Sept. 1, 1925. 1,552,397

W. D. EDWARDS

MECHANICAL MOVEMENT

Filed Sept. 23, 1922 4 Sheets-Sheet 1

Fig. 3.

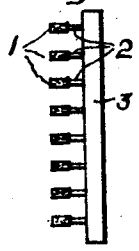


Fig. 1.

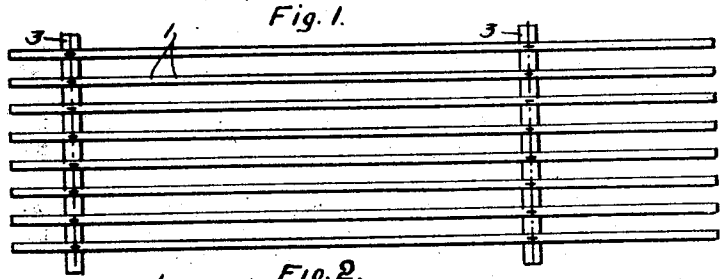


Fig. 2.

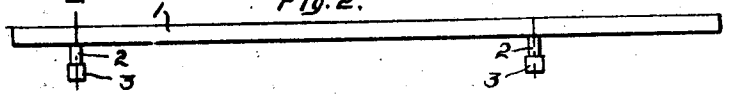


Fig. 5.

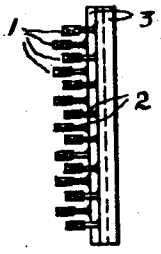


Fig. 4.

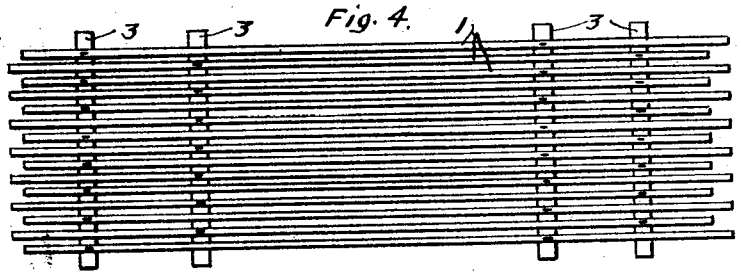
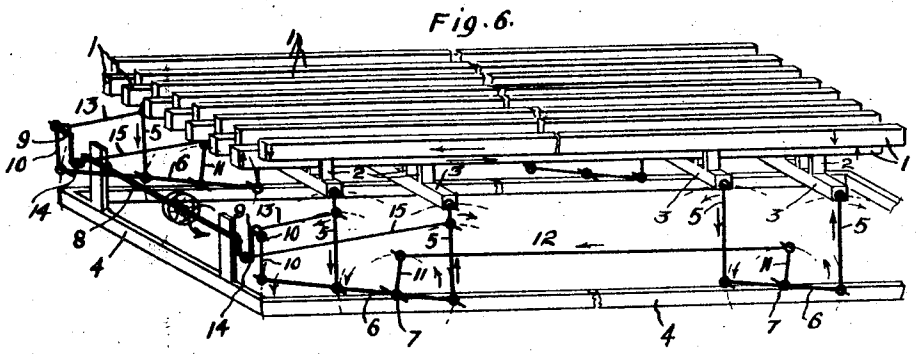


Fig. 6.



