

Dec. 6, 1938.

G. S. JENKINS

2,139,162

APPARATUS FOR UNDERGROUND MINING

Filed May 12, 1937

3 Sheets-Sheet 1

FIG. 1.

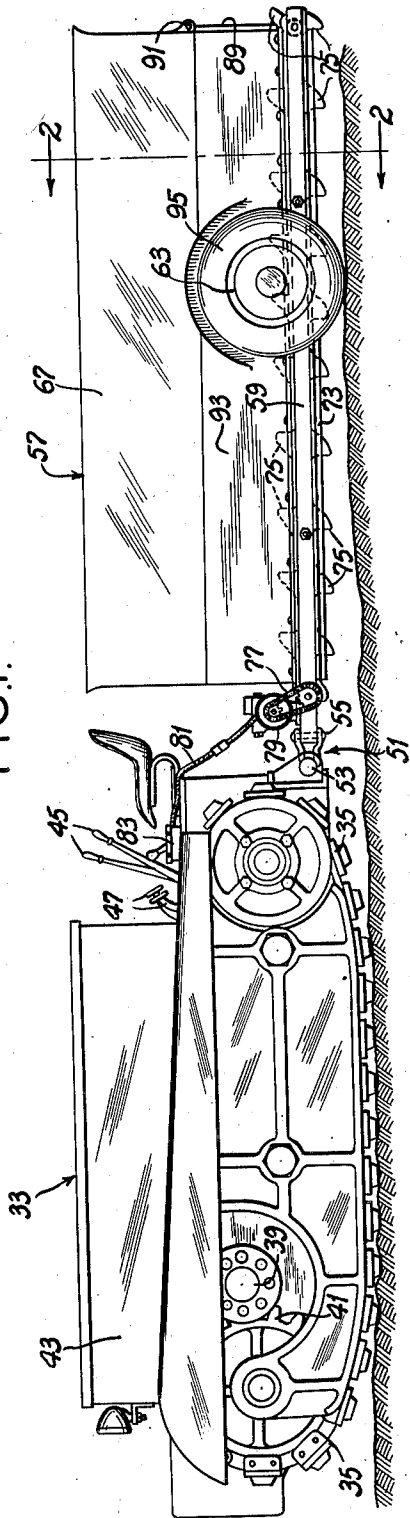


FIG. 3.

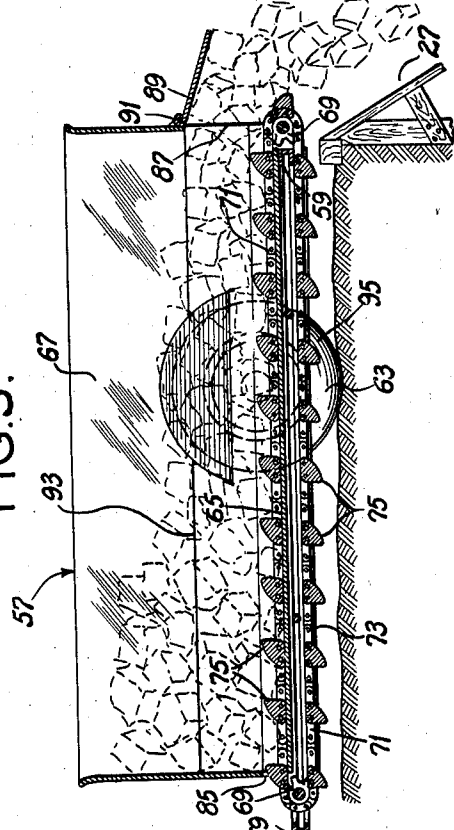
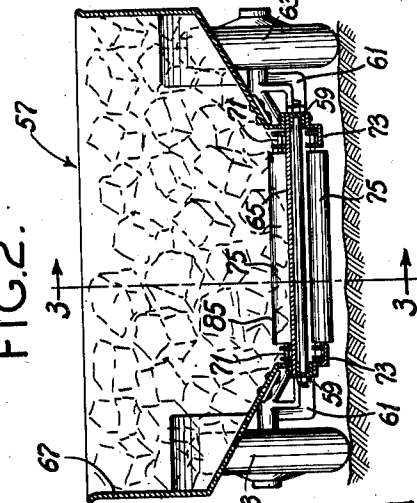


FIG. 2.



