April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 1

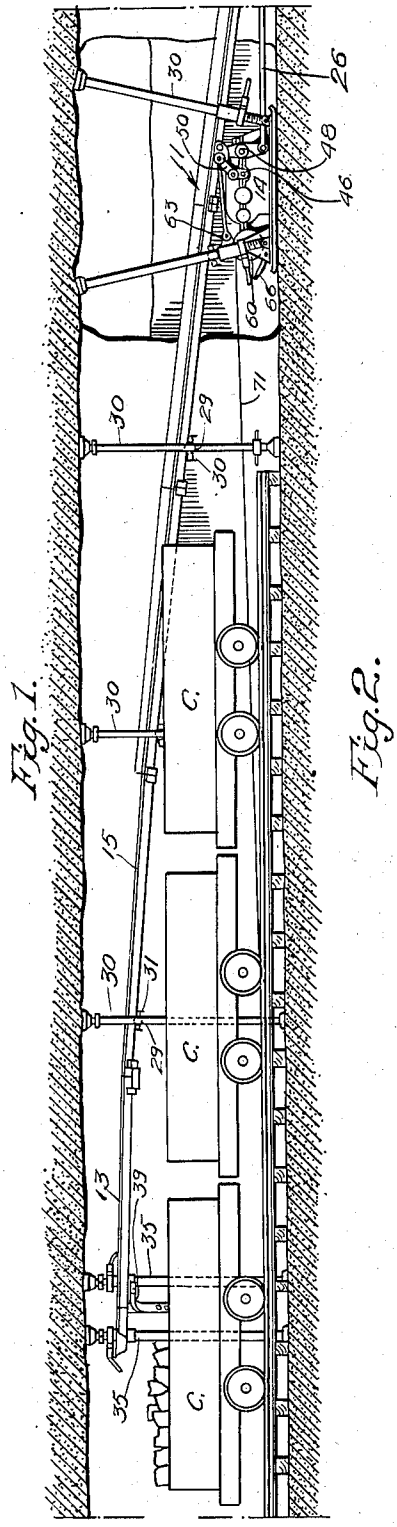


Fig. 1.

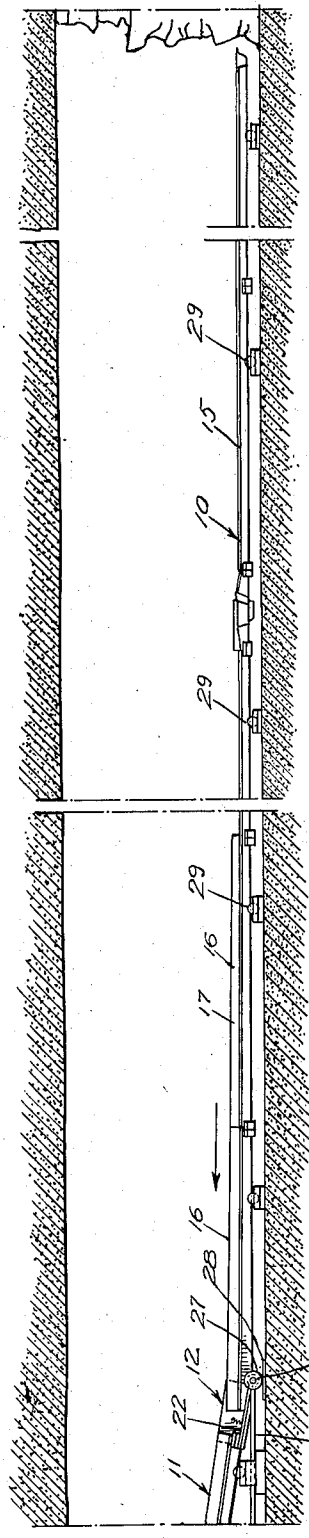


Fig. 2.

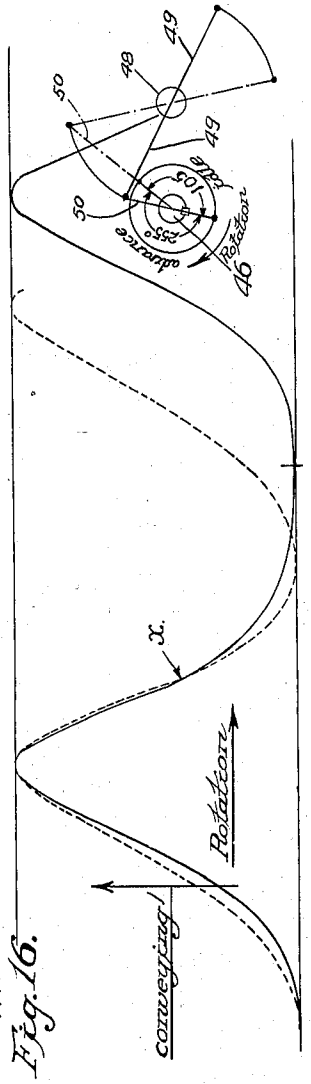


Fig. 16.

