

Feb. 15, 1944.

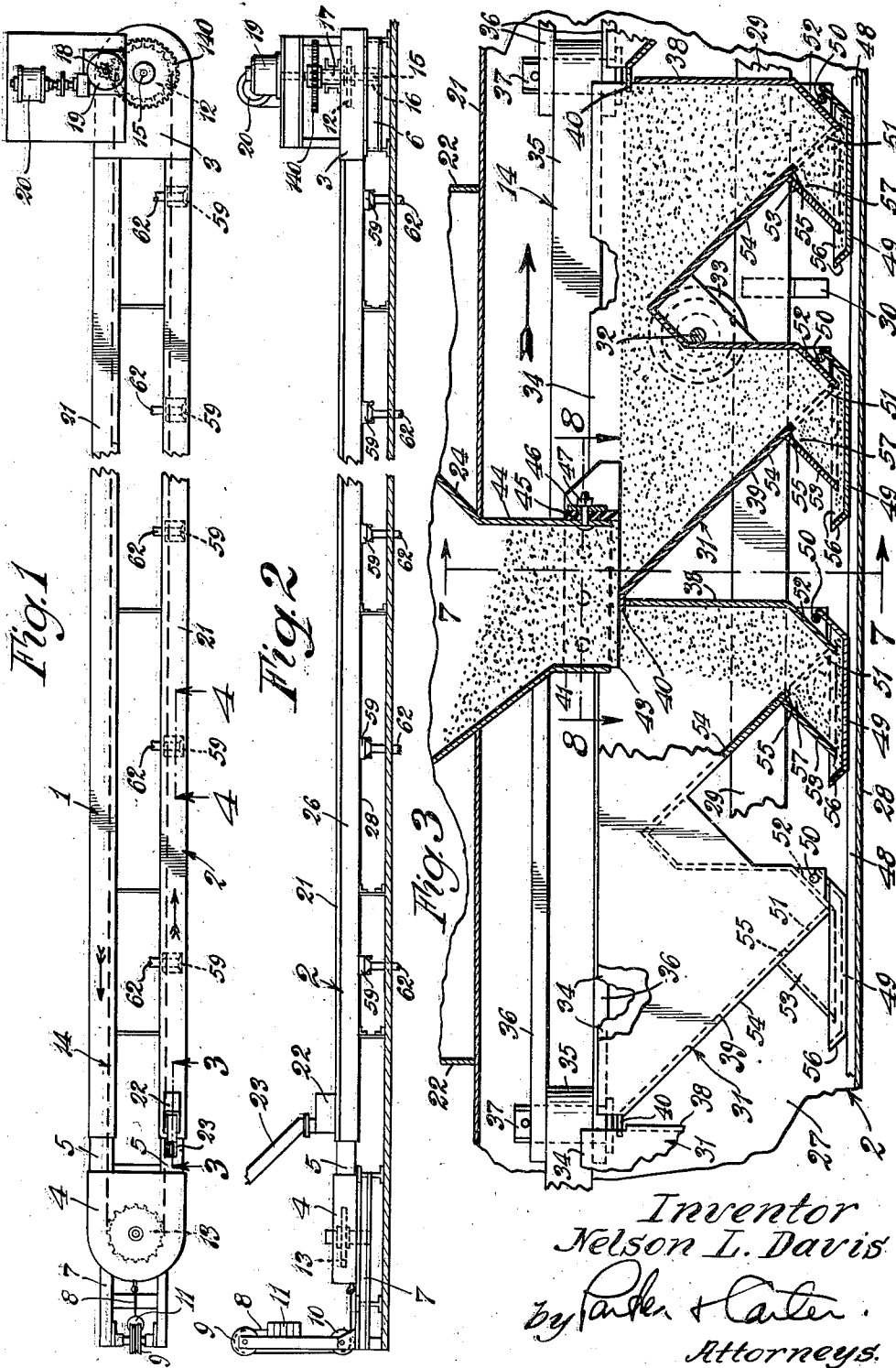
N. L. DAVIS

2,342,040

CONVEYER

Filed Sept. 28, 1942

4 Sheets-Sheet 1



Inventor
Nelson L. Davis
by Parker & Carter.
Attorneys.

Feb. 15, 1944.