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MECHANICAL MOVEMENT

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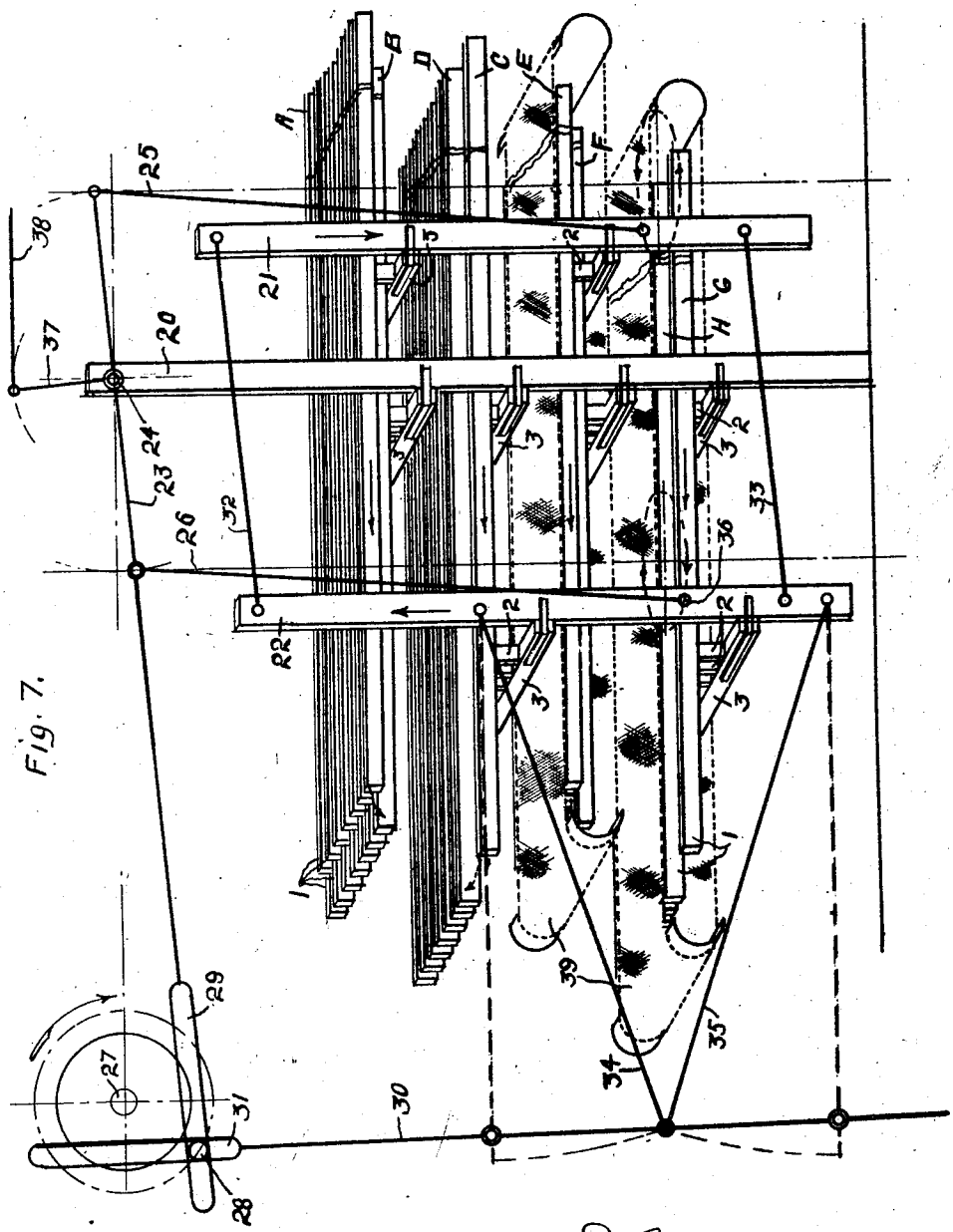


Fig. 7.