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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 2

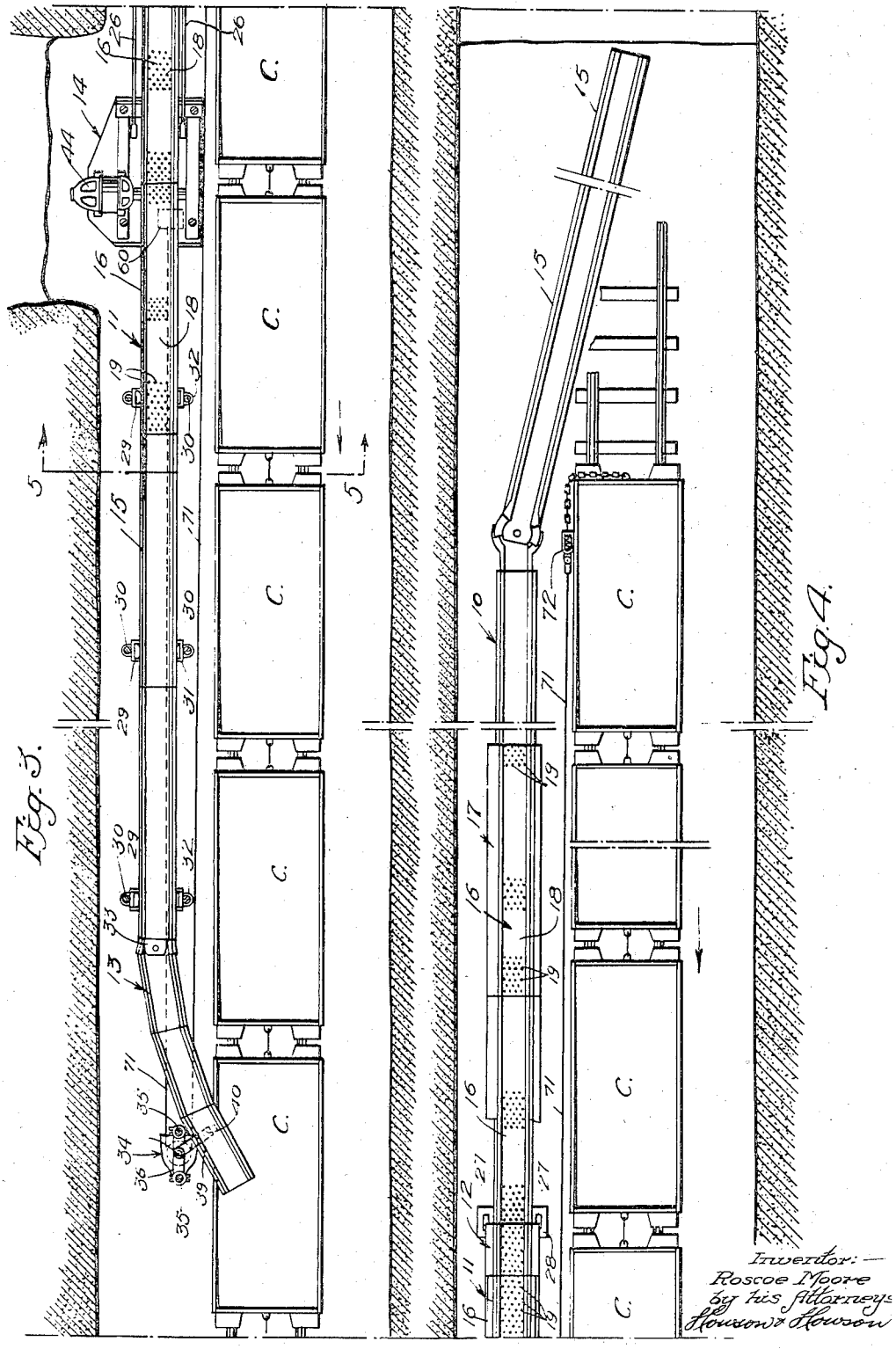


Fig. 5.

Fig. 4.

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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 3

Fig. 5.

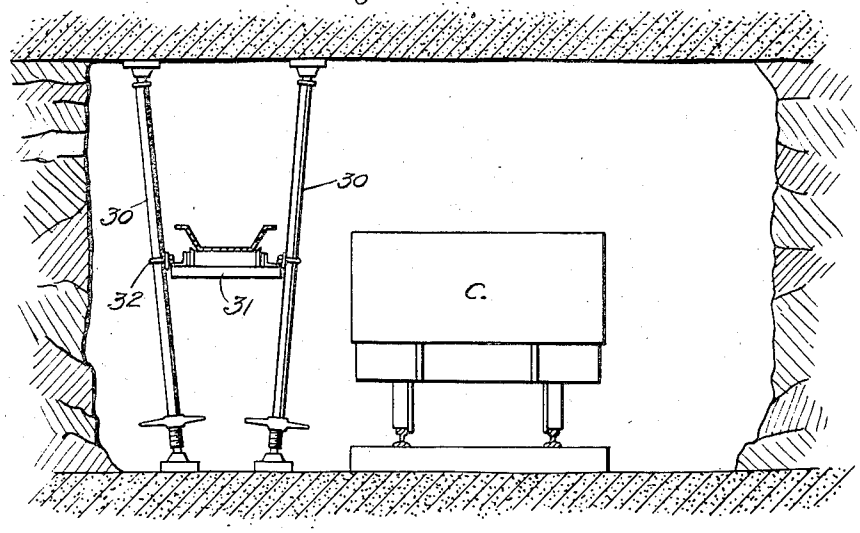


Fig. 6.

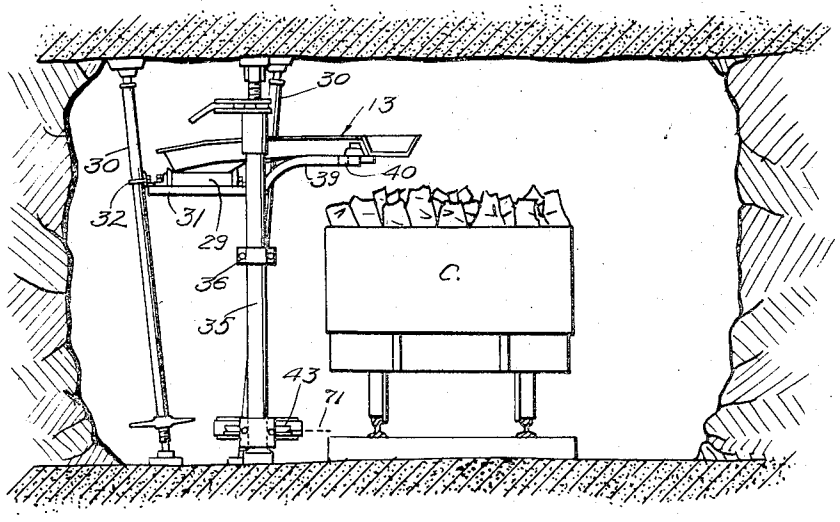
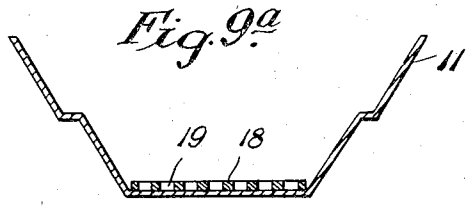