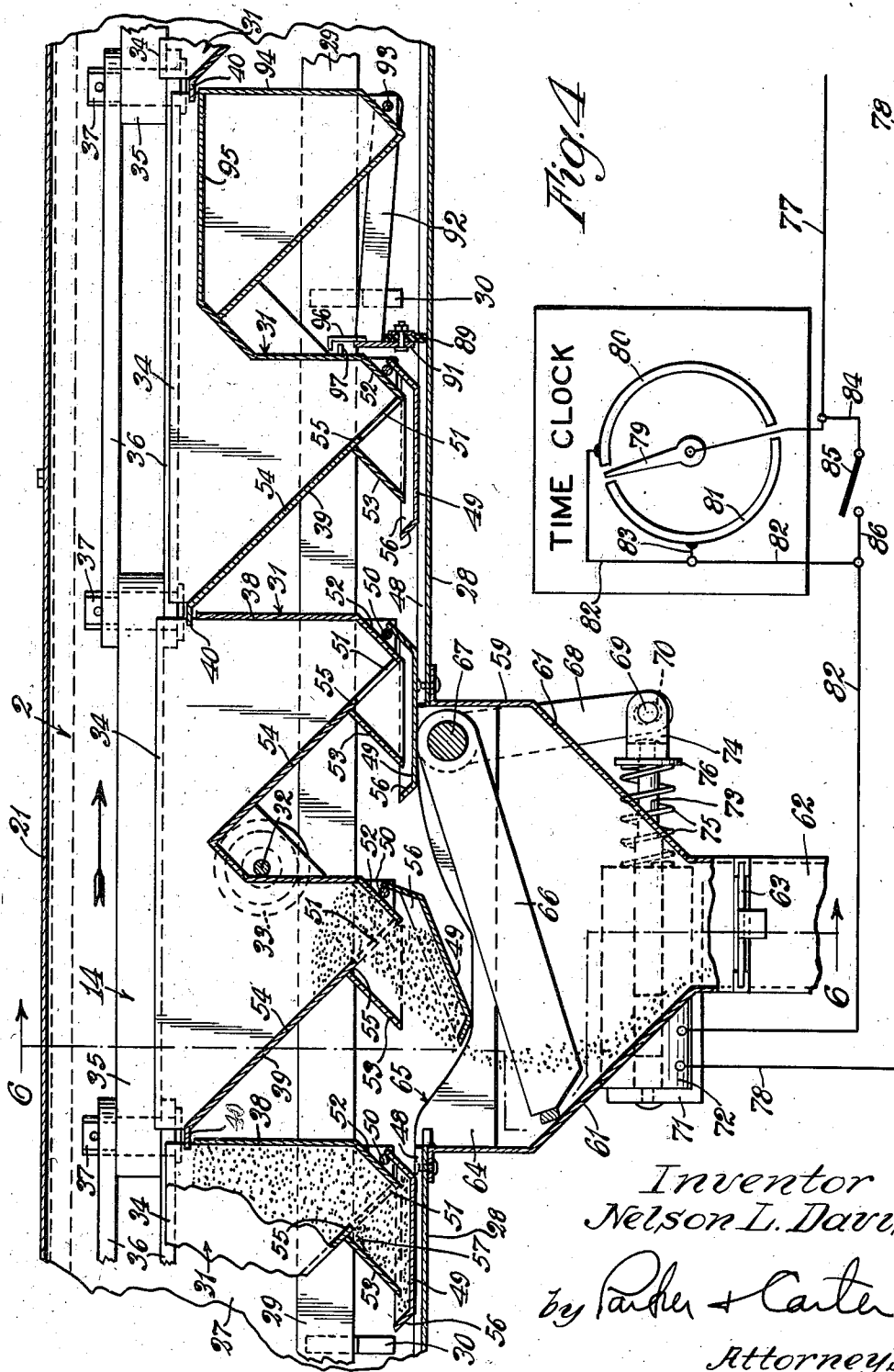
N. L. DAVIS

2,342,040

CONVEYER

Filed Sept. 28, 1942

4 Sheets-Sheet 2



Feb. 15, 1944.

