Dec. 23, 1941. R. OSTER 2,267,419

COAL LOADING AND PILING MACHINE

Filed March 16, 1939 2 Sheets-Sheet 1

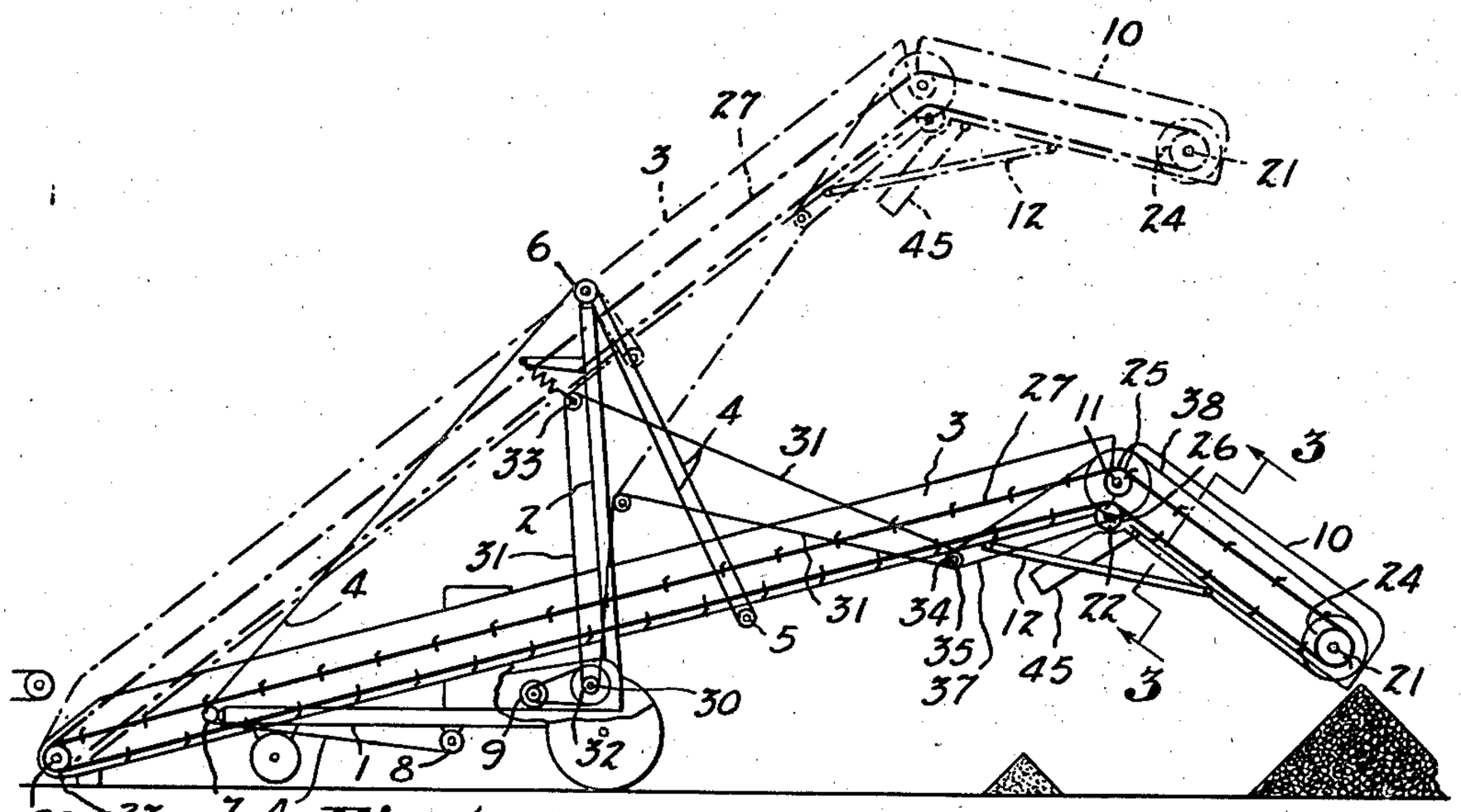

Fig. 1

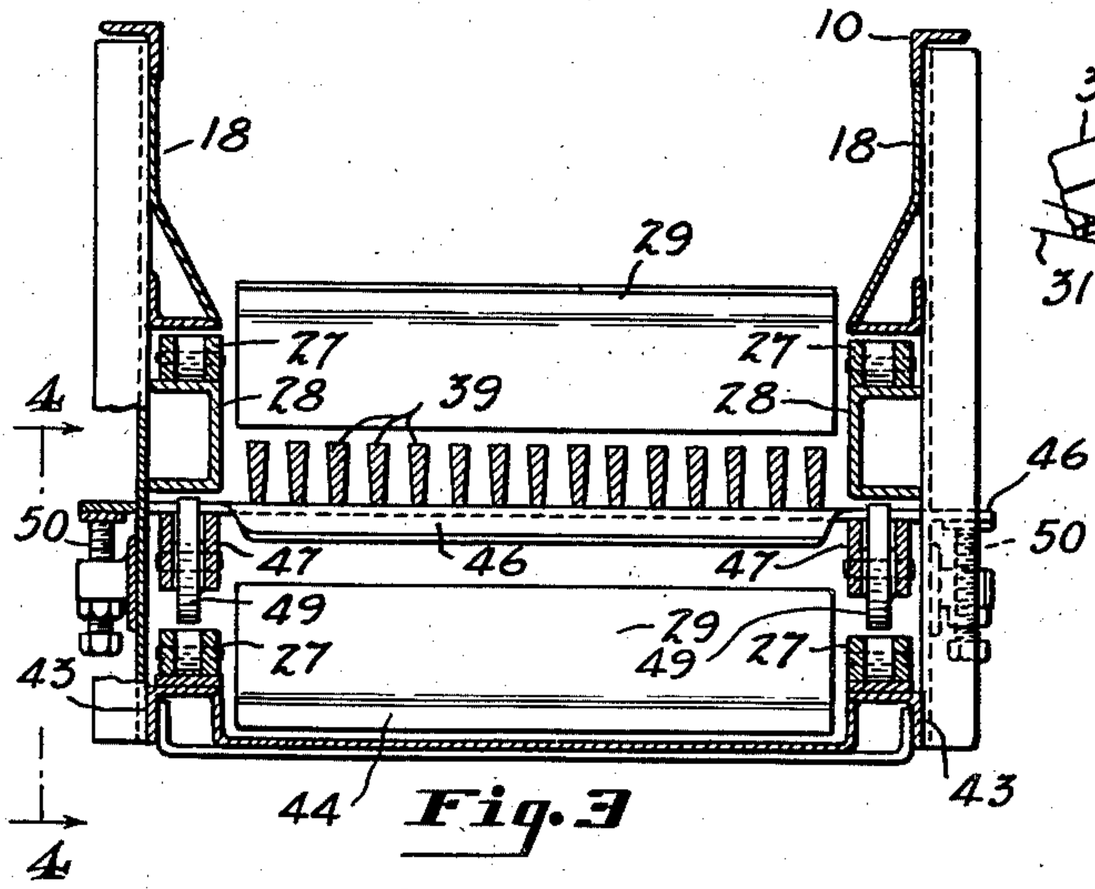