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MECHANICAL MOVEMENT

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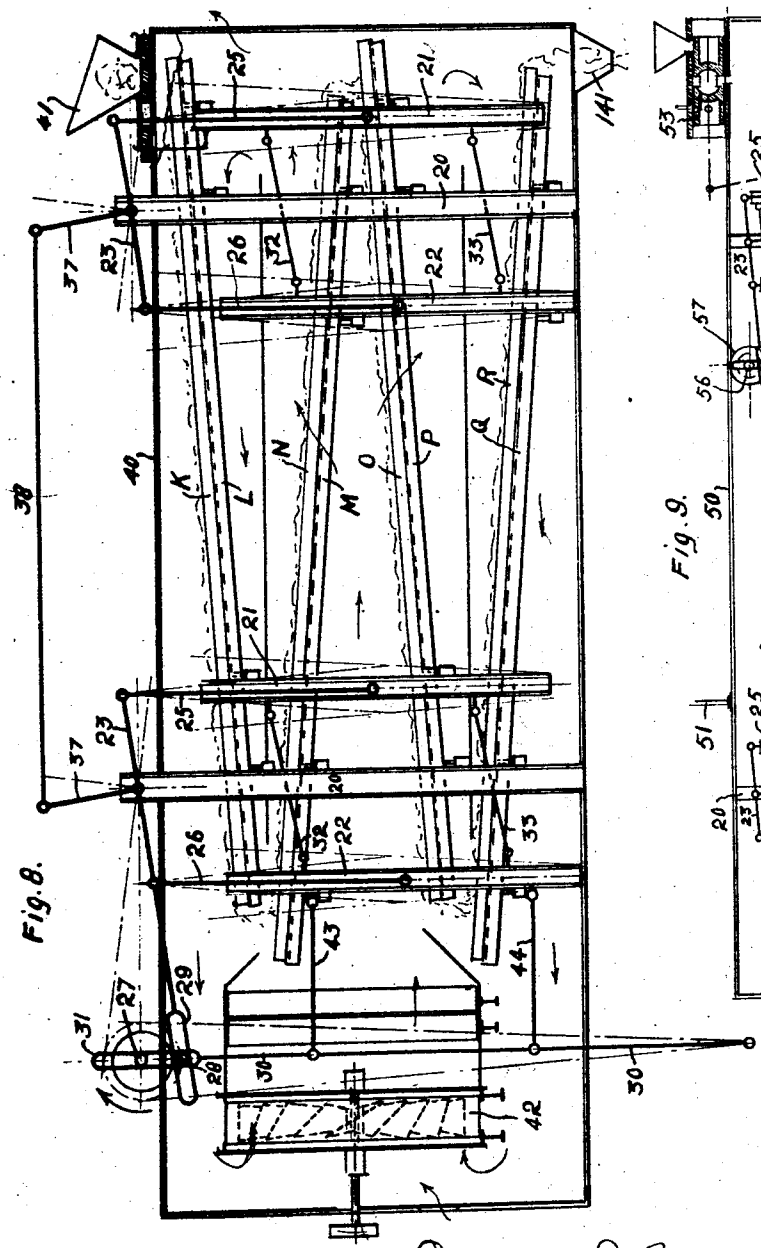


Fig. 8.

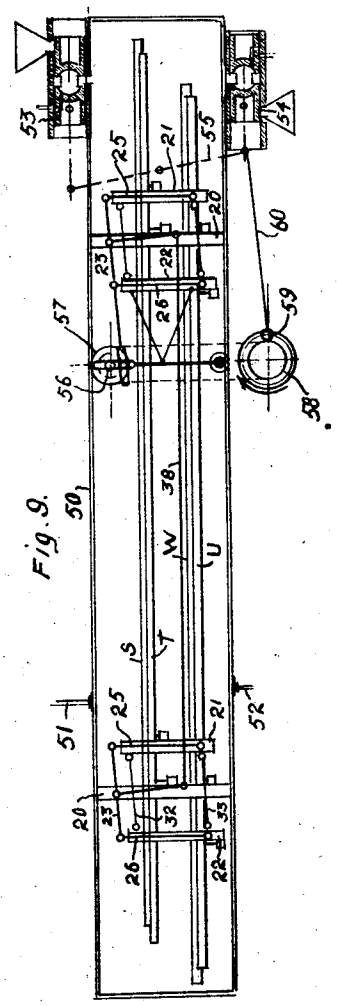


Fig. 9.

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MECHANICAL MOVEMENT

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Fig. 10.