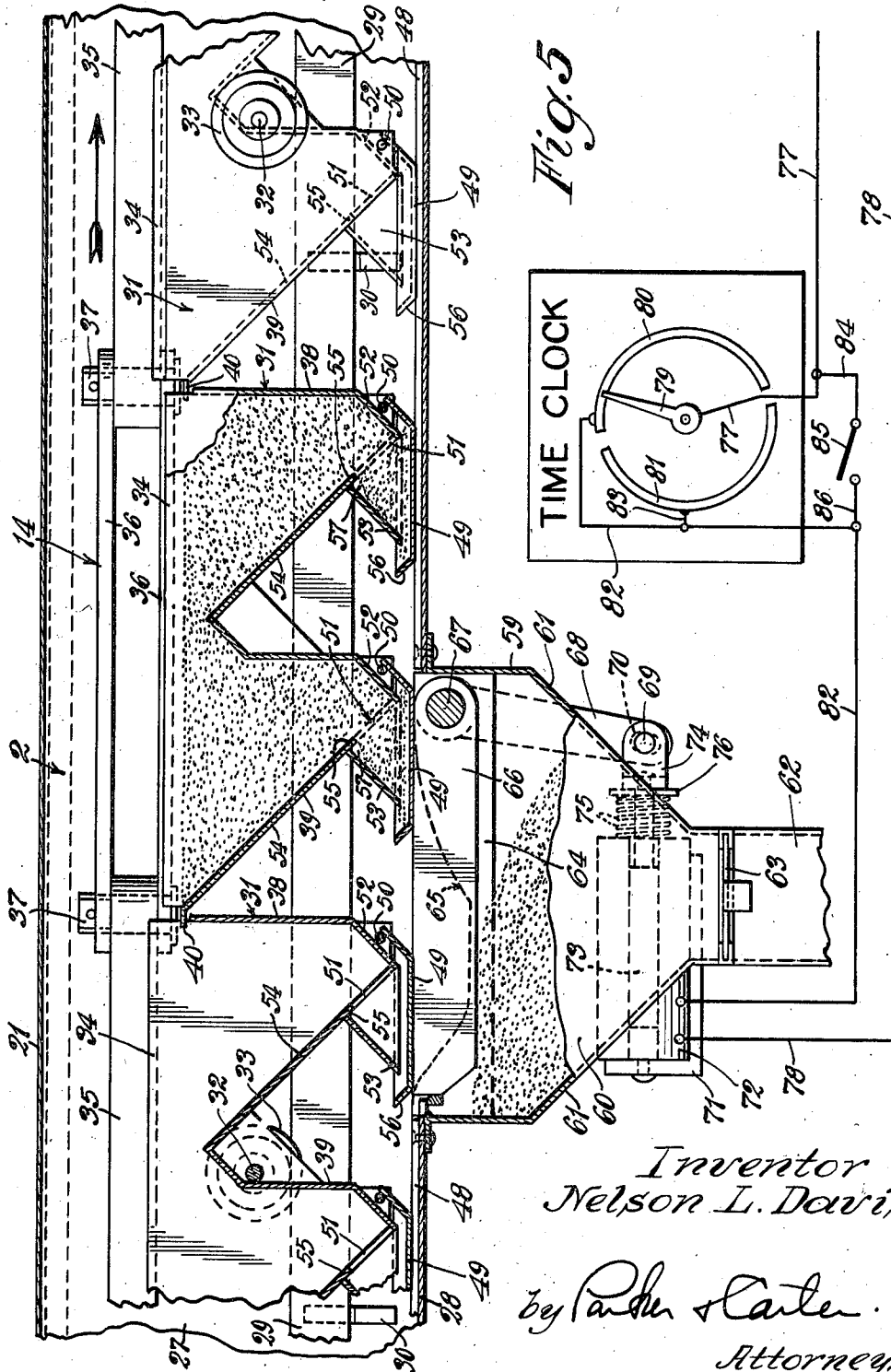
N. L. DAVIS

2,342,040

CONVEYER

Filed Sept. 28, 1942

4 Sheets-Sheet 3



Feb. 15, 1944.

