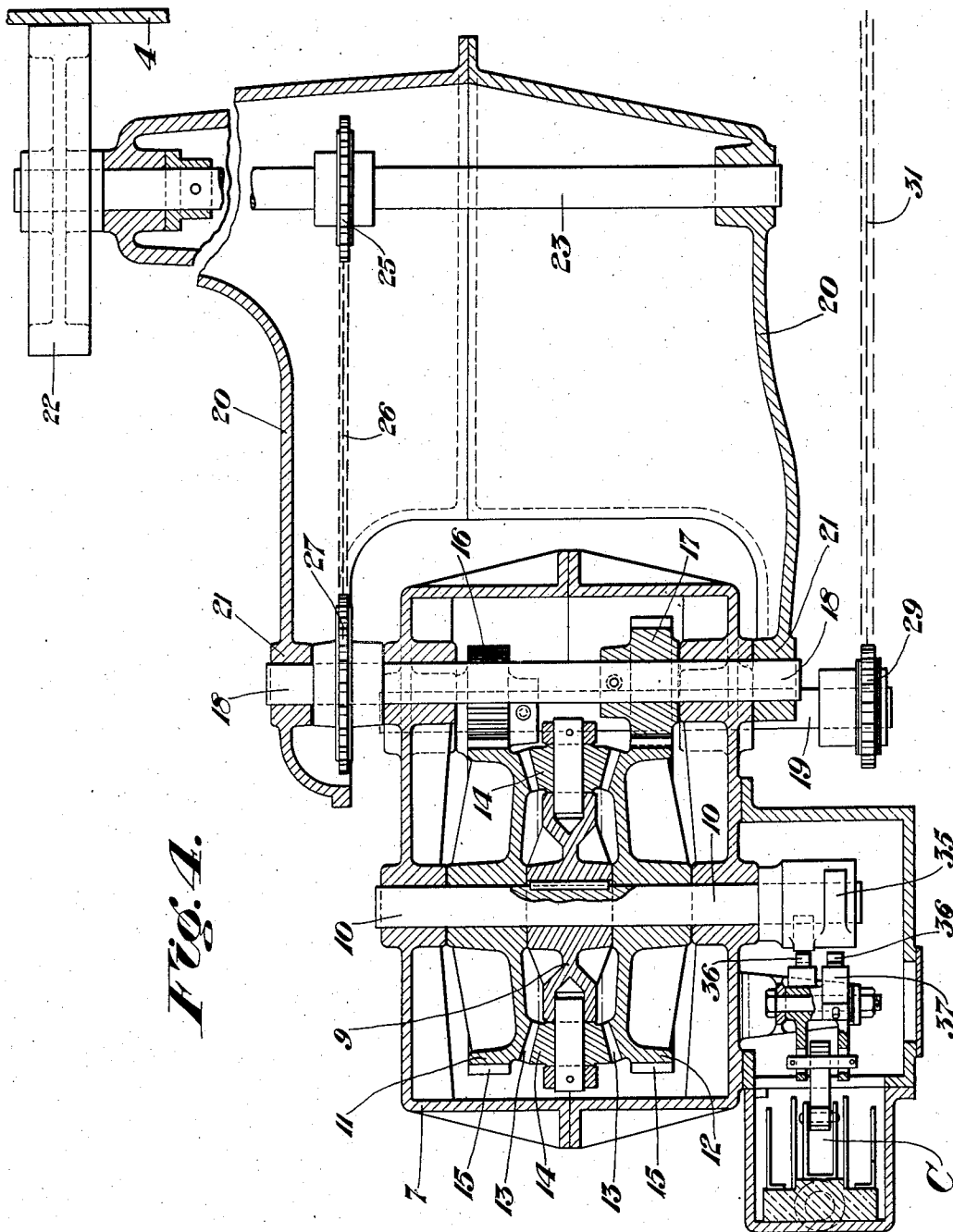
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CONVEYER SPEED CONTROL MECHANISM

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4 Sheets-Sheet 3



Witnesses:

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4 Sheets-Sheet 4

Fig. 5.

