

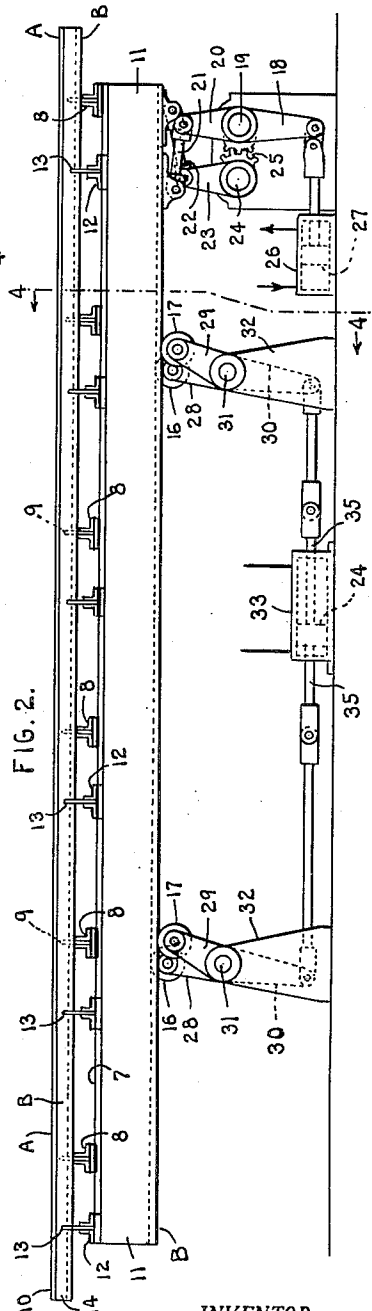
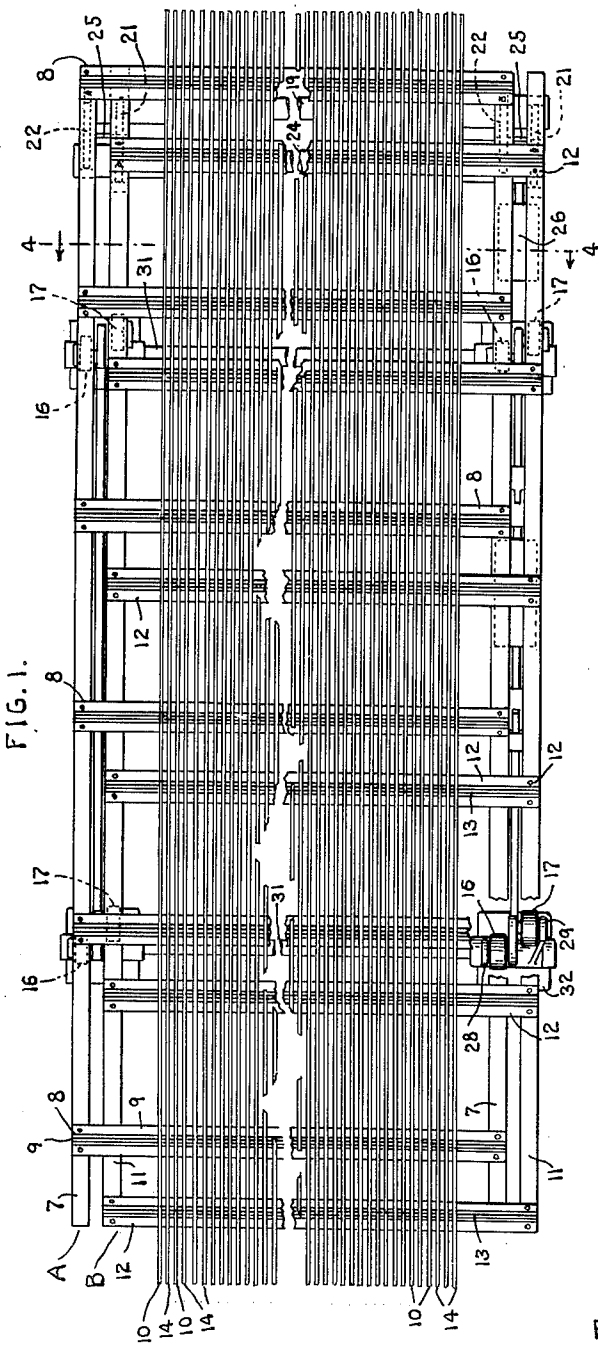
Nov. 10, 1953

