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Vosskuhler

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[54] **APPARATUS FOR COMPRESSING MATERIAL**

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[52] **U.S. Cl.** **100/98,** 100/150

[51] **Int. Cl.** **B30b 9/14**

[58] **Field of Search** ..... 100/98, 148, 150, 100/117, DIG. 3, 94

[56] **References Cited**

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[57] **ABSTRACT**

Material compression apparatus including a rotable auger provided with a variable pitch screw extending through a hopper for receiving material to be compressed, a material compression and shredding chamber and a material discharge chamber. The material compression and shredding chamber is provided with raised counter spirals for cooperating with the screw to shred and compress the material. A portion of the entrance shoulder to the material compression, and shredding chamber and the entrance shoulder to the material discharge chamber, are provided with predetermined angles for retarding the advancement of the material sufficiently to achieve material compression, and yet not retarding the material sufficiently to preclude advancement of the material.

7 Claims, 3 Drawing Figures

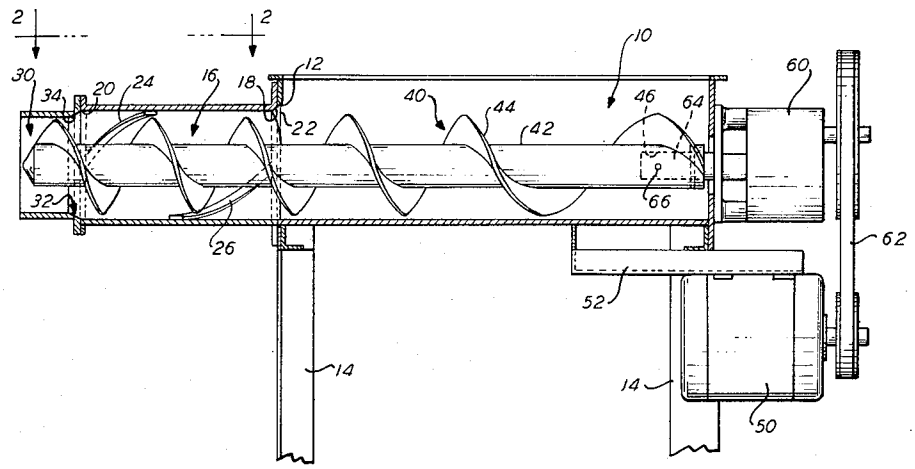


FIG. 1

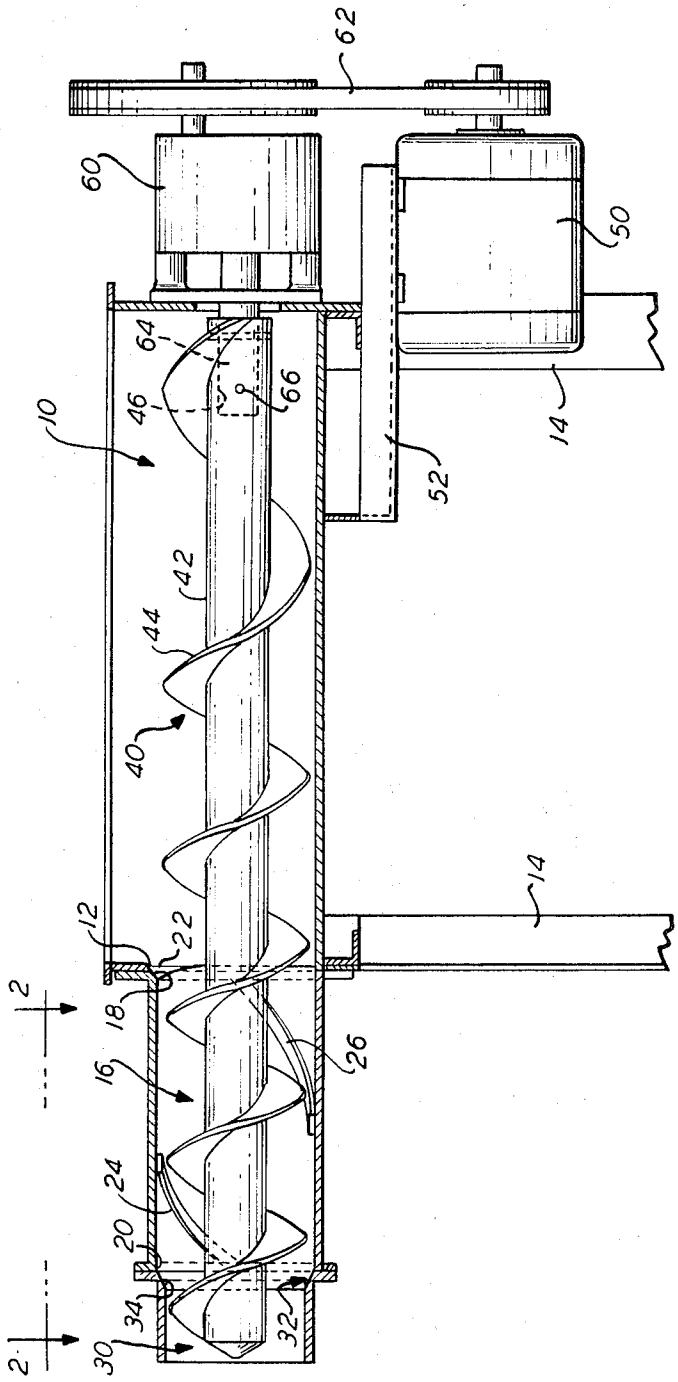


FIG. 2

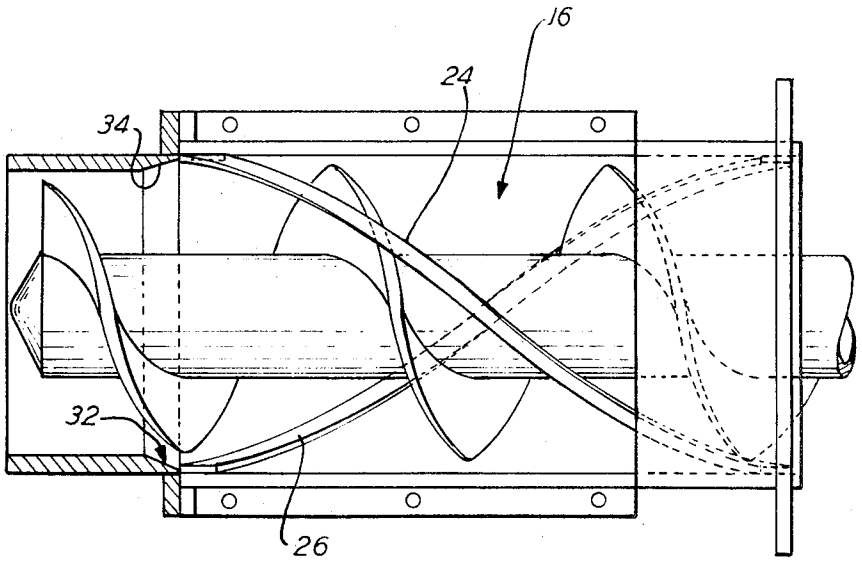
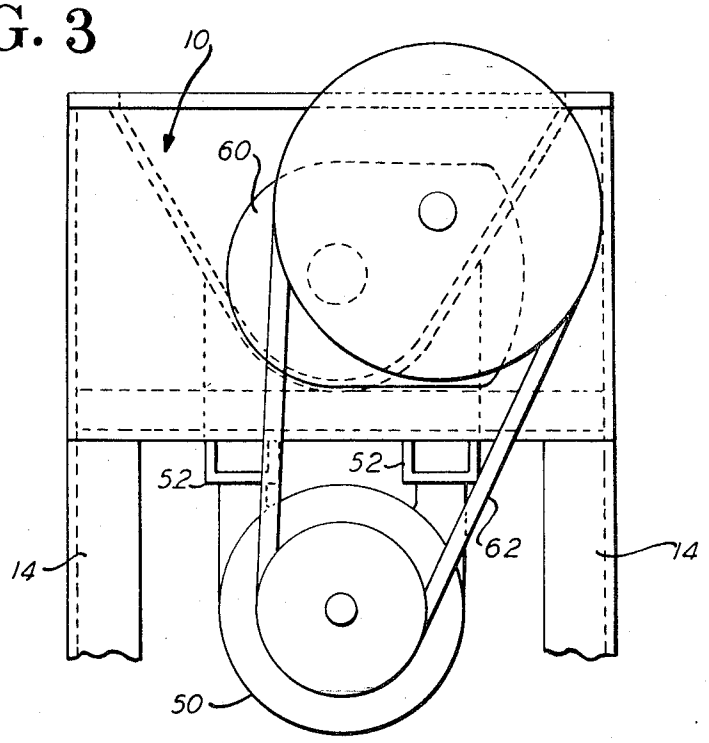


FIG. 3



APPARATUS FOR COMPRESSING MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to apparatus for compressing material; and more particularly, relates to apparatus for shredding and compressing material, such as for example, ordinary or typical household or restaurant waste or trash. The present invention is also particularly useful in commercial and other waste material producing establishments such as hospitals, dormatories, schools, cafeterias, military installations, housing projects, apartment houses, and the like.