Gerald S. Jenkins
 Inventor.
 Delos W. Haynes,
 Attorney.

Dec. 6, 1938.

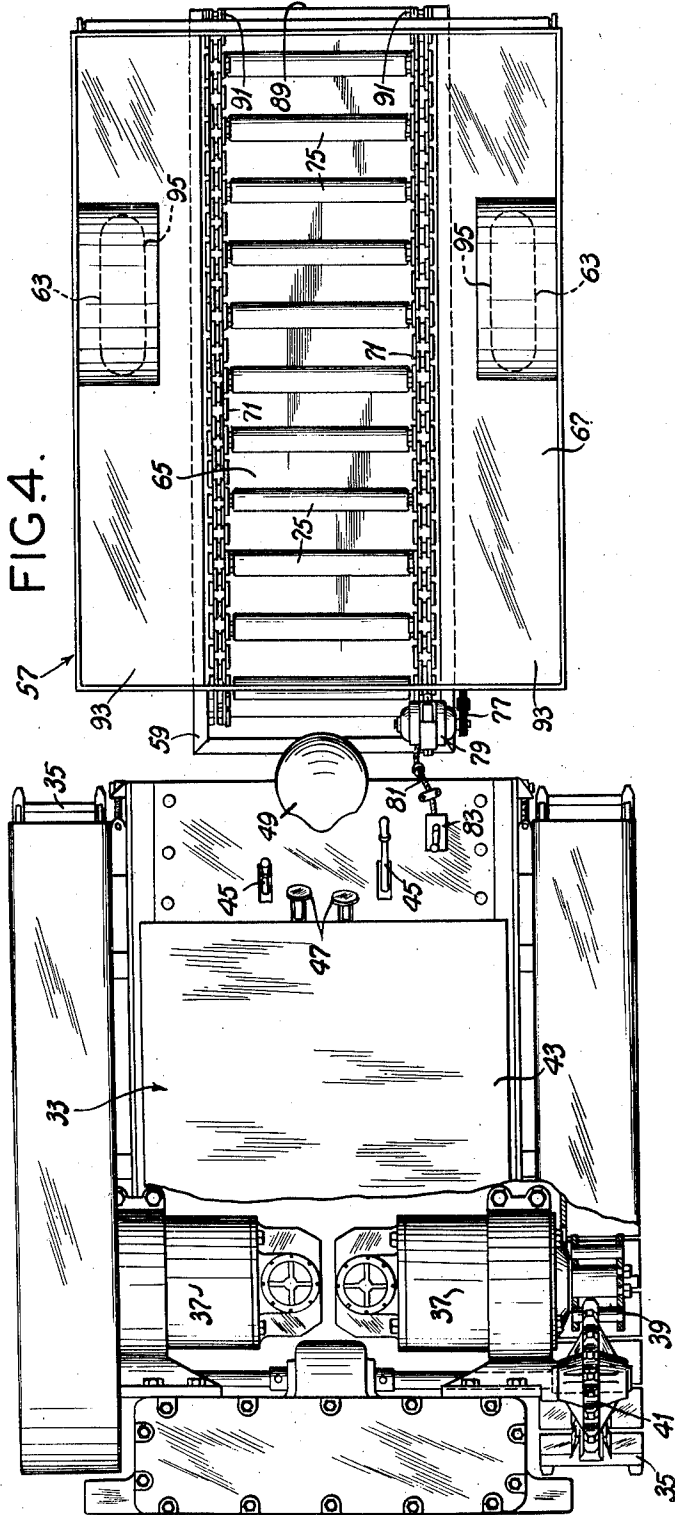
G. S. JENKINS

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3 Sheets-Sheet 2



Gerald S. Jenkins
Inventor
Delos W. Hughes,
Attorney

Dec. 6, 1938.

G. S. JENKINS

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FIG. 5.

