Oct. 1, 1940. Z. C. BRANDON 2,216,383

MECHANISM FOR HANDLING MATERIAL

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Fig. 1.

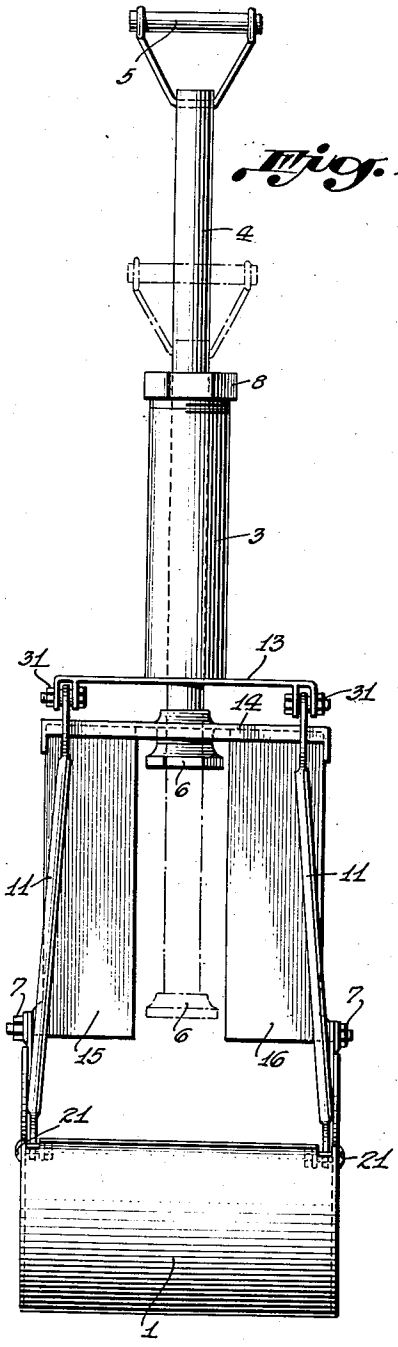
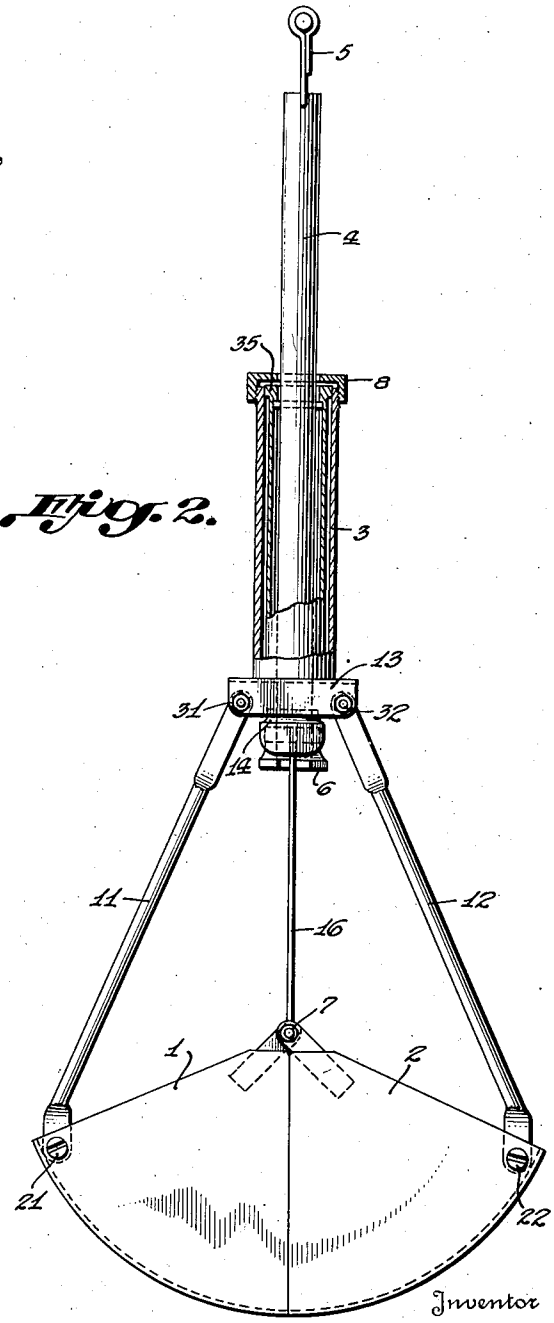


Fig. 2.



