Oct. 1, 1963 N. A. KENDZIA 3,105,435

APPARATUS FOR COMPACTING REFUSE

Filed Sept. 11, 1961 2 Sheets-Sheet 1

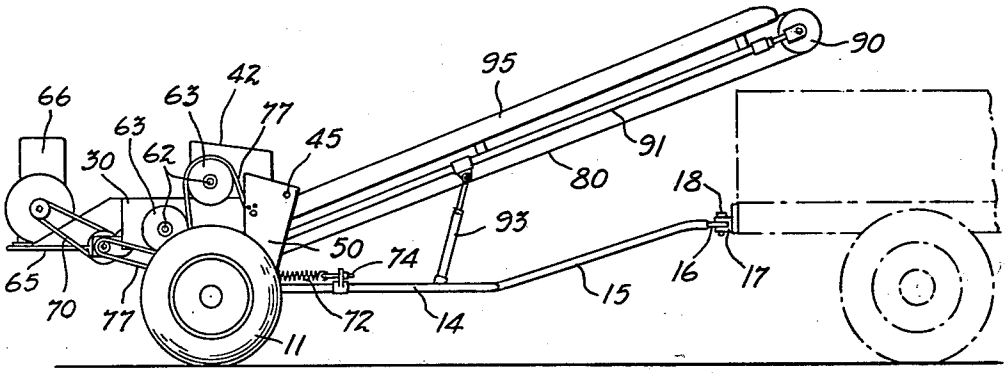


Fig. 1