N. L. DAVIS

2,342,040

CONVEYER

Filed Sept. 28, 1942

4 Sheets-Sheet 4

Fig. 7

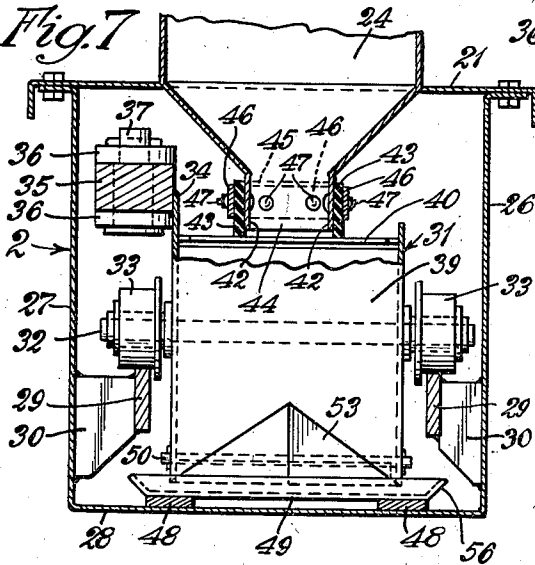


Fig. 6

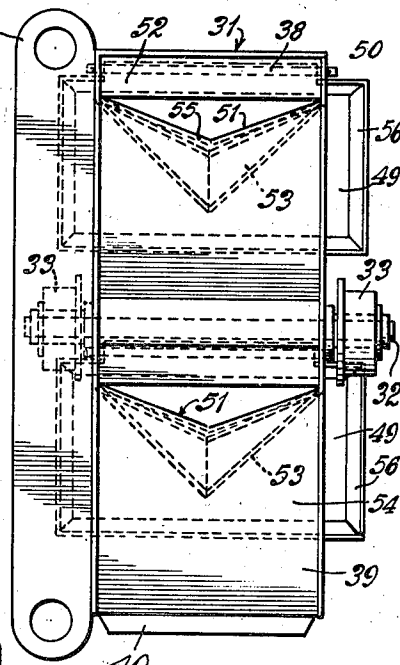
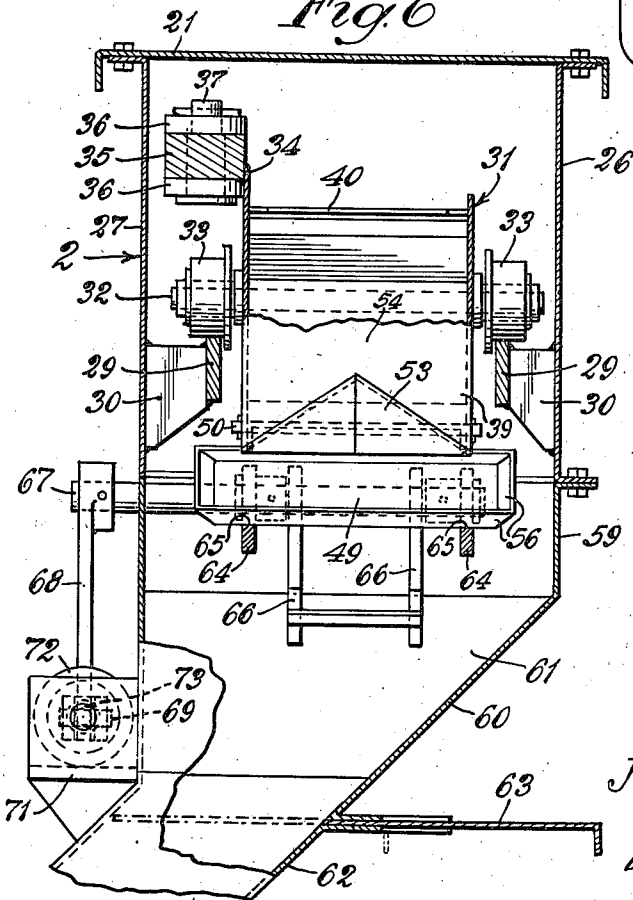


Fig. 9

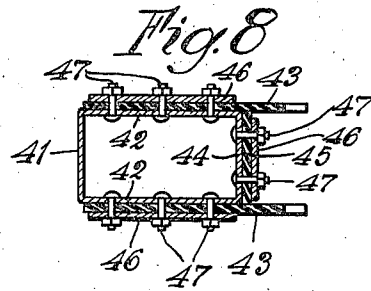


Fig. 8

Inventor
Nelson L. Davis
by *Parker & Carter*
Attorneys

UNITED STATES PATENT OFFICE

2,342,040

CONVEYER

Nelson L. Davis, Chicago, Ill., assignor to Link-Belt Company, Chicago, Ill., a corporation of Illinois

Application September 28, 1942, Serial No. 459,889

9 Claims. (Cl. 198—143)

My invention relates to improvements in automatic conveyers and has for one object to provide a new and improved form of conveyer which will receive, transport and discharge free flowing solid material.

Other objects are to provide a conveyer, which will handle solid material with a minimum of degradation; use a minimum of power; which will include manually, semi-automatically or full automatically operating means for discharging materials from the buckets or for preventing overloading receiving chute or bin.

Other objects are to provide in combination with such a conveyer, discharge control mechanism whereby one or more discharge receptacles or conduits may simultaneously be supplied with the proper amount of material during continuous operation; and to combine in a single unit the functions of conveyer, feeder and discharger.

Other objects will appear from time to time throughout the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a diagrammatic plan view;

Figure 2 is a diagrammatic side elevation;

Figure 3 is a section on an enlarged scale along the line 3—3 of Figure 1;

Figure 4 is a section on an enlarged scale along the line 4—4 of Figure 1;

Figure 5 is a section similar to Figure 4 showing the parts in a different position;

Figure 6 is a section along the line 6—6 of Figure 4;

Figure 7 is a section along the line 7—7 of Figure 3;

Figure 8 is a section along the line 8—8 of Figure 3;

Figure 9 is a plan view of one of the buckets;

Like parts are indicated by like characters throughout the specification and drawings.

1, 2, are two arms of a continuous conduit, joined at one end by a closed housing 3, rigidly attached to the arms 1, 2, and at the other end by a housing 4 which has sleeve extensions 5, telescoping with the arms 1, 2. The arms 1, 2 and the housing 3 are rigidly mounted on a framework shown diagrammatically at 6. The housing 4 is slidably mounted on the sub-frame 7 and as will hereinafter appear, slack in the conveyer chain is taken up by longitudinal movement of the housing under the impulse of the counterweight 11 connected by cable 8 passing over pulleys 9 and 10 with the housing 4.