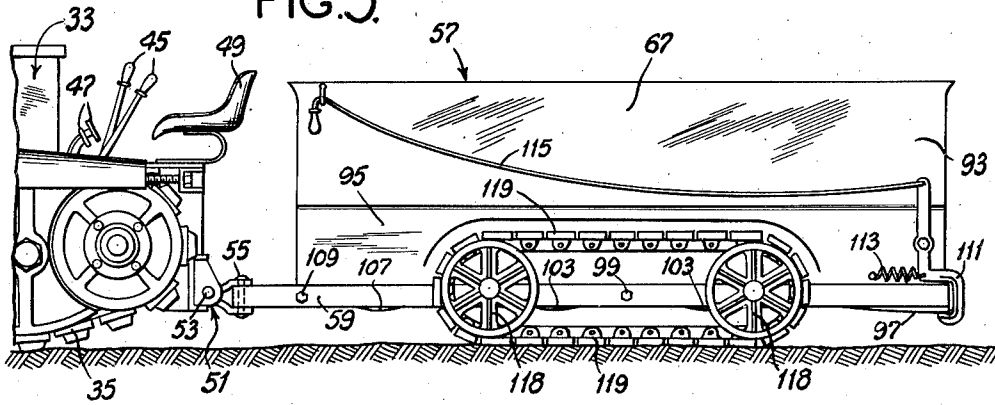
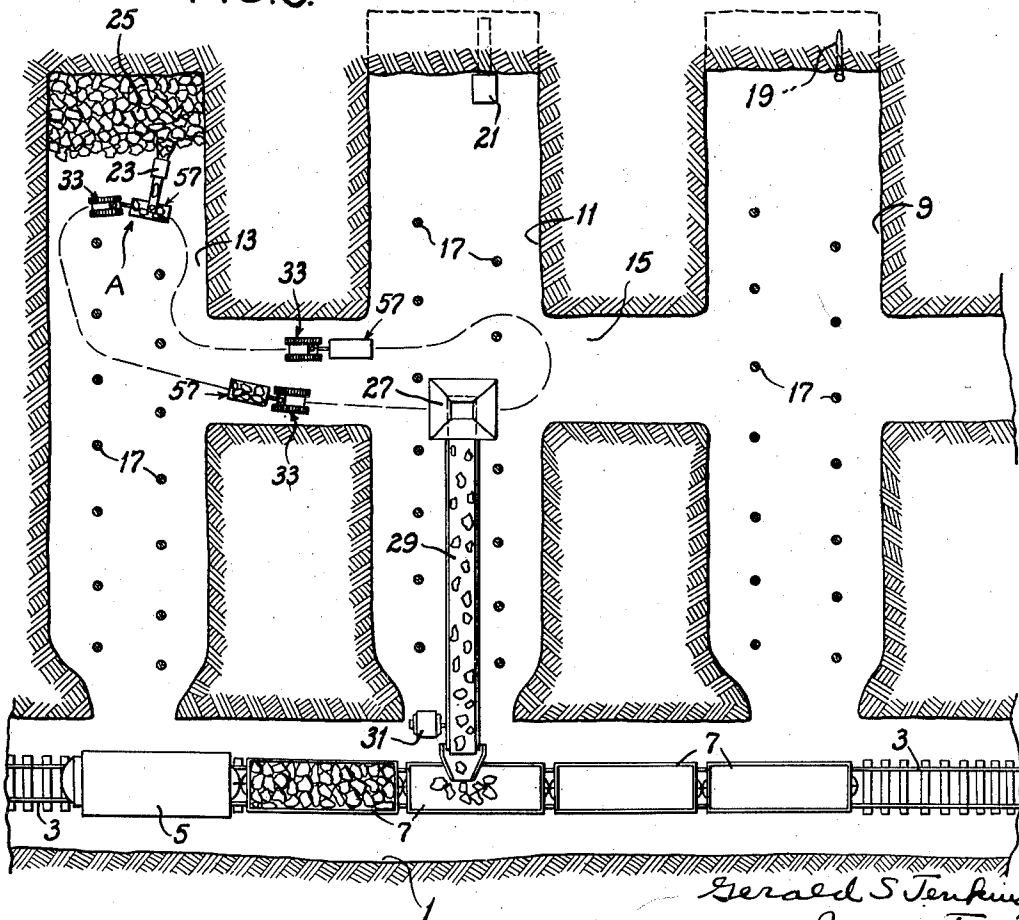


FIG. 6.