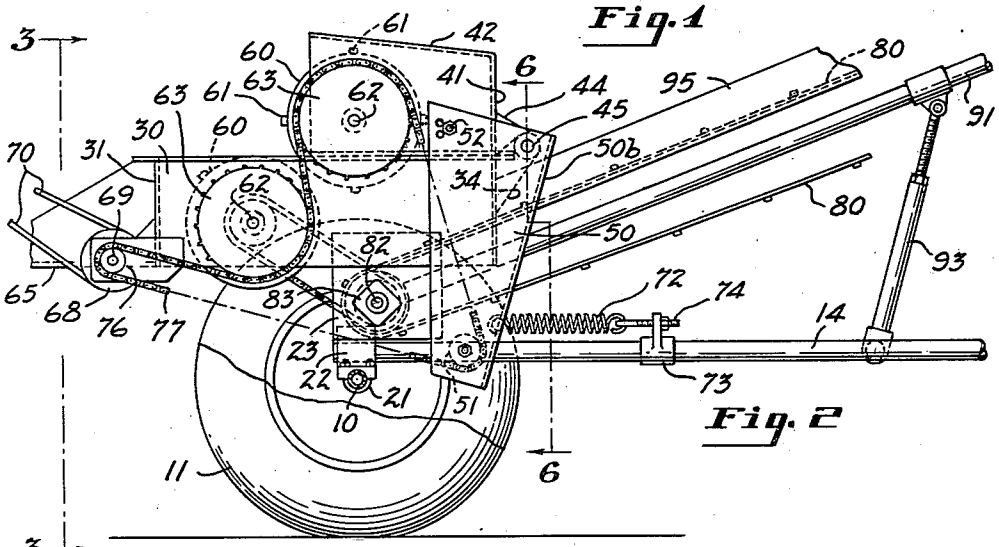


Fig. 2

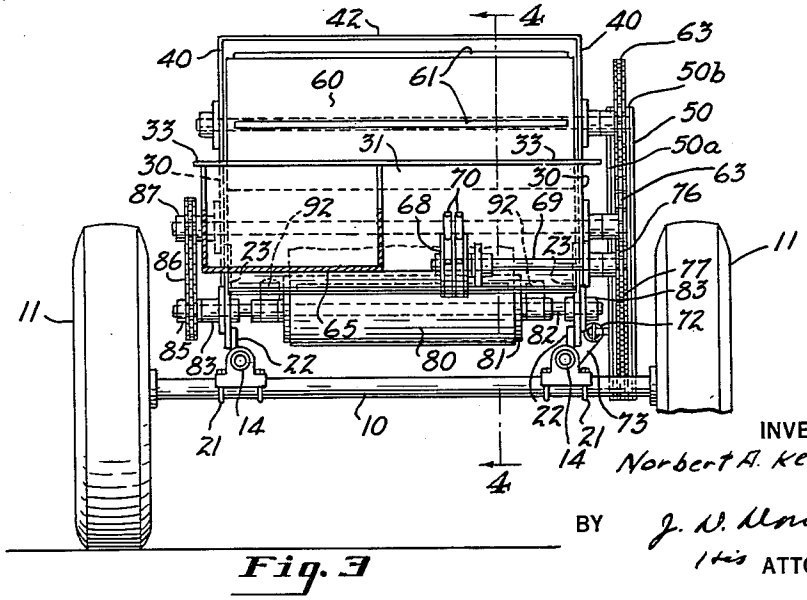


Fig. 3

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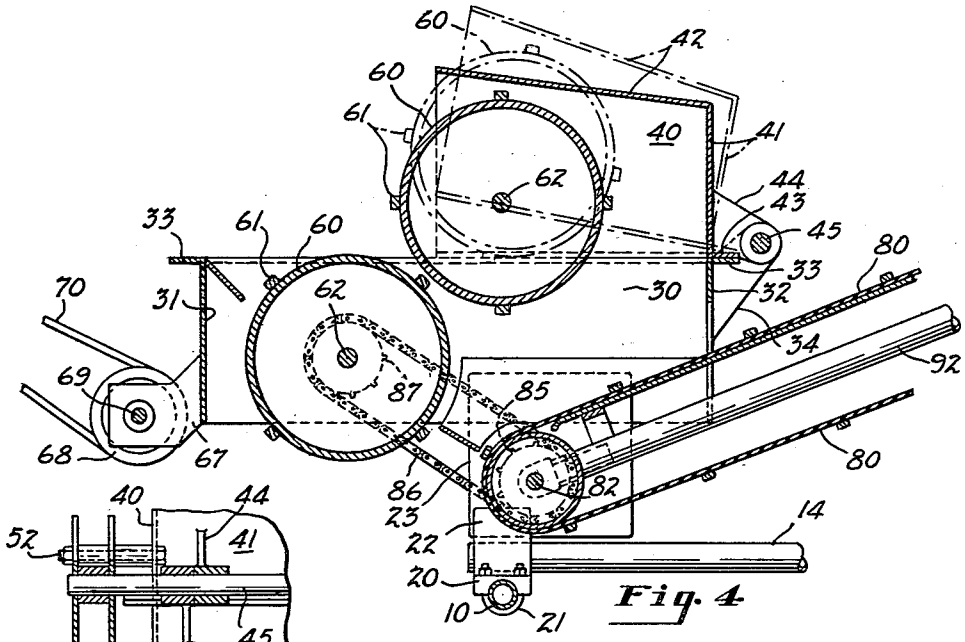