12 and 13 are conveyer chain sprockets; one each in the housings 3 and 4. 14 is an endless conveyer chain illustrated diagrammatically in Figure 1 by dash lines, traveling over the sprockets 12, 13 and carrying conveyer buckets as will hereinafter appear. The shaft 15 journaled at 16 and 17 carries rigidly mounted thereon, a

drive gear 140 and a conveyer sprocket 12. 18 is a pinion in mesh with the gear 140 driven through a reduction gear 19 from a motor 20. The sleeves 5 permit movement of the housing 4 without breaking the dust seal and without opening the conduit. The branches 1, 2 and the housings 3, 4 have floors 28 and side walls 26, 27 and are closed at the top by a removable cover shown diagrammatically at 21. 22 is a feeder housing mounted on the cover 21 of the branch 2 and is adapted to receive material through any suitable supply pipe 23 of the branch 2. It contains a feeder hopper 24 adapted to receive material from any suitable source not here shown, details of hopper, housing and supply source being illustrated only diagrammatically as they form no part of the present invention.

Spaced inwardly from the side walls 26, 27 are track strips 29 supported on webs 30 projecting inwardly from the side walls, thus ample clearance is left between the walls 26 and 27 and the track strips 29. Conveyer buckets 31, some or all of them, having roller shafts 32 which carry flanged wheels 33 to travel along the track strips 29, have upwardly extending flanges 34 to engage links 35 or 36 of the chain 14, there being one link for each bucket. The links are articulated by pintle pins 37 so as to make a continuous drive propelling chain and supported on the buckets 31. The chain 14 travels around the sprockets 12 and 13 and is always supported above the level of the buckets and above and to one side of the material contained in the buckets. This prevents abrasion and clogging of the chain.

Each bucket includes two hoppers 38 and 39. The front wall of each hopper 38 is masked by the lip 40 extending rearwardly from the back hopper 39 of the preceding bucket so that when the buckets are in line they present a continuous surface, the lip of each preceding bucket overlying the adjacent wall of the succeeding bucket. This overlap is effective always whenever the chain is traveling along a straight line. It is not the case with respect to travel around the sprockets 12 and 13 because the chain is adjacent the inner body of the conduit and as the chain travels around the sprockets 12 and 13, the buckets spread apart.

This characteristic of the chain and buckets limits the position of the feed housing 22. It can be anywhere in the system except where the chain is traveling around the sprocket. The feed housing as shown in Figure 3 contains the hopper 24 having a downwardly extending discharge spout 41 terminating just above the upper surface of the lips 40. The spout 41 has side walls 42 carrying downwardly extending flexible scraping members or squeegees 43 which may actually come in contact with the lip 40. The downstream spout wall 44 has a squeegee 45 which comes down also

to just touch the lip 40. The squeegees 43 and 45 may be of rubber as indicated, held in position by strips 46, and nut and bolt combinations 47 or may be of any other suitable flexible material. If desired, the spout 41 may come down almost to contact with the lip 40. Preferably, however, in order to avoid binding, it is well to have some flexible medium between the lower end of the spout and the lip 40.

As the conveyer buckets are moved in the direction of arrows shown in Figure 3, with the hopper 24 containing a sufficient supply of material, the material flows through the spout 41 to fill each successive bucket as it passes beneath the spout, the size of the spout being sufficient with respect to the speed of bucket travel so that by the time the bucket has passed the spout, the bucket will be filled level. Surcharging or overfilling of the bucket is impossible because as the material fills the bucket and banks up in the spout, the actual contact of the squeegees 43 and 45 provides a closed system to prevent any appreciable overflowing of the material. Thus each bucket is level filled and goes forward in a level filled condition after it has left the feed spout.

Wear strips 48 are disposed along the floor 28 of the conduits. These wear strips support bucket gates 49, pivoted at 50 on the under forward sides of each of the bucket hoppers 38 and 39. The bucket hoppers have triangular bottom discharge ports 51 extending upwardly from the lower edges of the downwardly and rearwardly inclined walls 52 which mask the pivot axes of the bucket gates.

53 is a shield or shroud extending rearwardly and downwardly from the inclined wall 54 of each bucket hopper and conforming in cross section as indicated in Figure 9 to the discharge opening 51, the shield, however, projecting rearwardly from the wall 54 a slight distance above the discharge opening as indicated at 55 to provide a certain amount of clearance between the normal line of flow of material passing through the port 51 and the shroud 53.