Fig. 9a



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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 4

Fig. 7.

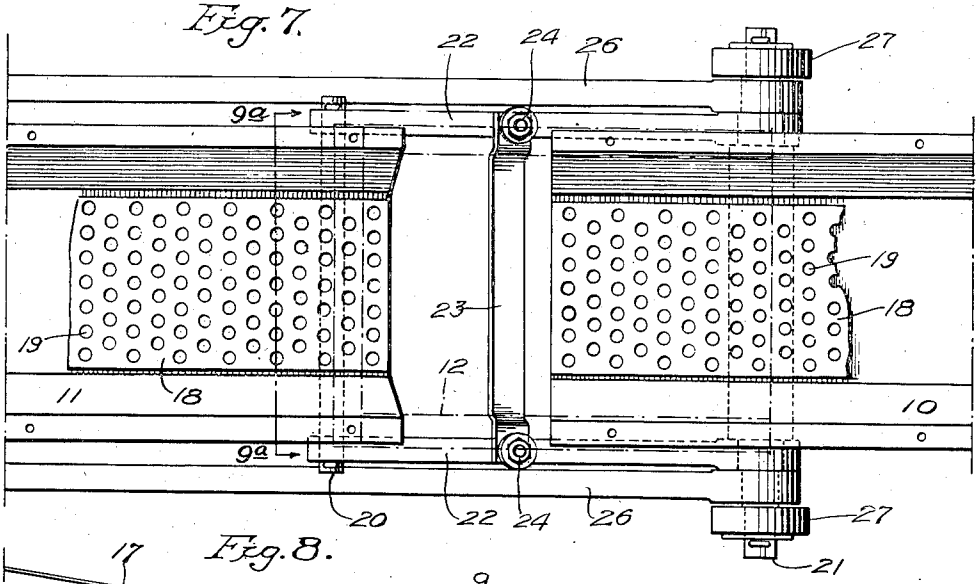


Fig. 8.

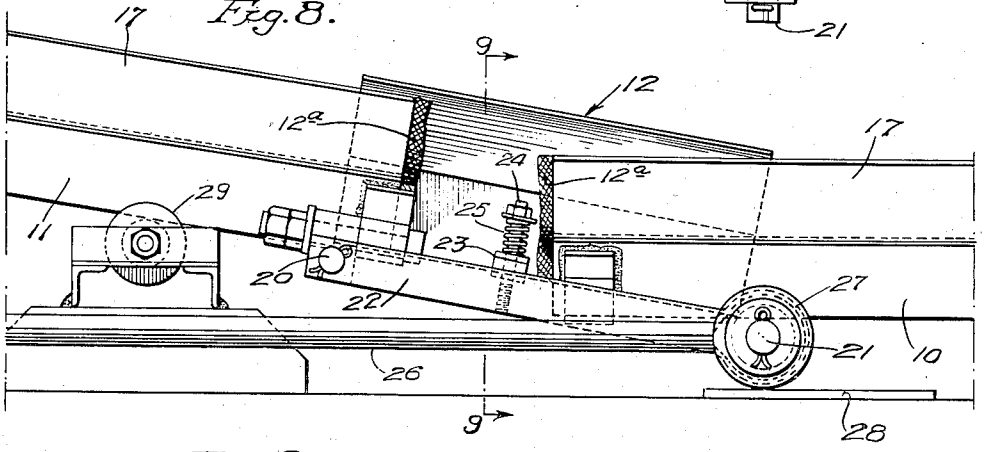
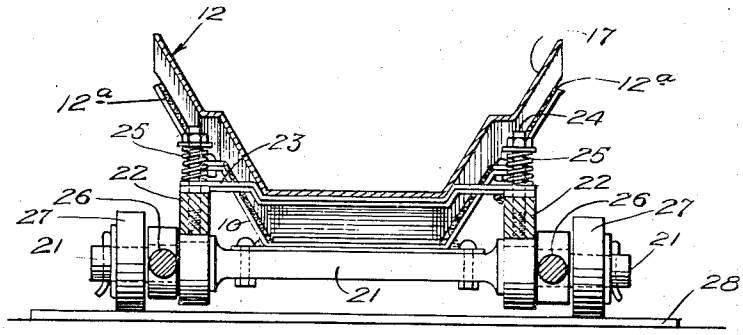


Fig. 9.



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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 5

Fig. 10.