2. Description of the Prior Art

Many varied apparatus for compressing material are known to the prior art, for example, the apparatus disclosed in U.S. Pat. Nos. 2,633,074; 2,903,960, 3,002,446; 3,063,361; and 3,422,748. However, with the present day general ecological concern for not further polluting the environment, and with the specific concern for better handling household and restaurant trash or waste material, there exists a need for simple, inexpensive and efficient apparatus for compressing such material, and such need is satisfied by the apparatus of the present invention.

SUMMARY

The present invention provides apparatus for compressing material which apparatus may operate as a separate unit; or which may conveniently and beneficially operate in conjunction with existing material handling or disposal apparatus, for example, the apparatus of the present invention may be positioned underneath an existing trash chute in an apartment house and such apparatus, without external structural modification to the existing facilities, will receive, compress, and shred if required, the trash or waste discharged from the chute. While the present invention is particularly useful in compressing and shredding waste or trash, its usefulness is not limited to such material and the present invetion may be beneficially utilized to compress virtually any compressible material.

DESCRIPTION OF THE DRAWING

FIG. 1 is a side view, partially in cross-section, and with parts broken away to facilitate illustration of various structural elements of an embodiment of the present invention;

FIG. 2 is a partial sectural view taken along the lines 2—2 in the direction of the arrows in FIG. 1 but enlarged to better illustrate certain structural elements; and

FIG. 3 is an end view as viewed from the right, of the apparatus of FIG. 1.

DESCRIPTION OF THE INVENTION

Referring now to FIG. 1 there is shown apparatus embodying the present invention and including a hopper 10 for receiving material to be compressed or to be compressed and shredded. The hopper 10 may be constructed from sheet metal, such as hot rolled sheet steel and the like, with the structural components thereof suitably joined into an integral unit such as by welding as shown. The entire top of the hopper may be completely open as shown or may be partially closed and provided with an opening suitably shaped so as to be complementary with other material handling facilities

such as a trash chute. As viewed in FIG. 1, the hopper 10 is provided at the left end with a circular, material discharge opening 12. The material compression apparatus of FIG. 1 may be provided with support members or legs 14, suitably joined to the hopper 10 such as by welding as shown, which support members may be of predetermined lengths to provide the apparatus with any desired height. Additionally, if desired or required, the support member 14 may be equipped with suitable rollers (not shown) for providing ready and easy mobility to the apparatus.

Positioned to the left of the hopper 10 in FIG. 1 is a cylindrical, material compression and shredding chamber 16 which is provided at its right end with a circular, material entrance opening 18, and which is provided at its left end with a circular, material discharge opening 20. As may be seen in FIG. 1, the circular, material entrance opening is provided with, or defined by, a circular shoulder which is aligned and positioned in mating engagement with the circular, material discharge opening 12 of the hopper 10. The cylindrical, material compression and shredding chamber 16 may be formed rom an integral steel tube which may be suitably split for accessibility to the interior and rejoined to such as by suitable bolts as shown in FIG. 2. The material of the chamber 16 may be suitably joined to the material of the hopper 10 such as by welding or by suitable bolts. As may be seen from FIG. 1 an annular portion of the shoulder of the circular, material entrance opening 18 is provided with an entrance angle 22 which, preferably, is between 40° to 45° measured from the horizontal. It has been found that particularly useful and desirable material compression may be accomplished if the annular portion of the shoulder of the circular, material entrance opening 18, provided with the aforementioned predetermined entrance angle, extends from between 20° to 25° below the centerline, i.e., extends for substantially 230°. The purpose and function of the entrance angle 22 will be set forth in detail below.

Referring now to FIG. 2, the cylindrical material compression and shredding chamber is provided internally with a plurality of raised counter spirals 24 and 26 which are displaced angularly with respect to each other 180°. The raised spirals may be suitably secured to the walls of the chamber 16 such as by welding. In an embodiment of the present invention the raises spirals were one-fourth inch in height. The purpose and function of the raised counter spirals will be set forth in detail below.