The gate 49 resting on the wear strips 48 is normally out of contact with the underside of the bucket hopper, as shown in Figures 3 and 5. The gate 49 is dish-shaped having upwardly and outwardly extending inclined walls 56. The slope of the shroud 53 is substantially equal to the angle of repose of the material discharged through the port 51 so that under ordinary circumstances, there is a clearance at 57 between the shroud 53 and the material. If this clearance were not present, upward movement of the gate 49 with respect to the bucket would not be possible without jamming, lifting the bucket off its wheels, or crushing the material. When the gate 49 is rotated upwardly the material between the bucket and the gate may be forced into the clearance without any harm being done. The shroud 53 and the inclined wall 52 all terminate within the area bounded by and slightly below the outer edges of the gate 49, thus while there might under some circumstances be a slight up pressure or upflow of the material around this area within the periphery of the gate, such up-flow is not sufficient to cause spillage of material about the periphery of the gate 49.

If there were no discharge from the conduit and if the wear strips 48 were continued throughout and if the buckets traveled around with material being fed to the hopper 24, a situation would ultimately ensue where the whole system,

that is, every bucket would be filled. When that situation prevailed, then there would be no outflow from the hopper 24 into the buckets. The buckets would merely pass beneath the hopper, the mass of material in the buckets would maintain a continuous closure to prevent outflow from the chute 41 and the buckets would continue to operate without any binding or jamming or spillage of material.

Spaced along the conduits 1 and 2, are a plurality of discharge hoppers 59. There may be one or more and they may be associated with conduit 1 or 2 or both. These discharge hoppers are especially well illustrated in Figures 4 and 6. The floor 28 and the wear strips 48 terminate at the upstream and downstream sides of the hopper 59. The hopper has inclined floors 60, 61 discharging into a chute 62 which may be controlled by a manually adjusted sliding gate 63 or by any suitable means as desired. Extending across the hopper in general alignment with the wear strips 28, are two or more fixed discharge cams 64. At each end the upper surface of these cams 64 are in horizontal alignment with the upper surfaces of the wear strips 48. Intermediate their ends, the cam surfaces 65 cause gradual opening and then gradual closing of the gates 49 as the bucket travels to the right. This is important because if the gates are suddenly opened and closed as the buckets pass along, shock on the mechanism would cause excessive wear and violent movement of the gates would tend to throw the material and thereby cause degradation and deposit on the conduit floor.

If only the cams 64 were provided, each bucket as it passed over the hopper would spill its load until the discharge hopper 59 was full. To insure adequate supply and proper control, it is desirable that the maximum capacity of the conveyer to supply the discharge hopper 59 be greater than the means for withdrawing material therefrom. In the absence of some separate control means the discharge hopper would gradually fill up and the level of material would rise above the cam surfaces 65, the doors 49 would drag along the surface of the material and an excess amount of material would be scraped forwardly into the downstream side of the conveyer conduit. This would result in clogging the conveyer conduit, thereby increasing the power required, perhaps even preventing bucket movement and would result in excessive degradation of the material.

To prevent such overcharging of the hopper 59, movable control arms 66 located in parallelism with the members 64 are rigidly mounted on shafts 67 journaled in the members 64. The shaft 67 projects at one end out through the wall of the hopper 59. A lever arm 68 is rigidly mounted on the shaft 67. A pin 69 is rotatable and longitudinally movable in a slot 70 in the lever arm 68. Mounted on the wall of the hopper 59 is a bracket 71 supporting a solenoid 72, a plunger 73 being slidable therein carrying a head 74 in which the pin 69 is rigidly mounted. A spring 75 is compressed between the solenoid 72 and the flange 76 on the head 74.

The spring 75 tends to assist gravity in moving the control arm 66 into the down position as shown in Figure 4. Under these circumstances as each bucket passes over the discharge station, each bucket gate 49 travels along the cam surface 65 and is allowed to open as indicated in Figure 4 so that some or all of the bucket load may discharge into the hopper. As long as

the arms 66 permits successive bucket gates to be lowered by the cam 65, each successive bucket will discharge into the hopper as it passes over it. This would continue if material were not withdrawn from the hopper 59 until the hopper were filled. It is, of course, not desired that the hopper ever be completely full, that is full to the point at which successive bucket gates will wipe material out of the hopper into the conveyer so under ordinary circumstances, the arms 66 are normally held in the upper position as indicated in Figure 5. This may be done by two separate control means.

77, 78 are lead wires from any suitable source of electric power. The wire 78 extends directly to one terminal of the solenoid. The wire 77 leads to one end of a wiper finger 79 which is associated with a time clock. The clock causes the finger to rotate along the two opposed segments 80, 81, there being a space between the segments at both ends so that as the wiper 79 makes a complete revolution, it is engaged most of the time with segments 80 or 81, but twice for a short interval during every revolution the finger 79 is out of contact with the conductor segments 80, 81 and the circuit is broken.

