Aug. 21, 1934. T. BRAUER 1,971,292

RECIPROCATING CONVEYER

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Fig. 1

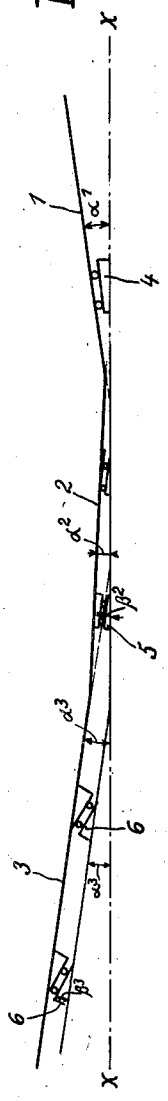
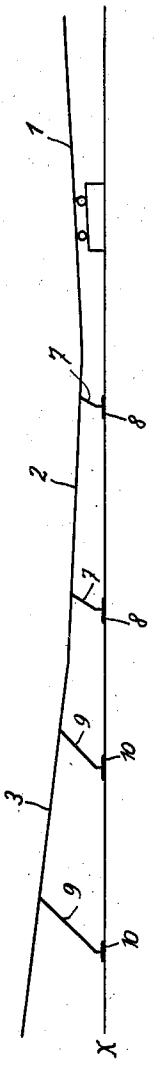