F. W. WEHMILLER
CONVEYING APPARATUS

2,658,608

Filed Oct. 26, 1949

3 Sheets-Sheet 1



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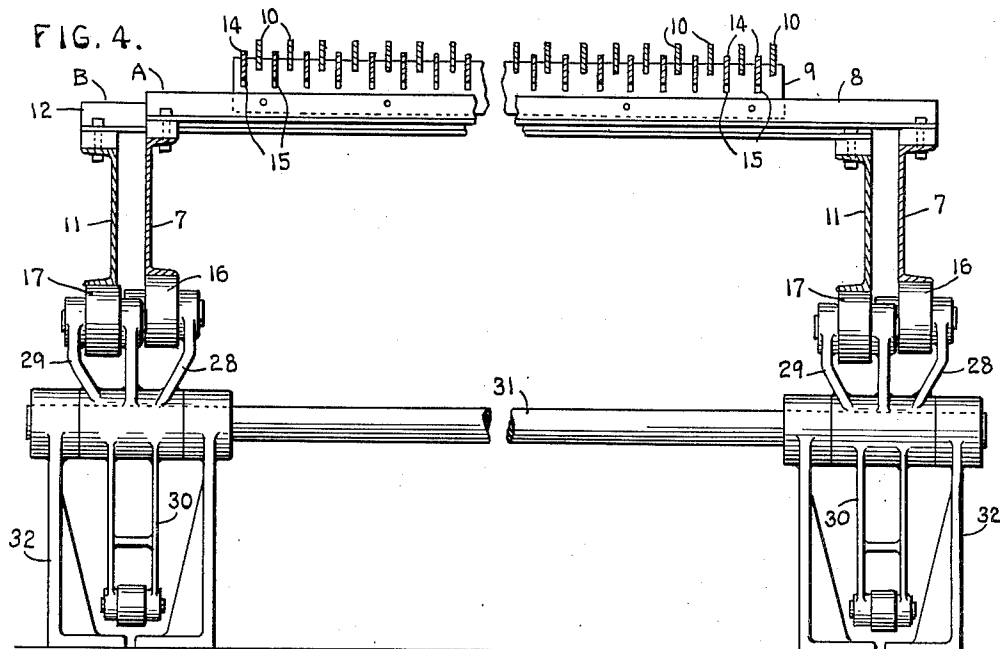
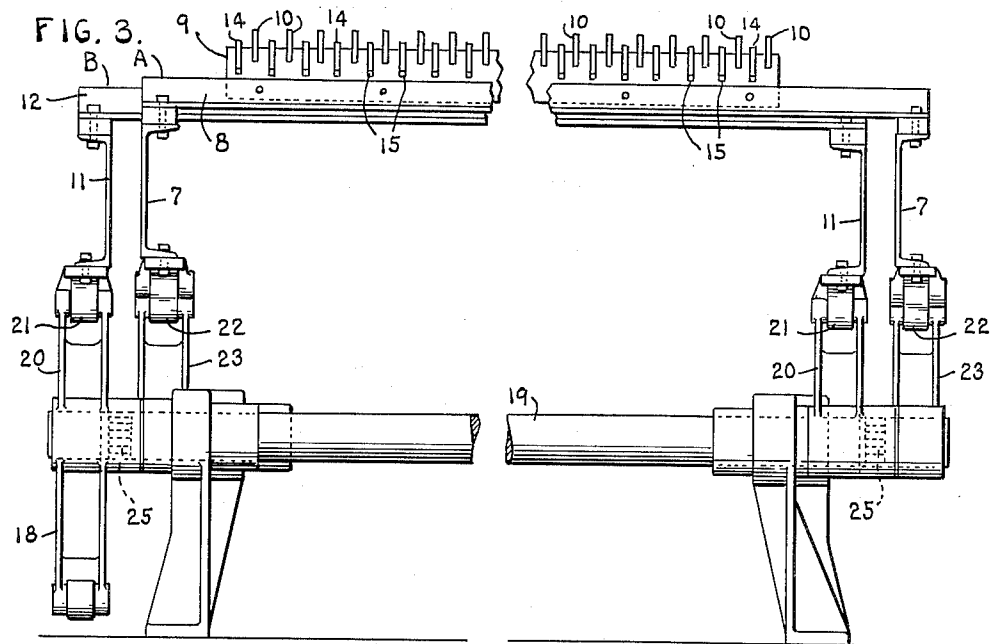
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FIG. 5.