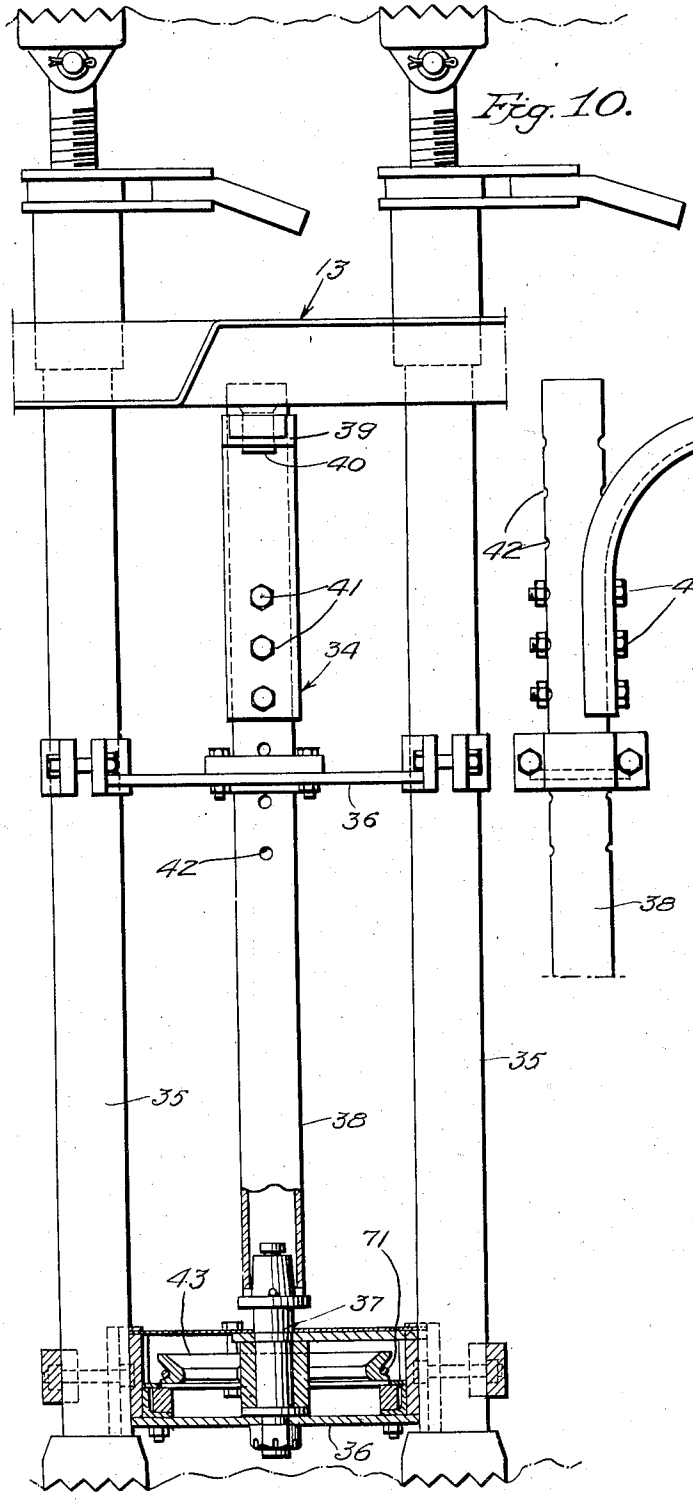
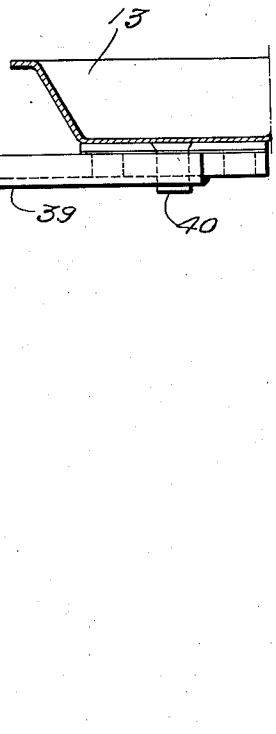


Fig. 11.



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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 6

Fig. 12.

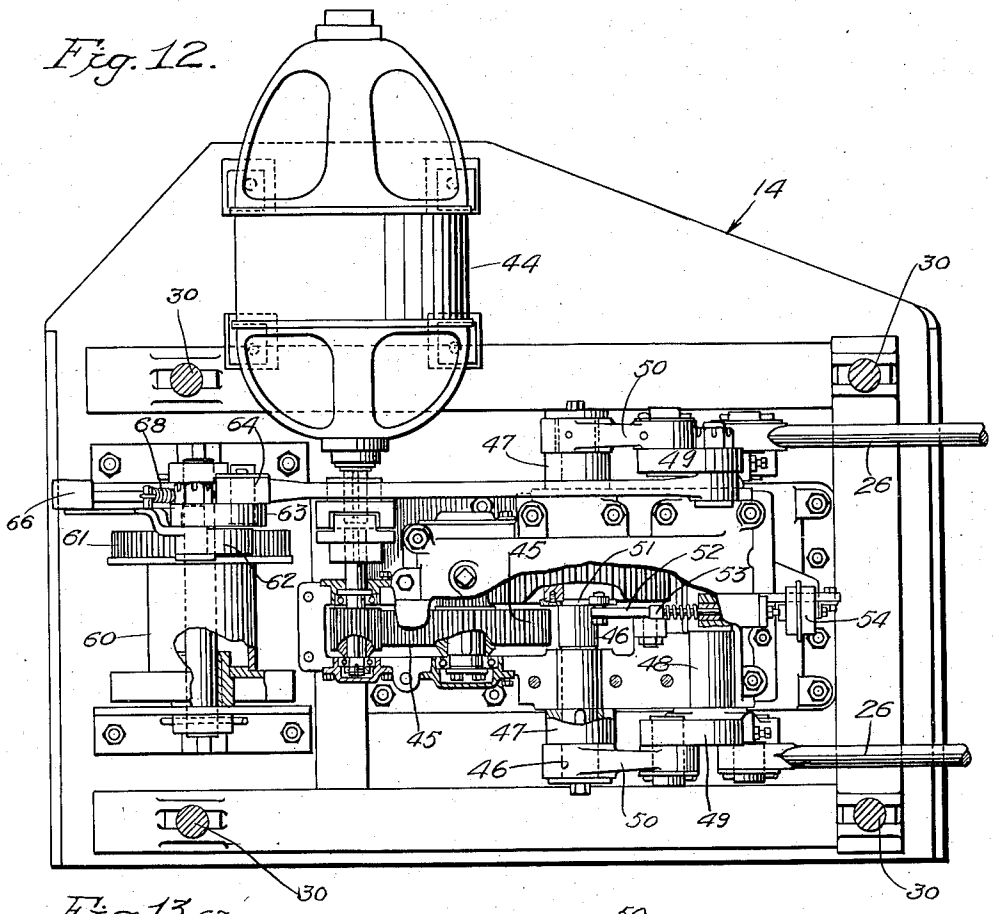
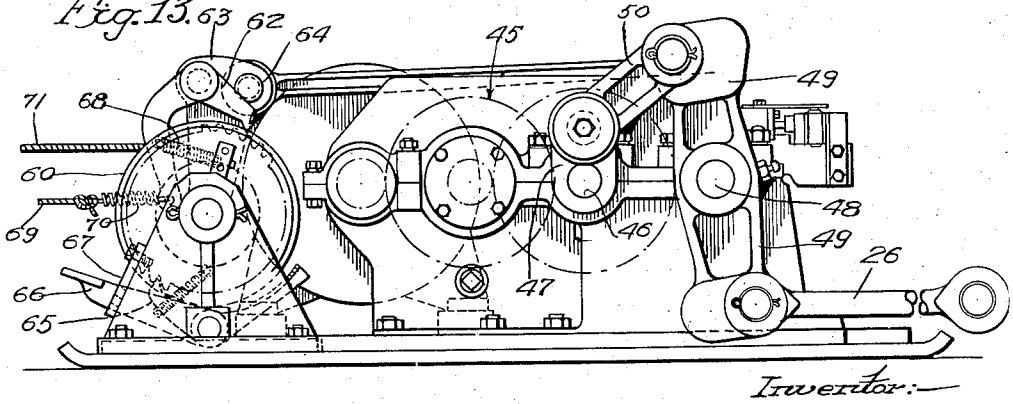