Fig. 2



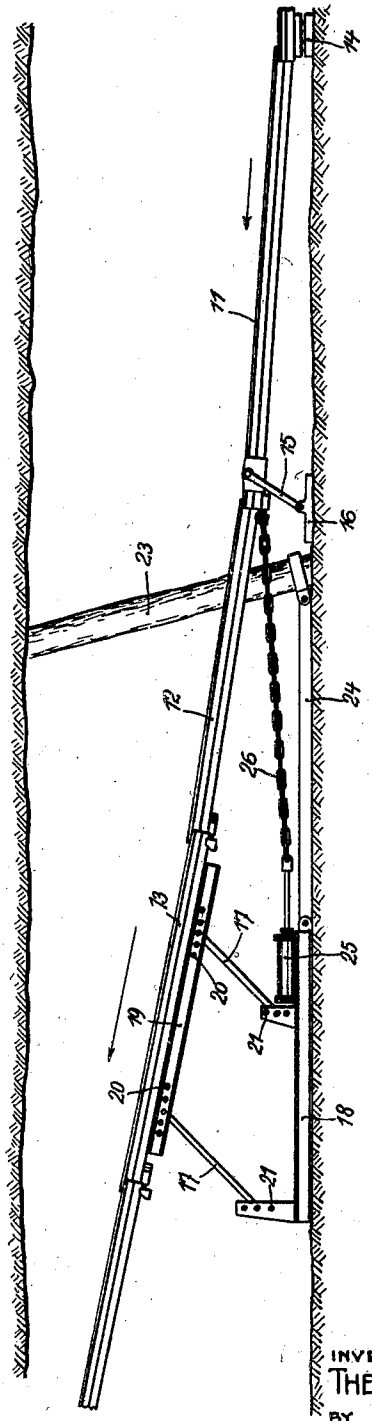


Fig. 3

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Fig. 4

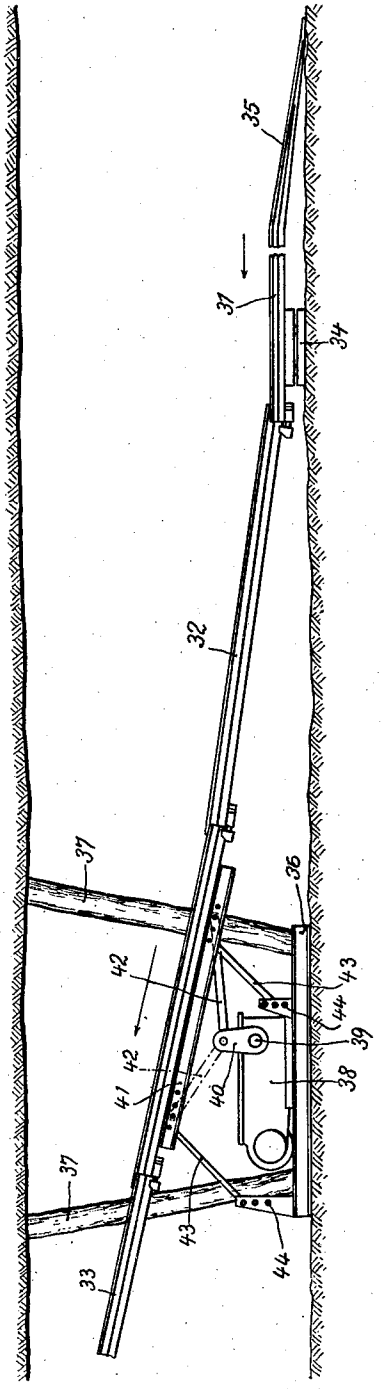


Fig. 10



Fig. 9



Fig. 8

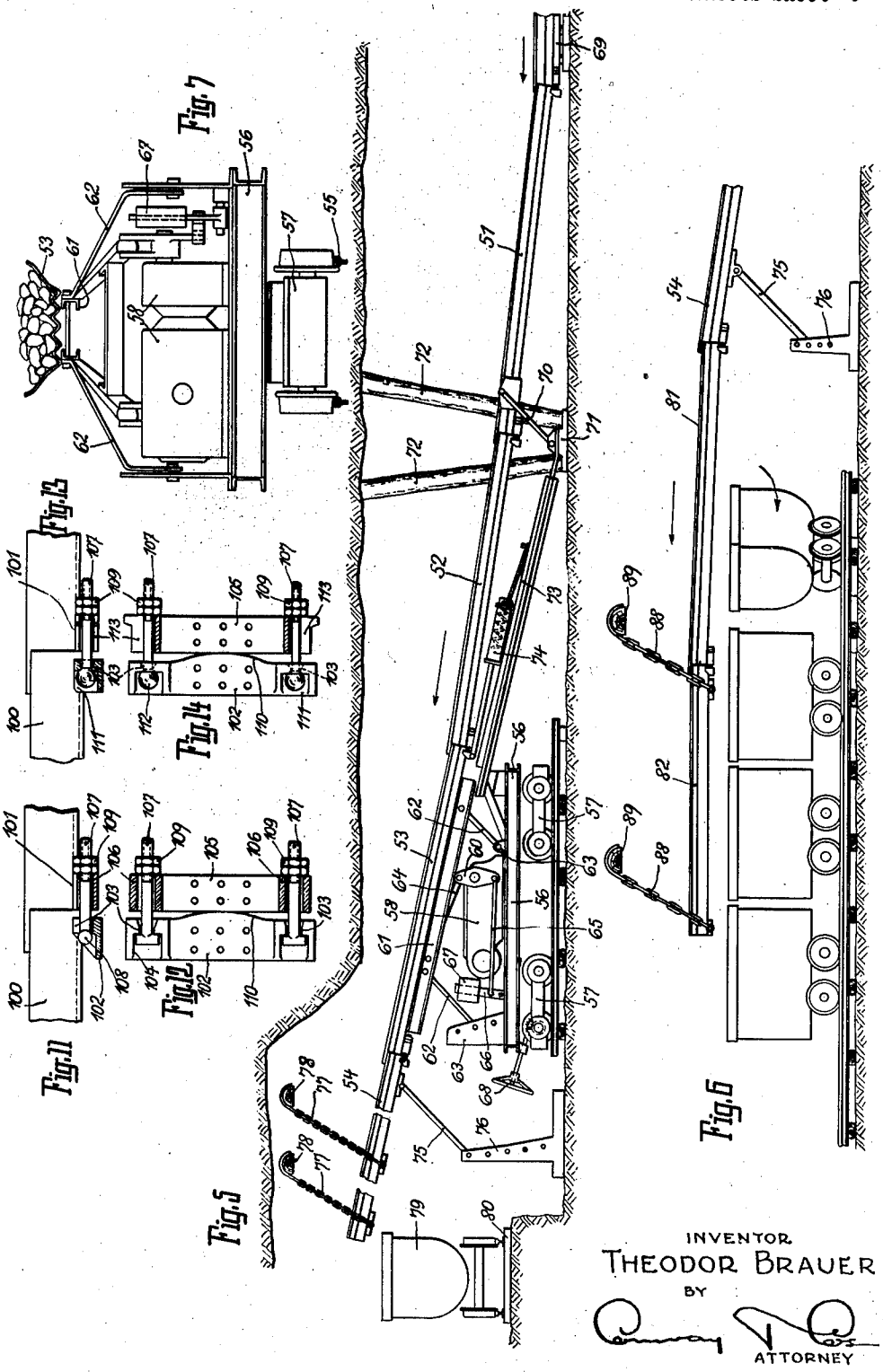


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UNITED STATES PATENT OFFICE

1,971,292

RECIPROCATING CONVEYER

Theodor Brauer, Bochum, Germany, assignor to Gebrueder Eickhoff, Bochum, Germany

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In Germany January 31, 1931

8 Claims. (Cl. 198—220)

The present invention relates to reciprocating shaker conveyers and more particularly to conveyers comprising a plurality of reciprocated sloping chutes connected together and forming different angles with the horizontal.

Such conveyers depend upon the reciprocatory motion of the chutes to cause movement of the material in an upward direction on the slopes. With conveyers of this type, as heretofore made, there has been considerable dissatisfaction because on the steeper portions the material would not move as rapidly and therefore became piled up on the less steep portions to which it was first fed. It is quite obvious that in an arrangement of this type the forces tending to cause reverse movement of the material are greater the steeper the slope of the chute.

The primary object of the present invention is to provide a conveyer consisting of a plurality of chutes arranged at different inclinations with means to cause the material to be fed equally rapidly along each part of the conveyer so that the material will not pile up on the parts having the least inclination but will be fed in equal amounts and at equal speeds along each chute portion of the conveyer.

A second object of the invention is to provide a novel arrangement for supporting the chutes in such a manner as to provide for producing the result described above. A further object is to provide a type of conveyer in which the friction of the more sharply inclined portions will be greater than that of the less sharply inclined portions so as to more nearly equalize the conveying effect of the various chute portions. Still another object is to provide a novel form of connection between the chutes. Finally, it is my purpose to supply a construction in which one or more of the chutes may be supported on a movable carriage, such carriage being provided with a moving counterweight which balances the effect of the forces of movement of the chutes so that there is at most only a slight tendency to move the carriage.