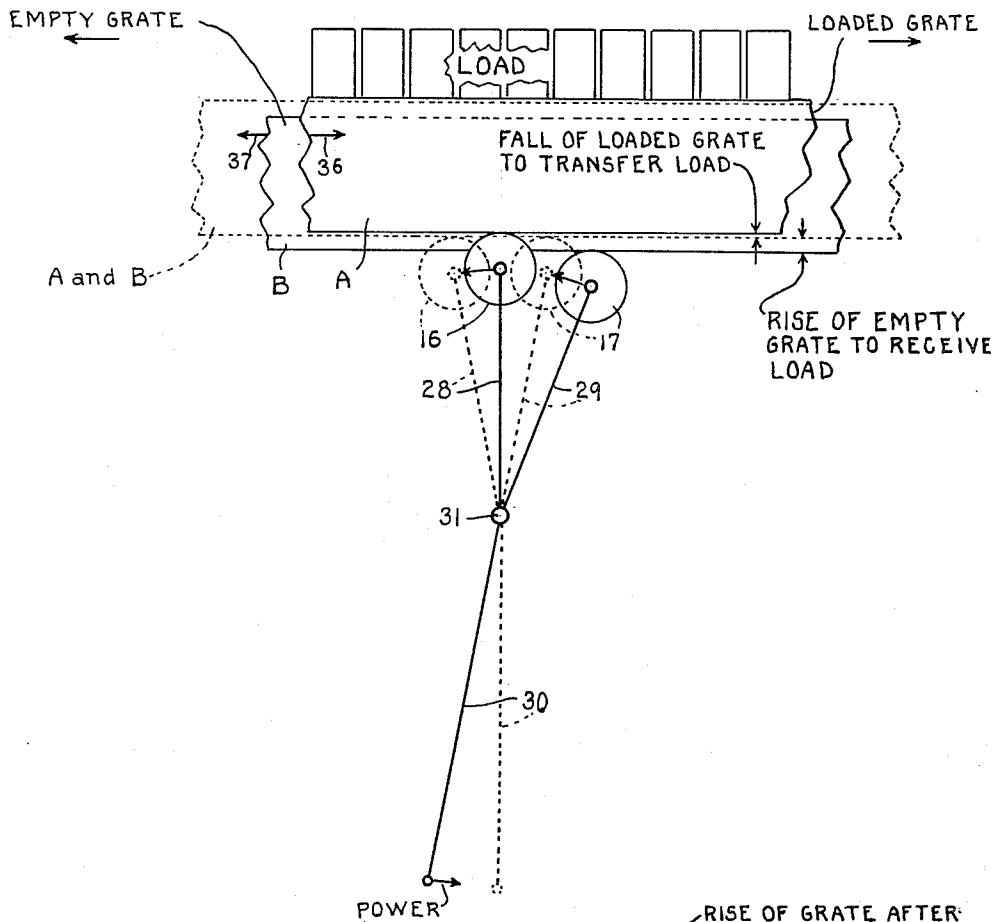
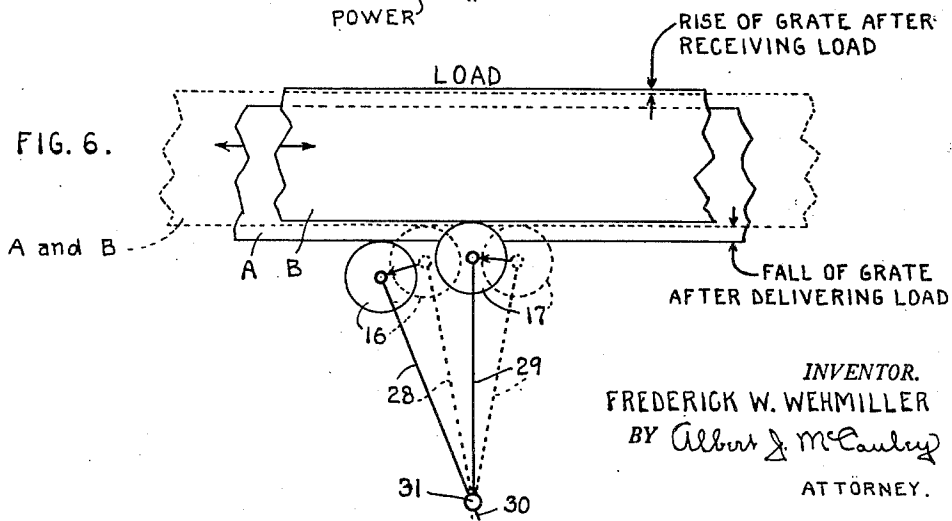


FIG. 6.