Fig. 3

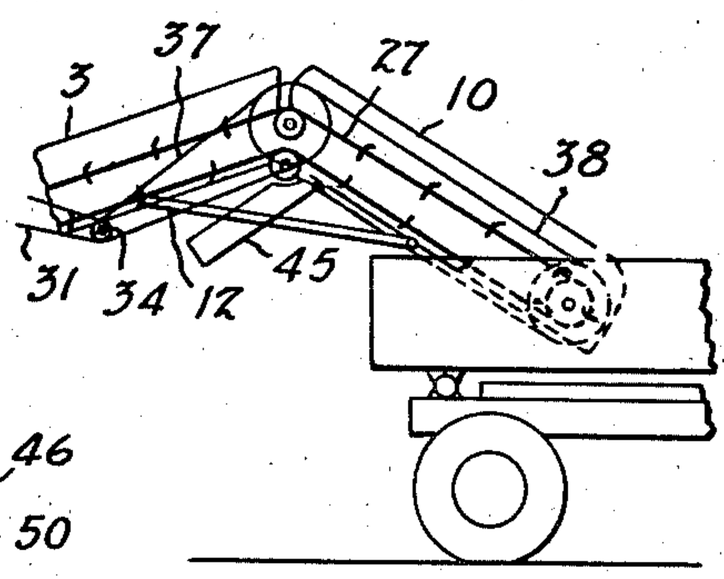

Fig. 2

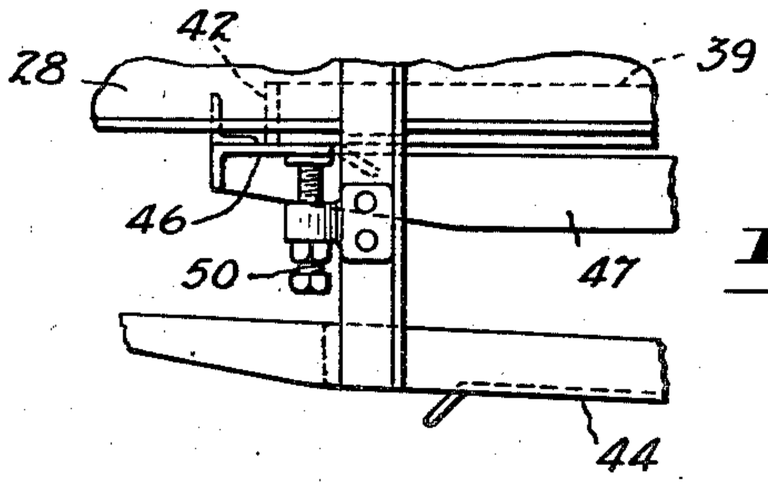

Fig. 4

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COAL LOADING AND PILING MACHINE