In order to produce equally rapid movement of the material in the several chutes, I provide means for moving the more steeply inclined chutes through a proportionately greater vertical distance than those less steeply inclined. This may be done in a variety of ways which will be described below.

Further objects and advantages of the invention will appear more fully from the following description taken in conjunction with the accompanying drawings which form a part thereof.

In the drawings:

Fig. 1 is a diagrammatic showing of a conveyer embodying the invention.

Fig. 2 is a similar showing of a modified form of the invention.

Fig. 3 is a side elevation showing the conveyer of the general type shown in Fig. 2 in use and connected to a fixed member.

Fig. 4 is a similar view showing a modified form of conveyer.

Fig. 5 is a similar view showing a still further modified form including a movable carriage.

Fig. 6 shows a construction applicable to the end of the device shown in Fig. 5.

Fig. 7 is an end view of the device shown in Fig. 5.

Figs. 8, 9 and 10 are cross-sections through various forms of chutes.

Fig. 11 is a side view partly in section through one form of device for connecting the chutes.

Fig. 12 is a top plan view of the same.

Fig. 13 is a side elevation partly in section of a modified form of connection.

Fig. 14 is a top plan view of the same.

Referring to Fig. 1, the conveyer consists of three chute portions 1, 2 and 3. The material is fed to the conveyer at the outer end of the chute 1 and is to be carried to the outer end of the chute 3. It will be noticed that the chute 1 slopes downwardly at an inclination α^1, the chute 2 slopes upwardly with an inclination α^2, and the chute 3 slopes upwardly with an inclination α^3 greater than α^2 In the ordinary type of reciprocating chute conveyer, the material on the chute 3 will tend to slide backward and will not be moved forward as rapidly as that on the chute 2, and such materials will therefore pile up on the chute 2 and prevent operation of the conveyer at full capacity.