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CONVEYING APPARATUS

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This invention relates to conveying apparatus of the type wherein a pair of load-carrying grates are reciprocated in cyclic paths to impart a step by step movement to the load. The grates are alternately raised and lowered to repeatedly transfer the load from one grate to the other. The loaded grate moves forwardly at a relatively high elevation to advance the load, while the empty grate moves rearwardly in a lower plane. At the end of each step, the empty grate moves upwardly to receive the load, and its companion grate then moves downwardly to an idle position where it moves rearwardly while the loaded grate moves forwardly.

Conveyors of this type are advantageously employed to gradually transmit extremely heavy loads through various kinds of treating zones. For example, the contents of numerous traveling bottles, jars or cans may be subjected to temperature-changing processes for pasteurization, etc., while supported on the conveyor.

In this field of invention, special problems arise in the movement of heavy loads which may range up to about 15 tons on large conveyors in the pasteurizing art, wherein 5 tons may be regarded as a medium load. Conveyors of this type are also desirable for the transmission of considerably heavier articles which subject the grates to much heavier loads.

An object of the present invention is to provide ample clearance between the top surface of a loaded grate and the top surface of a lower empty grate while said grates are moving longitudinally in opposite directions, and also to materially reduce the power requirements when it becomes necessary to lift a loaded grate during the frequency operations of transferring the heavy load from a descending grate to a rising grate.

More specifically stated, an object of the invention is to provide highly efficient leverage during a transfer period in which lifting power is required for a loaded grate, and at the same time cause a falling grate to serve as a counterbalance which aids in lifting the load. A further object is to cause a falling loaded grate to aid in lifting the empty grate.

A highly desirable form of the invention accomplishes all of these results under conditions wherein the loaded grate falls a very slight distance during a period of time in which the empty grate rises a much greater distance to receive the descending load.

With the foregoing and other objects in view, the invention comprises the novel combination

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and arrangement of details herein disclosed to illustrate one form of the invention. However, it is to be understood that the scope of the invention extends to numerous variations and modifications described by terms employed in the claims hereunto appended.

Fig. 1 is a diagrammatical top or plan view of a conveyor embodying features of the invention, middle portions of the grate structure being broken away.

Fig. 2 is a side view of the apparatus shown in Fig. 1.

Fig. 3 is an end view, drawn to a larger scale.

Fig. 4 is an enlarged vertical section on the line 4-4 in Fig. 1.

Fig. 5 is a diagram illustrating upward and downward movements which occur in transferring the load from one grate to another.

Fig. 6 is a similar diagram illustrating subsequent upward and downward movements which occur after the load has been transferred.

The conveyor shown in the drawings includes a pair of grates A and B on which the load is alternately supported and advanced step by step, as will be hereafter described.

The grate A comprises a pair of longitudinal side beams 7, transverse supports 8 having their ends secured to said side beams, transverse strips 9 in the form of combs secured to said transverse supports 8, and a group of elongated load-receiving grate bars 10 carried by said transverse strips 9.

The companion grate B likewise consists of a pair of longitudinal side beams 11, transverse supports 12 having their ends secured to the beams 11, transverse strips 13 secured to said supports 12, and a group of elongated load-receiving grate bars 14.

As shown most clearly in Figures 2 and 3, the load-receiving bars 10 of grate A and the similar bars 14 of grate B are alternately arranged with respect to each other. In these views, the grate bars 10 occupy elevated positions, so that the load can be carried on the top surfaces of said bars 10, while the corresponding bars 14 of the grate B occupy lower positions entirely below the load. Under these conditions, the elevated bars 10 can be moved forwardly to advance the load, while the lower bars 14 move rearwardly in a return step of their cycle.

The elevated grate bars 10 in Figures 1 and 3 are supported by the transverse strips 9. However, each of said strips 9 is provided with elongated slots 15 (Fig. 3) to idly receive the lower grate bars 14. In other words, the grate bars

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10 are carried by the transverse strips 9, while the grate bars 14 are independently supported by corresponding transverse strips 13, so that each grate can occupy an elevated position while its companion grate occupies a lower position. In the apparatus shown in the drawings, the side beams 7 of the grate A are seated on rollers 16, and the side beams 11 of grate B are supported on similar rollers 17, so as to reduce frictional resistance in moving the grates.

Attention is now directed to a means for reciprocating the grates on said rollers 16 and 17. A driving arm 18 extends downwardly from one end of a transverse shaft 19, as shown in Figures 2 and 3, said shaft being provided with arms 20 connected by means of links 21 to the side beams 11 of the grate B. It is to be understood that an oscillatory movement may be imparted to the shaft 19 and its arms 20, so as to transmit movement through the links 21, thereby reciprocating the side beams 11 of grate B on the rollers 17.