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Fig. 3.

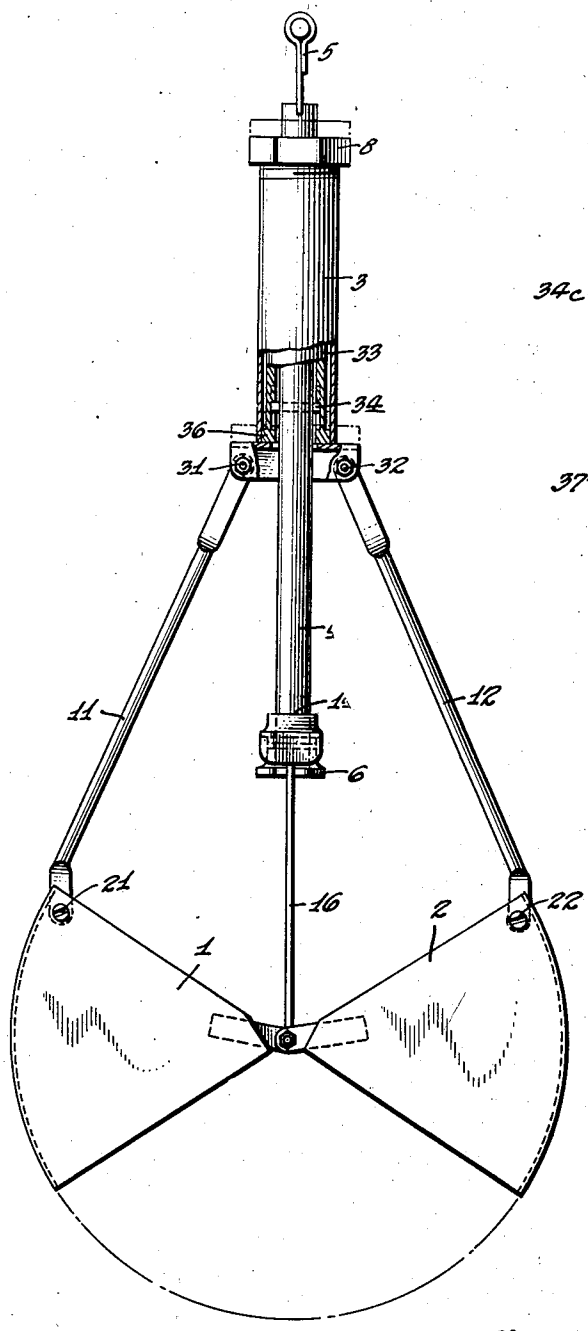


Fig. 6.

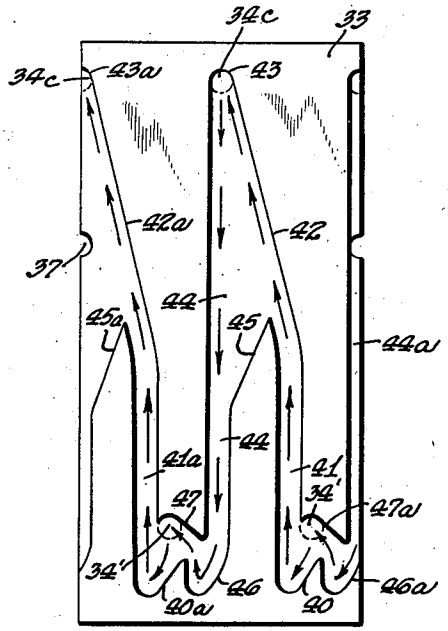
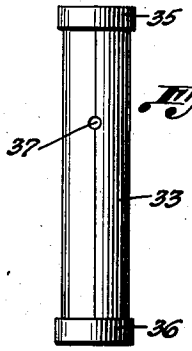


Fig. 5.



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MECHANISM FOR HANDLING MATERIAL

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Fig. 4.