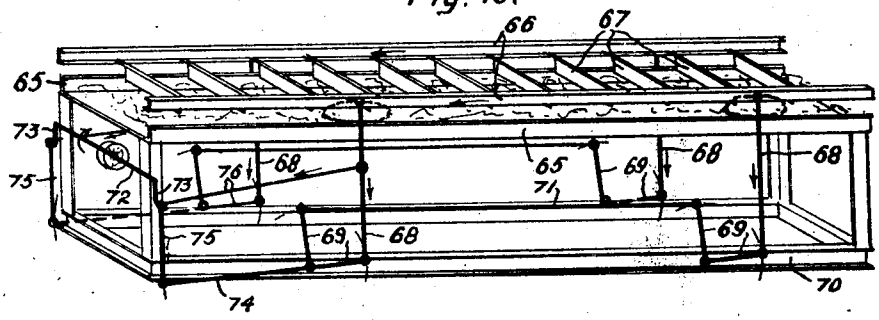
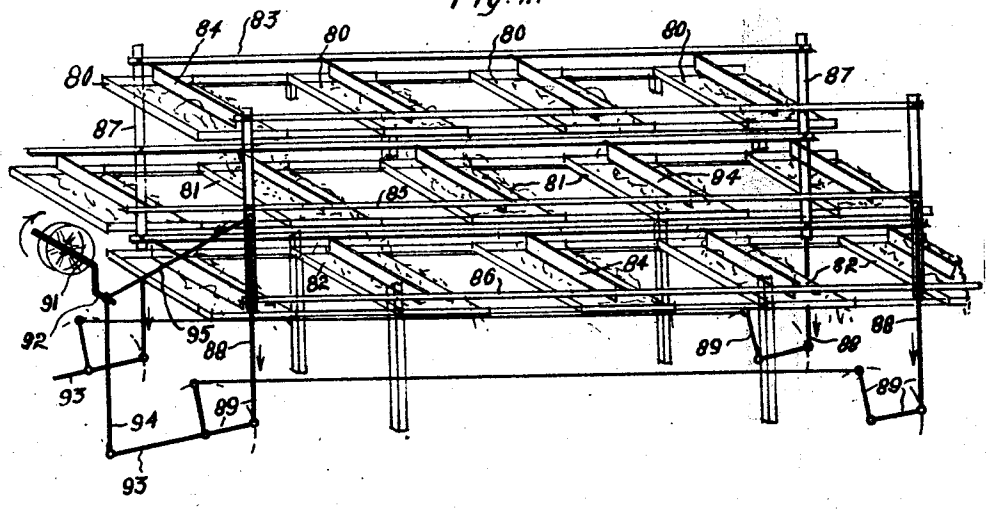


Fig. 11.



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By Wm. F. Frandemeick,

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Patented Sept. 1, 1925. 1,552,397

UNITED STATES PATENT OFFICE.

WILLIAM D. EDWARDS, OF MEMPHIS, TENNESSEE, ASSIGNOR OF ONE-HALF TO LUCY W. EDWARDS, OF MEMPHIS, TENNESSEE.

MECHANICAL MOVEMENT.

Application filed September 23, 1922. Serial No. 590,016.

To all whom it may concern:

Be it known that I, WILLIAM D. EDWARDS, a citizen of the United States, residing at Memphis, county of Shelby, State of Tennessee, have invented a certain new and useful Improvement in Mechanical Movements, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object to produce a simple and novel combination of relatively movable elements capable of being applied in many different fields of usefulness, as, for example, for the purpose of feeding materials in the manner of endless conveyors; feeding and at the same time agitating materials so as to permit work to be done on them or permit a separation of particles or elements of different characteristics during the feeding operation; or of producing a tractive effort if the working surfaces are rested upon the ground or other support, instead of serving for a support for materials to be fed.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a plan view of a tray forming one of the elements of a device or apparatus arranged in accordance with one form of my invention;

Fig. 2 is a side elevation and Fig. 3 an end elevation of the tray shown in Fig. 1;

Fig. 4 is a top plan view and Fig. 5 an end elevation of two of the trays illustrated in Figs. 1 to 3 inter-connected;

Fig. 6 is a perspective view of the trays in Figs. 4 and 5 mounted on suitable supporting means and provided with suitable actuating mechanism;

Fig. 7 is a perspective view of still another form of machine wherein material is adapted to be fed downwardly from one level to another and back and forth along such levels;

Fig. 8 is a view partly in elevation and partly in section of a dryer to which my invention is applied;

Fig. 9 is a view partly in elevation and partly in section of a machine for continuously cooking commodities and gradually feeding them from an inlet point to an outlet point, arranged in accordance with the present invention;

Fig. 10 is a perspective view of a machine arranged in accordance with a still further modification of my invention, whereby material may be fed along a trough or the like by means of a type of hoeing operation; and

Fig. 11 is a perspective view of a machine operating according to the principles of Fig. 10, adapted to feed material downwardly from one level to another.