The side beams 7 of grate A are likewise adapted to reciprocate on the rollers 16. As shown in Figures 1, 2 and 3, each side beam 7 is connected by means of a link 22 to the upper end of an arm 23 carried by a transverse shaft 24. Each arm 20 is provided with gear teeth meshing with teeth on an arm 23, as shown at 25 in Figures 2 and 3. Therefore, when the driving arm 18 is moved in an arc of a circle, the companion arms 21 and 23 (Fig. 2) will move in opposite directions, thereby causing the grates A and B to move longitudinally in opposite directions.

As a suitable means for transmitting power to the driving arm 18, Fig. 1, diagrammatically shows a cylinder 26 containing a piston 27 connected to said arm 18. Fluid under pressure may be admitted to and discharged from the cylinder 26 through the medium of any suitable automatic valve device, so as to impart intermittent movements to the driving arm 18. This arm is moved in one direction to impart forward movement to elevated grate bars 10 of the grate A, so as to advance the load one step, while imparting rearward movement to the lower grate bars 14 of the grate B. Thereafter, in a manner to be hereafter described, the grate bars 10 are lowered and the grate bars 14 are elevated, thereby transferring the load from the grate A to the grate B. The driving arm 18 (Fig. 1) is then actuated to impart forward movement to the elevated grate bars while imparting rearward movement to the lower grate bars. The grates A and B are thus reciprocated in cyclic paths to impart a step by step movement to the load.

Figures 2, 4, 5 and 6 illustrate a specific embodiment of the novel means for raising and lowering the grates to repeatedly transfer the load from one grate to another. In this form of the invention, a group of oscillatory levers is employed, each lever comprising a pair of supporting arms 28 and 29 integrally united with each other, and an operating arm 30 united with said pair of supporting arms. The rollers 16 form parts of the arms 28, while the rollers 17 likewise form parts of the supporting arms 29. Each of these peculiar levers is carried by a transverse shaft 31 having its end portions mounted in stationary bearings 32. The rollers 16 at the upper ends of the lever arms 28 lie below and form seats for the side beams 7 of grate A, while the similar rollers 17 of arms 29 lie below and provide seats for the side beams 11 of the grate B.

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As shown in Figures 2 and 5 the companion lever arms 28 and 29 are located at an angle to each other, so that the top of one lever arm can occupy an elevated position while the top of its companion arm is in a lower position. The grate A can be supported in an elevated position on the rollers 16, while the grate B is supported in a lower position on the rollers 17, as shown by full lines in Figures 2, 4 and 5. However, the lever arms 28 and 29 can be moved to the positions shown by full lines in Fig. 6 so as to lift the grate B to its elevated position while lowering the grate A to an idle position.

As a diagrammatical illustration of a suitable means for simultaneously operating all of the lever arms 28 and 29, Fig. 2 shows a cylinder 33 provided with a piston 34, and piston rods 35 connected to operating arms 33, the latter being secured to the transverse shafts 31. Any suitable automatic regulating means may be employed to control the admission and discharge of fluid at the cylinder 33, so as to move the lever arms 28 and 29 at regular intervals. These arms are to be actuated at the end of each feeding step of the conveyor, so as to lower a loaded grate and at the same time raise an empty grate, thereby transferring the load from one grate to another.

Attention is now directed to highly advantageous leverage conditions and varying changes in speed, coupled with desirable counterbalancing involved in raising and lowering the grates.

Assuming that the supporting rollers 16 and 17 are located in the positions shown by full lines in Fig. 5 while the elevated grate A moves in the direction of arrow 36 to advance the load, and the lower empty grate B moves rearwardly as indicated by arrow 37. During this period, the lever arms 28 and 29 are stationary. However, at the end of each feeding step, said lever arms 28 and 29 are moved in arcuate paths about the axis of their shaft, or fulcrum 31, while the grates move in vertical directions quite different from said arcuate paths. By uniting the lever arms 28 and 29, and separating them from each other in their arcuate paths, said lever arms can be moved at a uniform speed, with the result of moving the companion grates at very favorable non-uniform speeds.

For example, during the initial stage of their movement, said lever arms and their rollers 16 and 17 are shifted from the positions shown by full lines in Fig. 5 to the positions shown by dotted lines, so as to transfer the load from the grate A to the rising empty grate B. Study of Fig. 5 will show that the rollers 16 and 17 move simultaneously at the same speed, and in the same direction in their arcuate paths while passing from the positions shown by full lines to the positions shown in dotted lines. However, this movement of roller 16 allows the loaded grate to descend only a very slight distance, while the movement of roller 17 causes the empty grate to rise a much longer distance. The rollers then lie in approximately the same horizontal plane, so as to locate the grate B in a load-receiving position wherein its top surface is approximately flush with the top surface of the grate A. From this condition, shown by dotted lines in both Fig. 5 and Fig. 6, the lever arms 28 and 29 continue in motion to the positions shown by full lines in Fig. 6, thereby lifting the load on grate B a very slight distance, while the unloaded grate A descends a much greater distance, so as to provide the desired clearance between the top

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surface of the empty grate and the top surface of the loaded grate.