The chute 1 is mounted on a roller arrangement 4 which permits it to move backward and forward in a straight line, the rollers being so arranged that the plane of their axes forms an angle α^1 with the horizontal x—x. The chute 2 is arranged to be lifted at each forward movement and for this purpose is mounted on a pair of roller arrangements 5. The planes of the axes of the roller of these supports form with the horizontal x—x an angle β^2 greater than the angle α^2, for instance, the angle α^3. It will thus be seen that at each forward movement of the chute 2 the chute will be raised bodily through a certain distance, thus producing a forward movement of the material on the chute as the chute moves downwards and backwards to its original position.

The chute 3 is likewise mounted on a pair of roller arrangements or supports 6. The plane of the axes of each of these roller arrangements forms with the horizontal an angle greater than the sum of the angles α^3 and β^2 that is, it forms with the plane of the chute 3 an angle greater than the angle β^2, for instance, the angle β^3. Since the angle β^3 is greater than the angle β^2, the chute 3 will be raised during a forward move-

ment of the conveyer (which produces equal forward movement of each chute) by an amount greater than the amount through which the chute 2 is raised. The arrangement will therefore produce more rapid movement of the material in the chute 3 than would occur if this chute were raised only as far as the chute 2. Naturally, the angles are so proportioned that material in the chute 3 will move as fast as that in the chute 2 so that there will be no piling up of material in the chute 2 and so that the conveyer can be operated at full capacity.

In the form shown in Fig. 2, the same result is obtained in a slightly different manner. The chute sections 1, 2 and 3 are shown having substantially the same inclinations as in Fig. 1. The chute 1 is again mounted on a roller arrangement so that it is not raised or lowered, but merely reciprocates in a straight line. To support the chute 2, arms or links 7 are provided pivoted to fixed supports 8 and to the chute 2. These arms are parallel and are of different lengths so as to support the chute 2 at the desired inclination. To support the chute 3, arms 9 are provided pivoted to supports 10 and to the chute 3. These supports are likewise parallel and are of such a length as to hold the chute at the desired inclination. However, the lengths 9 form a less angle with the horizontal x—x than the links 7, so that equal horizontal movement of the chutes 2 and 3 will result in greater vertical movement of the chute 3 than of the chute 2. In this way the same result is achieved as is discussed above.

Any suitable mechanism may be provided for reciprocating the conveyers shown in Figs. 1 and 2.

Fig. 3 shows a form of the invention as actually used in a tunnel, mine or the like. In this form, three chute sections 11, 12 and 13 are provided, such sections being of gradually increasing inclination. The section 11 rests at its front or outer end on a support 14 in which it slides. The inner end of this chute is supported by a link 15 pivoted to a fixed member 16 and to the chute. The chute 13 is supported by links 17 likewise pivoted to the chute 13 and to a fixed support 18. The chute 12 is supported between the chutes 11 and 13.

In order to permit adjustment of the links 17, the upper ends of these links engage in any one of a plurality of openings 20 in a bar or frame 19 fixed on the lower side of the chute 13. Similar openings 21 are provided in uprights on the frame 18 to permit adjustment of the lower ends of these links. It will be noted that the links 17 form a less angle with the horizontal than the link 15 so that the chute 13 receives a greater vertical movement than the chute 11. The chute 12 will of course receive a movement intermediate between the movements of the chutes 11 and 13.

The frame 18 may be fixed to a prop 23 or the like by means of a bar or similar arrangement 24. A driving cylinder 25 supplied with motive fluid in any suitable manner is connected by a chain or tension member 26 to the chute 11 and draws the same in the direction of the arrow. This causes movement of all the chutes in the conveying direction, and the chutes may move by their own weight back to the original position, after which fluid is again admitted to the cylinder to cause a second reciprocation.

Fig. 4 shows a still further form of the invention. In this form, three chute sections 31, 32 and 33 are provided. The first chute section 31 is arranged on a suitable roller support 34 to move horizontally in a straight line. This chute 31 may be provided at its outer end with a shovel portion 35 adapted to pick up material off the floor of the tunnel in which the conveyer is used. This shovel portion may be moved transversely on its support.