Referring again to FIG 2, the material compression apparatus of the present invention further includes a cylindrical, material discharge chamber 30 which is provided with acircular, material entrance opening 32 and which opening is provided with, or defined by, a circular shoulder which is provided with an entrance angle 34. The entrance angle 34 preferably extends for a full 360° and is between 20° to 30° as measured from the horizontal. As with regard to entrance angle 22, the purpose and function of entrance angle 34 will be set forth in detail below. The circular, material entrance opening 32 of the chamber 30 is aligned and positioned in mating engagement with the circular, material discharge opening 20 of the cylindrical, material compression and shredding chamber 16. It will be noted by those skilled in the art that the diameter of the chamber 30 is smaller than the diameter

of the chamber **16**, the reason for this and the advantage thereby is set forth in detail infra.

As with the cylindrical, material compression and shredding chamber **16**, the cylindrical, material discharge chamber **30** may be formed from an integral steel tube and the material of the chamber **30** may be suitably joined to the material of the compression and shredding chamber **16** such as by welding or by bolts.

Also shown in FIG. **1** is an auger **40** including a shaft **42** having a variable pitch screw **44** provided along its length. The screw **44** may be secured to the shaft such as for example by welding or the like. As shown in FIG. **2**, the auger **40** is mounted rotably and is received within and extends through the hopper **10**, the circular, material discharge spring **12** of the hopper, the circular, material entrance opening **18** of the chamber **16**, the compression and shredding chamber **16** itself, the circular, material discharge opening **20** of the chamber **16**, the circular, material entrance opening **32** of the material discharge chamber **30**, and the material discharge chamber **30** itself. It will be noted and understood by those skilled in the art that the diameter of the convolutions of the variable pitch screw residing in the hopper **10** are longer than the diameter of the screw convolutions residing in the chamber **16** which are in turn longer in diameter than the screw convolution residing in the chamber **30**. The reason for, and the result achieved is set forth below. As shown, the auger **40** is mounted for rotation.

Reference is now made to the rightward end portion of the apparatus shown in FIG. **1**, and FIG. **2**, wherein there is shown a motor **50** suitably secured to the hopper **10** by support members **52-52** and by welding or the like. Also suitable secured such as by welding to the end of the hopper is a torque or rmp reduction unit **60** which is driven by the motor **50** by means of the pulley **62**. The reduction unit **60** includes a rotable shaft **64** extending into the hopper **10** as is best shown in FIG. **1**. The shaft **64** extends into a bore **46** provided in the end of the auger shaft **42** and the shaft **42** is pivotably secured to the shaft **64** by a pin **66**; rotation being imparted to the shaft **42** upon rotation of the shaft **64**.

In one embodiment of the present invention, plus or minus one thirty-second inch manufacturing clearance was provided between the outer diameter of the raised counter spirals **24** and **26** and the outer diameter of the convolutions of the screw **44** residing within the material compression and shredding chamber **16**. However, it will be understood by those skilled in the art, that in operation and upon rotation of the auger **40**, the raised counter spirals are engaged by the screw and provide a bearing surface for the screw.

With regard to the operation of the apparatus, the apparatus of the present invention may be provided with suitable sensing devices for initiating operation upon the receipt of material to be compressed within the hopper **10**, or the apparatus may be operated manually or periodically by a suitable timing device. However, upon material to be compressed being received within the hopper **10** and upon rotation of the auger **40** by the motor **50** and reduction unit **60**, the variable pitch screw **44** engages such material and advances the material leftwardly as viewed in FIG. **1**, through the hopper, the material compression and shredding chamber **16**, and the material discharge chamber **30**. The variable pitch screw, upon such rotation, cooperates with the chambers **16** and **30** and the respective shoulders provided with the predetermined angles **22** and **34** to progressively compress the material upon advancement by the screw.

More specifically, it will be understood and appreciated by those skilled in the art, that the angles **22** and **34** have been determined to assure that they retard the advancement of the material sufficiently to accomplish compression of the material being advanced but also determined and provided such that they do not retard the material advancement sufficiently so as to cause the apparatus to jam or stall.

Referring now with particularity with regard to the raised counter spirals **24** and **26**, such raised counter spirals cooperate with the variable pitch screw **44** to shred and compress the material upon the advancement of the material through the cylindrical, material and compression chamber **16**. Due to the above-mentioned clearance between the outer diameter of the screw convolutions and the raised counter spirals, and due to the pivoted mounting of the screw shaft **42** with the drive shaft **64**, the counter spirals loosely engage the screw and an amount of play or oscillatory movement is permitted or provided to the auger **40** upon rotation thereof, so as to assist in enabling the advancement of the progressively compressed material through the chamber **16**.