Fig. 13.



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April 9, 1935. R. MOORE 1,997,495

SHAKER CONVEYER

Filed May 29, 1933 7 Sheets-Sheet 7

Fig. 14.

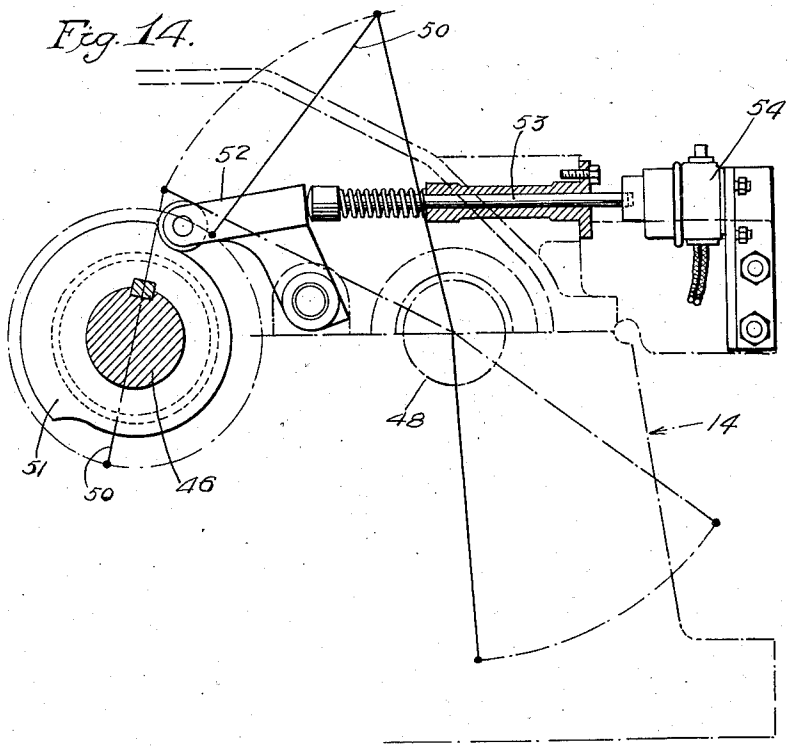
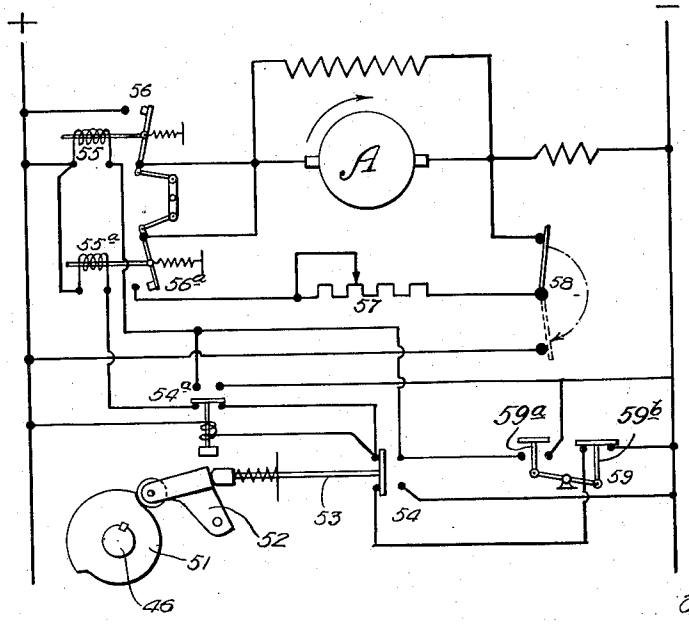


Fig. 15.