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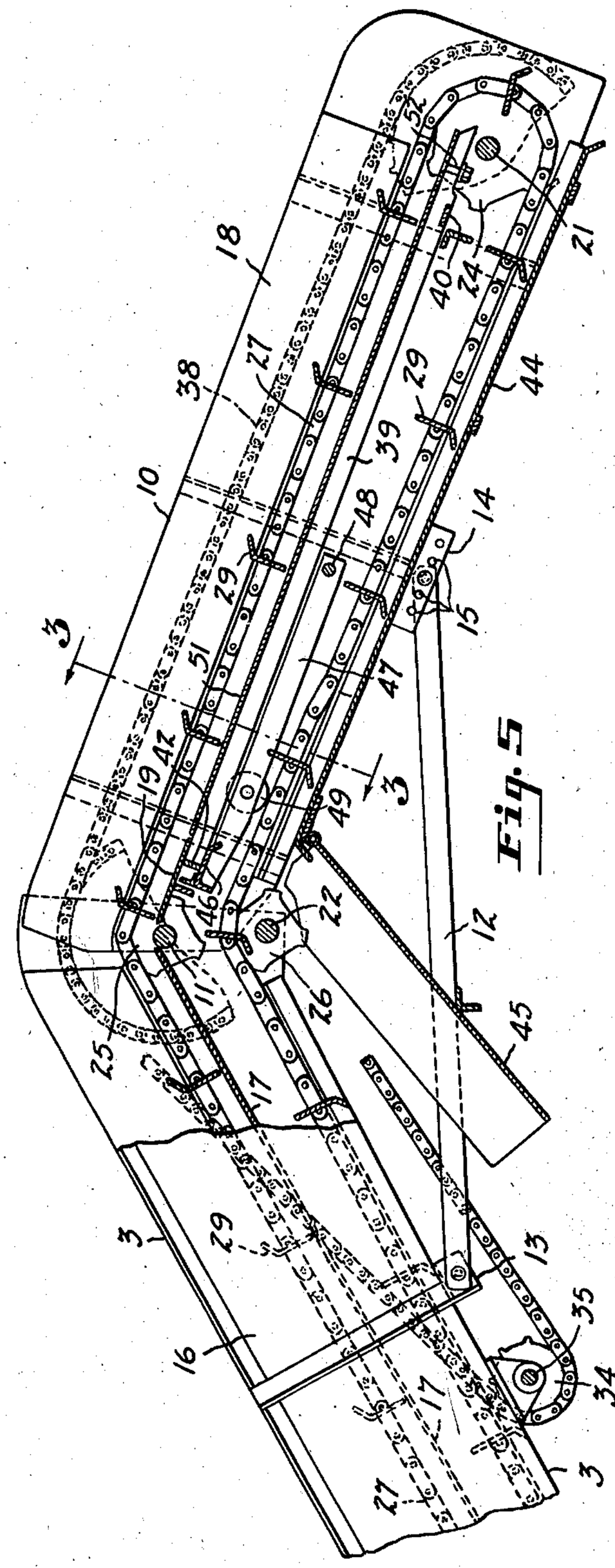