In the form of my invention illustrated in Figs. 1 to 6, inclusive, I make use of two similar trays, each composed of a plurality of parallel bars 1, supported by means of short posts or standards 2 from cross pieces 3. The bars are spaced apart from each other distances greater than the thickness of one of the bars, so that two of the trays may be placed together with the bars of one lying between the bars of the other; the cross pieces being so disposed that all of the cross pieces may lie on the same side as the assembled trays without interfering with each other. In the arrangement shown, the two trays are alike, each being provided with two cross pieces spaced unequally from the ends of the tray. In building the two interlocked trays one is arranged as though it had been turned end for end, thus bringing the cross piece nearest one end thereof opposite that end of the other tray where the spacing of a cross piece from the end is greatest. The interlocked trays may be mounted on a suitable base or support 4, as shown in Fig. 6: each end of each cross piece being pivotally connected to the upper end of an approximately vertical strut 5. The two struts on the same side and at the same end of the compound tray are pivotally connected at their lower ends to opposite ends of a lever 6, pivotally connected to the supporting base or frame at the middle, as indicated at 7. The arrangement is such that when the levers are oscillated, all of the struts that support one of the two trays are moving upwardly while the other struts are moving downwardly. In other words,

by oscillating the supporting levers in unison, the bars of each tray alternately rise and fall, so that one set of bars projects above what may be termed a neutral plane and then drops below that plane, while the other set of bars is dropping below and then rising above such plane. It will be seen that if each set of bars is caused to move in the direction of its length, say toward the left, as viewed in Fig. 6, while it remains above the neutral plane, and to travel in the opposite direction while remaining below the neutral pane, the effect on an object placed on the compound tray will be, that first one of the trays lifts the object and carries it toward the left, and finally deposits it on the bars of the other tray, these movements taking place while the second tray is travelling below the neutral plane toward the right, the depositing of the object on the second tray occurring just as the latter starts to rise above the neutral plane and move toward the left. In other words, by oscillating the supporting levers and reciprocating the trays in opposite directions in proper time relation, an object will be moved along the compound tray with a step by step movement. The oscillation of the levers and the reciprocation of the trays may conveniently be produced by means of a crank shaft 8 placed at one end of the supporting base. At each end of the crank shaft is a crank 9 which is connected by a link 10 to an extension of the nearest of the levers 6, with the result that as the crank shaft is revolved the two levers at that end of the apparatus are oscillated in unison with each other. The two levers on the same side of the apparatus or machine may be connected together in any suitable way so as to operate in unison with each other. In the arrangement shown, each lever has at the middle an upwardly projecting arm 11 fixed thereto. The ends of the two arms 11 on the same side of the machine are connected together by a rod 12. Consequently, when the crank shaft is rotated, all four of the supporting levers are oscillated in unison with each other and through like angles. A connecting rod 13 extends between each crank 9 and the upper end of the nearest supporting strut 5, so that as the crank revolves, these two struts are oscillated about their points of connection with the corresponding supporting levers, causing one of the trays to reciprocate. The crank shaft is provided with two other similar cranks 14, arranged near the ends thereof. Each of the cranks 14 is connected to the second strut on the same side of the machine by means of a rod 15. The cranks 9 and 14 are oppositely disposed, so that when one of the trays is being drawn toward the left, the other is being pushed toward the right. It will be seen that the movement of one tray is precisely the same as that of the other, the timing being such, however, that one tray lags half a cycle behind the other. It will further be seen that the movement of any given point on any one of the trays is in the path which takes the form of an ellipse lying in the plane at right angles to the plane of the trays, the long axis of the ellipse being parallel with such plane. The bars are so proportioned that the long axes of the imaginary ellipses all lie in what may be regarded as the neutral plane, which is the plane of the upper faces of all the bars when the trays are shifted to bring such faces into a common plane, which is the position which must exist when the load is being transferred from one set of bars which is starting down and back to the other set of bars which is going up and starting to travel forward.

It will be understood that one tray or set of bars may be held stationary with the upper surface thereof in the neutral plane, while the other tray or set of bars may be moved as heretofore described. In this case the feeding of material will take place during one half of the time that the machine is in operation, because the material or work, after it has been deposited on a stationary tray, will remain there until the moving bars have completed that half of the travel which takes place underneath the neutral plane. In Fig. 7 I have shown an arrangement in which one of the elements of the compound tray is stationary, and have also shown other modifications, which permit material to be fed in one direction, then deposited to a second compound tray and fed in the opposite direction, and so on indefinitely.