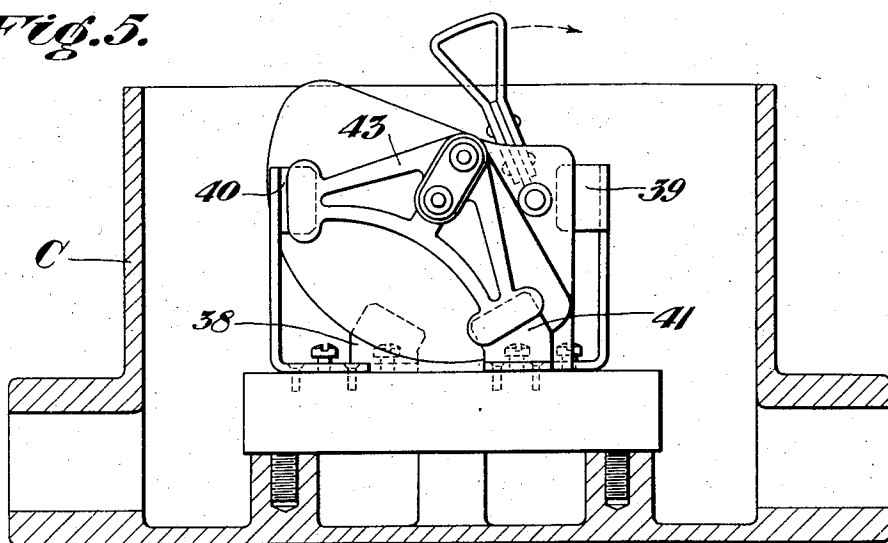


Fig. 6.

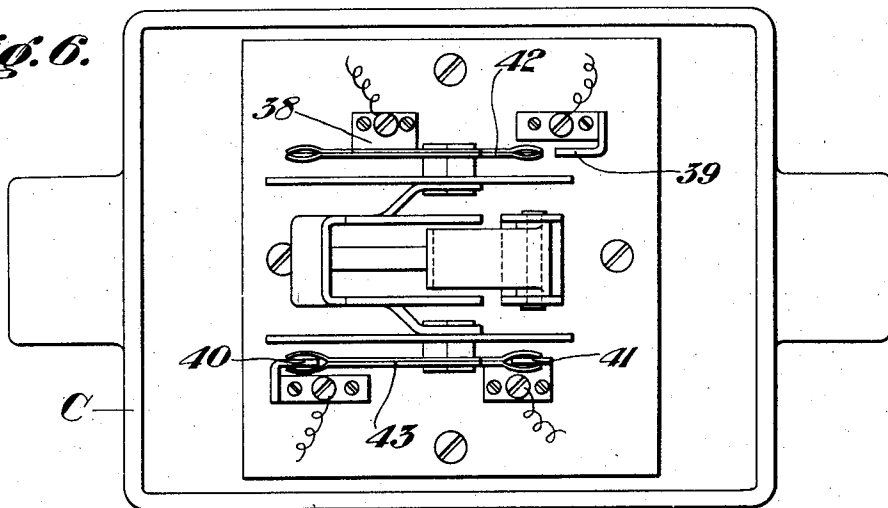
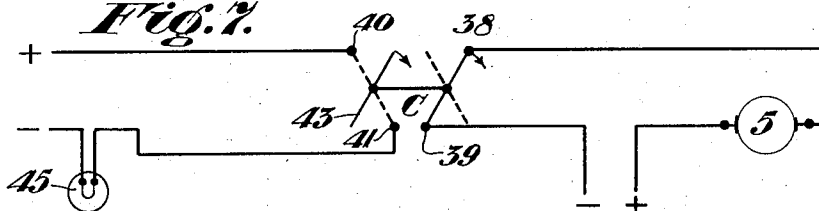


Fig. 7.



Witnesses:

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Patented Mar. 3, 1925.

1,528,030

UNITED STATES PATENT OFFICE.

FRANK E. SMITH, OF SCOTTDALÉ, PENNSYLVANIA.

CONVEYER SPEED-CONTROL MECHANISM.

Application filed June 16, 1924. Serial No. 720,300.

To all whom it may concern:

Be it known that I, FRANK E. SMITH, a citizen of the United States, and resident of Scottdale, in the county of Westmoreland and State of Pennsylvania, have invented certain new and useful Improvements in Con-
5 conveyer Speed-Control Mechanisms, of which the following is a specification.

This invention relates to means for meas-
10 uring the speed of two moving parts of a machine, conveyer or the like, and for stopping said machine when the speed of one part exceeds the other a predetermined amount.

