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3,204,550 CAN CRUSHER

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This invention relates to a device for use in effectively crushing and compacting articles such as cans, cartons and the like, and more particularly to a device which is automatically operable through one cycle of operation to progressively crush, compact, and discharge an article such as tin cans or the like.

An object of this invention is to provide a device, of simple and inexpensive construction, for use in crushing and compacting cans, cartons and the like and including a ram mounted for movement along a guideway, and drive means operable in response to an initial energization for automatically reciprocating the ram through a complete cycle of operation thereby obviating the need of close and constant operational control by an operator.

A more specific object of this invention is to provide a novel and improved device for use in crushing and compacting cans, cartons and the like, including a ram mounted for movement along a guideway through a forward crushing stroke and return thereof, and reversible drive means having a revolvable threaded drive connection with the ram for driving the same through a forward stroke to very effectively crush and compact articles such as cans, cartons and the like, and wherein the drive means is automatically reversible in response to a decrease in the angular speed of the drive connection to thereby return the ram to its original starting position.

A further object of this invention is to provide a can crushing device of the class described and wherein a discharge opening is provided adjacent the area where the crushing occurs to thereby allow the crushed article to be automatically removed from the device during initial movement of the ram in the return direction.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like character references refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a top plan view of my invention with certain concealed parts thereof illustrated by dotted line configuration;

FIG. 2 is a side elevational view thereof;

FIG. 3 is an end elevational view thereof; and

FIG. 4 is a circuit diagram of the electrical circuitry employed in my invention.

Referring now to the drawings it will be seen that one embodiment of my novel crushing and compacting device, designated generally by the reference numeral 10, is there-shown. This crushing and compacting device 10 includes an elongate, open-top housing or support 11, preferably constructed of a suitable rigid metallic material, such as sheet steel or the like. This support 11 includes side walls 12 each comprised of an upper portion 13 and a lower portion 14. It will be noted that the upper portions 13 of the side walls 12 are disposed in substantially parallel relation with respect to each other and that the lower portions 14 converge downwardly to meet in a longitudinal center line plane. It will therefore be seen that the inner surface of the side walls 12 actually defines an elongate channel-shaped guideway 15. It will also be noted that the upper portion 13 of each of the side walls is provided with a small intumed generally horizontal flange 16 as best seen in FIGS. 1 and 3.

The support 11 is also provided with a rear wall or

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plate 17 which as best seen in FIG. 3 is of substantially rectangular configuration and which is rigidly affixed to the rear ends of the side walls 12. The support 11 is also provided with a front wall 18 which is also of substantially rectangular configuration and which is rigidly affixed to the forward ends of the side walls 12. This front wall 18 actually defines a pressure plate having an inner surface or face 19 against which articles such as tin cans, cartons and the like may be crushed and compacted. Referring again to FIGS. 1 and 2 it will be seen that the lower converging portions 14 of the side walls 12 are recessed at their forwardmost ends so that the upper portions 13 extend slightly beyond the lower portions. It will also be noted that the front wall 18 is actually connected to the upper portions 13 of the side walls 12 and cooperates with the side walls so that a downwardly facing opening or discharge aperture 20 is defined at the forward end of the support 11. It will be seen that since the front wall of pressure plate 18 actually bounds one edge of the opening 20, an article which is crushed against this pressure plate, when released, will fall by action of gravity through the opening 20.

Means are provided for crushing the articles against the pressure plate 18 and to this end a ram structure 21 is provided for sliding movement along the guideway 15. The ram structure 21 while being somewhat smaller in length than the support 11 is similarly shaped and contoured to the support and includes side walls 22 each including an upper portion 23 and a lower portion 24. It will be seen that the upper portions 23 of the side walls are disposed in substantially parallel relation with respect to each other and are also disposed in bearing engagement with the upper portions 13 of the side walls 12. Similarly, the lower portions 24 of the ram structure side walls converge towards each other and bear against the inner surfaces of the side wall portions 14. It is to be further noted, however, that the lower inner edges of the lower side wall portions 24 are interconnected by a substantially flat horizontal interconnecting portion 25 which, as best seen in FIG. 3, is spaced above the juncture line of the side walls 12. The respective upper portions 23 of the side walls 22 are provided with intumed flanges 26 which engage and underlie the flanges 16 of the side walls 12. The flanges 16 cooperate with the flanges 26 to prevent accidental vertical displacement or disengagement of the ram structure 21 from the guideway 15.

