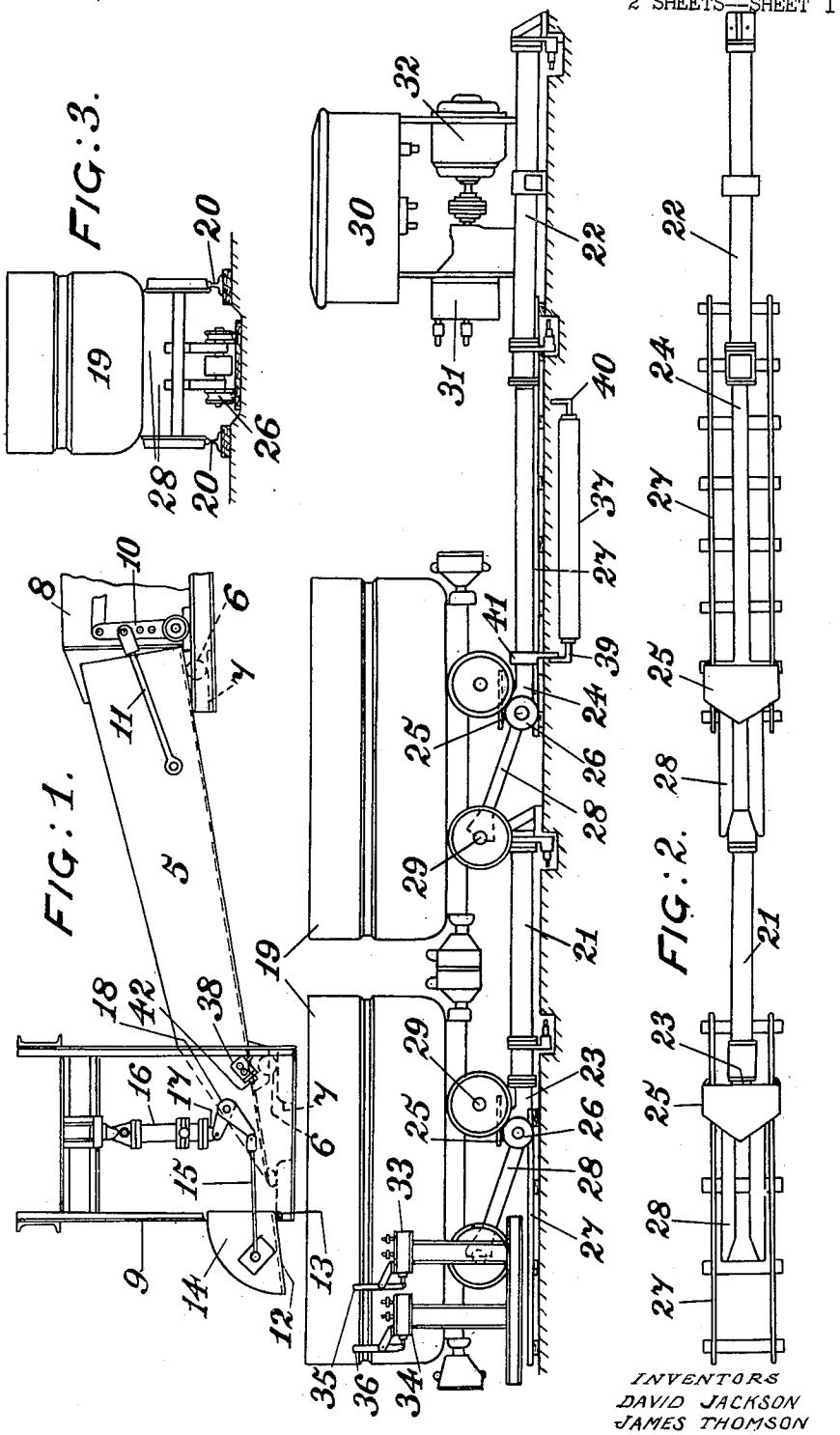
March 18, 1952 D. JACKSON ET AL 2,589,814