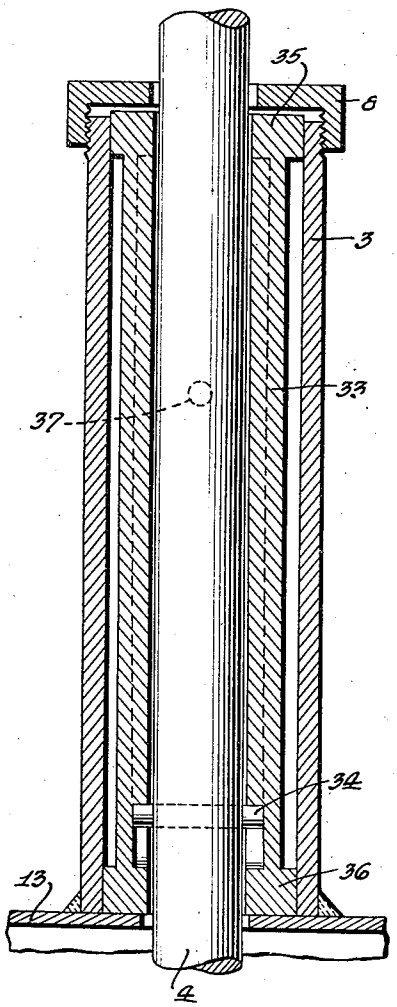
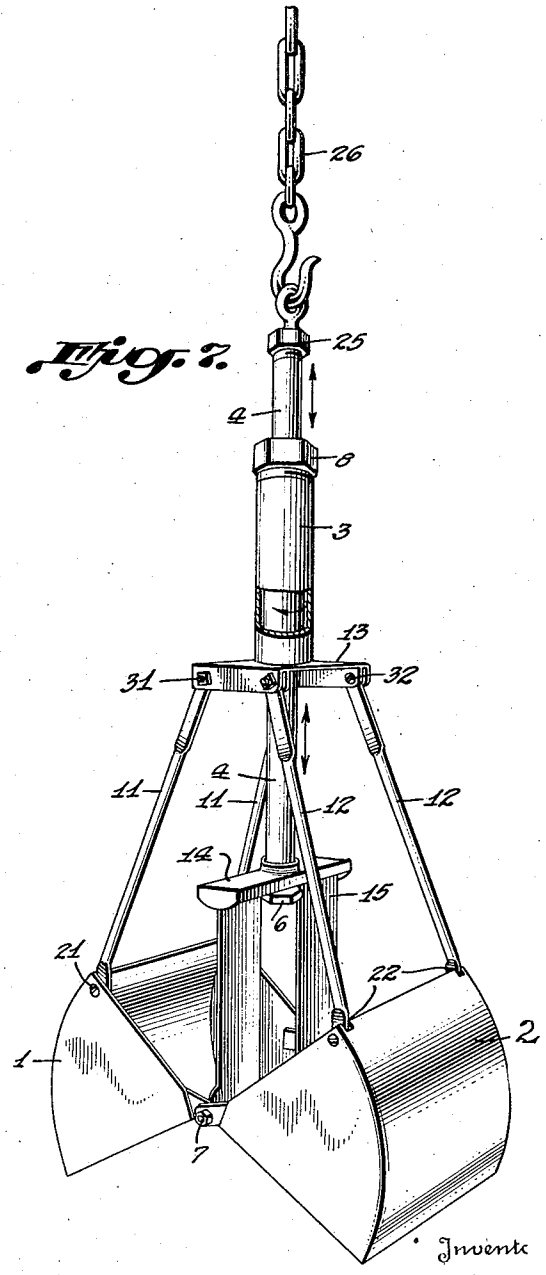


Fig. 7.



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UNITED STATES PATENT OFFICE

2,216,383

MECHANISM FOR HANDLING MATERIAL

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Application May 11, 1940, Serial No. 334,637

15 Claims. (Cl. 294—110)

This invention relates to a mechanism for handling materials, and more particularly to a novel device embodying pivoted jaws which may be operated automatically between alternate positions by the lifting and lowering of the device.

It is the object of the present invention to provide a mechanism for handling materials embodying pivoted jaws and an operating mechanism therefor which is rugged in construction and reliable in operation.

It is a further object of the invention to provide a mechanism for handling materials embodying a camming device in the form of a rotary cylinder which is moved into successive angular positions for controlling the opening and closing movements of the jaws of the device in response to the lifting and lowering movements thereof in conjunction with the relief against gravity when the device is brought to rest in either its open or closed positions.

It is a further object of the invention to provide a grab-bucket which requires no complex controls for the opening and closing of the component parts thereof, the mere hoisting and lowering of the bucket between its loading and unloading position being effective to control the necessary operations.