The ram structure 21 also includes a rear wall or plate 27 and a front wall or plate 28 integrally formed with the side walls 22. This front wall or plate 28 is provided with a front face 28a which engages the article to be crushed to move the same against the face 19 of the pressure plate 18. Thus in the crushing operation it will be seen that during the forward stroke of the ram structure 21, the article to be crushed will be progressively engaged and moved forwardly by the face 28a against the face 19 of the pressure plate 18 until the article, such as a tin can or the like is compacted to a structure of relatively small compass. Thereafter, during the initial movement of the ram structure 21 in the return direction, the crushed article will be released and will fall through the discharge aperture 20 by action of gravity.

Means are provided for automatically reciprocating the ram structure 21 through one complete cycle of operation in response to a single manipulation by the operator. This means for reciprocating or driving the ram structure 21 includes an elongate sleeve member 29 which is centrally located and extends between and is rigidly connected with the front and rear plates 28 and 27, respectively. The rear end portion of the sleeve 29 has an internally threaded annular member or nut 30 affixed in concentric relation therein.

An elongate threaded member or shaft 31 threadedly

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engages the nut 30 and projects into the sleeve 29 as best seen in FIGS. 1 and 2. The helical threads of the threaded member 31 are continuous and extend in a right handed direction so that when the threaded member is revolved in a counterclockwise direction as viewed in FIG. 3, the ram assembly will be moved in the direction of the forward stroke.

The rear end of the threaded shaft 31 is connected in coaxial relation to a driven shaft 32 by means of a coupling element 33. This coupling element 33 is preferably internally threaded and is threadedly engaged by the respective ends of the shafts 31 and 32, these shafts being locked in place by suitable locking pins 34 as best seen in FIG. 1. The shaft 32 is revolvably supported in a pair of tapered bearings mounted in opposed relation to each other in a bearing housing 35, the latter being supported by the rear wall of plate 17 of the support 11.

Referring again to FIGS. 1 and 2 it will be seen that the driven shaft 32 projects beyond the bearing housing 35. A relatively large driven pulley 36 having a hub 37 is mounted on the ram portion of the shaft 32 for revolving movement relative thereto. It will be seen that the rear end portion of the shaft 32 projects beyond the rear end of the pulley hub 37 and that the shaft 32 has a relatively small pin 38 affixed thereto and extending radially outwardly therefrom. The rear terminal edge of the pulley hub 37 has a small pin 39 affixed thereto and projecting axially outwardly therefrom in obstructing relation with respect to the pin 38. Thus it will be seen that if the pulley 36 is revolved in a counter-clockwise direction as viewed in FIG. 3, the pulley will move substantially a complete revolution relative to the shaft 32 and until the pin 38 strikes the pin 39. It will therefore be seen that a lost motion effect is produced between the driven pulley 36 and the driven shaft 32 regardless of the direction of movement of the pulley.

Power means are also provided for driving the pulley 36 and the shaft 32 and this power means includes an electric motor 40 which is preferably of the Westinghouse model FHT or the like. It will be seen that motor 40 is provided with a mounting plate 41 which is secured to the web portion of a mounting bracket 42, the latter having legs 43 extending upwardly and rigidly connected to the respective lower portions 14 of the side walls 12. Electric motor 40 is provided with a drive shaft 44 which has a relatively small drive pulley 45 affixed thereto for rotation therewith. The drive connection between the pulleys 36 and 45 comprises an endless V-type drive belt 46 which is trained around these pulleys and it will be seen that the drive belt, driven pulley 36 and drive pulley 45 actually constitutes a speed reducing drive connection.

The electric motor 40 is of the reversible type and when initially energized, will drive the ram structure 21 from its retracted initial position through a forward stroke whereby the article is crushed, and thereafter automatically return the ram structure to its original retracted position. Referring now to FIG. 4 it will be seen that the electrical circuitry for the motor 40 is diagrammatically illustrated. In the preferred embodiment the electric motor 40 is connected to a suitable source of A.C. current by main input lines 47 and 48 respectively. This motor circuit is provided with a start switch 49 which is preferably of the push button type and which requires momentary contact to energize the motor 40 for operation through one complete cycle of operation including a forward stroke and return of the ram structure 21. It will be seen that when the start switch 49 is depressed, switches 50, 51 and 52 are moved from the full line position to the dotted line position whereby contacts 54 and 56 connect the start winding 60 in a forward direction. It will be noted that when switch 52 is moved to the dotted line position to engage contact 59, the circuit for the start winding 60 as well as the run winding 61 is closed. The motor is then revolving in a direction to shift the ram structure 21 towards the pressure plate 18.