Referring to Fig. 7, A is a movable tray of the kind heretofore described, and B is a similar tray which is held stationary. Four such compound trays are illustrated; A and B being the uppermost compound tray, C and D the movable and stationary elements of the second tray arranged below the upper tray, E and F being the movable and stationary elements of a third tray arranged below the second tray, and G and H the movable and stationary elements of a fourth or lowermost tray. All of the stationary trays may conveniently be mounted on a stationary upright frame member 20. In this connection it should be noted that Fig. 7 shows only one end of the machine and the supporting mechanism for only one side of the trays. The supporting means will of course be duplicated at the other end, which is broken away, and at the other side. The first and third movable trays, A and E, are attached to a vertical piece 21, while the second and the fourth movable trays, C and G, are attached to a vertical piece 22. The members 21 and 22 are hung from the

ends of the lever 23 pivoted at its center, as indicated at 24, to the upper end of the stationary frame member; a link 25 connected to one end of lever 23 and at its other end to a point near the lower end of the vertical piece 21, supporting the latter piece; and the link 26 hung from the other end of the lever and pivotally connected at its lower end to the vertical piece 22 at a point near the lower end of the latter, supporting the piece 22. It will be seen that when the lever 23 is oscillated one of the vertical pieces will move up while the other is moving down. In other words, while the first and third movable trays are traveling down, the second and fourth movable trays are traveling in the upward direction. If now the movable trays be reciprocated in the direction of their lengths, so that the first and third trays move in one direction, while the second and fourth trays move in the opposite direction, a progressive feeding movement from the right toward the left, for example, may be obtained for material carried by the first and third trays, while a similar movement of material on the other two trays from the left toward the right may be obtained. Then, by disposing the trays so that when the material reaches the left hand end of the upper tray it drops to the second tray, and thus drops from one tray to the other throughout the entire series, an object or material to be fed or carried will be placed on the right hand end of the upper tray, and will finally be discharged at the right hand end of the lowermost tray. The actuation of the supporting lever and the reciprocation of the movable tray elements may be brought about by the use of a crank shaft, indicated conventionally at 27, the crank or crank pin being indicated at 28. One end of the lever 23 is extended and is provided with a slotted portion 29 fitting over the crank pin. As the crank shaft revolves, the lever will be rocked up and down. The reciprocation of the trays may be brought about by providing a long rocking lever 30, the upper end of which has a slotted end 31 fitting over the crank pin, while the lever is connected at intermediate points with the vertical supporting pieces 21 and 22. In the arrangement shown, the pieces 21 and 22 are connected together at their upper and lower ends, respectively, by means of links 32 and 33, while the member 22 is connected to the rocking lever 30 in any suitable way, as, for example, by means of two diverging rods 34 and 35 fastened at their meeting point to the rocking lever, and at their other ends to separated points on the member 22 lying respectively above and below the pivotal connection 36 between the supporting link 26 and the member 22. Consequently, as the crank shaft revolves, the supporting members 21 and 22 are alternately raised and lowered, and are reciprocated in unison in the direction of the length of the trays. The result is that each point on each movable tray describes the elliptical path heretofore explained. At the middle of the lever 23 is fixed an arm 37 projecting at right angles thereto. A connecting rod 38 extending from the free end of this arm to the free end of the similar arm at the opposite end of the machine causes the same movements to take place at the opposite end as at the end illustrated.

If the material which is being fed is fine or contains fine particles which would be apt to fall down between the bars of the trays, each compound tray may be covered with an endless belt of cloth or fine wire mesh, as indicated at 39, without interfering with the feeding operation, because the belt itself will be fed step by step with the material.

In Fig. 8 I have illustrated my invention as developed in Fig. 7, as applied to a dryer, in which the mechanism is confined in a housing 40 having at one end a hopper 41, into which the material is fed, and having at the bottom, at the same end, a discharge outlet 41. In the opposite end of the housing is a suitable fan blower 42. Four sets of trays, as shown in Fig. 7, are employed, the only difference being that in Fig. 8 the trays are shown inclined, so as to permit gravity to assist the feeding mechanism. The movable elements of the four trays are indicated at K, M, O and Q, respectively, while the stationary elements are indicated at L, N, P and R. The actuating mechanism is the same as that shown in Fig. 7, duplicated at the two ends of the machine, with the single exception that two parallel connecting rods 43 and 44 are arranged between the vertical rocking lever 30 and the supporting piece 22, instead of the two converging rods 34 and 35 in Fig. 7.