Other objects and purposes will appear from the more detailed description of the invention following hereinafter, taken in conjunction with the accompanying drawings, wherein:

Figure 1 is an end view of the mechanism in accordance with the present invention in closed position;

Figure 2 is a front view of the device with certain parts in section;

Figure 3 is a view corresponding to Figure 2 with the parts in different position, and in which the jaws are open;

Figure 4 is a longitudinal sectional view of the upper part of the supporting frame showing the cylindrical housing and camming cylinder in section, and the lifting rod in elevation;

Figure 5 is a front elevation of the exterior of the camming cylinder;

Figure 6 is an open developed view of the interior of the camming cylinder showing the configuration of the cam grooving surfaces therein; and

Figure 7 is a perspective view of the mechanism in open position showing a different form of operating attachment therefor.

The embodiment of the invention illustrated herein is in the form of a grab-bucket composed of two bucket-shaped jaws 1 and 2 which are pivoted upon opposite sides thereof at pivot joints 7. The jaws may assume any other desired forms, such as tongs, grippers and the like, adapted to the handling of different materials, such as stacked sheets of metal, paper, etc. The jaw 1 is supported at points 21 displaced from the pivoted joint and the jaw 2 is likewise supported at points 22 by rods 11 and 12 respectively, extending from the pivoted joints 21 and 22 to pivoted joints 31 and 32, respectively, on opposite sides of a supporting frame 13 on the upper end of which is fixed a cylindrical housing 3. The several pivotal joints enumerated above may be formed by bolts and nuts, rivets, or equivalent connecting means.

Extending through the cylindrical housing 3 of the support is a tubular rod 4, at the upper end of which is connected a handle 5 or equivalent attachment means whereby the mechanism may be lowered or lifted either manually or by machinery. At the lower end of the rod 4 is disposed a stop element 6 which may be threadedly connected thereto. The camming cylinder 33 is disposed within the interior cylinder 3, and is capable of rotary movements therein under the control of the pin 34 which extends diametrally of the tubular rod 4, and which is engaged in a series of continuous cam grooves provided on the interior of the cylinder 33. The camming cylinder 33 may be removed from the cylindrical housing 3 upon the disengagement of the bushing 8 at the upper end of the housing 3, whereupon the tubular rod 4 may be withdrawn from the upper end of the device after the element 6 is unscrewed from the upper end of the device after the element 6 is unscrewed from the lower end thereof. An opening 37 in the peripheral surface of the camming cylinder 33 permits the introduction and the removal of the camming pin 34 from the tubular rod 4 when the same is brought into registry with the opening. Enlargements 35 and 36 at the upper and lower ends of the camming cylinder assure a snug engagement of the cam cylinder within the housing 3.

In addition to the parts recited above, the pivoted joints 7 are connected to the lower ends of bars or plates 15 and 16, which extend upwardly therefrom to a cross-piece 14 below the frame 13. The cross-piece 14 has an opening 54 therein whereby the cross-piece together with the members 15 and 16 are mounted for reciprocating movement on the rod 4. The relationship of these parts is clearly shown in Figure 7.

In Figure 7 is also shown the attachment 25, threaded to the top of the tubular rod 4, and provided with an eye which is designed to en-

gage the hook 26 of a hoisting chain, whereupon the lifting and lowering movements of the hoisting chain will operate to alternately close and open the jaws as explained in detail below.

The parts of the mechanism are assembled as explained above for the purpose of effecting an alternate closing and opening of the jaws in response to the lifting and lowering movements of the mechanism. This is accomplished primarily by the cooperation between the lateral pin 34 extending from the rod 4 engaging the cam groove surfaces on the interior of the cylinder 33 which are illustrated in detail in Figure 6. The position of the pin 34 is illustrated in Figure 6 at the upper end of the cylinder at 34c indicating the position of the parts when the jaws are in closed position, and at the lower end of the camming cylinder at 34o indicating the location of the pin when the jaws are in the open position. Assuming this latter position of the parts which is correspondingly shown in Figures 3 and 7, the bucket and handle are moving downwardly for the purpose of engaging work to be picked up, and the pin 34 is adjacent either surface 47 or 47a. In view of the fact that the interior of the camming cylinder is divided into two parts of like contour, whereupon two complete cycles of operation of the device effect a single rotation of the cam cylinder, or in other words, the alternate closing and opening movements of the jaws effect a rotation of the cam cylinder through 90°, the operation of the machine will be explained with respect to only one set of these cam surfaces, the corresponding cam grooving being designated in Figure 6 by the appendage *a* to the corresponding reference characters.