A frame 36 is provided which is fixed to the props 37 in any suitable manner. On this frame is mounted a motor 38 which oscillates a shaft 39 to cause the similar movement of a crank arm 40. The chute 33 carries on its lower side a beam or frame 41, and a link 42 connects the crank arm 40 to the beam 41. As in Fig. 3, the chute section 33 is supported by links 43 adjustably pivoted to uprights 44 on the frame 36 and to the beam or frame 41. It is quite evident that in this form the chute 31 will have no upward movement, the chute 33 will have a considerable upward movement, and the chute 32 will have an intermediate upward movement which will therefore be less than the upward movement of the chute 33.

The link or rod 42 may be moved into the broken line position as shown and will still drive the chute 33 but with a somewhat different movement. In some cases, it may be desirable to give a different cycle of movement to the conveyer and this arrangement is suitable for producing such a result.

In Fig. 5, an arrangement is shown in which the motor and the more steeply inclined chute section are mounted on a movable carriage. The conveyer as shown in this form consists of four chute sections 51, 52, 53 and 54. The section 54 is really merely an extension of the section 53 and is moved in such a manner as to be constantly aligned therewith.

A track 55 is provided on the front of the tunnel. On this track runs a car having a frame 56 carrying wheel trucks 57. A motor 58 is mounted on the carriage and drives a shaft which carries a two-armed lever 60.

The chute 53 carries on its lower side a beam or frame 61 having a plurality of openings in which may be pivoted links 62 which are mounted on uprights 63 carried by the frame 56. A link 64 is pivoted to one arm of the lever 60 and to the beam 61, so that the oscillating movement of the arm transmitted from the motor through the shaft 59 gives a reciprocatory motion to the chute section 53. To the other arm of this lever is connected a link 65 which is pivoted at its other end to an arm 66 pivoted on the frame 56, such arm carrying a counter-weight 67. This counter-weight is made of such dimensions that the reaction on the frame due to the pressure exerted in one direction against the chute section 53 is substantially balanced by the reaction caused by the forces exerted in the opposite direction on the counter-weight 67. In this manner, only light hand brakes or the like are required to hold the carriage 56 in position. Means 68 may be provided for moving the carriage on its tracks when it is desired to advance the conveyer.

The chute section 51 rests at one end on a support 69 in which it is slidable while its other end is supported by a link 70 pivoted to a fixed plate 71 and to the section 51. Of course, the angle which this link forms with the horizontal is made greater than the corresponding angle of the links 62 as in the modifications described above. The chute section 52 is supported by the two sections 51 and 53.

The plate 71 is fixed to one or more props 72

in any suitable manner. Means such as a beam 73 may be provided connecting this plate with the frame 56 of the carriage. This beam preferably extends approximately toward the point of intersection of the forces which act on the carriage 56 so that these forces will be balanced and will cause no distortion or deformation of the whole arrangement. A driving cylinder 74 may be provided connected at one end to the beam 73 and at the other end to the chute section 53 for moving the chute sections positively back to their lowest positions without reliance on the forces of gravity.

The chute section 54 is supported by a link 75 pivoted to the section 54 and to an upright 76, such link 75 having substantially the same inclination as the links 62. This section may also be supported at its outer end by chains 77 secured to the roof of the tunnel or to suitable supporting means 78, the length of these chains being such that the movement of the chute section 54 is substantially the same as that of the section 53. The chute may discharge into cars 79 mounted on a suitable track 80.

Fig. 6 shows a form of the end portion of a conveyer in which the inclination of such end portion is less than that of the intermediate portions. In this form, the chute section 54 corresponds to the similarly numbered section in Fig. 5, being supported by the pivoted link 75 and the upright 76. Two sections 81 and 82 are connected together and to the section 54. The last of these sections 82 is substantially horizontal and is supported by chains or similar devices 88 from suitable frame members 89. The section 81 is supported between the chute sections 54 and 82. Such an arrangement gives an extension of the chute if desirable without affecting the operation thereof.