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Patented Apr. 9, 1935 1,997,495

UNITED STATES PATENT OFFICE

1,997,495

SHAKER CONVEYER

Roscoe Moore, Kingston, Pa.

Application May 29, 1933, Serial No. 673,532

13 Claims. (Cl. 198—220)

This invention relates to shaker conveyers of the type utilized for transportation of coal or similar material from the mining point to the loading point in the mine.

It has heretofore been impossible to practically produce a shaker conveyer which would successfully elevate material up an incline of any appreciable grade, such devices being employed only after the placement for the conveyer is level or has a slight slope from the loading to the discharge point. For this reason it is necessary that these conveyers have some type of elevator associated therewith for elevating the material to a carloading position and the multiplicity of handlings thus necessary for the coal causes an excessive breakage thereof in addition to the excessive cost in maintenance.

An important object of this invention is the provision of a shaking conveyer including horizontal and inclined portions and so constructed that material may be continuously moved thereover without the provision of riffles or other devices which will damage the coal.

One of the principal reasons for the failure of the ordinary type of shaker conveyer to elevate material moving therealong through any appreciable incline lies in the fact that the operating mechanism employed with such conveyers is of such character that the material does not come to rest between alternate advancing strokes, with the result that the frictional engagement between the material and the trough of the conveyer is reduced to a point where it is insufficient to cause such elevation.

A further and specific object of this invention is the provision of operating mechanism for shaker conveyers which may be either operated in the usual manner or may be so operated that the material comes to rest at the terminus of each stroke.

A further object of the invention is the provision of a novel and improved trough construction which will admit of provision of additional frictional engagement between the coal, or other material, and the trough while at the same time presenting a surface which will not break or damage the material.

A further object of the invention is the provision of a novel and improved transfer connection between horizontal and inclined sections of such a conveyer.

A further object of the invention is the provision of a construction such that the discharge end of the conveyer may be disposed at an angle to the inclined portion thereof and thus overlie tracks for pit cars, which tracks parallel the inclined section and, accordingly, permit of the disposition of a number of cars for passage beneath the discharge section.

A still further object of the invention is the provision of a construction such that the operating mechanism of the conveyer may be employed as desired for moving cars which have been loaded from beneath the discharge section and the placement of an empty car therebeneath.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a side elevation showing one end of conveying apparatus constructed in accordance with my invention;

Fig. 2 is a side elevation of the other end of the apparatus;

Fig. 3 is a plan view of one end of the apparatus;

Fig. 4 is a plan view of the opposite end of the apparatus;

Fig. 5 is a section on line 5—5 of Fig. 3;

Fig. 6 is an end elevation showing the discharge end of the apparatus;

Fig. 7 is a fragmentary plan view of the connection between the horizontal and inclined sections of the conveyer, the connecting section being illustrated in dotted lines;

Fig. 8 is a side elevation of the connection between the horizontal and inclined sections;

Fig. 9 is a section on line 9—9 of Fig. 8;

Fig. 9—*a* is a section on line 9—*a*, 9—*a* of Fig. 7;

Fig. 10 is an enlarged elevation partially in section showing the supporting bracket for the discharge section;

Fig. 11 is a detached elevation of the pivot element of the discharge section;

Fig. 12 is a plan view partially broken away of the operating unit;

Fig. 13 is a side elevation thereof;

Fig. 14 is a detailed sectional view showing the switch control;

Fig. 15 is a simplified wiring diagram showing the control of the motor by the switch; and

Fig. 16 is a diagrammatic view illustrating the variation in operation obtained by the modification of operation of the unit.

Referring now more particularly to the drawings, a shaker conveyer constructed in accordance with my invention comprises a horizontal section 10, an inclined section 11, a transfer section 12 connecting the horizontal and inclined sections,

an angular or arcuate discharge section 13 for the inclined section and an operating mechanism 14 for these sections. Both the horizontal and inclined sections 10 and 11 include ordinary trough units 15 and modified trough units 16, of which the modified trough units in both instances are disposed adjacent the transfer section 12. The modified trough units comprise sides 17 which have slightly greater depth than the sides of the ordinary units, as more clearly shown in Figs. 1 and 2, and these units have disposed at the bottoms thereof flat plates 18 perforated as indicated at 19. Perforations 19 are, preferably, staggered in adjacent rows, as more clearly shown in Fig. 7, and during operation of the conveyer the holes 19 fill with smaller particles of conveyed material and, thus, present a surface which is substantially smooth and yet presents a much higher friction co-efficient than the smooth metallic bottom of the ordinary unit. As the material in the openings is worn away by the friction of material passing thereover, it will be replaced by other materials so that the friction surface is self-renewing. By staggering the openings of the plates, any continuous surface of relatively low frictional co-efficient is eliminated.

The transfer section 12 comprises a short trough unit seating at its ends upon the adjacent ends of the trough units of the horizontal and inclined sections, this trough unit being modified in its construction after the manner of formation of the modified trough units 16 of the horizontal and inclined conveyer sections. Soft packing 12—*a* is preferably disposed between opposed faces of the unit 12 and the supporting units to prevent sifting of finely divided material therebetween. Adjacent ends of adjacent units of the inclined and horizontal conveyer sections 10 and 11 are provided at their under surfaces and at opposite sides thereof with pivot elements 20 and 21 which may comprise opposite ends of transversely-extending shafts, as more clearly shown in Fig. 7. These pivot elements are connected at opposite sides of the conveyer by links 22 and secured to opposite sides of the transfer section 12 are brackets 23 overhanging the links 22 and apertured for the passage of studs 24 seated in these links. Springs 25 extending between the brackets and the heads of the studs serve to constantly urge the trough section downwardly and to maintain the ends of this trough section in sealing engagement with the troughs of the inclined and horizontal conveyer sections. It will be obvious that the studs will act to prevent longitudinal movement of the transfer section with relation to the links 22 and that since the pivots of links 22 are substantially coincident with the ends of the transfer trough section there will be no appreciable longitudinal movement of the ends of the trough section upon the horizontal and inclined sections. Pivots 21 which are mounted on the horizontal trough section, in addition to providing mounting for the links 22 likewise provide mounting for connecting rods 26 connecting the conveyer to the operating mechanism hereinafter to be described, and for rollers 27 operating upon a foundation plate 28.