Fig. 5

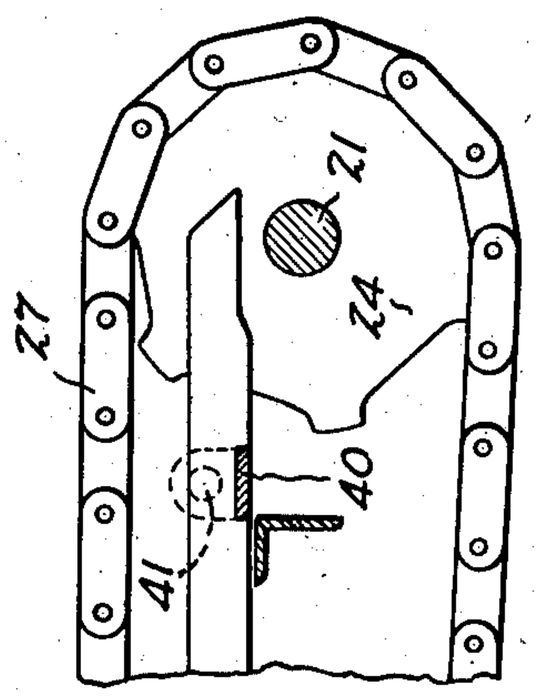

Fig. 7

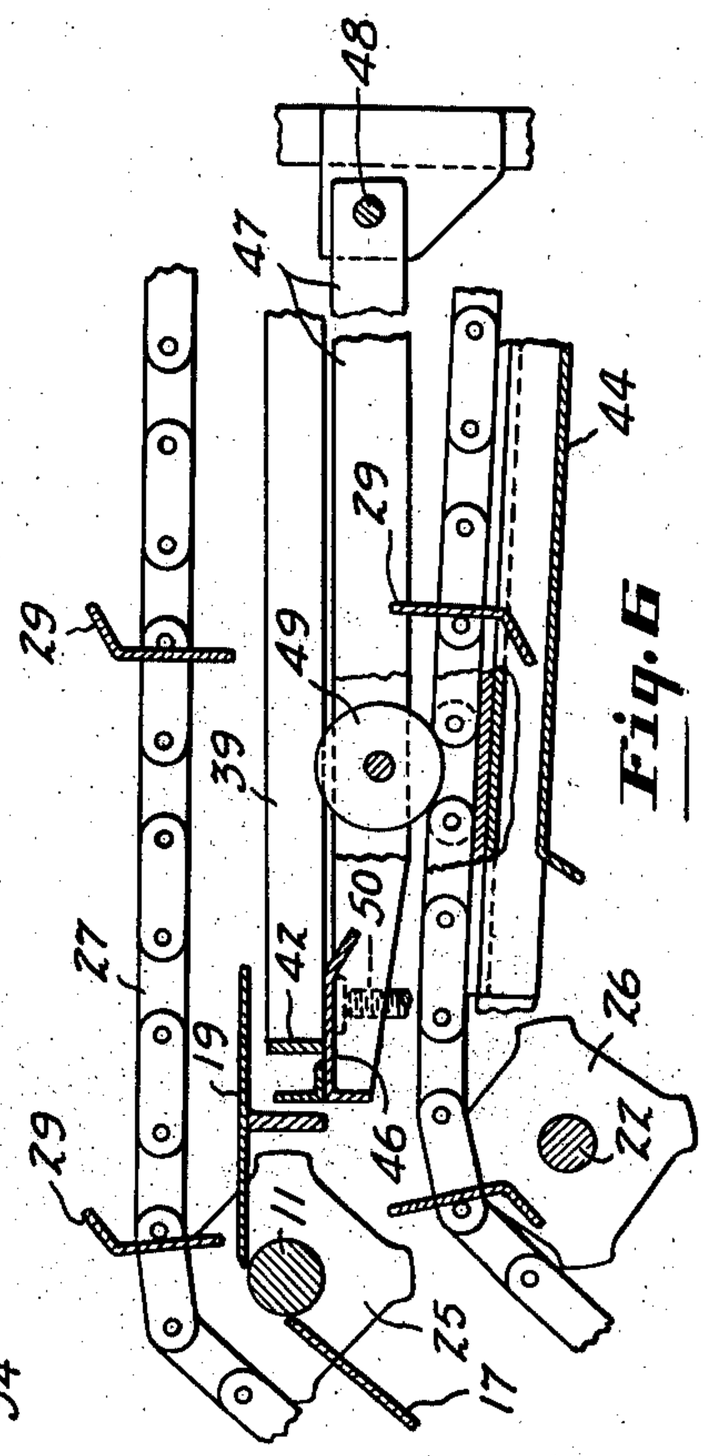

Fig. 6

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2,267,419

COAL LOADING AND PILING MACHINE

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9 Claims. (Cl. 209—241)

This invention relates to coal loading and piling machines of the type employing an endless flight conveyor carried by a boom mounted for vertical adjustment on a suitable carriage. Such machines are commonly employed for delivering coal into storage piles and for loading coal into cars, trucks, or bins. The conveyor boom is commonly mounted for vertical swinging movement on the carriage so that its discharge end may be positioned to deliver the coal at various elevations to a pile on the ground or into a car truck or bin, while its receiving end remains close to the ground to receive coal which may be delivered thereto manually or by means of a loading machine, or through a chute from a car or bin.

In the use of machines of this character for handling the softer varieties of coal, such as bituminous or lignite coal, serious losses have heretofore been incurred due to breakage of coal.

An important object of the present invention is to provide a conveyor so constructed that breakage of coal in discharging to a pile on the ground or in a car, truck, or bin is greatly lessened.

Loading and piling machines of the type above referred to are commonly provided with screening discharge chutes for separately discharging the fine coal commonly called slack. A chute screen is not effective unless of a length such that there is time enough during the passage of the coal over the screen for the fines to sift through the lumps to the screen, and in all positions of adjustment of the boom, the chute must be disposed at an inclination to the horizontal sufficient to insure continuous gravity flow of coal. The use of such discharge chutes causes considerable breakage of coal due to the drop from the end of the conveyor onto the chute and the discharge of the coal at high velocity from the end of the chute onto the coal pile. The use of a discharge chute of a sufficient length to provide thorough screening is not feasible since such a chute would cause a great increase in coal breakage. In coal loading and piling machines of the boom conveyer type screening chutes are inefficient for the further reason that in the lower positions of adjustment of the boom the chute is disposed at an inclination so steep that a large proportion of the slack passes with the lumps to the pile due to the velocity of flow of the coal over the screen.