A conductor 82 extends from the segment 80 to the other pole of the solenoid. A short conductor 83 joins the conductor 82 and the segment 81. A conductor 84 extends from the conductor 77 to one terminal of a switch 85. A conductor 86 extends from the other terminal of the switch 85 to the conductor 82.

If the switch 85 is in the closed position, the solenoid will be actuated, and will overcome the pressure of the spring 75, raise the arms or bars 66 into alignment with the tracks or wear strips 48 and the buckets will no longer discharge. Thus by manual manipulation of the switch 85 the buckets may be permitted to load or not as the case may be. Such manual manipulation, of course, is not satisfactory under all conditions and under normal operating conditions it is advisable to let the time clock function. As the time clock rotates twice during each revolution of the clock, the circuit is broken for a period, the length of which depends upon the rate at which the clock travels and the distance between the two opposed ends of the conductor segments 80 and 81. Each time the circuit is broken at the time clock, assuming that the switch 85 is open, the spring 75 tends to move the strip 66 down to permit successive buckets to unload. If material is being drawn out of hopper 59 at a rate such that the hopper will fill more rapidly than the buckets can supply it, each time the bars 66 are lowered, material will tend to pile up in the hopper each time the circuit is closed and the strips 66 are moved up through the material in the hopper. The material in the hopper will offer little if any resistance to the movement of the bar 66 but as the hopper fills up, the bars tend more and more to be supported on the material and this condition will continue with each successive movement of the bar 66 until a time will be reached when the hopper is so full that the bars cannot sink even under the influence of gravity and the spring 75 far enough below the cam 65 to permit discharge of the buckets. This situation will continue. The solenoid will be deenergized periodically but no material will be discharged. As soon as material has been drawn out of the hopper sufficient to make it necessary for further material to be

fed, the bars 66 will be free to fall and supply to the hopper will take place.

All that is necessary under these circumstances is that the timing of the clock be such that under maximum withdrawal from the hopper 59, the clock will operate often enough to permit the strips 66 to move down often enough, that is for a sufficiently long period of time to permit material to be fed to the hopper in amount great enough to supply the demand therefrom. That means the apparatus will normally be set so that the conveyer will be able to feed a little more material to the hopper than the maximum withdrawal. Under those circumstances, the time clock and the supporting of the bars 66 by the material in the hopper will be sufficient to compensate for the difference so that under all circumstances the hopper 59 will be filled.

If for any reason it is desired to permanently prevent withdrawal from the hopper 59, the shutter 63 is provided which may close the chute 62 discharging from the hopper 59.

There is, of course, always the possibility that a certain amount, usually a very small amount of material may find its way into the conduit itself beneath the buckets. In order that such material may be quickly removed, a scraper plate 89 is provided, preferably of rubber or other flexible similar material. It is notched to straddle the wear plates 48, is supported on a rigid blade 91, which blade is supported on arms 92 pivoted on a shaft 93. The shaft 93 is associated with a dummy bucket hopper 94 which is closed at its top as indicated at 95. This blade travels across the hopper being limited in its downward movement by the stop 96 engaging a lug 97 so that whatever loose material is found in any part of the conduit will be scraped along to discharge at the next discharge hopper.

It will be realized that while I have shown and described an operating device, still many changes might be made in the shape, size, number, arrangement and disposition of parts without departing materially from the spirit of my invention. I wish, therefore, that my showing be taken as in a large sense diagrammatic.

I claim:

1. A conveyer including a bucket having a bottom discharge aperture, a gate controlling said aperture, means for holding the gate normally in closed position, a discharge station along the path of travel of the bucket, means associated with the discharge station for first opening the gate as it enters the station and for then closing the gate as it leaves the station, means associated with the discharge station and independent of the gate opening means for separately holding the gate closed as it passes through the discharge station, said means including a movable arm and means for moving it into and out of position to engage the gate and hold it closed, the means for moving the arm into the gate closing position including a solenoid, a connection between the solenoid and the arm and means for normally energizing the solenoid to hold the movable arm in gate closing position and for periodically deenergizing the solenoid to cause the movable arm to move into gate opening position.

2. A conveyer including a bucket having a bottom discharge aperture, a gate controlling said aperture, means for holding the gate normally in closed position, a discharge station along the path of travel of the bucket, means associated with the discharge station for first opening the gate as it enters the station and for then closing the

gate as it leaves the station, means associated with the discharge station and independent of the gate opening means for separately holding the gate closed as it passes through the discharge station, said means including a movable arm and means for moving it into and out of position to engage the gate and hold it closed, the means for moving the arm into the gate closing position including a solenoid, a connection between the solenoid and the arm and means for normally energizing the solenoid to hold the movable arm in gate closing position and for periodically de-energizing the solenoid to cause the movable arm to move into gate opening position, there being associated with the solenoid, means for supplying electric current thereto, a time clock and a switch actuated thereby adapted to normally close the circuit through the solenoid and to periodically open the circuit.