During all of these movements, the load falls and rises a very slight distance, for example one-sixteenth of an inch. Therefore, a relatively low degree of power is required for the operation of lifting the load. Furthermore, during this lifting movement, the power is transmitted from the roller 17 as it moves a relatively long distance, from its midway position shown by dotted lines in Fig. 6 to its highest position shown by full lines. This results in extremely favorable leverage during the period in which power is required to lift the load, the lever arm 29 (Fig. 6) being moved a relatively long distance to lift the load a very slight distance.

Additional important advantages appear in the manner in which the united lever arms 28 and 29 cooperate to provide power-saving counterbalances. During the first half of the movements illustrated by Figures 5 and 6, the rollers 16 and 17 move from extreme positions shown by full lines in Fig. 5 to midway positions shown by dotted lines, so as to lower the load on grate A while lifting the empty grate B. At this time the descending heavy load on grate A tends to impart downward movement to the roller 16 of the lever arm 28. This downward thrust at lever arm 28 tends to elevate its companion lever arm 29, thereby imparting an upward thrust to the roller 17 below the rising empty grate B. The united lever arms 28 and 29 are thus employed to provide a counterbalance wherein the falling load tends to lift the rising empty grate.

Furthermore during the subsequent operation of lifting the load, when the rollers 16 and 17 move from midway positions shown by dotted lines in Fig. 6 to extreme positions shown by full lines in the same view, the falling empty grate A imparts a downward thrust to the roller 16, tending to force said roller downwardly from the position shown by dotted lines to the position shown by full lines in Fig. 6. This downward thrust is imparted to the lever arm 28, and transmitted to the companion lever arm 29, so as to aid in moving said arm 29 and its roller 17 to positions shown by full lines in Fig. 6. The weight of the falling empty grate A on the roller 16 is thus employed to aid in lifting the loaded grate B.

The value of such counterbalancing is improved by the specific arrangement of the united lever arms 28 and 29. For example, in Fig. 6 the empty grate A falls a relatively long distance on the roller 16, while the loaded grate B rises a very slight distance on the roller 17. Under these specific conditions there is a very favorable leverage factor in the transmission of power from the falling empty grate to the rising loaded grate. A similar favorable condition appears in the counterbalancing suggested by Fig. 5, wherein the loaded grate A falls a very slight distance to aid in lifting the empty grate B a much greater distance.

In Figures 5 and 6 the transferring operations begin when the lever arms 28 and 29 are located in extreme positions shown by full lines in Fig. 5 and conclude by locating said arms in the extreme positions shown by full lines in Fig. 6. However, the same kind of transferring conditions will be obtained when said lever arms are moved reversely from the extreme positions of Fig. 6 to the extreme positions of Fig. 5. It will be observed in Fig. 5 that the vertical lever arm 28 extends upwardly from the horizontal axis of the fulcrum 31 which lies below the grates, the

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roller 16 being in a "dead center" position directly above said axis, while the companion lever arm 29 and its roller 17 occupy lower positions at the right side of the vertical arm 28. These extreme positions of Fig. 5 are to be compared with the opposite extreme positions of Fig. 6, wherein the arm 29 occupies the vertical position while the arm 28 and its roller 16 occupy lower positions at the left of said vertical arm 29. Therefore, during the next transferring operation, which occurs after the load has been advanced one step on the grate B, the lever arms 28 and 29 can be moved back from the extreme positions shown by full lines in Fig. 6 to the opposite extremes shown by full lines in Fig. 5 to obtain the same values in the transmission of power and counterbalancing as previously described in referring to these diagrams.

The arcuate strokes of the companion lever arms 28 and 29 are uniform in length, and when said arms are arranged as herein shown the total upward movement of a grate is equal to the total downward movement of its companion grate. It may be noted that this desirable equalization is obtained despite the fact that the grates are deliberately moved simultaneously a different speeds to obtain several highly important advantages.

Figures 5 and 6 show only one pair of the lever arms 28 and 29. However, it will be understood that there are several pairs located below the grates A and B, and movable simultaneously in the manner described in referring to Figures 5 and 6. Any suitable operating means may be employed to move these companion lever arms, so as to transfer the load from one grate to another at the end of each feeding step of the conveyor.