The trough units throughout the conveyer are supported on suitable roller supports which may be of any suitable character and are generally designated at 29. These roller supports, substantially throughout the inclined surface, are mounted upon jack posts 30 and are adjustable thereon to admit of variation of the level at which they are disposed. In the present instance the base 31 of the roller mounting is shown as equipped at its opposite ends with U-clamps 32 surrounding the jack posts.

The discharge section 13 is connected with the main inclined portion by a pivotal connection indicated at 33 and this discharge section is supported through this pivotal connection and through a swinging supporting bracket generally designated at 34. The swinging bracket comprises a pair of spaced standards, preferably jack posts 35 connected at their lower ends and their approximate centers by transverse struts 36. The lower transverse strut mounts a step-bearing 37 the upper end of which rotatably receives a pivot 38 the upper end of which is equipped with a horizontally-extending arm 39 directly engaging the discharge unit through the medium of a pivot pin 40. The arm 39 is secured to the pivot 38 through bolts 41 interchangeably engageable in a vertically extending series of openings 42 on pivot 38 so that the vertical position of the discharge unit may be adjustably determined. Step-bearing 37, in addition to forming a mounting for pivot 38, likewise constitutes a mounting for a sheave wheel 43, the purpose of which will presently appear. It has been found desirable to gradually decrease the pitch of the conveyer on the incline after leaving the foot of the inclined portion to thereby provide increased velocity of the material as it approaches the discharge point. This prevents crowding back of the oncoming material and insures a smooth, even flow thereof.

The driving mechanism comprises a drive motor 44 connected through a train of gearing generally designated at 45 with a shaft 46 having cranks 47. A rock shaft 48 has arms 49 centrally connected thereto, one end of each arm being connected with a crank 47 by a link 50 and the other end thereof being connected to the conveyer through one of connecting rods 26.

The construction, so far described, is one fairly commonly employed in one form or another in the operating mechanisms of shaker conveyer troughs and sorting tables, and the connections between the arms 49 and the cranks are so proportioned and relatively positioned that the reciprocating stroke of the connecting rods 26 produced at each rotation of shaft 46 is of greater duration in one direction than in the other. In Fig. 16 I have diagrammatically illustrated both the mechanical operating mechanism and the stroke obtained thereby, this stroke being illustrated by the dotted line. In the diagram of the mechanism it will be noted that the advancing stroke extends through 255 degrees of rotation of shaft 46 while the idle stroke extends through only 105 degrees. Obviously, material on the conveyer at the end of the advancing or working stroke, since its movement is accelerated, tends to continue its movement during the relatively short period of the idle stroke. During the first half of the idle stroke the material is still moving rapidly and during the latter half thereof it tends to slow down but not to become stationary, with the result that when the working stroke is repeated the material is still moving in the direction of the working stroke and, accordingly, has little, if any, frictional engagement with the trough at this time.

While this condition is satisfactory in horizontal transportation by shaker conveyer methods, it is unsatisfactory and renders inoperative any shaker conveyer disposed upon an appreciable incline. For this reason, I incorporate in the

operating mechanism 14, means for increasing the duration of the return stroke and more particularly means for increasing the duration of the latter portion of this stroke by slowing down or stopping entirely the motor 44 during the latter part of the stroke. I have at present illustrated shaft 46 as equipped with a cam 51 acting through a rocker 52 and a plunger 53 upon a switch 54 which controls the operating coils 55 and 55—*a* of interlocked switches 56 and 56—*a*. Shunting the motor armature A of motor 44 is an adjustable resistance 57. Switches 56 and 56—*a* alternately close this shunt and one side of the motor line. Through a double throw switch 58, the switch 56—*a* may be employed to place the adjustable resistance 57 in series with the armature. The circuit of the coil 55—*a* of switch 56—*a* may be opened through a suitable switch 59. It will be obvious that with switch 59 closed at 59—*a* the motor will operate continuously and the only actuation of the conveyer will be that normally given to conveyers through the mechanical motion of the drive. With switch 59 closed at 59—*b* and switch 58 in its solid line position, each time the cam 51 releases switch 54 and thus closes switch 56—*a*, switch 56—*a* completes the circuit of the resistance about the armature of the motor and opens the circuit to the line at switch 56. With switch 58 in its dotted line position at each closing operation of switch 56—*a* through cam 51 and switch 54, the resistance is placed in series with the armature. With switch 58 in mid position, the armature circuit is opened at each closure of switch 56—*a*. Obviously, any of these arrangements will cause a slowing down of the motor, one applying a dynamic braking thereto and the others a reduction or interruption of the input thereto. The particular type of dynamic braking herein illustrated may, of course, be varied and the switches 56 and 56—*a* operated in various manners.

It is apparent that the adjustment of the resistance 57 may be improper or some unusual friction may occur during the operation of this device causing the motor to come to rest with the rocker 52 bearing upon the depressed portion of cam 51, in which case the machine would fail to start. Pilot device 54—*a* with a time element somewhat greater than one normal cycle will now open the circuit to switch 56—*a* and close switch 56 causing the motor to start. This pilot device may be of any of the well known time element relays.