In the operation of many machines, it is
15 either desirable or necessary that two moving parts move at substantially the same speed, and if one of such parts should move faster than the other, it is also desirable to either stop the machine or control the move-
20 ment of the fast part, and this invention provides a novel means for measuring the speed of two moving parts and for operating a suitable controller to control the speed or movement of the parts.

My invention is especially adaptable to
25 the control of a conveyer system when the belt of one conveyer unit slips on the drive pulley sufficiently to slacken the speed of the belt a predetermined amount.

I have illustrated my invention as applied
30 to a conveyer system of standard construction, although it will be understood that the invention may be applied to many other forms of machines.

In the drawings, Figure 1 is a side eleva-
35 tion of a conveyer system embodying my invention.

Figure 2 is a plan of the system of Fig-
40 ure 1.

Figure 3 is a side elevation of the novel
45 control mechanism used in carrying out my invention.

Figure 4 is a sectional plan thereof on the
50 line IV—IV of Figure 3.

Figure 5 is a sectional elevation and Fig-
55 ure 6 is a top plan, of the switch operated by the control mechanism to break the circuit to the motor driving the conveyer.

Figure 7 is a simple wiring diagram il-
60 lustrating the operation of the switch of Figures 5 and 6.

Referring more particularly to the draw-
ings, the letters A and B designate the con-
65 veyer sections or units as a whole, the unit A being above the unit B and being adapted to deliver material onto the unit B.

It will be understood that while I have shown only two sections or units of a conveyer system any number of units may be used.

Each of the units A and B, in their simplest form, comprises a head pulley 2, an idler pulley 3, and an endless conveying belt 4 trained about said pulleys. The head pul-
65 leys 2 are the driving members of the units and are connected with electric motors 5 or other prime movers. The prime movers 5 of each section are preferably interlocked so that the stoppage of the prime mover of one unit will stop the prime movers of all the
70 other units.

As is well known in the art, flexible conveying members, such as the belts 4, will often slip on the pulleys 2 and 3, therefore, causing one belt to move materially faster
75 than the other, and when a number of units are in use, delivering material from one to the other, if the belt on one unit moves slower than the belt of the delivering unit, an accumulation of material will form on the
80 slow unit with serious results.

The present invention is adapted to stop this accumulation of material on a slipping unit by stopping the operation of several units as soon as the slip of the conveying belt
85 exceeds a predetermined amount.

The control mechanism for stopping the conveying units when slippage occurs, comprises a casing 7 supported in any manner desired, in close proximity to the head or
90 drive pulley 2 of the receiving unit B, as on bracket support 8. A differential mechanism is enclosed in the casing 7 and comprises the usual spider member 9 keyed to a shaft 10, pinion or spider drive gears 11 and 12
95 mounted for free rotation on said shaft 10 at the opposite sides of the spider 9, and each provided with a beveled tooth portion 13 in mesh with the pinions 14 of the spider 9, and a peripheral rim toothed portion 15. The portions 15 of the respective gears 11
100 and 12 are in mesh, respectively, with gears 16 and 17 on shafts 18 and 19 mounted in suitable bearings in the casing 7.

The shaft 18 has its ends projecting
105 through and beyond the side walls of the casing 7 and the shaft 19 has one end projecting through and beyond the one side wall of the casing 7.

An arm 20 having spaced bearing portions
110 21 at its lower end, which bearing portions are apertured and fitted over the projecting

ends of the shaft 18, is provided for supporting a conveyor belt speed measuring wheel 22. The wheel 22 is mounted on a shaft 23 journaled in suitable bearings in the upper end of the arm 20 and is adapted to frictionally engage the conveyor belt 4 of the section or unit B. The overhang and weight of the arm 20 is generally sufficient to hold the wheel 22 against the belt 4. However, should slippage occur between the wheel 22 and belt 4, any of the usual expedients, such as counterweights or tension springs, may be employed to force the wheel into a more firm engagement with the belt. The shaft 23 is provided with a sprocket wheel 25, which is keyed thereto, and which is connected by a drive chain 26 with a second sprocket 27 keyed on the shaft 18, so that as the wheel 22 is rotated by the belt 4, its movement will be conveyed through the sprockets 25 and 27 and chain 26 to the shaft 18 and then through the gears 17 and 12 to the spider 9.