CHUTE FOR THE DELIVERY OF MATERIAL SUCH AS COAL

Filed June 13, 1947 2 SHEETS—SHEET 1



INVENTORS
DAVID JACKSON
JAMES THOMSON
BY Otto Munn
THEIR ATTY

March 18, 1952 D. JACKSON ET AL 2,589,814

CHUTE FOR THE DELIVERY OF MATERIAL SUCH AS COAL

Filed June 13, 1947

2 SHEETS—SHEET 2

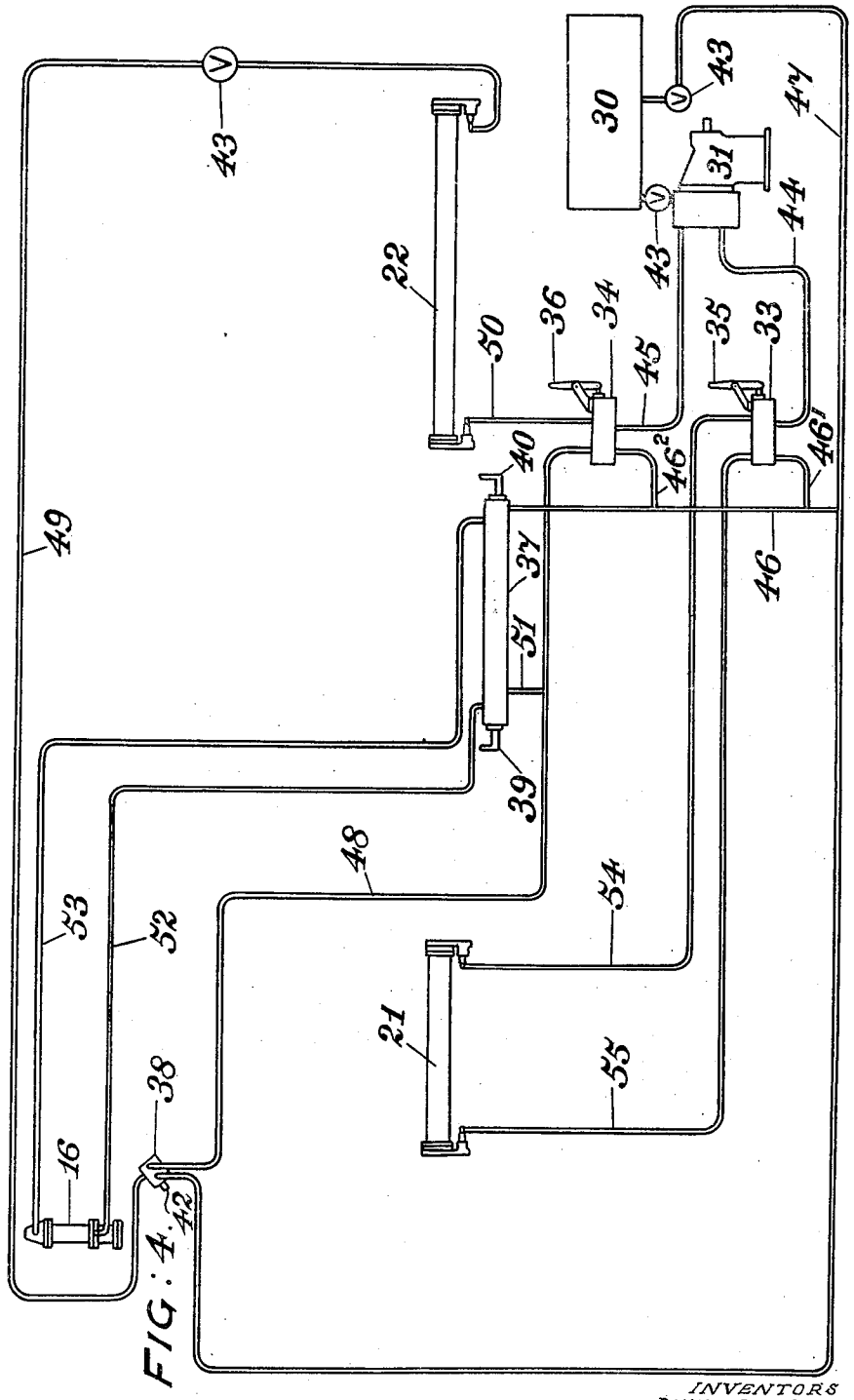


FIG. 4.