It is an object of the present invention to provide a screening device which is highly efficient in all positions of adjustment of the boom and which does not cause breakage of coal.

With the above and other objects in view the invention may be said to comprise a machine as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification, in which:

Figure 1 is a side elevation of a coal loading and piling machine embodying the invention, the boom being shown in full lines with its discharge end close to the ground for starting a pile, and in dotted lines adjusted to deliver to the top of a pile of substantial height;

Fig. 2 is a fragmentary side elevation showing the discharge end of the boom positioned to deliver into a truck;

Fig. 3 is a section taken on the line indicated at 3—3 in Figs. 1 and 5;

Fig. 4 is a fragmentary side elevation viewed as indicated by the arrows 4—4 in Fig. 3;

Fig. 5 is a fragmentary sectional elevation on an enlarged scale showing the discharge portion of the conveyor in longitudinal section, the screen being adjusted to a non-vibrating position and covered by a plate so that the conveyor discharges without screening; and

Fig. 6 and Fig. 7 constitute a view similar to Fig. 5, showing the screen with the cover plate removed and the screen supporting rollers engaging the conveyor chains so that the screen is jolted by the passage of the chain links beneath the rollers.

Referring to the accompanying drawings, the invention is shown applied to a portable coal loading and piling machine of a common and well known type in which the coal handling mechanism is mounted upon suitable carriage 1 which has a pair of vertical standards 2 adjacent the rear end thereof. A conveyor boom 3 is provided which has its forward end projecting beyond the front end of the carriage and which extends rearwardly and upwardly at an inclination between the standards 2. The boom 3 is adjustably supported between the standards 2 by means of cables 4, each of which is anchored to the upper end of a standard 2, passes downwardly and rearwardly under a pulley 5 mounted on the boom 3, upwardly over a pulley 6 mounted on the upper end of the standard 2, downwardly

over a pulley 7 adjacent the forward end of the carriage, and rearwardly to a drum 8 adjacent the rear end of the carriage. The drums may be operated by means of a motor 9 to wind or unwind the cables to raise and lower the rear end of the boom, suitable means being provided for holding the boom in its various positions of adjustment. The boom hoisting means is not illustrated in detail since such hoists are standard equipment in loading machines of this character.

The boom 3 has a downwardly inclined section 10 at its discharge end which is connected to the main portion of the boom by means of a cross shaft 11 mounted in the main section of the boom at its upper end. The cross shaft 11 provides a pivotal support for the downwardly inclined section 10 which is held in fixed position with respect to the upwardly inclined end portion of the boom by means of braces 12 which are attached at their opposite ends in brackets 13 and 14 attached to the under sides of the oppositely inclined boom sections. It may sometimes be desirable to slightly change the angle between the boom sections and any suitable adjustable connection may be provided for angular adjustment of the section 10 with respect to the main section of the boom. As herein shown, the brackets 14 are provided with a series of spaced holes 15 to receive the connecting bolts by which the brace members are attached to the bracket.

The conveyor boom is formed to provide a trough throughout the length thereof, the main section of the boom having side walls 16 and a bottom wall 17 and the downwardly inclined section 10 having side walls 18 which closely overlie the upper ends of the side walls 16 of the main section, and an apron 19 which forms a continuation of the trough bottom beyond the shaft 11. The upper edge of the bottom wall 17 of the main section and the upper edge of the apron 19 closely overlie the shaft 11 so that a continuous support if provided for the coal passing from the upwardly inclined to the downwardly inclined portion of the trough is provided. A transverse shaft 20 is provided at the lower forward end of the boom 3 and a transverse shaft 21 is provided adjacent the lower end of the inclined section 10. A shaft 22 is mounted in the upper end of the main section of the boom directly beneath the shaft 11. Pairs of sprockets 23, 24, 25, and 26 are mounted upon shafts 20, 21, 11, and 22, respectively, the sprockets 23, 24 and 25 being positioned with their top portions above the trough bottom, the sprockets of each pair being mounted within the opposite side walls of the trough and closely adjacent thereto. Two endless sprocket chains 27 are mounted with their upper runs traveling over the sprockets 23, 24, and 25 and with their lower runs passing over the sprockets 26. The upper runs of the chains 27 are supported on guide rails 28 at the sides of the trough and the two chains are connected at intervals by flights 29 which are attached at their ends to links of the chains. The flights project above and below the chains with their lower edges closely adjacent the bottom of the trough so that when the chains are driven in a direction to move their upper runs toward the discharge end of the boom, the flights advance the coal along the bottom of the trough. The endless flight conveyor composed of the chains 27 and flights 29 is driven from a drive shaft 30 on the carriage by means of a sprocket chain 31 running over a sprocket 32 on the drive shaft 30, over a movably mounted slack take-up sprocket 33 on the standard 2, and over a sprocket 34 on a cross shaft 35 mounted on the under side of the boom adjacent its upper end. The shaft 11 is driven from the shaft 25 by means of a sprocket chain 37, and the shaft 21 at the lower end of the section 10 of the boom is driven by a sprocket chain 38 extending from the shaft 11 to the shaft 21.