The projected end of the shaft 19 is provided with a sprocket 29 which is connected to a sprocket 30 on the shaft 30' of the head or driving pulley 2 by a chain 31, so that as the head pulley rotates, its movement will be conveyed through the sprocket 30, chain 31, and sprocket 29 to the shaft 19 and then through the gears 16 and 11 to the spider 9.

From the above, it will be seen that speed of the belt travel is indicated in the differential by the gear 12 and the speed of the pulley travel is indicated by the gear 11. The connections between the belt 4 and gear 12, and pulley 2 and gear 11 are so proportioned and arranged that the gear 11 will rotate a predetermined amount faster than gear 12. The result of this is that the spider 9 rotates in the same direction as the faster gear 11, and will continue until both gears 11 and 12 have the same speed, when it will remain stationary with the pinions 14 of the spider idling.

When the belt 4 slips on the pulley 2 for any reason, so that its travel speed is not sufficient to drive the gear 11 at the same or a greater speed than the gear 12, the spider will be compelled to follow the faster turning gear 12 and so reverse its direction of rotation. It will, therefore, be understood that the differential mechanism acts as a measuring mechanism and measures the relative speeds of the belt and head pulley.

The spider 9 being keyed to the shaft 10, said shaft will rotate with the spider. The shaft 10 projects, at one end, beyond the casing 7 and is provided with a cam member 35 adapted to engage spring pressed latches 36 on one end of a rocking lever 37. The other end of the lever 37 is operatively engaged with a switch C adapted to be thrown into off and on positions by the lever 37.

The switch C may be of any standard con-

struction. The switch shown is of the double pole construction and has two sets of contacts, 38, 39 and 40, 41, arranged on opposite sides of the operating mechanism, and adapted to be bridged by bridge arms or blades 42 and 43, respectively. The arms or blades 42 and 43 are so arranged that one arm or blade is out of contact with its contacts when the other arm or blade is engaged with its contacts.

In practice the set of contacts 38 and 39 are connected in the motor circuit to the motor 5 of the conveyor unit B, while the contacts 40, 41 are connected in a signal light circuit leading to a signal light 45.

In operation, when the slip of the belt 4 has become sufficient to reverse the direction of rotation of the spider 9 and shaft 10 and so has operated the switch C, due to the cam 35 engaging the lever 37, the motor circuit to the motor 5 will be broken through the unbridging of contacts 38 and 39 and the signal light circuit through the contacts 40 and 41 will be made through the bridging of these contacts.

When the circuit to motor 5 is broken the motors on all the units will stop, due to the fact that they are interlocked one with the other. Therefore, all the units of the conveying system will be stopped when the belt on one of the units slips sufficiently to cause the differential control to operate the switch C and break the circuit to its motor. When the switch C breaks the motor circuit it makes the signal light circuit, thereby notifying the operator which unit has its conveying belt slipping.

It will, of course, be understood that this control mechanism is not limited to use with conveying units, but may be adapted to various forms of machines where it is desired to prevent one moving part from running ahead of the other. It will also be understood that the differential mechanism is not limited to the operation of a switch such as the switch C, but may be used to operate any of the well known form of controllers.

If desired or necessary, fluid or explosive operated prime movers may be substituted for the motors 5, and in that case, suitable valves or other controlling mechanism may be substituted for the switch C.

Many other changes in details may be made without departing from the scope of my invention as defined in the appended claims.

I claim—

1. The combination with a conveyor comprising a flexible conveying member, drive and idling pulleys, and a prime mover for operating said drive pulley, of a mechanical differential mechanism adapted to measure the speed of said conveying member and said drive pulley, and means adapted to be operated by said differential mechanism

to stop said prime mover when the speed of said drive pulley exceeds the speed of said conveying member a predetermined amount.

2. The combination with a conveying system having a plurality of conveying sections or units adapted to deliver one to the other, each of said units comprising a conveyer belt and at least one drive pulley and one idler pulley, and an electric motor operatively connected to each of said drive pulleys for driving the same, the motors of each of said units being interlocked so that stoppage of one of said motors will stop all of said motors, of a mechanical differential mechanism adapted to measure the speeds of the belt and drive pulley of at least one of said units, and means adapted to be operated by said differential mechanism to break the circuit to the motor of said measured unit when the speed of the drive pulley of said unit exceeds the speed of said conveying member of said unit a predetermined amount.