In Fig. 9 I have shown the embodiment of the invention contained in Fig. 7 as applied to a continuous cooker. In this machine there is a closed housing 50 having a steam inlet 51 and a steam or water outlet 52. In the housing are two compound trays arranged one above the other, the upper tray consisting of a movable element S and a stationary tray element T, while the lower compound tray consists of a movable tray element U and a stationary tray element W. The upper compound tray does not extend as far to the left as the lower tray, so that material can be fed from the right hand end of the upper tray through the housing, be deposited on the left hand end of the lower tray, and then be carried through the housing to the right hand end, where it is discharged. The delivery of the material to be cooked is into the top of the housing at the right hand end, so that it will drop on the upper tray. The outlet for the material,

after it has been cooked, is at the bottom of the right hand end. The inlet and outlet are controlled by suitable slide valves 53 and 54, respectively. These slide valves are connected to opposite ends of a lever 55 pivotally supported at its center. The crank shaft 56, for operating the trays, is provided with a belt pulley 57, over which passes a belt which drives a suitable wheel 58, having thereon a crank pin 59. A connecting rod 60 extends from this crank pin to the lever 55, so as to reciprocate the slide valves and control the intake and the discharge of material.

By referring again to Figs. 7 and 8 it will be seen that since the upper end of the rocking lever 30 moves through greater distances than points lower down, and since the movements of the vertical supporting pieces 21 and 22 correspond to those of the rocking lever, the reciprocatory movement of the uppermost movable tray member will be greater than that of the corresponding member immediately below it, and so on through the series. Therefore the uppermost tray will feed faster than the next one, and, in the same way, each tray will feed faster than the one below it. If the rocking lever were inverted, just the reverse condition would be true. Therefore, by properly locating the rocking lever and properly proportioning its length relatively to the length of the supporting pieces 21 and 22, a wide variation in the character of the feed throughout the entire path which the material must travel, may be obtained.

In Fig. 10 I have shown an arrangement embodying to an extent the principle heretofore explained. Referring to this figure, 65 represents a trough in which the material to be fed lies. Above the trough is a ladder-like structure comprising side bars 66 and cross pieces 67, which are adapted to enter the trough when the ladder-like feeding device is lowered. The feeding device is supported from four struts 68, each of which is pivotally connected at its lower end to one arm of a bell crank lever 69, pivotally supported on the stationary frame 70, which also supports the trough. The other two arms of each pair of bell crank levers on one side of the machine are connected together by a connecting rod 71, so that when one of the bell crank levers on each side is oscillated, the feeding frame will be moved up and down. The bell crank levers may conveniently be actuated by means of a crank shaft 72 having cranks 73 on the ends thereof. Each crank is connected to an arm 74 fixed to one of the bell crank levers by means of a connecting rod 75. As the crank shaft is revolved it oscillates all of the crank levers in unison with each other. Each of the cranks is also connected with the nearest supporting strut by means of a connecting rod 76, so that when the crank shaft rotates, the strut is swung about its point of pivotal connection with the corresponding bell crank lever. It will be seen that when the crank shaft revolves in the direction of the arrow, the feeding frame will be moved toward the left by reason of the connecting rod 76, and will be drawn down through the action of the bell crank levers on the struts. When the crank shaft has completed a quarter of a revolution, the frame will still be moving downward, but will start to travel toward the right, continuing this movement toward the right for another half revolution, after which it again starts to travel toward the left. The downward movement of the frame continues during the first half of the revolution, after which there is an upward movement during the next half revolution. In other words, the cross pieces on the feeding frame travel through elliptical paths in the same way as points on the trays heretofore explained, so that during one half of each revolution of the crank shaft they are held down in the trough and are moving the material in the latter ahead of them toward the right, while during the other half revolution they are being held above the material in the trough and are carried toward the left, to be again forced down into the material, taking new hold on the same. The operation is therefore similar to that of a hoe with multiple blades which are pressed down, so that the material will be moved, drawn forward a short distance, then lifted and returned to the starting point and again inserted in the material.