A screen may be provided in the downwardly inclined section 10 of the conveyor boom. This screen is preferably movably mounted and is formed by a series of parallel bars 39 which preferably extend substantially the full length of the inclined section, the lower ends of the bars 39 overlying the shaft 21 and the upper end thereof underlying the apron 19. The screen bars 39 are connected adjacent their forward ends by a cross bar 40 which extends across the under side of the bars 39 and which may be connected at its ends by pivots 41 to the side members of the boom section. The upper ends of the bars 39 beneath the apron 19 are connected by a cross bar 42.

The top surface of the screen is formed solely by the flat top edges of the closely spaced bars 39 so that the sliding movement of the coal over the screen is not impeded. The spacing of the bars 39 provides narow slots through which the screenings may pass, and in order to permit free passage of the screenings through the spaces between the bars and avoid choking of the screen by accumulations of fines between the bars, the individual bars 39 are preferably thicker at their top edges than at their bottom edges and taper from their upper to their lower edges as shown in Fig. 3.

The downwardly inclined section 10 of the boom is provided at opposite sides thereof with rails 43 providing supports for the lower runs of the chains 27, a bottom plate 44 being provided between the supporting rails 43 to form a second trough beneath the main trough through which the flights 29 travel in a reverse direction to convey the screenings away from the discharge end of the conveyor. The bottom plate 44 terminates at its upper end rearwardly of the cross shaft 22 to provide a discharge opening through which screenings may pass and a chute 45 may be provided to receive the screenings and deliver them to a separate pile on the ground, into a truck, or to a suitable conveyor.

In the operation of the machine, coal is moved up the main portion of the boom 3 and down to the end of the inclined section 10 where it is discharged. In passing down the inclined section 10 the slack is separated from the lumps and falls into the lower trough where it is carried by the flights 29 upwardly to the chute 45.

A suitable vertically movable support is provided for the screen together with suitable means for imparting a jolting or vibrating motion to the support and through the support to the screen during operation of the machine. The vibration imparting support comprises a screen supporting cross bar 46 which is attached to the forward ends of arms 47 which are pivoted at 48 to the side walls of the boom section 10. The cross bar 46 is positioned at a suitable distance from the pivot 41 and, preferably, near the upper end of the screen. The arms 47 carry rollers 49 which engage the top surfaces of the chains 27 traveling upwardly on the lower supporting rails 43 and these rollers are jolted by the passage of links of the chains 27 beneath them. The jolting movement of the rollers is transmitted through the

bar 46 to the screen bars 39 so as to jar the coal sliding slowly down the screen, causing the fines to be sifted through the lumps and to pass by gravity through the screen, thus effecting the separation of a very high percentage of the fines. Means is preferably provided to vary the amplitude of movement of the screen bars so as to regulate the intensity of the jarring or vibrating action and this result may be accomplished by limiting the extent of downward movement of the arms 47 and rollers 49. As herein shown, the opposite ends of the bar 46 are supported upon the upper ends of vertical adjusting screws 50 which limit the downward movement of the cross bar 46, arms 47, and jogging rollers 49. By adjusting the screws 50 the amplitude of the vertical movements imparted the screen bars 39 may be regulated, and, if desired, the rollers 49 may be adjusted to a position entirely clear of the chains 27 so that no vibratory motion is imparted to the screen bars.

It is often desirable to pile or load coal without screening and the machine of the present invention is so constructed that screening devices may be readily put out of service. Sufficient clearance is provided between the lower edges of the flights 29 and the screen bars 39 to permit the insertion of a cover plate 51 and when it is desired to pile or load coal without separating the fines therefrom, the cover plate 51 may be slipped over the grate bars 39 through the open discharge end of the boom section 10 and secured in place thereon by means of clamping bolts 52 passing through the plate adjacent its lower end and between the laterally spaced bars 39. By placing the cover plate 51 upon the screen bars and adjusting the screws 50 to lift the jolting rollers 49 clear of the conveyor chains, a trough with an imperforate bottom is provided throughout the length of the boom to the discharge end thereof, and the coal is discharged without screening.