I claim:

1. In a conveyor, a pair of load-carrying grates adapted to reciprocate in cyclic paths to impart a step by step movement to the load, and means for raising and lowering said grates to transfer the load from one grate to the other, the load being transferred from a descending grate to an empty rising grate, said raising and lowering means comprising a plurality of oscillatory supports for said grates, each of said oscillatory supports including a pair of seats united with each other so as to oscillate simultaneously, one seat of each pair being a support for one of said grates, while the other seat of the same pair forms a support for the other grate, the seats of each pair being separated from each other in their arcuate lines of oscillation, so that when one seat occupies an elevated position the companion seat of the same pair is in a lower position, and means for oscillating all of said oscillatory supports and hence all of said pairs of seats in their arcuate paths to lower the elevated seats and thereby lower the elevated grate, while raising the other seats to elevate the other grate, the united seats of each pair being moved simultaneously in their arcuate paths so as to impart a comparatively rapid initial upward movement to the rising empty grate, while imparting a relatively slow initial downward movement to the loaded grate, thereby transferring the load during said initial downward movement of the loaded grate.

2. In a conveyor, a pair of load-carrying grates adapted to reciprocate in cyclic paths to impart a step by step movement to the load, and means for raising and lowering said grates to transfer the load from one grate to the other, the load being transferred from a descending grate to an

empty rising grate, said raising and lowering means comprising a group of oscillatory levers supporting said grates, each of said oscillatory levers being movable about a substantially horizontal axis and including a pair of seats united with each other so as to oscillate simultaneously about said axis, one seat of each pair being a support for one of said grates, while the other seat of the same pair forms a support for the other grate, the seats of each pair being located at the same side of said axis in an angularly separated relation, so that when one seat occupies its elevated position the companion seat of the same pair is in an angularly spaced lower position, and means for oscillating all of said levers in their arcuate paths to lower the elevated seats and thereby lower the elevated grate, while raising the other seats to elevate the other grate, the united seats of each pair being moved simultaneously and at the same speed in their arcuate paths so as to impart a comparatively rapid initial upward movement to the rising empty grate, while imparting a relatively slow initial downward movement to the loaded grate, thereby transferring the load during the initial downward movement of the loaded grate.

3. In a conveyor, a pair of load-carrying grates adapted to reciprocate longitudinally in cyclic paths to impart a step by step movement to the load, and means for raising and lowering said grates to transfer the load from one grate to the other, the load being transferred from a descending grate to an empty rising grate, said raising and lowering means comprising a plurality of lever arms supporting said grates, said lever arms being arranged in pairs with the arms of each pair integrally formed and located at an acute angle to each other, so that the top of one lever arm of each pair occupies its elevated position while the top of its companion lever arm is in a lower position angularly spaced therefrom, the top of one lever arm of each pair being located below one of said grates to form a support therefor, while the top of the other lever arm of the same pair lies below and forms a support for the other grate, and means for oscillating all of said pairs of lever arms in arcuate paths to lower the elevated arms along an arcuate path and thereby drop the elevated grate, while raising the other arms along an arcuate path to elevate the other grate, the integral lever arms of each pair being moved simultaneously in the same direction and at the same speed, so as to impart the counterweight effect of the loaded grate on the initial upward movement of the empty rising grate, and to impart the counterweight effect of the empty grate upon the rising loaded grate movement.

4. In a conveyor, a pair of approximately horizontal load-carrying grates adapted to reciprocate in cyclic paths to impart a step by step movement to the load, and means for raising and lowering said grates to transfer the load from one grate to the other, the load being transferred from a descending grate to an empty rising grate, said raising and lowering means comprising a plurality of lever arms supporting said grates, said lever arms being arranged in pairs with the arms of each pair integrally formed and located at an angle to each other, so that the top of one lever arm of each pair occupies its elevated substantially vertical position while the top of its companion lever arm is in an angularly spaced lower position, the top of one lever arm of each pair being provided with a roller located below

one of said grates to form a seat therefor, while the top of the other lever arm of the same pair is provided with a roller located below and forming a seat for the other grate, and means for oscillating all of said pairs of lever arms in arcuate paths to lower the elevated arms and thereby drop the elevated grate, while raising the other arms toward a substantially vertical position to elevate the other grate, the integral lever arms of each pair being moved simultaneously so as to impart a comparatively rapid initial upward movement to the empty rising grate, while imparting a relatively slow initial downward movement to the loaded grate, thereby transferring the load during said initial downward movement of the loaded grate.