3. A conveyer including a bucket having a bottom discharge aperture, a gate controlling said aperture, means for holding the gate normally in closed position, a discharge station along the path of travel of the bucket, means associated with the discharge station for first opening the gate as it enters the station and for then closing the gate as it leaves the station, means associated with the discharge station and independent of the gate opening means for separately holding the gate closed as it passes through the discharge station, said means including a movable arm and means for moving it into and out of position to engage the gate and hold it closed, the means for moving the arm into the gate closing position including a solenoid, a connection between the solenoid and the arm and means for normally energizing the solenoid to hold the movable arm in gate closing position and for periodically de-energizing the solenoid to cause the movable arm to move into gate opening position, yielding means associated with the solenoid tending in opposition to the solenoid to urge the gate closing means into the gate opening position.

4. A conveyer including a bucket having a bottom discharge aperture, a gate controlling said aperture, means for holding the gate normally in closed position, a discharge station along the path of travel of the bucket, means associated with the discharge station for first opening the gate as it enters the station and for then closing the gate as it leaves the station, and means independent of bucket movement for preventing opening of the gate, said means including a movable member adapted to engage the gate independent of the first mentioned opening and closing means to hold the gate in closed position throughout its travel through the discharge station, a solenoid, a connection between it and the movable member, means for normally energizing the solenoid to hold the movable member in gate closing position, and means for deenergizing the solenoid to cause the gate holding member to move to gate opening position.

5. In combination, a track, a plurality of buckets and means for moving them along the track, each bucket having a gate supported on and held in closed position by the track, a discharge cam in alignment with the track adapted to cause movement of the bucket gate to the open position as the bucket travels therealong, a separate bucket closing means including an arm pivoted at one end adapted to move vertically in general parallelism with the cam, a lever, a connection between the lever and the arm, a solenoid and a connection between the solenoid and the lever,

the solenoid when energized being adapted to hold the arm in bucket gate closing position.

6. In combination, a track, a plurality of buckets and means for moving them along the track, each bucket having a gate supported on and held in closed position by the track, a discharge cam in alignment with the track adapted to cause movement of the bucket gate to the open position as the bucket travels therealong, a separate bucket closing means including an arm pivoted at one end adapted to move vertically in general parallelism with the cam, a lever, a connection between the lever and the arm, a solenoid and a connection between the solenoid and the lever, the solenoid when energized being adapted to hold the arm in bucket gate closing position, yielding means associated with the solenoid adapted to thrust the lever into bucket opening position when the solenoid is deenergized.

7. In combination, a track, a plurality of buckets and means for moving them along the track, each bucket having a gate supported on and held in closed position by the track, a discharge cam in alignment with the track adapted to cause movement of the bucket gate to the open position as the bucket travels therealong, a separate bucket closing means including an arm pivoted at one end adapted to move vertically in general parallelism with the cam, a lever, a connection between the lever and the arm, a solenoid and a connection between the solenoid and the lever, the solenoid when energized being adapted to hold the arm in bucket gate closing position, means for periodically energizing and deenergizing the solenoid.

8. In combination, a track, a plurality of buckets and means for moving them along the track, each bucket having a gate supported on and held in closed position by the track, a discharge cam in alignment with the track adapted to cause movement of the bucket gate to the open position as the bucket travels therealong, a separate bucket closing means including an arm pivoted at one end adapted to move vertically in general parallelism with the cam, a lever, a connection between the lever and the arm, a solenoid and a connection between the solenoid and the lever, the solenoid when energized being adapted to hold the arm in bucket gate closing position, means adapted to thrust the lever into bucket opening position when the solenoid is deenergized, means for periodically energizing and deenergizing the solenoid, said means including a time clock, a plurality of conductor segments, a contact arm operated by the clock adapted to travel along said segments, the segments being out of contact with one another, the contact arm being adapted to close a circuit through the solenoid when it engages the segments and to break the circuit through the solenoid to deenergize it when passing from one segment to another.

9. A conveyer including a bucket having a bottom discharge aperture, a gate controlling said aperture, means for holding the gate normally in closed position, a discharge station along the path of travel of the bucket, means associated with the discharge station for first opening the gate as it enters the station and for then closing the gate as it leaves the station, additional means, independent of the bucket movement, for preventing opening of the gate and means for periodically rendering said independent means active and inactive.

NELSON L. DAVIS.