As shown in Fig. 1 of the drawings, the length and inclination of the discharge section 10 of the boom is such that the discharge end of the conveyor may be positioned closely adjacent the ground in the lowermost position of adjustment of the boom 3 and the section 10 is disposed at a downward inclination to the surface upon which it is discharging throughout the range of adjustment of the boom. By adjustment of the boom, the discharge end of the flight conveyor may thus be maintained closely adjacent to the surface of the pile upon which the conveyor is discharging as the height thereof increases to retard the velocity of the coal up to the time it is deposited upon the pile.

It has heretofore been considered essential to provide a discharge chute over which the coal is discharged from the conveyor to the pile, the chute serving to break the fall of the coal somewhat by preventing a vertical drop from the end of the conveyor to the ground in starting a pile or from the end of the conveyor to the floor of a truck body or bin. Also, the chute has provided a surface on which a screen may be placed to separate slack from the lumps.

The provision of the inclined section at the discharge end of the boom, however, greatly reduces the breakage of coal and, when screening is desired, the provision of a screen in the downwardly inclined discharge portion of the conveyor trough effects a more complete separation of the fines than is possible with a relatively short screening chute.

When a chute is employed, it is necessary to space the receiving end of the chute beneath the upper end of the flight conveyor and inwardly of the outer end of the trough over which the coal is discharged with sufficient clearance between the chute and trough to permit passage of the flights. The coal passing from the upper end of the conveyor to the discharge chute has a vertical drop from the conveyor trough to the chute and the impact of the freely falling lumps of coal against the chute bottom and against other lumps causes considerable breakage. Also, the chute must be inclined at an angle of approximately 40° or more to the horizontal in all positions of the boom in order to insure a continuous flow of coal in the chute and avoid lodgment of lumps between the bottom of the chute and the flights of the conveyor which would cause damage to the chute and to the flights. The velocity of the coal moving by gravity down the chute is accelerated with the result that it passes from the ends of the chute to the pile at a considerable velocity, the momentum of the heavier lumps causing them to strike the pile and roll down the side thereof. The impact of these lumps against lumps on the pile and the impact of lumps rolling down the sides of the pile causes considerable breakage. When a screen is employed in the chute, it is necessary that the chute be of substantial length in order to accommodate a screen of sufficient length for effective screening. The longer the chute the greater the velocity of the discharge and the more breakage due to discharge of lumps from the chute to the pile.

In the machine of the present invention the coal passes from the upwardly inclined portion of the trough to the downwardly inclined portion thereof without any impact between lumps such as to cause breakage, the flights serve to retard the flow of coal in the downwardly inclined discharge portion of the trough keeping the coal moving at the rate at which the flights move. In passing from the downwardly inclined end of the conveyor to the pile, lumps of coal resting against the flights slide off the end of the flights as the flights pass the horizontal position in their travel around the end sprockets, and since the flights, after they have passed the forward extremity of the sprockets are moving forwardly and from the pile, there is little likelihood of the pile building up sufficiently beneath the conveyor to interfere with movements of the flights. With the discharge end of the conveyor close to the pile the larger lumps engage the pile before they pass out of engagement with the flights and the flights serve to gently lay the lumps upon the surface of the pile, with the result that the lumps are not subjected to destructive impact, and there is little rolling of the lumps down the sides of the pile.

In delivering coal into a receptacle such as the body of a truck, the downwardly inclined discharge end of the boom may be lowered into the receptacle to bring the discharge end close to the floor as shown in Fig. 2 of the drawings, thus avoiding the breakage of coal incident to the use of a chute or due to the vertical drop from the conveyor projecting over the top of the receptacle.

The machine of the present invention effects a very thorough screening of the coal because of the fact that the coal passes slowly over the length of the screen. It has heretofore been proposed to place a screen in the upwardly inclined trough of a conveyor, but such screens have been inefficient because the weight of the

coal tends to pack the lumps and slack together in a coherent mass against the bottom of the trough and the front faces of the flights. In an upwardly inclined flight conveyor, the material forms piles in advance of each flight, the weight of the pile being imposed partially upon the flight and partially upon the bottom of the trough. The material of such piles tends to pack into a coherent mass due to the weight of the material. Even a vibrating screen will not effectually break up such piles and separate the fines from the lumps.

In the machine of the present invention the piles of coal in passing over the shaft 11 from the upwardly inclined to the downwardly inclined portion of the trough are broken apart by gravity due to the shifting of the bases of the piles in passing from the upwardly inclined portion of the trough to the downwardly inclined portion thereof. The lumps in the mass are thus separated and the pressure on the fine material between the lumps is released so that the force of gravity causes the fine material to sift through the lumps to the bottom of the trough to the screen.

It will be apparent that the device of the present invention overcomes two very serious defects of prior coal loading and piling machines of the boom conveyor type in that it enables the coal to be handled with a minimum of breakage and in that it provides a coal screening device auxiliary to the conveying means which operates efficiently without increasing the breakage of coal.