Gerald S. Jenkins
Inventor.
Delos S. Hayes,
Attorney.

UNITED STATES PATENT OFFICE

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APPARATUS FOR UNDERGROUND MINING

Gerald S. Jenkins, St. Louis, Mo.

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5 Claims. (Cl. 214-83)

This invention relates to apparatus for underground mining, and with regard to certain more specific features, to coal mining apparatus.

Among the several objects of the invention may be noted the provision of apparatus for underground mining which eliminates the necessity for laying rails in the mine rooms; the provision of transportation apparatus which effects increased flexibility but with much simplified form and reduced amount of machinery, whereby larger output may be effected by reason of the better organization of drilling, cutting and loading operation thereby made possible; and the provision of apparatus of this class which is easily loaded and unloaded and which is simple in construction and operation. Other objects will be in part obvious and in part pointed out hereinafter.

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

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention.

Fig. 1 is a side elevation showing a tractor with a coupled semi-trailer;

Fig. 2 is a cross section taken on line 2-2 of Fig. 1;

Fig. 3 is a longitudinal section taken on line 3-3 of Fig. 2;

Fig. 4 is a plan view of Fig. 1;

Fig. 5 is a side elevation of an alternative form of trailer; and

Fig. 6 is a diagrammatic plan view of a mine system employing the machinery herein described.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring more particularly to Fig. 6, there is shown a diagrammatic plan view of an underground mine in which numeral 1 indicates an entry 1 in which is a railway track 3 for accommodating passage of a main line locomotive 5 which hauls a string of cars 7.

Connecting with the entry 1 are rooms 9, 11 and 13, for example, between which are cross passages 15. The props which necessarily must be used are shown at numeral 17.

At the ends of the rooms 9, 11 and 13 are the usual drill 19 (shown for example in room 9), cutting machine 21 (shown for example in room 11), and loading machine 23 (shown for example

in room 13). In room 13 the coal which has been shot down is indicated at numeral 25.

At about the part where the first cross passages 15 intercept the room 11 is located a hopper 27 with a feeder to a conveyor 29 which extends out into the entry 1 for purposes of successively loading the main line cars 7. The conveyor 29 is driven by a suitable motor drive 31.

Referring now to Fig. 1, there is shown at numeral 33 a caterpillar tractor. This tractor includes oppositely located chains 35 of endless-track lugs, the respective chains 35 being independently driven by motors 37 (Fig. 4). The drives are effected through lantern gears 39 meshing with sprockets 41, which in turn mesh with and drive the respective chains 35. The motors 37 are energized from a battery 43 carried on the tractor.

Mounted on the tractor are two forward-and-reverse controls 45, each being respectively connected to suitable controlling switch gear for one of the motors 37. For example, one of the controls controls the left-hand motor and the other the right-hand motor. When a given control is thrown forward, the chain of lugs controlled thereby moves that side of the vehicle forward, and when the same control is pulled backwards, that side of the vehicle tends to move backward. Thus, if both endless-track chains 35 are moving forwardly at the same rate, the vehicle moves forwardly in a straight line; if they move backwardly at the same rate, the vehicle moves backwardly in a straight line. Likewise, when one of the chains of lugs moves forwardly at a faster rate than the other, then the vehicle turns; or, if one of the chains is moved forwardly and the other rearwardly, the vehicle turns on an axis between the chains of lugs. This feature of an endless-track tractor is quite favorable to its use underground, and this has not heretofore been recognized, to my knowledge.

Individual foot brakes 47 are also provided for the respective chains of tractor lugs for more complete control. A driver's seat 49 is provided adjacent the controls 45 and 47.

At the rear of the tractor 33 is a coupling 51 having horizontal axes 53 and 57 providing a universal movement. The coupler 51 is for coupling a trailer 57, which in the example shown in Figs. 1-4, 5 and 6 is of the semi-trailer class.

In Figs. 1-4 the trailer comprises a frame 59 supported upon stub-axes 61 and wheels 63. The frame 59 supports a bottom plate 65 and a hopper 67.