With the pin 34 resting adjacent surface 47 on the right of Figure 6, the bucket is lowered by the handle 5 or chain 6 until the same comes in contact with the work to be engaged thereby. In view of the fact that the joints 21 and 22 are fixed with respect to the support 13 through bars 11 and 12, the frame support 13 and cylindrical housing 3, together with the cam cylinder 33 are stopped, but the tubular rod 4 is capable of a small amount of relative movement in a downward direction whereupon the pin 34 drops relatively to the camming cylinder 33 and strikes the inclined surface 40 having a longitudinal as well as a circumferential component, the latter of which causes the sleeve to rotate 90° to bring the pin 34 into alignment with the longitudinally extending groove 41. The relative longitudinal movement executed by the parts is only of a slight extent and is indicated by the solid and dot-and-dash lines shown in Figure 3. Thereafter, when the tubular rod 4 is lifted, the pin 34 is capable of riding along longitudinally extending slot 41 and against camming surface 42 having a circumferential component in addition to the longitudinal component, until the pin 34 comes to the upper limit of travel of the groove, at which time the jaws are closed and operate to confine the material engaged thereby. The mechanism is then hoisted to any desired position, and is brought to rest at some other desired point. When the mechanism is brought to rest, the tubular rod 4 is free to drop along the longitudinally extending slot 44, to the position shown in dotted lines in Figure 1, and when the same strikes the bottom of the slot against surface 46, which has a small circumferential component, at the end of its falling movement, the camming cylinder is rotated for 90° to bring the pin within the field of operation of the surface 47, which locks rod 4 against upward movement. Even should the jaws be closed incompletely, which would prevent the pin 34 reaching the upper limit of the cam groove at 34c, the dropping of the rod 4 would strike against the camming surface 45 and would force the downward travel of the rod into the groove 44 with the consequent rotation of the cylinder by the camming surface 46. Thereupon a lifting of the mechanism by the handle 5 or element 25 permits the crosspiece 14 to slide on the tubular rod 4 from the position shown in solid lines in Figure 1 to the position shown in Figure 7 whereat the crosspiece 14 strikes the stop 6. When the mechanism is carried to the point of another engagement with the material, the pin 34 rises against the camming surface 47, which is substantially a circumferential portion, and which operates to block the upward travel of the pin 34, thereby maintaining the jaws in their open position as shown in Figures 3 and 7. When the jaws come in contact with the material to be engaged, the relief of gravity against the jaws effects a slight longitudinal relative movement between the jaws and the supporting frame therefor and the rod 4 with the pin thereon at the pivotal joints, to actuate the cam cylinder by contact with the camming surface 40a as has been described in connection with camming surface 40, and the cycle as described above is repeated.

The illustrated embodiment is capable of modification in several respects without altering the basic combination of the parts. For example, the pivotal joints may be arranged singly rather than in pairs, and as stated above, the jaws may assume any form or configuration, depending upon the functioning thereof and the character of the work to be performed thereby. The positioning of the jaws and the connected parts may be aided in part by the manipulation thereof by operators in the course of engagement of the device with the work handled therewith.

While I have described my invention as embodied in specific form and as operating in a specific manner for purposes of illustration, it should be understood that I do not limit my invention thereto, since various modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim is:

1. In a device of the class described, a pair of jaws pivotally joined with each other, movable means connected with the pivotal joint of said jaws and composed of two relatively displaceable members having one end of one of said members connected to said pivotal joint and the opposite end of the other one of said members adapted to execute lifting and lowering movements, supporting means for said movable means and said jaws, and a cam device carried by said supporting means operated by the lowering and lifting movements of said device and cooperating with said other member of said movable means for cyclically controlling the opening and closing movements of said pair of jaws.

2. In a device of the class described, a pair of jaws joined with each other at a pivotal joint, a support for said jaws comprising a cylinder frame above said jaws, connections from said frame to said jaws at points displaced from said pivoted joint, a cam device in said cylinder frame, movable means extending through said cylinder frame and connected with said pivoted

joint, said movable means composed of two relatively slidable members subjected to lifting and lowering movements by force and gravity effects, said cam device adapted to control the movements of one of said members and consequently the opening and closing movements of said pair of jaws.