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As the motor moves in the forward direction, the centrifugal switch 62 which is normally closed is opened whereby the circuit to the start winding is opened. Movement of the ram structure 21 in the forward direction also causes limit switch 63 to close and release of the start switch 49 also shifts the switch 52 back to its full line position. It is further pointed out that release of the start switch 49 also causes the switches 50 and 51 to return to their original position and to respectively engage contacts 53 and 55 associated therewith. This arrangement connects the circuit to the start winding 60 for operation in the reverse or return direction. It is again pointed out that when switches 50, 51 and 52 are returned to their original normal positions, the centrifugal switch 62 is opened so that the circuit to this start winding is in the opened condition.

As the ram structure 21 progressively crushes and compacts an article such as a tin can or the like, the resistance encountered during this compressing action results in a drop in the speed of the motor 40 which in turn causes the centrifugal switch 62 to close. When the centrifugal switch 62 is closed, the start winding is phased in thereby reversing the direction of operation of the motor 40 and this centrifugal switch will be closed until the speed of the motor in the reverse direction is such as to throw the switch to the open condition. When this occurs, the run winding will continue to be energized so that the ram structure 21 is moved in a return direction. The ram will be moved in the reverse direction until the cam 64 engages the limit switch 63 to open the same and thereby open the circuit to the run winding 61. Although in the embodiment shown, no cover or closure member for the housing is shown it is pointed out that this housing may be provided with a suitable closure member to thereby protect an operator during the operation of the device. In the event that the closure is provided, the electric circuit for the motor 40 may also include an emergency switch 65 which will automatically open in the event that such a closure member is opened. With this arrangement the motor 40 would be automatically de-energized if the closure member opened during operation of the device.

During operation of the article crushing and compacting device 10, the ram structure 21 will be initially disposed at the beginning of the cycle in the positions illustrated in FIGS. 1 and 2. The article to be crushed, designated by the reference character A will be positioned upon the guideway 15 forwardly of the ram structure. The start switch 49 will be momentarily depressed whereby the circuit to the motor will be closed and more specifically both the start and run windings will be phased in. When the start winding 60 is energized, the shaft 44 will be revolved in a counter-clockwise direction as viewed in FIG. 3 and the load on the motor will be relatively small since the pulley 36 will move relative to the shaft 32. When the pulley 36 and the shaft 32 are revolved in unison, the ram structure will be shifted longitudinally in a forward direction along the guideway 15 whereby the cam 64 will be moved out of engaging relation with the limit switch 63 thereby permitting this normally closed limit switch to close. It is further pointed out that when the start switch 49 is released, the contact 59 will be shorted out whereby the current will pass through the closed limit switch 63. The start winding 60 will also be phased out during initial movement of the shaft 44 since the centrifugal switch 62 will be opened as the motor shaft is rotated. The lost motion of action between the pulleys 36 and the driven shaft 32 allows the motor 40 to reach its operating speed before the operating load is exerted on the motor. It is also pointed out that the direction the motor shaft will be driven is determined by the direction of drive produced by the start winding.

As the shaft 44 and the shaft 32 are revolved in the counter-clockwise direction as viewed in FIG. 3, the

threaded shaft 31 will be similarly rotated in a counter-clockwise direction at a predetermined speed thereby causing the ram structure 21 acting through the nut 30 to be moved longitudinally through a forward stroke. The article A supported upon the guideway 15 will be engaged by the face 28a of the front plate 28 and will be moved forwardly until the article engages the face 19 of the pressure plate 18. The ram will continue in its forward movement to cause the article to be crushed and compacted into a structure of relatively small compass and which will be substantially smaller than the opening 20. During the crushing of the article A between the faces 29 and 19, the load on the motor 40 will be progressively increased whereby the angular speeds of the shafts 31, 32 and 44 will be progressively decreased. This crushing action of the ram will continue until the article to be crushed, such as a tin can or the like, is crushed and compacted into the smallest space possible. Thereafter the ram structure 21 will be prevented from travelling in the forward direction and this stops the revolving movement of shafts 31, and 32 and motor shaft 44.