At the opposite ends of the trailer 57 are carried

pairs of sprockets 69 for accommodating endless lengths of conveyor chains 71. Each conveyor chain 71 forms a reach which is above the plate 65 and a reach which is below said plate, as shown. Each lower reach is carried along upon one flange of an angle iron 73, as shown in Fig. 2. Between the lengths of chains 71 are supported scraper lugs 75.

The sprockets 69 at the front end of the trailer are driven by means of a drive 77 from a motor 79 which is energized by a flexible plug connection 81 from a control box 83 on the tractor 33. When the motor 79 is energized, the scraper lugs 75 are caused to traverse the inside of the bottom 65 from front to rear, and to traverse the angle irons 73 from the rear to the front. The lugs enter the hopper 67 at an opening 85 and leave by means of an opening 87.

The opening 87 is normally covered by a door 89 which is hinged above the opening as shown at 91 and tends to gravitate shut. Without material in the trailer, the door normally hangs downwardly over the opening, and by reversing the motor 79, the direction of movement of lugs 75 may be reversed so that a lug may be forced against the outside of the door 89 as shown in Fig. 1 to hold the door shut, against the gravity action of material within the trailer.

The control 83 for the motor 79 has a forward position and a reverse position, the latter incorporating known means for reducing the power of the motor in reverse, so that the conveyor flight, when it runs backwards to hold shut the gate 89, will not be broken by the resistance met. For example, the introduction of resistance into the battery circuit upon reversal accomplishes this result.

Another feature of the motor 79 is that it includes a solenoid brake and release to prevent the motor shaft from turning except when the motor is energized. The details of the solenoid brake and of the control 83 are not further particularized, because electrical apparatus of this class is known per se.

An advantage of a semi-trailer of the type shown in Figs. 1-4, wherein a conveyor flight is used, as described is that upon reversing the motor 79, the trailer is put into condition for receiving a load. Then, when it is desired to dump the load as shown in Fig. 3, it is necessary merely to set the controller 83 to a position such that the motor 79 drives the conveyor flight to force the lugs 75 to the right (Figs. 3 and 4), thereby causing door 89 to open automatically and to push material therethrough, until the hopper 67 is entirely empty. The sloping sides 93 of the hopper assure that all of the material gravitates to the lugs 75, and thus assure that all of the material will ultimately be emptied from the trailer.

Advantageous features of the general combination of an endless-track tractor and semi-trailer are that, unlike a railway system in an underground room, the apparatus is quite flexible. That is to say, it may be more advantageously positioned in respect to the loading machine, as shown at index A in Fig. 6. Also, it may pass through the cross passages 15 without special switches and track. The use of the hopper 27 and conveyor 29 in conjunction with this tractor and trailer equipment obviates the necessity of running a vehicle all the way back to the entry 1.

The combination of an endless-track tractor and a semi-trailer is advantageous over the use of the combination of a trailer and, say, a four-

wheel tractor, in respect to the flexibility of operation. For example, the endless-track tractor 33 may be turned around upon an axis within the endless-track, whereas a four-wheel tractor is not so readily turned in this manner. This is because, if it is desired to sharply turn a four-wheel tractor, the front wheels are at such an angle that, with a fully loaded trailer, excessive resistance is met. Furthermore, rugged and rough contour of the mine floor makes the use of four-wheel tractors disadvantageous, for these, like the endless-track tractors, must carry batteries, and the extreme rolling of the four-wheel tractors causes excessive sloshing of the liquid in the battery and excessive erosion of the battery plates due to the liquid flow thereover. In endless-track type of tractors, even rough contours do not cause rolling to such a degree.

As shown on the drawings, the center line of the axle of the trailer is behind the center of gravity of the trailer, including its load, enough to throw some load upon the rear end of the caterpillar tractor. The arrangement in each case is such that the load applied to the tractor by the battery and by said trailer is about balanced along the tractor tread. That is to say, the endless-track tractor does not tend to become excessively loaded at one end or the other. Excessive loading at one end or the other tends to cause the tractor to control with less facility. Hence, by applying the semi-trailer load, as described, the control of the endless-track is maintained in an optimum condition.