The resulting stroke is diagrammatically illustrated by the solid line in Fig. 16, the point X indicating approximately the point at which dynamic braking of the motor begins its operation. It will be noted by comparison of these stroke diagrams that the entire added length of the stroke is confined to the latter half of the return or idle stroke, with the result that a sufficient interval is provided for the material to come to rest upon the trough so that it may move therewith. The use of a rheostat permits the duration of the idle stroke to be adjustably regulated so that the period is of just sufficient duration to permit the material to come to rest. This is necessary due to the fact that transportation systems embodying shaker conveyer troughs are kept in touch with the source of supply by elongating the receiving end of the trough. Under these circumstances, with each addition to the length of the trough the greater load is obviously imposed thereon which load, of itself, acts as a brake, necessitating the modification of the dynamic braking applied at the motor.

The operating mechanism further incorporates a reel 60, one end of which is provided with a ratchet 61 having associated therewith an operating pawl 62 mounted upon a rocker arm 63 operated by a link connection with one of the arms 49, as indicated at 64, and a holding pawl 65. Holding pawl 65 is withdrawable by a pedal 66, which pedal may be held in its released position by a latch cam 67. The actuating pawl 62 is normally held out of engagement with the ratchet 61 by a spring 68 and is engageable with the ratchet through an operating cord 69, preferably including a spring 70. Operating cord 69 is extended to the operator's station which is at the discharge end of the conveyer and a cable 71 wound upon the reel is extended from the reel about sheave wheel 43 then back along the conveyer and is connected to the end of a train of cars C arranged alongside the conveyer through a shock absorbing connection 72. This arrangement is employed assuming that cars C are to be moved in the direction of the arrows on Figs. 3 and 4. In case movement of the cars is desired in the opposite direction following loading, the cable will, obviously, be connected to the opposite end of the train. When loading of any car is completed, the operator simply exerts a pull on the control cord 69, thereby engaging the actuating pawl and causing the cable to be wound upon the drum. After loading of a train of cars is completed, the cable may be connected to the end of a second train and allowed to pay out by simply releasing the holding pawl 65. It will be obvious that by use of apparatus of this character manipulation of the cars being loaded is materially facilitated.

It may sometimes be desirable to have the control of the cable reel accomplished electrically, in which case the actuating pawl 62 would be controlled by a suitable solenoid and push button switch at the operator's station, avoiding the use of the control cord.

Direct current apparatus has been used for illustrating the principles involved, but it is obvious alternating current apparatus may also be used for the purpose with substitution of equivalent elements.

While I have described the propelling apparatus as employed with a conveyer including inclined sections, it will, of course, be obvious that its usefulness is not limited to such conveyers, as it will increase the efficiency of any type of shaker conveyer with which it is employed.

Since the construction illustrated is capable of considerable modification without in any manner departing from the spirit of my invention, I do not wish to be understood as limiting myself thereto except as hereinafter claimed.

I claim:

1. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said section, and means yieldably urging the ends of the short transfer section into engagement with said horizontal and inclined sections.

2. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said section, links connecting said horizontal and inclined sections, means to hold said transfer section in longitudinally fixed relation to said links and

means to drive one of said horizontal and inclined sections.

3. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said section, links connecting said horizontal and inclined sections, and connections between said links and said transfer section for maintaining the ends of the transfer section in engagement with the horizontal and inclined trough sections.

4. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said sections, links connecting said horizontal and inclined sections, connections between said links and said transfer section for maintaining the ends of the transfer section in engagement with the horizontal and inclined trough sections, and packing between adjacent faces of said transfer and horizontal and inclined sections.

5. A metallic shaker conveyer trough having sockets in the bottom thereof to contain material being conveyed, the bottom of said conveyer trough being smooth and the mouths of the sockets being perpendicular to the line of passage of material over the trough.

6. A conveying trough for shaker conveyers comprising a smooth surface free from projections and composed at least in part of the material being conveyed.

7. In a shaker conveyer, a horizontal conveyer section, an inclined conveyer section, a short transfer conveyer section supported at its ends by the horizontal and inclined conveyer sections and conveying material from the horizontal to the inclined section, link connections between the inclined and horizontal sections, means to hold said transfer section in longitudinally fixed relation to said links and means to reciprocate one of said sections.

8. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said sections, means yieldably urging the ends of the short transfer section into engagement with said horizontal and inclined sections, and means to hold the short trough section against longitudinal movement with relation to the horizontal and inclined trough sections.

9. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said sections, and means to hold the short trough section against longitudinal movement with relation to said horizontal and inclined trough sections, including a part yieldably urging the ends of the short transfer section into engagement with said horizontal and inclined sections.

10. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said sections, links connecting said horizontal and inclined sections, and connections between said links and said transfer section for maintaining the ends of the transfer section in engagement with the horizontal and inclined trough sections and holding said short trough section against longitudinal movement with relation to said links.

11. A shaker conveyer comprising a horizontal trough section, an inclined trough section, a short transfer trough section having its ends extending into and resting upon said sections, links connecting said horizontal and inclined sections, and connections between said links and said transfer section for maintaining the short trough section against longitudinal movement with relation to the links.

12. A trough unit for a shaker conveyer having a perforated plate superimposed upon the bottom thereof, the bottoms of the openings of the plate being closed by the bottoms of the trough unit and the mouths of the openings of the plate lying substantially in the general plane of the plate whereby the bottom of the conveyer is substantially smooth and said openings will be filled with the material being conveyed.

13. A trough unit for a shaker conveyer having a perforated plate superimposed upon the bottom thereof, the bottoms of the openings of the plate being closed by the bottoms of the trough unit and the mouths of the openings of the plate lying substantially in the general plane of the plate whereby the bottom of the conveyer is substantially smooth and said openings will be filled with the material being conveyed, the openings of the plate being so disposed as to eliminate unperforated paths over the face of the plate which extend longitudinally of the unit.

ROSCOE MOORE.