When the motor shaft 44 ceases to revolve, the centrifugal switch 62 is urged to the closed condition thereby phasing in the start winding 60 for operation in the opposite direction. The run winding 61 is subordinate to the start winding 60 and the start winding will cause the shaft 44 to be revolved in the opposite or clockwise direction as viewed in FIG. 3. The shaft 44 acting through drive pulley 45 and the belt 46 will cause the pulley 36 to be revolved in the clockwise or reverse direction as viewed in FIG. 3 so that the pulley will revolve relative to the driven shaft 32 until the pin 38 is moved through substantially a complete revolution and strikes the pin 39 with a relatively sharp blow. The start winding will thereafter be phased out as the centrifugal switch 62 is opened while the run winding 61 will continue to revolve the shaft in the clockwise direction or reverse direction. The ram structure will continue in the reverse direction until the limit switch cam 64 strikes the switch 63 to open the same and thereby open the circuit to the motor 40.

As the ram structure 21 is moved in the return direction, the crushed article will be released from its clamped relation between the faces 19 and 28a respectively thereby allowing the article to fall through the discharge aperture 20.

It will be seen that in this crushing process, the article A such as a tin can, cardboard carton or any similar article of rather large volume will be supported upon the guideway 15 during the initial crushing operation. The ram structure will engage and move the article A while in the supported position against the pressure plate 18 and will continue to operate through its forward stroke until the ram structure 21 cannot move longitudinally of the guideway any additional distance. Thereafter the process includes automatic return of the ram structure in a direction away from the pressure plate while simultaneously releasing the crushed article which has been crushed to its smallest compass. The process further contemplates simultaneous de-energization of the motor means upon arrival of the ram structure to its original position. Therefore this crushing operation during one complete cycle includes not only guided support of the article to be crushed but also the application of continuous progressive force through the forward stroke, release of the crushed article, and automatic return of the force applying crushing medium.

Thus it will be seen that we have provided a novel crushing and compacting device especially adaptable for crushing tin cans, cardboard cartons and the like. It will be noted that our crushing device includes a ram structure mounted for guided reciprocating movement towards and away from a pressure plate thereby permitting crushing of a rigid article such as a tin can and automatic

discharge of the crushed article as the ram structure is returned to its original position.

It will further be noted that our novel crushing device includes drive means operable for shifting the ram structure through one cycle of operation wherein the ram structure is first moved towards the pressure plate to crush an article thereagainst and is automatically returned to its original position when forward movement is prevented.

Thus it will be seen that we have provided a novel and improved crushing device which is not only of simple and inexpensive construction but one which functions in a more efficient manner than any heretofore known comparable device.

It will of course be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of our invention.

What is claimed is:

1. A device for crushing and compacting rigid articles such as cans, cartons and the like, said device comprising downwardly converging wall member defining an elongate channel-shaped guideway, a rigid pressure plate fixedly connected with one end of said guideway and presenting a substantially flat inner face, said guideway having a downwardly-facing opening in one end portion thereof, said pressure plate bounding one side of the opening, a ram structure including a lower portion corresponding generally in shape to said guideway and mounted for longitudinal sliding reciprocating movement along said guideway towards said pressure plate and return therefrom, said ram structure presenting a substantially flat face disposed in substantially opposed relation with respect to the flat inner face of said pressure plate, an elongate sleeve member fixedly mounted on said ram structure, a threaded element in said sleeve member, an elongate revoluble threaded member threadedly engaging said threaded element and projecting into said sleeve member and being revoluble relative thereto reciprocate the ram structure along the guideway, and reversible drive means being automatically operable through one cycle of operation to revolve said threaded member in a direction to shift the ram structure towards the pressure plate whereby said ram structure will progressively crush and compact articles such as cans, cartons and the like against said pressure plate, said drive means including a control mechanism operable in response to reduction of angular speed of the threaded member to automatically reverse the direction of drive of said drive means and thereby reverse the direction of rotation of the threaded member and to thereby automatically shift the ram structure in a return direction whereby the crushed article will be released to fall through the opening in the guideway.
2. A device for crushing and compacting rigid articles such as cans, cartons and the like, said device comprising an elongate channel-shaped guideway, a rigid pressure plate fixedly connected with one end of said guideway and presenting a substantially flat inner face, said guideway having a downwardly-facing opening in one end portion thereof, said pressure plate forming one side of the opening, a ram structure mounted for longitudinal reciprocating movement along said guideway towards said pressure plate and return therefrom, and presenting a substantially flat face disposed in substantially opposed relation with respect to the flat inner face of said pressure plate,