3. In a device of the class described, a pair of jaws joined with each other at a pivotal joint, a support for said jaws comprising a cylinder frame above said jaws, connections from said frame to said jaws at points displaced from said pivoted joint, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, the upper end of said rod adapted for reciprocation thereof while a stop element is provided at the lower end thereof, and a movable member slidable on said rod below said cylinder frame and connected to said pivoted joint, said member adapted to drop by gravity against said stop element to open said pair of jaws.

4. In a device of the class described, a pair of jaws joined with each other at a pivotal point, a support for said jaws comprising a cylinder frame above said jaws, connections from said frame to said jaws at points displaced from said pivoted joint, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, said cam grooving having portions extending longitudinally of the cam cylinder for permitting reciprocating movement of said rod, other portions having both longitudinal and circumferential components for rotating said cam cylinder and thereby positioning it for the next cyclical operation of the device, and a portion extending circumferentially for locking said rod against movement, the upper end of said rod adapted for reciprocation thereof while a stop element is provided at the lower end thereof, and a movable member slidable on said rod below said cylinder frame and connected to said pivoted joint, said member adapted to drop by gravity against said stop element to open said pair of jaws, the relief against the force of gravity operating on the device in both the open and closed positions of the jaws adapted to execute a rotation of the cam cylinder preparatory to the next cyclical movement of the jaws.

5. In a device of the class described, a pair of jaws joined to each other at a pivotal joint, a support for said jaws comprising a cylinder frame above said jaws, connections from said frame to said jaws at points displaced from said pivoted joint, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, said cam grooving having portions extending longitudinally of the cam cylinder for permitting reciprocating movement of said rod, other portions having both longitudinal and circumferential components for rotating said cam cylinder and thereby positioning it for the next cyclical operation of the device, and portions extending circumferentially for blocking the upward movement of said pin and thereby locking said rod against movement in an upward direction, the relief against the force of gravity operating on the device in the open position of the jaws adapted to move the cylinder frame relatively to the blocking pin to thereby rotate the sleeve from a circumferential portion within the field of the pin to a longitudinal portion, and the relief against the force of gravity operating on the device in the closed position of the jaws adapted to permit the rod to drop by gravity and thereby to rotate the sleeve to bring a circumferential portion of the groove within the field of operation of the pin, a stop element at the lower end of said rod, a movable member slidable on said rod below said cylinder frame and connected to said pivoted joint adapted to drop by gravity against said stop element to open said pair of jaws, said jaws being maintained open by the locking of said rod by said circumferential portion against upward movement as long as the rod and cylinder frame are moving in the same direction.

6. The device as set forth in claim 5 wherein the cam groove is provided with two equidistantly disposed upper extremities representing the location of the pin when the jaws are closed, and two equidistantly disposed lower sets of operating surfaces aternating with the upper extremities whereby two complete cycles of operation of the device execute one revolution of the cam cylinder.

7. The device as set forth in claim 5 wherein the cam groove at the upper portion of the cam cylinder is cut away and is provided with a camming surface below the adjacent camming surface to influence the proper positioning of the parts in response to the dropping of the rod despite faulty seating of the pin in the upper extremity of the cam groove occasioned by an incomplete closing of the jaws.

8. In a material handling device, a pair of jaws pivotally joined with each other, movable means connected with the pivotal joint of said jaws for selectively opening and closing said jaws, and rotary camming means cooperating with said movable means for cyclically controlling the movements of said movable means in response to the lifting and lowering movements of said device.

9. In a material handling device, a pair of bucket-shaped jaws pivotally joined with each other on opposite sides of said jaws, movable means connected with the pivotal joints of said jaws and composed of two relatively displaceable members, one of said members being in the form of vertically extending elements connected at their lower ends to said pivotal joints, and the other one of said members adapted to execute lifting and lowering movements, unitary supporting means for said movable means and said jaws, and a cam device carried by said supporting means and cooperating with said other member of said movable means for cyclically controlling the opening and closing movements of said pair of jaws in response to the lifting and lowering movements of said other member.