Fig. 4

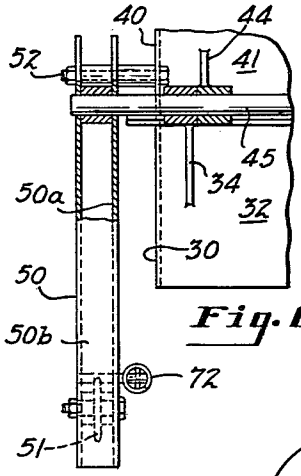


Fig. 6

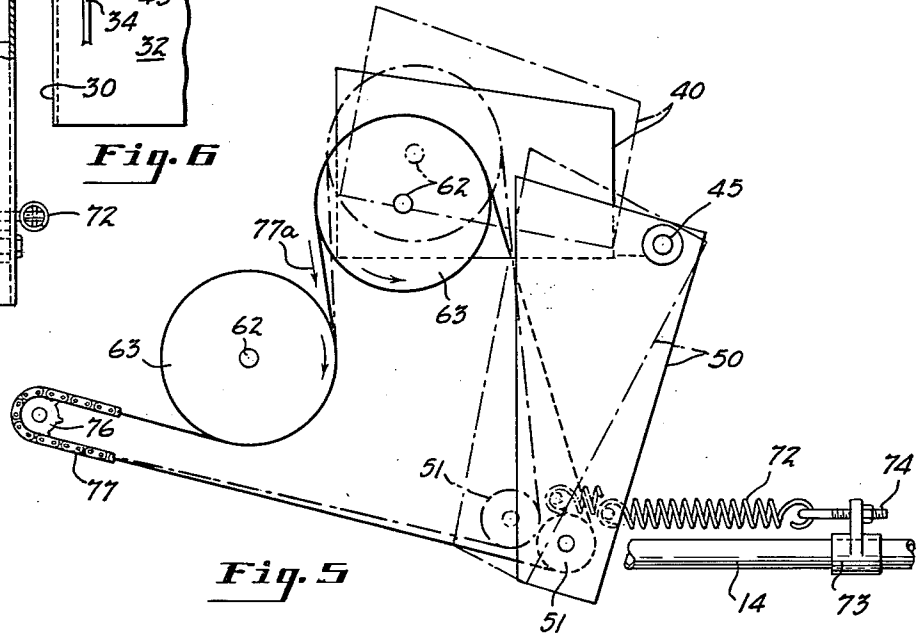


Fig. 5

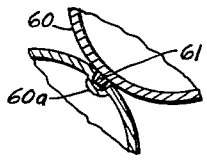


Fig. 4a

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APPARATUS FOR COMPACTING REFUSE

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This invention relates to apparatus for disposing of refuse and more particularly to an apparatus for crushing collapsible articles such as tin cans, bottles etc. in order that the space they take on a refuse truck and in the place of disposal of the refuse is reduced to a minimum.

As is well known, the disposal of refuse material such as tin cans, bottles etc. is an extremely expensive procedure. This is brought about by the fact that the majority of disposable trash comprises empty bottles, boxes and tin cans.

Heretofore, as a practical matter, the householder merely throws the trash into a large container and the refuse collector merely empties the container into the truck which carts it away. Since the refuse disposal site is usually located in one particular place for any municipality, it frequently happens that most of the trips are several miles, particularly when the disposal place is on one side of town and the collection is taking place on the other. Therefore, it can be seen if the number of trips can be reduced and the collection truck can stay in one place longer before it is emptied, the collection of the refuse takes place much faster and with a vast savings in money.

The problem of disposing of refuse may be better understood if it is borne in mind that refuse is the kind of material that utilizes a large space. This can be better appreciated in considering an ordinary 6 oz. beer can. A beer can which measures 2½" in diameter by 4¾" long, takes up over 23 cubic inches. If that same can is crushed flat, the amount of space it takes up is about 1/10 that amount. When it is realized that cans placed in a truck helter skelter, take up even more room, then it can be realized that if the hollow articles can be reduced to their smallest volume, a truck can conservatively hold more than ten times the amount that it would by the normal collection process. This simply means that if the volume of the refuse can be reduced to 1/10 for each ten trips to the refuse dump previously taken, the truck will now only need to make one. This results in an enormous saving in manpower, fuel consumption and normal depreciation of the equipment. Still another factor, that cannot be ignored, is the fact that, at the place of disposal, ten times the amount of refuse may be deposited than was heretofore possible.

Briefly, the present invention contemplates a device that may be towed behind the usual refuse truck. The refuse is dumped into a hopper and the material is compacted or broken and conveyed up and into the truck. It will thus be seen that the device not only reduces the volume of the load, but it also constitutes a loader which eliminates the need for an expensive and especially designed truck for handling the refuse. In addition it reduces the number of men needed on the truck. All of these are savings which any community can use to their advantage.

More specifically the device contemplates a pair of power driven crusher rollers or drums into the throat of which the refuse is fed. In its passage between the drums the bottles, boxes and tin cans are crushed or broken and compacted. At the exit to the rollers the compacted and broken refuse is discharged onto a conveyor by which it is conveyed continuously to the truck.