As specifically noted above, the diameter of chamber **30** is smaller than the diameter of chamber **16**, this difference in diameter causes the material to be still further progressively compressed upon its advancement into and through the material discharge chamber **30** since a given length of such material will have less volume or space to occupy in the chamber **30** than in the chamber **16**.

In addition, it will be further understood by those skilled in the art, that the present invention may further include automatic apparatus for stopping and/or reversing the motor **50** upon the occurrence of a stalled or overload condition.

It will be further understood by those skilled in the art that the afore-going description is merely illustrative of the present invention and that many modifications and variations may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for compressing material, comprising:

means providing a hopper for receiving material to be compressed, said hopper provided with a circular, material discharge opening formed at one end thereof;

means providing a cylindrical, material compression and shredding chamber, said chamber provided with a circular, material entrance opening formed at one end thereof and provided with a circular, material discharge opening formed at the other end thereof;

said circular entrance opening of said cylindrical compression and shredding chamber provided with a circular entrance shoulder which shoulder is aligned and positioned in mating engagement with said circular, material discharge opening formed in said hopper and a predetermined portion of said circular entrance shoulder provided with a predetermined entrance angle measured from the horizontal;

means providing a cylindrical, material discharge chamber, said chamber provided with a circular, material entrance opening formed at one end

thereof and with a material discharge opening formed at the opposite end thereof;

said circular entrance opening of said cylindrical, material discharge chamber provided with a circular entrance shoulder which shoulder is aligned and positioned in mating engagement with said circular, material discharge opening formed in said cylindrical, material compression and shredding chamber and said entrance shoulder provided with a predetermined entrance angle measured from the horizontal;

auger means including a shaft having a variable pitch screw provided therealong, said auger means received within and extending through said hopper and said cylindrical, material compression and shredding chamber and extending into said cylindrical, material discharge chamber, and said auger means received for rotation within said hopper, said cylindrical, material compression and shredding chamber and said cylindrical, material discharge chamber;

said variable pitch screw increasing in pitch from said hopper toward said cylindrical, material discharge chamber;

a first raised counter spiral provided in said cylindrical, material compression and shredding chamber and surrounding and loosely and rotatably engaging said screw extending through said cylindrical, material compression and discharge chamber and providing a bearing surface for said screw;

a second raised counter spiral provided in said cylindrical, material compression and shredding chamber and surrounding and loosely and rotatably engaging said screw extending through said cylindrical, material compression and discharge chamber and providing a bearing surface for said screw;

said first and second raised counter spirals displaced angularly with respect to each other a predetermined angular distance;

drive means including a shaft pivotally connected to said auger means at that end of the hopper which is opposite to the hopper discharge opening, said drive means providing rotation to said auger means;

upon rotation of said auger means said variable pitch screw engaging material received within said hopper and said screw advancing said material from said hopper through said cylindrical, material compression and shredding chamber and through and out of said material discharge chamber;

said variable pitch screw, upon said rotation of said auger means, cooperating with said cylindrical chambers and said shoulders having said predetermined angles, to progressively compress said material upon said advancement thereof; and

said first and second raised counter spirals upon rotation of said auger means, cooperating with said variable pitch screw to shred and compress said material upon said advancement of said material through said cylindrical, material compression and shredding chamber.

2. Apparatus according to claim **1** wherein said predetermined entrance angle provided on said predetermined portion of said circular entrance shoulder provided on said circular entrance opening of said cylindrical compression and shredding chamber is between 40° to 45° measured from the horizontal.

3. Appparatus according to claim **2** wherein said predetermined portion of said predetermined entrance angle extends for 230°.

4. Apparatus according to claim **2** wherein said predetermined entrance angle provided on said circular entrance shoulder provided on said circular entrance opening of said cylindrical, material discharge chamber is between 20° to 30° measured from the horizontal.

5. Apparatus according to claim **1** wherein said first and second raised counter spirals are displaced angularly from each other 180°.

6. Apparatus according to claim **1** wherein said hopper is provided with a substantially parabolic cross-sectional configuration for enhancing said engagement of said material received within said hopper with said variable pitch screw.

7. Apparatus according to claim **1** wherein the diameter of said cylindrical, material discharge chamber is smaller than the diameter of said cylindrical, material compression and shredding chamber, said difference in diameter for retarding said advancement of said material by said screw and thereby cooperating with said screw to compress said material upon said advancement thereof.

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