INVENTORS
DAVID JACKSON
JAMES THOMSON
BY Otto Munk
THEIR ATT'Y

Patented Mar. 18, 1952

2,589,814

UNITED STATES PATENT OFFICE

2,589,814

CHUTE FOR THE DELIVERY OF MATERIAL SUCH AS COAL

David Jackson and James Thomson, Glasgow, Scotland, assignors to Mavor & Coulson, Limited, Glasgow, Scotland

Application June 13, 1947, Serial No. 754,472
In Great Britain November 22, 1944

2 Claims. (Cl. 214—41)

1

This invention refers to chutes for the delivery of material such for instance as coal, and it is particularly although not exclusively concerned with shaking chutes for directing the output of a conveyor in a coal mine into trains of separate tubs or like vehicles for transport to the surface. Modern high speed mining methods make special demands on such shaking chutes. In discharging say coal into rapidly changed tubs, it is desirable that the discharge of coal should be interrupted for a short space of time commensurate with the usual space between adjacent tubs as each tub moves out of the filling position and the next tub moves into that position.

Therefore an object of the present invention is to provide a chute for directing the output of a conveyor to vehicles in succession with a door which controls the discharge of the chute and which is open only when a vehicle is in the filling position and power means which are operable under the control of apparatus for moving the vehicle and which are applied to the door to open and close it as one vehicle after another is moved into and out of the filling position.

Another object of the present invention is to provide such a chute with a door for controlling the discharge of the chute in combination with apparatus for moving the vehicles, power means applied to the door so as to open and close it as one vehicle after another is moved by said apparatus into and out of the filling position, and control means for co-relating the operation of the door's power means with the vehicle-moving apparatus so that the door is opened when a vehicle is moved into said position, is maintained open while the discharge is distributed in the vehicle and is closed before the filled vehicle is moved from said position.

Another object is to provide a pressure-fluid ram unit for opening and closing the door in combination with a pressure-fluid ram unit for advancing the vehicles to the door.

Another object is to provide in a shaking chute system a discharge section which is stationary, i. e. non-shaking, which stationary section carries the door and also carries power-operated mechanism for opening and closing the door. Generally, the said mechanism will be of pressure-fluid type, but it may be electrical.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an elevation of a coal delivering installation including a shaking chute system

2

in combination with tub-moving apparatus. Fig. 2 is a plan of components of the tub-moving apparatus. Fig. 3 is an end elevation showing components of the tub-moving apparatus applied to a tub, which is shown in simple outline. Fig. 4 is a diagram of a hydraulic control system incorporated in the installation.

Referring to the drawings, the shaking chute system includes a shaking chute 5 supported at opposite ends by rollers 6 which ride upon rails 7 on stationary structures 8 and 9. The structure 8 is incorporated in the framework at the delivery end of a coal conveyor. A power-oscillated arm 10 journaled on the structure 8 is connected by a link 11 to the chute 5. The structure 9 is the stationary delivery end section of the shaking chute system. A door 12 is hinged at its lower edge, at 13, to the section 9. The door has side checks 14, each of which is connected by a link 15 to power-actuated mechanism for opening and closing the door. The mechanism includes a quick-acting hydraulic unit 16 on the section 9, the ram 17 of the unit being connected to a bell-crank lever 18 connected in its turn to the link 15.

In operation of the chute system, the chute 5 receives a reciprocatory shaking motion from the mechanism 10, 11 and delivers coal to the stationary section 9, which provides in conjunction with the hinged door 12 a hopper of sufficient capacity to contain the coal that is prevented from being discharged by the door while closed. The door is opened and closed at appropriate intervals (as hereinafter described) by the mechanism 15 to 18, the coal being discharged while the door is open.

The chute system is arranged to deliver the discharged coal at a loading station, or filling position, to a train of separate interconnected tubs in succession; twenty-one tubs is a customary number in a train. In Figs. 1 and 3, tubs 19 are shown in simple outline, the tubs running on a line of rails 20 (Fig. 3). As shown, adjacent tubs 19 are spaced apart. These rails extend under the chute section 9. The train is brought to the loading station and thereafter the tubs are moved in succession below the door 12 by means of hydraulic apparatus, the function of which is to push a tub into appropriate positional relation with the door, which is closed for the time being; then, when the door is opened, to push the tub slowly forward, thus distributing or trimming the coal in the tub; next, the door being again closed, to push the next tub into appropriate positional relation with the

door, thus forcing the first-mentioned truck beyond the door; and so on.

The hydraulic apparatus includes two double-acting hydraulic ram units 21 and 22, both fixed longitudinally at ground level between the rails 20. The rams 23 and 24 of the respective units each have a head plate 25 with wheels 26 which run on rails 27, and they each have a pair of pivotal arms 28 forming a one-way catch bar for engagement with the tub axles 29. Each catch bar 28 is urged upwards (say by spring or weight means, not shown) to a raised position in which the catch bar can grip and push an axle, as shown in Figs. 1 and 3. Each catch bar is yieldable downwards, so that an axle can pass over it without obstruction when the tub is being pushed forwards.