Of particular interest is the fact that the design is

such that articles that cannot be compacted, such as small solid articles, do not jam the compacting rollers since these rollers are arranged to move apart upon the passage of a non-compactable article. Since very large articles are not usually placed in the householder collection can but laid alongside it, these extremely large articles, which are in the minority, are merely thrown into the truck, thus by-passing the crusher.

Another feature of the device is in the arrangement of the power drive, which is such that the driving forces tend to implement the crushing action.

Still other advantages of the invention, as well as the invention itself, will become more apparent from the following description of an embodiment thereof which is illustrated by the accompanying drawings and forms a part of this specification.

In the drawings:

FIG. 1 is a side elevational view, on a reduced scale, of the apparatus of my invention and illustrating the manner of its mounting at the rear of an ordinary truck;

FIG. 2 is an enlarged elevational view of the major portion of the compactor, with certain parts omitted to better disclose the remaining parts;

FIG. 3 is a view taken from the line 3—3 of FIG. 2;

FIG. 4 is a section taken from the line 4—4 of FIG. 3 and illustrating in dashed lines an alternate position taken by certain of the parts;

FIG. 4*a* is a fragmentary section illustrating a different formation of drum surfaces;

FIG. 5 is a diagrammatic view illustrating the operation of the drive means; and

FIG. 6 is a section taken from the line 6—6 of FIG. 2.

Referring now to the drawings, throughout which like parts are designated by like reference characters, and particularly to FIGS. 1 to 3 inclusive, I provide a chassis which includes an axle 10 upon the ends of which a pair of pneumatic tired wheels 11 are journalled. Although the main load of the device is unsprung, it will be apparent that springs could be used if desired, but are omitted from the drawings in the interest of clarification of the real invention.

The chassis frame comprises a pair of tubes 14 which converge toward each other and merge into a single draw bar 15 provided with an eye 16 arranged to be secured in a clevis 17 on the back of the truck by a draw pin 18.

The tubes are secured to the axle 10 by brackets 20 and U-bolts 21. Each of the brackets has an upstanding plate 22 which supports a rectangular bearing plate 23.

The bearing plates in turn support a generally box-like base frame which is comprised of rectangular side plates 30 and a forward plate 31 and a rear plate 32. The frame is provided with a peripheral flange 33 on its upper edge. This flange may extend outwardly or inwardly. Both the bottom and the top of the frame are open. At the rear of the frame there is provided a pair of spaced aligned hinge brackets 34 which extend upwardly and outwardly beyond the top and rear of the frame.

A second movable box frame is hingedly supported above the base frame. It comprises side walls 40, a back wall 41 and a top wall 42. The front and bottom are open and the three side walls are provided with a peripheral flange 43 at the lower edge. The flanges on the movable frame are arranged to register with and be supported by the flanges on the lower frame. The top frame is likewise provided with hinge brackets 44 which extend outward and downward alongside the brackets 34 and a hinge pin 45 extends through all four of the brackets and thus the upper frame is hingedly connected to the lower frame. The hinge pin preferably spans the space between the hinge pin brackets 34 and 44, which brackets are spaced apart on the back side of the frames

and fairly close to their sides. It also extends out-board on the near side, as viewed in FIG. 1, through a chain guard and idler sprocket support 50.

As best shown in FIGS. 2 and 3, the chain guard and idler sprocket support 50 is comprised of a pair of spaced trapezoidal shaped side walls 50*a* connected together by a back wall 50*b*. The lower end of the chain guard has an idler sprocket 51 rotatably journalled between its sides. The support 50 is secured to the upper frame member 40 by adjustment means 52 in such a manner that it is fixed thereto and moves with it as a unitary element. Thus, although the upper frame and chain guard are adjusted relative to each other once adjusted, if the upper frame moves upward, as shown in the dashed lines in FIGS. 4 and 5, the lower end of the support 50 moves toward the front of the machine.