In Fig. 11 I have shown an arrangement based on the hoeing principle, in which material is scraped from one shelf to another shelf on a lower level, and so on indefinitely, only three levels being illustrated. Referring to this figure, 80, 81 and 82 represent a group of three shelves, arranged one below the other, the shelf 81 having one edge underlying one edge of the shelf 80 and the opposite edge overlying one edge of the shelf 82. Any desired number of such groups may be utilized, there being, in the arrangement shown, five of them. Above the uppermost shelves is a scraping or hoeing frame 83, provided with cross pieces 84. Above the second tier of shelves is a similar hoeing or scraping frame 85, while another hoeing or scraping frame 86 is placed above the lower tier of shelves. The hoeing or scraping frames are all connected together by means of uprights 87 rigidly fastened thereto at opposite ends thereof. The uprights are supported on the upper ends of struts 88 which are pivotally supported at their lower ends on bell crank levers 89. The two bell crank levers on the same side of the machine are connected together by means of the connecting rod 90. At one end of the machine is a

crank shaft 91, having at the ends cranks 92, of which only one is shown. Each crank is connected to an arm 93, fixed to the nearest bell crank lever by means of a connecting rod 94. Consequently when the crank shaft rotates, it moves the frames up and down. Each crank shaft is also connected, by means of a connecting rod 95, to one of the uprights or posts 87, so that as the crank shaft revolves, it reciprocates the frames. It will thus be seen that as the crank shaft rotates it moves the hoeing frames in the same manner as explained in connection with Fig. 10, so that each blade travels through an elliptical path; the bars being so proportioned that the blades come down into the material at the left hand ends of the shelves and scrape the material toward the right hand ends, where the material falls over the edges of each tray to the tray beneath; the blades being then raised above the material and carried back to the left hand ends of the shelves, where they are again forced down into the material, so as to carry it forward on the next forward movement.

I have heretofore described my invention as applied to the feeding of objects or material, but in some of its forms it is capable of other uses. If, for example, the device shown in Fig. 6 were turned upside down so as to permit the trays to rest upon the ground, then, upon rotating the crank shaft, the device would travel along the ground, giving the effect of walking.

While I have illustrated and described only a few preferred forms of my invention and referred only to a few uses to which it may be put, I do not desire to be limited to the particular structural details thus illustrated and described, or to the particular uses enumerated, but intend to cover all forms and arrangements, wherever used, which come within the terms and definitions of my invention constituting the appended claims.

I claim:

1. A mechanical movement comprising two parallel members, a support, levers pivoted to said support with their pivotal axes spaced apart in the direction of the length of said members, links pivoted to and connecting said levers to one of said members, and means for simultaneously rocking said levers and swinging said links about their connections with the levers.

2. A mechanical movement comprising two members each composed of parallel bars arranged in the spaces between the bars of the other member, a support, levers pivoted to said support so as to be capable of swinging in planes transverse to the plane of said bars, links extending between said levers and one of said members, and means for rocking said levers and during the whole of such rocking movement and reciprocating the said member connected thereto in the direction of the length of said bars so as to cause points in said bars to travel in a path forming a closed loop.

3. A mechanical movement comprising two members each composed of parallel bars arranged in the spaces between the bars of the other member, a support, levers pivoted to said support so as to be capable of swinging in planes transverse to the plane of said bars, connections between said levers and one of said members permitting that member to reciprocate in the direction of the length of the bars and to move with the levers transverse to the planes of the bars, and means for reciprocating the latter member and oscillating said levers in cycles such that each point in the latter member travels in an elliptical path.

4. A mechanical movement comprising two members each composed of parallel bars arranged in the spaces between the bars of the other member, a support, levers pivoted to said support so as to be capable of swinging in planes transverse to the plane of said bars, connections between said levers and one of said members permitting that member to reciprocate in the direction of the length of the bars and to move with the levers transverse to the planes of the bars, a crank shaft having cranks thereon; and connections between said cranks and the levers and between the cranks and the last-mentioned member to cause the levers to be oscillated and the said members to be reciprocated in a predetermined time relation to each other when the crank shaft is rotated.

5. A mechanical movement comprising two parallel members, a support, levers pivoted to said support so as to be capable of swinging in planes transverse to a plane extending in the direction of the length of said members, links connecting said levers to one of said members, a crank shaft having cranks thereon; and connecting rods between the cranks and the levers and between the cranks and the last-mentioned member to cause the levers to be oscillated and the said member to be reciprocated in a definite time relation to each other when the crank shaft is rotated.

In testimony whereof, I sign this specification.

WILLIAM D. EDWARDS.