Furthermore, it is to be understood that the particular form of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modificatoins of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. A loading and piling machine comprising a boom arranged for pivotal movement about its lower end and providing a trough inclined upwardly toward the discharge end said boom having a pivotally connected portion at the discharge end which is inclined downwardly, an endless conveyor having flights which travel through said trough to move the material up the trough and restrain flow of material by gravity in the downwardly inclined end portion, means for driving the conveyor, a screen in the downwardly inclined end portion of the trough, means on said conveyor for vibrating said screen, a second trough beneath said screen in which said flights travel in a reverse direction to convey screenings away from the discharge end of the conveyor, and a chute positioned to receive the screenings from the upper end of said second trough.

2. A loading and piling machine comprising a boom providing a vertically adjustable trough inclined upwardly toward the discharge end and having a vertically adjustable portion at the discharge end which is inclined downwardly, an endless conveyor having flights which travel through said trough to move the material up the trough and restrain flow of material by gravity in the downwardly inclined end portion thereof, means for driving the conveyor, a screen in the downwardly inclined end portion of the trough, means on said conveyor for vibrating said screen, and a second trough beneath said screen in which said flights travel in a reverse direction to convey screenings away from the discharge end of the conveyor.

3. A loading and piling machine comprising a boom providing a trough inclined upwardly toward the discharge end and having a portion at the discharge end which is inclined downwardly, an endless conveyor comprising chains which travel along the bottom of said trough adjacent opposite sides thereof, spaced flights connecting said chains, supports for the chains beneath said downwardly inclined portion of the trough, a screen movably mounted in the bottom of the downwardly inclined portion of the trough, and screen supporting means including rollers resting on said chains beneath the trough for vibrating said screen.

4. A loading and piling machine comprising a boom providing a trough inclined upwardly toward the discharge end and having a portion at the discharge end which is inclined downwardly, an endless conveyor comprising chains which travel along the bottom of said trough adjacent opposite sides thereof, spaced flights connecting said chains, supports for the chains beneath said downwardly inclined portion of the trough, a screen movably mounted in the bottom of the downwardly inclined portion of the trough, screen supporting means including rollers resting on said chains beneath the trough for vibrating said screen, and means for supporting said screen with the said rollers out of contact with said chains.

5. A loading and piling machine comprising a boom providing a trough inclined upwardly toward the discharge end and having a portion at the discharge end which is inclined downwardly, an endless conveyor comprising chains which travel along the bottom of said trough adjacent opposite sides thereof, spaced flights connecting said chains, a second trough parallel with the downwardly inclined portion of the main trough beneath the same in which said chains and flights travel in a reverse direction, a screen movably mounted in the bottom of the downwardly inclined portion of the main trough, said screen being composed of laterally spaced longitudinal bars disposed endwise in parallel relation, and screen supporting means including rollers resting on said chains in the lower trough for vibrating said screen.

6. A loading and piling machine comprising a boom providing a trough inclined upwardly toward the discharge end and having a portion at the discharge end which is inclined downwardly, an endless conveyor comprising chains which travel along the bottom of said trough adjacent opposite sides thereof, spaced flights connecting said chains, supports for the chains beneath said downwardly inclined portion of the trough, a screen movably mounted in the bottom of the downwardly inclined portion of the trough, screen supporting means including a cross bar upon which the screen rests, said cross bar being mounted for vertical movement in the boom, and rollers carried by said cross bar and engaging said chains beneath the trough.

7. A loading and piling machine comprising a boom providing a trough inclined upwardly toward the discharge end and having a portion at the discharge end which is inclined downwardly, an endless conveyor comprising chains which travel along the bottom of said trough adjacent opposite sides thereof, spaced flights connecting said chains, supports for the chains beneath said downwardly inclined portion of the trough, a

screen movably mounted in the bottom of the downwardly inclined portion of the trough, screen supporting means including a cross bar upon which the screen rests, said cross bar being mounted for vertical movement in the boom, rollers carried by said cross bar and engaging said chains beneath the trough, and adjustable means for limiting the downward movement of said supporting bar whereby the amplitude of movement imparted by the chains through the rollers to the bar may be varied.

8. In a machine of the character described, a trough having a screen movably mounted in the bottom thereof, an endless flight conveyor having its upper run in said trough and comprising side chains and cross flights for moving material along the trough and over said screen, and a support for said screen having rollers which rest upon said side chains.

9. In a portable piling device adapted for movement over general terrain, a mobile carriage, a boom movably carried by the carriage for angular adjustment relative thereto, said boom having an apex intermediate its ends to provide a long upwardly inclined section and a short downwardly inclined section converging at said apex, said boom having a materials-receiving end at the bottom of the long section adapted to receive materials directly from the ground, an endless conveyor unit trained between the ends of the boom and over said apex, a screening device movably mounted under the upper rim of the conveyor unit on the short section of the boom, and a power device carried by the mobile carriage for driving the conveyor unit and for vibrating the screening device.

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