A pair of crushing drums or rollers are provided, and as can best be seen from FIG. 4, one is carried by the lower frame and the other by the upper frame. They may be identical and are each made of heavy steel in the form of a hollow cylinder 60 having outwardly extending longitudinal ribs 61. The number of ribs may vary, four being shown in the drawings. They should be of such a height that objects fed to the drums will be caught thereby and forced between the drums. On the other hand, the height should be the minimum possible in order that the other materials will be crushed the maximum amount. By spacing the ribs on one drum between those of the other drum, as shown in FIG. 4, the maximum height of ribs, with the minimum spacing between the drums, may be obtained.

It is contemplated that where the rib 61 on one drum is toward the surface of the other drum, the surface of that drum opposite the rib on the other drum could be provided with a longitudinal indentation 60*a*. This would allow higher ribs to be used and enable the drums to be placed closer together, thus compacting the material the maximum possible amount.

The drums are fixed to and supported on axial shafts 62 which are rotatably journalled in the side walls of the frames. On the near side, as shown in the figures, the shafts project outboard and have chain sprockets 63 carried thereby.

At the front of the lower frame member 30 there is provided a forwardly extending platform 65, which supports an engine 66. On the front wall 31 of the lower frame a pair of brackets 67 support a sheave 68 on a countershaft 69, which is connected to the engine by a belt 70.

Means may be provided for implementing the weight of the upper drum such as an adjustable drum spring 72 which is connected between the lower part of the chain guard 50 and a bracket 73 by an eye bolt 74. Thus the pressure of the upper roller or drum toward the lower one may be adjusted.

The countershaft 69 extends outward to the right, as viewed in FIGS. 3 and 2, and carries a drive sprocket 76. The sprockets 76, 63 and 51 are all aligned with each other and an endless drive chain 77 passes around the sprocket 76, under the lower sprocket 63, over the upper sprocket 63, around the idler sprocket 51, and back to the drive sprocket 76. By this means the two drums are driven in opposite directions, the lower one clockwise and the upper one counter-clockwise.

The fastening means 52, for the chain guard may comprise a bolt which extends through apertures in the chain guard and the side 40 of the frame. The apertures on the side and chain guard are formed by drilling holes in the chain guard and the frame simultaneously. Each pair of holes is drilled for a separate position of the chain guard relative to the frame. The chain tightening means may be moved by positioning the bolt in different holes in the frame to change the position of the idler sprocket relative to the chain, and thus to enable tightening of the chain.

In operation, the machine is started by starting the engine and the drive chain causes the crushing drums to be operated in opposite directions. The refuse is fed to the hopper, which in turn directs it into the entrance throat between the drums where the ribs pick it up and force it between the drums where it is crushed. Should a solid object, such as a stone, be encountered, the upper frame pivots about the pivot pin 45 and allows it to rise against the weight of the upper frame and the pressure exerted by the spring 72. This action is illustrated by the dashed lines in FIG. 4 and similarly diagrammatically in FIG. 5.

It will be noticed that when the upper sprockets 63 rises, the lower idler sprocket 51 moves forward in an arc. Thus the chain does not loosen or tighten on this movement but retains the same tension. This is brought about by arranging the distance from the center of the pivot point 45 to the pitch line of the upper sprocket 63 opposite to a center line through the pivot 45 and the axis of the upper sprocket 63 so that it is equal to the distance from the center of the pivot 45 to the pitch line of the sprocket 51, opposite to a line through the axis of pivot 45 and sprocket 51.

It should also be noticed that the drive for the drums is such that pull on the chain 77 is downward, as indicated by the arrow 77*a*, in FIG. 5, and that it thus causes a greater downward pressure on the upper drum when it meets a resistance from an object to be crushed.

The crushed refuse is discharged from between the drums onto a belt conveyor 80.

The lower end of the belt conveyor 80 is supported on and driven by a drum 81, which is carried by a shaft 82 journalled in bearings 83, carried by the plates 23. One end of the shaft, on the far side of the machine, extends outboard and has a sprocket 85 which is connected by a chain 86 to a drive sprocket 87 on the drive shaft 62 of the lower drum.