In the example, the unit 21 is slow-acting, being placed more or less below the section 9. The unit 22 is designed to act at a higher speed and its stroke is much longer than that of the unit 21, behind which the unit 22 is located in alignment.

The unit 16 of the door 12 and the units 21 and 22 of the tub-pushing apparatus are incorporated in the same hydraulic system, as Fig. 4 shows. The hydraulic system also includes an oil reservoir 30, an oil pump 31 driven by an electric motor 32 (Fig. 1), control means consisting of two distributing valves 33 and 34, having control handles 35 and 36 respectively for their operation, and interlock valves 37 and 38 which control the working relation between the door unit 16 and the tub-pushing apparatus. Each of the control handles 35 and 36 has three available positions, referred to herein as the "first," "second" and "third" positions.

In Fig. 4 the components of the hydraulic system are shown connected by appropriate piping. In this diagram, the components are shown without regard to their true positional relationship for simplicity and clearness of illustration; the approximate positional relationship of the components can be gathered from Fig. 1, from which the piping is omitted. The valve 37 has tappets 39 and 40 at opposite ends of its valve rod, which is actuated by a striker 41 arranged on the ram 24 of the unit 22 in order to cooperate with the tappets 39 and 40. The valve 38 has a tappet 42 on its valve rod, the bell-crank lever 18 serving as striker to the tappet 42. Stop valves 43 are connected at appropriate points in the piping of the hydraulic system.

The pump 31 draws oil from the reservoir 30 and discharges the oil under pressure to the distibuting valves 33 and 34 through pipes 44 and 45. In the first (or neutral) position of the control handles 35 and 36, the oil returns through pipes 46^1 and 46^2 to return pipes 46 and 47 leading back to the reservoir 30, thus circulating idly.

Assume that the door 12 is closed and that an empty tub 19, one of a train of interconnected tubs, has to be advanced for filling with coal. The door ram 17 is fully advanced and the tappet 42 depressed by the lever 18. The tub-advancing ram 24 is fully withdrawn, with its catch bar 28 engaging an axle 29 of the tub next behind the tub to be filled. The coal-trimming ram 23 also is withdrawn, its catch bar 28 being inactive.

In operation of the hydraulic system, a worker moves the control handle 36 into its second position. Thus, the oil passing through the valve 34 is cut off from the return pipes 46^2, 46 and 47 and is supplied by way of a pipe 48, the valve 38

and a pipe 49 to the working end of the unit 22, so that the ram 24 is quickly advanced from its cylinder. In this way, the tub engaged by the unit 22 and the tub or tubs ahead of it are advanced, and the arrangement is such that the first empty tub comes below the door at the forward limit of the stroke of the ram 24. Oil passes from the return end of the unit 22 through a pipe 50 and the valve 34 to the return pipes 46^2, 46 and 47. It is essential to this train-advancing movement that the door 12 must be fully closed (in order to maintain the valve 38 properly positioned). Thus, as this movement involves passage of an inter-tub space of the train through the loading station, coal cannot be discharged between the tubs and loss of coal is prevented.

At about the end of this train-advancing movement, the striker 41 engages the tappet 39 and actuates the valve 37, so that oil is supplied from the pipe 48, a pipe 51, the valve 37 and a pipe 52 to the door-opening end of the unit 16. Thus the ram 17 is quickly withdrawn into its cylinder and opens the door 12, oil returning from the other end of the unit 16 by a pipe 53 and the valve 37 to the return pipe 46. At the start of the door-opening movement, the lever 18 releases the previously depressed tappet 42, so that the working end of the unit 22 is cut-off from the oil supply pipe 48. The timing of the operations is such that the door 12 is fully opened by the quick action of the unit 16 at about the instant when the tub-advancing unit 22 completes its working stroke. At this instant the front axle of the first empty tub moves over the catch bar 28 of the unit 21, and the catch bar engages it.