an elongate revoluble threaded member threadedly engaging said ram structure and being revoluble relative thereto to reciprocate the ram structure along the guideway,
 reversible rotary drive means for revolving said threaded member,
 drive connections including inter-engaging drive transmitting elements one of which is connected with said threaded member for revolving movement therewith, said other drive transmitting element being connected with said drive means respectively for transferring rotary drive from said drive means to said threaded member, said drive transmitting elements being disengageable during initial rotary movement of said rotary drive means in either direction whereby drive to said threaded member is rendered ineffective during initial rotary movement of said drive means, said rotary drive means being automatically operable through one cycle of operation to revolve said threaded member in a direction to shift the ram structure towards the pressure plate whereby said ram structure will progressively crush and compact articles such as cans, cartons and the like against the pressure plate,
 and said drive means including a control mechanism operable in response to a reduction in the angular speed of the threaded member to automatically reverse the direction of drive of said rotary drive means and thereby reverse the drive of the threaded member and to thereby automatically shift the ram structure in a return direction whereby the crushed article will be released to fall through the opening in the guideway.

3. A device for crushing and compacting rigid articles such as cans, cartons and the like, said device comprising an elongate channel-shaped guideway,
 a rigid pressure plate fixedly connected with one end of said guideway and presenting a substantially flat inner face,
 said guideway having a downwardly-facing opening in one end portion thereof, said pressure plate bounding one side of the opening,
 a ram structure mounted for longitudinal reciprocating movement along said guideway towards said pressure plate and for return therefrom, and presenting a substantially flat face disposed in substantially opposed relation with respect to the flat inner face of said pressure plate,
 elongate revoluble threaded shaft means threadedly engaging said ram structure and being revoluble relative thereto to reciprocate the ram structure along the guideway,
 reversible rotary power means having drive connections with said threaded shaft means for revolving the same,
 said drive connections including a pulley mounted on said shaft means for rotation therewith and rotation relative thereto,
 a pair of interengaging drive elements mounted on said pulley and shaft means respectively for transferring rotary motion from said pulley to said shaft means, said drive elements being disengageable during initial movement of said pulley whereby drive to said shaft means during initial energization of said power means is rendered ineffective,
 said power means being automatically operable through one cycle of operation to revolve said shaft means in a direction to shift the ram structure towards the pressure plate whereby said ram structure will progressively crush and compact articles such as cans, cartons, and the like against the pressure plate,

said power means including a control mechanism operable in response to a reduction in the speed of rotation of the shaft means to automatically reverse the drive of said rotary power means and thereby reverse the direction of rotation of the shaft means and to thereby automatically shift the ram structure in a return direction whereby the crushed article will be released to fall through the opening in the guideway.

4. A device for crushing and compacting rigid articles such as cans, cartons and the like, said device comprising an elongate channel-shaped guideway,
 a rigid pressure plate fixedly connected with one end of said guideway and presenting a substantially flat inner face,
 said guideway having a downwardly-facing opening in one end portion thereof, said pressure plate forming one side of the opening,
 a ram structure mounted for longitudinal reciprocating movement along said guideway towards said pressure plate and return therefrom, and presenting a substantially flat face disposed in substantially opposed relation with respect to the flat inner face of said pressure plate,
 elongate revoluble threaded shaft means threadedly engaging said ram structure and being revoluble relative thereto to reciprocate the ram structure along the guideway,
 reversible electric motor means having drive connections with said threaded shaft means for revolving the same,
 said drive connections including a pulley mounted on said shaft means for rotation therewith and rotation relative thereto,
 a pair of inter-engaging drive elements mounted on said pulley means and shaft means respectively transferring rotary drive from said pulley to said shaft means, said drive elements being disengageable during initial movement of said pulley whereby said drive from said motor means to said shaft means is rendered ineffective during initial energization of the motor means,
 said drive means being operable through one cycle of operation to first revolve said shaft means in a direction to shift the ram towards the pressure plate to cause progressive crushing and compacting of articles such as cans, cartons and the like against said pressure plate,
 and centrifugal switch means being responsive to a reduction of the angular speed of the shaft means to automatically reverse the direction of rotation of the motor means and to thereby automatically shift the ram structure in a return direction whereby the crushed articles will be released to fall through the opening in the guideway.

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