The other end of the belt conveyor 80 is carried around a roller 90, carried by a frame 91, the lower ends of which are pivotally connected at 92 to the shaft 82 on opposite ends of the lower drive chain 81. The position of the upper end of the conveyor is determined by a jack or jacks 93 connected between the frame members 14 and the frame 91. The upper rim of the conveyor is provided with suitable guard boards 95 to prevent the compact refuse from falling off the conveyor.

It will thus be seen that I have provided a means, which because it can be manufactured as an auxiliary device, may be used with conventional equipment and thus result in a considerable savings. Although it has been described as being an auxiliary device, it is apparent that it could be incorporated as a unitary part of a refuse collection truck, if it should be desired.

Refuse fed into the hopper is compacted to a fraction of its normal size. Tin cans are flattened out; bottles are pulverized and sticks, boxes and other frangible material are reduced to their smallest dimensions. Bricks and stones which do not break readily and other non-breakable material pass through the machine readily due to the ability of the rollers to separate. The longitudinal ribs not only pull the material through the drums but also cause it to be broken, when it can be broken. Due to its nature it does not have to be rotated at an extremely high rate and therefore it is materially less dangerous and considerably less noisy.

The manner of connecting the drive chain between the rollers is such that the materials that are harder to break are subjected to greater pressure due to the direction of pull of the chain. It should be noted that the auxiliary tension spring 72, in many instances, could be omitted but has the advantage when used that the pressure upon the rollers may be implemented. Further pressure could also be obtained by securing weights to the top wall 42 of the upper frame 40.

As the chain wears, the fastening means 52 may be

moved to different holes to retain the desired tension. Although only three positions are shown, it is apparent that a wider range of adjustment could be attained by providing more holes. This particular structure has an advantage in that it is simple, has no wearing parts and when the chain is to be replaced, may be removed to allow the chain guard to swing freely.

It is also apparent that a duplicate set of sprockets and chain could also be provided on the opposite side of the frame and the counter-shaft 69 extended to provide drives to each side.

Having thus described the invention, in an embodiment thereof, I am aware that numerous and extensive departures may be made therefrom without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A device of the class described comprising a frame, a roller mounted on a fixed axis on said frame, a second frame pivotally connected to the first frame and a second roller rotatably mounted on the second frame above the first frame and being urged by gravity toward the fixed roller, an idler sprocket depending from said second frame in fixed relation thereto and movable therewith, a drive sprocket on the first frame and driven sprockets on the first and second rollers, chain drive means trained around the drive sprocket and around the sprocket for the fixed roller in one direction and around the sprocket for the movable roller in the other direction and around the idler sprocket and motor means connected to the chain in driving relation thereto.

2. A device as described in claim 1, wherein the means provided for causing rotation of the rollers rotates the rollers in such a direction that upon meeting an obstruction, at the entrance to the rollers, the driving pressure forces the movable roller toward the fixed roller.

3. A device as described in claim 2, wherein the point where the movable frame is pivotally connected to the first frame and the axis of said idler sprocket are such that when an object forces said rollers apart the movable roller sprocket and the idler sprocket rotate about the pivot of the second frame in such amounts as to maintain constant tension on the chain.

4. An apparatus of the class described comprising a

first frame having a cylindrical compacting drum mounted therein, a second frame pivotally connected to and disposed above and movable by gravity toward the first frame and having a second cylindrical drum rotatably mounted therein, with said second drum juxtaposed to the first drum, an idler sprocket frame adjustably carried by the second frame and arranged to pivot in fixed relation therewith, a drive sprocket on each of said drums and an idler sprocket carried on the idler frame, drive means supported by the first frame and including a drive sprocket, endless drive means connected around the last mentioned drive sprocket, under the sprocket for the first drum, over the sprocket for the second drum and around said idler sprocket.

5. A device as described in claim 4, wherein the distance from the pivot for the second frame along a line from said pivot and through the axis of said sprocket for the second frame and to the pitch line of said sprocket is equal to the distance from said pivot point along a line through the axis of said idler sprocket to the pitch line of said idler sprocket.

6. A device as described in claim 5, wherein supplementary tension means is connected to the scond frame to increase the pressure of the second drum toward the first drum.

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