10. In a material handling device, a pair of bucket-shaped jaws joined with each other at coaxially arranged pivoted joints on opposite sides of said jaws, a support for said jaws comprising a cylinder frame above said jaws, pairs of bars extending from the lower part of said support to the opposite sides of said jaws at points displace

from said pivoted joints, a cam device in said cylinder frame, movable means extending through said cylinder frame and connected with said pivoted joints, said movable means composed of two relatively slidable members subjected to lifting and lowering movements by force and gravity effects, and said cam device adapted to control the movements of one of said members and consequently the opening and closing movements of said pair of jaws.

11. In a material handling device, a pair of bucket-shaped jaws joined with each other at coaxially arranged pivoted joints on opposite sides of said jaws, a support for said jaws comprising a cylinder frame above said jaws, pairs of bars extending from the lower part of said support to the opposite sides of said jaws at points displaced from said pivoted joints, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a tubular rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, the upper end of said rod adapted for reciprocation thereof while a stop element is provided at the lower end thereof, and a movable member composed of a cross-piece slidable on said rod below said cylinder frame and plates extending below said cross-piece and connected to said pivoted joints, said member adapted to drop by gravity to abut said cross-piece against said stop element to open said pair of jaws.

12. In a material handling device, a pair of bucket-shaped jaws joined with each other at coaxially arranged pivoted joints on opposite sides of said jaws, a support for said jaws comprising a cylinder frame above said jaws, pairs of bars extending from the lower part of said support to the opopsite sides of said jaws, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a tubular rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, said cam grooving having portions extending longitudinally of the cam cylinder for permitting reciprocating movement of said rod, other portions having both longitudinal and circumferential components for rotating said cam cylinder and thereby positioning it for the next cyclical operation of the device, and a portion extending circumferentially for locking said rod against movement, the upper end of said rod adapted for reciprocation thereof while a stop element is provided at the lower end thereof, and a movable member composed of a cross-piece slidable on said rod below said cylinder frame and plates extending below said cross-piece and connected to said pivoted joints, said member adapted to drop by gravity to abut said cross-piece against said stop element to open said pair of jaws, the relief against the force of gravity operating on the device in both the open and closed positions of the jaws adapted to execute a rotation of the cam cylinder preparatory to the next cyclical movement of the jaws.

13. In a material handling device, a pair of bucket-shaped jaws joined with each other at coaxially arranged pivoted points on opposite sides of said jaws, a support for said jaws comprising a cylinder frame above said jaws, pairs of bars extending from the lower part of said support to the opposite sides of said jaws at points displaced from said pivoted joints, a rotary cam cylinder within said cylinder frame provided with cam grooving on the interior surface thereof, a tubular rod mounted for reciprocating movement within said cam cylinder and cylinder frame and provided with a lateral pin for engaging the cam grooving of said cam cylinder, said cam grooving having portions extending longitudinally of the cam cylinder for permitting reciprocating movement of said rod, other portions having both longitudinal and circumferential components for rotating said cam cylinder and thereby positioning it for the next cyclical operation of the device, and portions extending circumferentially for blocking the upward movement of said pin and thereby locking said rod against movement in an upward direction, the upper end of said rod adapted for reciprocation thereof while a stop element is provided at the lower end thereof, a movable member composed of a cross-piece slidable in said rod below said frame and plates extending below said cross-piece and connected at their lower ends to said pivoted joints, said member adapted to drop by gravity to abut said cross-piece against said stop element to open said pair of jaws, the relief against the force of gravity operating on the device in the open position of the jaws adapted to move the cylinder frame relatively to the blocking pin to thereby rotate the sleeve from a circumferential portion within the field of the pin to a longitudinal portion, and the relief against the force of gravity operating on the device in the closed position of the jaws adapted to permit the rod to drop by gravity preparatory to do the dropping of said cross-piece against said stop element to open said jaws and to position the cam cylinder for locking said rod against upward movement as long as the rod and the cylinder frame are moving in the same direction.

14. The device as set forth in claim 13, wherein the cam groove is provided with two equidistantly disposed upper extremities representing the location of the pin when the jaws are closed, and two equidistantly disposed lower sets of operating surfaces alternating with the upper extremities whereby the alternate movements of the device effect a successive rotation of the cam cylinder through 90°.

15. The device as set forth in claim 13 wherein the cam groove at the upper portion of the cam cylinder is cut away and is provided with a camming surface below the adjacent camming surface to influence the proper positioning of the parts in response to the dropping of the rod despite faulty seating of the pin in the upper extremity of the cam groove occasioned by an incomplete closing of the bucket-shaped jaws as a result of material caught therebetween.

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