The trailer with a conveyor type of bottom saves the expense and necessity of a suitable pit as required with the dump-bottom type of trailer such as will be described hereinafter.

Reference may also be made to the pneumatic tires 95 upon which the wheels 63 are carried. These serve to reduce wheel wear and improve the efficiency with which the trailer may be drawn.

In mines that may have soft bottoms, it may be desirable to employ a trailer which itself has running gear comprising endless-track treads. Such a trailer is shown in Fig. 5. In this case there is simply employed either of the body constructions already described or any other suitable one as shown. In Fig. 5 two wheels 118 are shown on each side with endless-track chains 119 thereover. These chains may be centered with respect to the trailer body, as shown, or set back so that the load is distributed as above described. A centered form is shown by way of example. It will be understood that the endless-tracks of the trailer are not self-powered.

In operation, a room such as 9 has a drill such as 19 operating at the end of it, while an adjacent room such as 11 has a cutting machine operating at the end of it. At this time the next adjacent room such as 13 has or is having coal shot down as indicated at numeral 25, and the loading machine 23 does the loading of trailers which are successively brought into position by the tractors, as indicated in Fig. 6. These operations are more or less contemporaneous.

After the coal which has been shot down into room 13 has been entirely removed, the drill 19 is moved into room 13 from room 9 and the drilling commenced to advance the room. At this time cutting machine 21 is transferred from room 11 to room 9, while the coal is shot down in room 11. At this time the loading machine is moved into room 11, and the operation of coal removal is carried out in said room 11. Ac-

ording to the above example, the operations succeed in order from room to room.

It will be understood that a single tractor can pull several trailers, if suitable couplers are provided between trailers. In this case any trailer could be uncoupled and left to unload itself, provided the motor 19 thereon is provided with energy from a suitable source of electric power by the application of a suitable electric plug from a suitable electric source.

The invention expedites the transportation of coal to such a degree that the output is substantially increased. At the same time there is avoided the overhead cost of rail equipment. The overhead cost of tractor and trailer equipment is much less, because duplicate equipment is not necessary in each room, and the same is true of the conveyor equipment such as 27, 28.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the 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.

I claim:

1. A dump-truck comprising a load-containing body, a bottom therein, a conveyor flight associated with said bottom and having a reach above the bottom and another reach below, said body having an exit opening adjacent one end of the flight, the reach of said flight above the bottom being movable toward said opening, a door adjacent said opening openable outwardly in the direction of movement of said upper reach, and means for reversely moving the flight in a direction so that said upper reach moves inward from said opening, said door being swingable normally to automatically close and to be locked by a reversely traveling portion of said flight.

2. A dump-truck comprising a hopper, a bottom for said hopper and tapering sides leading thereto, a conveyor flight having an upper reach

movable along said bottom from one end of the hopper to the other, and having a lower return reach, means on said truck supporting said return reach for movement, said body having an opening at one end for the entry of said upper reach, and an opening at the other end for its exit, a door openable outward from said exit opening, said door being adapted to be incidentally opened by one movement of the said upper reach and to be locked shut by opposite movement thereof.

3. A dump-truck comprising a load-containing body, a bottom therein, a conveyor flight associated with said bottom, said body having an exit opening adjacent one end of the flight, said flight having a reach movable toward said opening, a door adjacent said opening which opens outwardly in the direction of outward movement of said reach, and means for reversely moving the flight in a direction so that said reach moves inward from said opening, said door swinging normally to be locked automatically by a reversely travelling portion of said flight.

4. A dump-truck comprising a load-containing body, a bottom therein, a conveyor associated with said bottom, said body having an exit opening, the conveyor having portions movable outwardly of said opening to eject material therefrom, an outwardly movable door associated with said opening, said door being automatically opened by the conveyor when the conveyor is moved outwardly and being automatically closed by the conveyor when the motion of the conveyor is reversed.

5. A dump-truck comprising a load-containing body, a conveyor therein, said body having an exit opening, the conveyor having portions movable to said opening to eject material, a door associated with said opening, means whereby said door is automatically opened when said conveyor is started for ejecting purposes and automatically closed when the conveyor is reversed in direction of movement, and remote-control means for controlling conveyor movement.

GERALD S. JENKINS.