The apparatus is now ready for the trimming operation. Therefore the worker moves the control handle 35 into its second position, so that oil is supplied from the pipe 44 through the valve 33 and a pipe 54 to the working end of the unit 21, the ram 23 of which slowly advances the engaged tub as it fills with coal. Meantime, oil returns from the other end of the unit 21 through a pipe 55, the valve 33 and the pipe 46' to the return pipes 46, 47. Moreover, the worker moves the control handle 36 into its third position, in which the return end of the tub-advancing unit 22 is connected through the pipe 50 and the valve 34 to the oil supply pipe 45, so that the ram 24 is retracted into its cylinder, oil from the other end of the unit 22 passing through the pipe 49 and the valve 42 to the return pipe 47. In addition, the action of moving the handle 36 into its third position cuts off the pipe 48, valves 37 and 38 and unit 16 from the supply pipe 45. At about the end of the return of the ram 24, the striker 41 engages the tappet 40 and returns the valve 37 to its initial position, in which the connections through the valve 37 are reversed, namely, the temporarily cut-off pipe 48 is connected through the pipe 51, valve 37 and pipe 53 to the door-closing end of the unit 16, and the other end thereof is connected through the pipe 52 and valve 37 to the return pipe 46. Thus, the connections to the unit 16 are re-set in readiness to close the door 12 on the return later of the control handle 36 into its second position. When the tub being filled is about full, the worker moves the control handle 35 to its third position, in which oil is supplied from the pipe 44 through the valve 33 and pipe 55 to the return end of the unit 21, oil passing from the opposite end there-

of through the pipe 54, valve 33 and pipe 46[1] to the return pipes 46 and 47. Finally, the worker returns the control handle 36 through its first position to its second position, thus supplying oil from the pipe 45 through the valve 34, pipe 48, pipe 51, valve 37 and pipe 53 to the door-closing end of the unit 16. Thus the door 12 is closed when the leading tub is fully advanced to the end of its trimming movement. As the door closes, the lever 13 strikes the tappet 42 and returns the valve 33 to the position in which oil is supplied to the working end of the unit 22, which therefore engages another tub of the train and pushes that tub and those in front of it sufficiently to remove the last filled tub from the loading station and to bring the now first empty tub thereinto. Thus, the cycle of operations is ended and another cycle is started. As will be understood, the new first empty truck is next engaged by the unit 21 and the necessary trimming operation is performed as the tub is loaded. The cycle of operations is repeated for each successive tub of the train.

In another patent application of even date, now Patent No. 2,572,687, by John Anderson and Andrew Fraser, of which Mavor & Coulson, Limited, are assignees, the invention claimed concerns a vehicle-moving apparatus including two pressure-fluid ram units, one of which can advance a vehicle into a loading station and the other of which can impart a trimming movement to said vehicle while in said station.

We claim:

1. A chute for discharging the output of a conveyor to a filling position for vehicles separated by inter-vehicle spaces, a door operatively associated with the discharge end of said chute, a pressure-fluid operated unit connected to said door for opening and closing it, pressure-fluid operated apparatus for moving the vehicles in succession into the filling position, a pressure fluid system incorporating both said unit and said apparatus, control means also incorporated in said pressure fluid system to control operation of said apparatus and said unit, and a valve connected in said system and actuated by said unit in the closed position

of said door to set said control means into condition for advancing the vehicles so as to bring an inter-vehicle space past the closed door.

2. A chute for discharging the output of a conveyor to a filling position for vehicles separated by inter-vehicle spaces, a door operatively associated with the discharge end of said chute, a pressure-fluid operated unit connected to said door for opening and closing it, pressure-fluid operated apparatus for moving the vehicles in succession into the filling position, a pressure-fluid system, manually operable distributing valve means in said system for operatively connecting said system to said unit and said apparatus, mechanically operable valve means in said system operatively associated with said apparatus, said mechanically operable valve means being actuated by said apparatus, said mechanically operable valve means being actuated by said apparatus to set said system for a door-opening operation by said unit whenever a vehicle is advanced by said apparatus into the filling position and being actuated by said apparatus to set said system for a door-closing operation by said unit whenever a filled vehicle is ready for movement by said apparatus from said filling position, and a valve device connected in said system and actuated by said unit in the closed position of said door to set said system for operation of said distributing valve means so that the vehicles will be advanced to bring an inter-vehicle space past the closed door.

D. JACKSON.
JAMES THOMSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
588,899	Dodge	Aug. 24, 1897
1,079,718	Piercy	Nov. 25, 1913
1,898,021	Schellentrager	Feb. 21, 1933
2,149,710	Smith	Mar. 7, 1939
2,288,763	Winship et al.	July 7, 1942
2,317,175	Burdick	Apr. 20, 1943