3. The combination with a conveying system having a plurality of conveying sections or units adapted to deliver one to the other, each of said units comprising a conveyer belt and at least one drive pulley and one idler pulley, and an electric motor operatively connected to each of said drive pulleys for driving the same, the motors of each of said units being interlocked so that stoppage of one of said motors will stop all of said motors, of a control mechanism operatively connected to at least one of said units and adapted to control the circuit to the motor of said unit, said control mechanism including a differential mechanism having the usual spider member and driving gears engaging the opposite faces of said spider, one of said driving gears being operatively connected to the conveyer belt of said controlled unit so as to be rotated thereby, the other of said driving gears being operatively connected to the drive pulley of said unit so as to be rotated thereby, said gears being so proportioned and arranged that said driving gear connected to said conveyer belt will normally rotate at a greater speed than the other of said gears and, therefore, will normally rotate said spider in the same direction, and means adapted to be operated by said spider when its direction of rotation is reversed, due to the speed of the drive pulley of said controlled unit exceeding the speed of said conveying belt of said unit a predetermined amount, to break the circuit to the motor of said controlled unit, and thereby stopping all the motors of said system due to their being interlocked.

4. The combination with a conveying system having at least two conveyer sections delivering the material from one to the other, each section comprising a flexible

conveying member and drive pulleys therefor, and at least one prime mover for driving said pulleys, of a control mechanism for controlling the flow of power to said prime mover, said control mechanism including a differential mechanism having the usual spider member and driving gears engaging its opposite faces, one of said driving gears being operatively connected to said conveying member of one of the conveyer sections so as to be rotated thereby, the other of said driving gears being operatively connected to the drive pulley of said section and rotated thereby, said gears being so proportioned and arranged that said driving gear connected to said conveying member will normally rotate at a greater speed than the other of said gears and, therefore, will normally rotate said spider in one direction, and means adapted to be operated by said spider to control the flow of power to said prime mover if the driving gear connected to said conveyer drive pulley should rotate at a greater speed than the gear connected to said conveying member, due to slip of the conveying member on said drive pulley, thereby reversing the direction of rotation of said spider.

5. The combination with a machine including a driving and driven member and a prime mover for operating said driving member, of a control mechanism for controlling the flow of power to said prime mover, said control mechanism including a differential mechanism having the usual spider member and driving gears engaging its opposite faces, one of said driving gears being operatively connected to said driving member and rotated thereby, the other of said driving gears being operatively connected to said driven member and rotated thereby, said gears and said spider being so arranged and proportioned that one of said driving gears will normally rotate at a greater speed than the other of said gears and, therefore, will normally rotate said spider in one direction, and means adapted to be operated by said spider to control the flow of power to said prime mover if the other of said driving gears should rotate faster than said last named gear and thereby change the direction of rotation of said spider.

6. The combination with a machine having at least two moving parts adapted to be moved at substantially equal speed, and prime movers for said parts, of a control mechanism for controlling the flow of power to said prime movers, said control mechanism including a differential mechanism having the usual spider member and driving gears engaging its opposite faces, one of said driving gears being operatively connected to each of said moving parts of said machine, said gears and said spider be-

- ing so arranged and proportioned that one of said driving gears will normally rotate at a greater speed than the other of said gears and, therefore, will normally rotate
- 5 said spider in one direction, and means adapted to be operated by said spider to control the flow of power to said prime movers if other of said driving gears should rotate faster than said last named gear due to
- 10 an increase in speed of the moving part to which it is connected, which will thereby change the direction of rotation of said spider.
- 15 7. The combination with two moving members adapted to be moved at substantially equal speeds, and power means for moving said members, of a control mechanism for controlling the operation of said power means, said control mechanism including a differential mechanism having the
- usual spider member and driving gears engaging its opposite faces, one of said driving gears being operatively connected to each of said moving members and rotated thereby, said gears and said spider being so
- 25 arranged and proportioned that one of said driving gears will normally rotate at a greater speed than the other of said gears and, therefore, will normally rotate said spider in one direction, and means adapted
- 30 to be operated by said spider to control the operation of said power means if the other of said driving gears should rotate faster than said last named driving gear, due to the increased speed of the moving member
- 35 to which it is connected, and thereby change the direction of rotation of said spider.
- In testimony whereof, I have hereunto set my hand.

FRANK E. SMITH.