Figs. 8, 9 and 10 show cross-sections through constructions which are designed to increase the frictional qualities of the chute and thereby to increase the forward moving effect of the reciprocatory movement. The chutes have preferably high sides 90 forming a trough, the bottom of this trough being formed with one or more corrugations or ribs 91. These corrugations may be either placed close together as shown in Fig. 8 or may be separated by flat portions 92 as shown in Fig. 9. If the steeply inclined chute sections such as 3, 13, 33 and 53 are formed in this manner, while the remaining chute sections are plain, it is not necessary to give as great an increase of upward movement to the more steeply inclined chute sections as in the forms in which all the chute sections are alike. That is, the increased friction caused by these configurations prevents a portion of the backward sliding and thereby reduces the amount of piling up in the less steeply inclined portions.

Figs. 11 and 12 show one form of connection between two chute sections. The chute section 100 carries on its lower side a cross beam or fish plate 102 having at each end an upwardly extending ear 103 provided with a slot 104. The other chute seition 101 has on its lower side a cross beam or fish plate 105 provided at each end with an eyelet or aperture 106. The slots 104 are tapered as is clearly shown in Fig. 12. Bolts 107 are provided having cylindrical heads 108 which fit behind the ears 103 in such a manner that the shanks of the bolts extend through the slots 104. These shanks extend through the eyelets 106 and on their free ends are mounted one or more nuts 109. Upon one or both of the beams a curved face 110 is provided which, together with the loose fit of the bolts 107 in the eyelet 106, will permit some slight angular movement between the beams. Angular movement in a vertical plane between the two chute sections is permitted by the slots 104.

Figs. 13 and 14 show a modified form of connection in which the ears 103 are provided only with tapered openings 111, while the bolts 107 are provided with spherical heads 112. The eyelets are replaced by slots 113 opening to the side to permit slight sideward play between the chute sections.

It will be quite clear from the foregoing that the primary object of the invention, namely, to provide a conveyer of this type in which there will be no piling up of material on any of the sections in spite of the varying inclinations of the several sections will be accomplished by the constructions discussed above.

While I have therefore described several embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the appended claims.

I claim:

1. In a shaking conveyer for conveying material in an upward direction having a plurality of inclined chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, means to raise said more inclined section during reciprocation through a greater vertical distance than the less inclined sections.

2. In a shaking conveyer having a plurality of chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, a frame, and means on said frame to support said more steeply inclined section, said frame being movable, and a counterweight on said frame movable to balance the movement of said more steeply inclined section.

3. In a shaking conveyer for conveying material in an upward direction having a plurality of inclined chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, means to produce substantially equal rapidity of movement of the material in each of said sections, said more steeply inclined section having longitudinal ribs therein to increase the frictional qualities thereof.

4. In a shaking conveyer for conveying material in an upward direction having a plurality of inclined chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, means to produce substantially equal rapidity of movement of the material in each of said sections, said more steeply inclined section having longitudinal ribs therein to increase the frictional qualities thereof, the remaining sections having substantially plain bottoms.

5. In a shaking conveyer having a plurality of chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, and means con-

necting said chute sections, said means comprising a cross beam on the end of each section, apertures in one of said beam, slots in the other of said beams, and bolts extending through said apertures and slots.

6. In a shaking conveyer having a plurality of chute sections in which material is caused to move only by reciprocation of said chute sections, one of said chute sections being more steeply inclined than the others, and means connecting said chute sections, said means comprising a cross beam on the end of each section, apertures in one of said beams, slots in the other of said beams, and bolts extending through said apertures and slots, said apertures being tapered and the heads of said bolts being spherical.

7. In a shaking conveyer for conveying material in an upward direction having a plurality of inclined chute sections in which material is caused to move only by reciprocation of said chute sections, and including at least three chute sections, the intermediate section being more steeply inclined than one of the end sections and the other end section being more steeply inclined than the intermediate section, and means to raise the intermediate section during reciprocation through a greater vertical distance than the first end section and the second end section through a greater vertical distance than the intermediate section during reciprocation of said sections.

8. In a shaking conveyer for conveying material in an upward direction having a plurality of inclined chute sections in which material is caused to move only by reciprocation of said chute sections, and including at least three chute sections, the intermediate section being more steeply inclined than one of the end sections and the other end section being more steeply inclined than the intermediate section, and means to raise the intermediate section during reciprocation through a greater vertical distance than the first end section and the second end section through a greater vertical distance than the intermediate section during reciprocation of said sections, said intermediate section being supported only by said end sections.

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