5. In a conveyor, a pair of approximately horizontal load-carrying grates adapted to reciprocate longitudinally in cyclic paths to impart a step by step movement to the load, and means for raising and lowering said grates to repeatedly transfer the load from one grate to the other, the load being transferred from a descending grate to an empty rising grate, said raising and lowering means comprising pairs of pivoted lever arms supporting said grates, the lever arms of each pair being united with each other and located at an angle to each other at the same side of the pivots therefor, so that the top of one lever arm of each pair occupies an elevated substantially vertically directed position while the top of its companion lever arm is in an angularly spaced lower position, the top of one lever arm of each pair being located below one of said grates to form a support therefor, while the top of the other lever arm of the same pair lies below and forms a support for the other grate, and means for pivotally oscillating all of said pairs of lever arms in arcuate paths to lower the elevated arms along arcuate paths and thereby drop the elevated grate, while raising the other arms along arcuate paths to elevate the other grate, the integral lever arms of each pair being moved simultaneously in the same direction and at the same speed, so as to impart a comparatively rapid initial upward movement to the empty rising grate, while imparting a relatively slow initial downward movement to the loaded grate, the arcuate strokes of said pairs of lever arms being uniform in length to equalize the upward and downward movements of the grates, and the load-receiving top surfaces of said grates being in approximately the same plane when said companion lever arms lie midway between the ends of their arcuate strokes.

6. In a conveyor, a pair of alternately effective load conveying grates adapted to be reciprocated in raised and lowered paths to impart a step by step movement to the load, means for alternately raising and lowering said grates repeatedly to transfer the load therebetween comprising pivoted levers each having a pair of integral and angularly spaced grate supporting arms, like arms of each lever supporting one of said grates at all times in the alternate raising and lowering thereof, means for simultaneously moving said levers alternately between a position in which like arms supporting one grate are in a vertically erect position and a position in which the arms supporting the other grate are in a similar vertically erect position, said pivoted levers alternately passing a position of load transfer from a loaded descending grate to an empty rising grate in which the effective travel of the descending loaded grate is less than the effective travel of

the rising empty grate to the position of load transfer, and means for reciprocating said grates simultaneously and in opposite directions between alternate movements of said levers.

7. Conveying apparatus comprising a pair of grates each having a plurality of load supporting bars with the bars of said grates in interleaved relationship and relatively movable longitudinally and transversely of each other, lever means pivoted at one side of said grates opposite the load, said lever means having a pair of arms extending into supporting relation with said grates with one arm supporting one of said grates and the remaining arm supporting the other of said grates, and means for moving said lever means angularly about the pivot in opposite directions relative to a position of the lever means wherein said arms occupy positions intermediate the limits of angular travel of the lever means with said pair of grates in substantially the same plane for transferring the load alternately from one grate to the other, said pair of arms having an acute angularly spaced relation to maintain the component of movement of said arms parallel with the length of said grate bars greater than the component of movement of said arms transversely of said grate bar length.

8. Conveying apparatus comprising a pair of grates having interleaved load supporting bars relatively movable longitudinally and transversely of each other, lever means pivoted at one side of said grates opposite the load side thereof, a pair of arms on said lever means extending into grate supporting relation with one arm for one of said grates and the other arm for said other grate, and means for moving said lever means in an arcuate path to move said pair of arms in an arcuate path and alternately into positions wherein each arm moves above the other arm and has a direction of motion substantially parallel with said grate which is supported thereby, said moving means moving said lever means at a substantially uniform speed and said pair of

arms having an angular spaced relation such that the linear component of movement parallel with the longitudinal movement of said grates for each arm is always in excess of the component of movement parallel with the transverse movement of said grates.

9. Conveying apparatus comprising a pair of elongated grates movable relative to each other in directions parallel with the longitudinal and transverse axes of said grates, a plurality of levers pivoted at one side of said grates, each of said levers having a pair of angularly spaced arms with one arm extending into supporting relation with one grate and the other arm extending into supporting relation with the other grate, power means connected with and simultaneously oscillating said levers at a uniform speed for alternately moving said grates parallel with the transverse axes thereof whereby each grate extends outwardly of the other grate in alternating cycles, said arms on each lever following arcuate paths which have components of movement parallel with the longitudinal and transverse axes of said grates and the speed of said arms in the direction of said longitudinal component predominates over the speed of said arms in the direction of said transverse component, and separate power means connected with said grates for alternately moving said grates in opposite directions parallel with the longitudinal axis of the grates between the oscillations of said levers by said first mentioned power means.

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