Dec. 17, 1946. R. T. BOWLING 2,412,709

BRIQUETTING MEANS

Filed Aug. 24, 1943 3 Sheets-Sheet 1

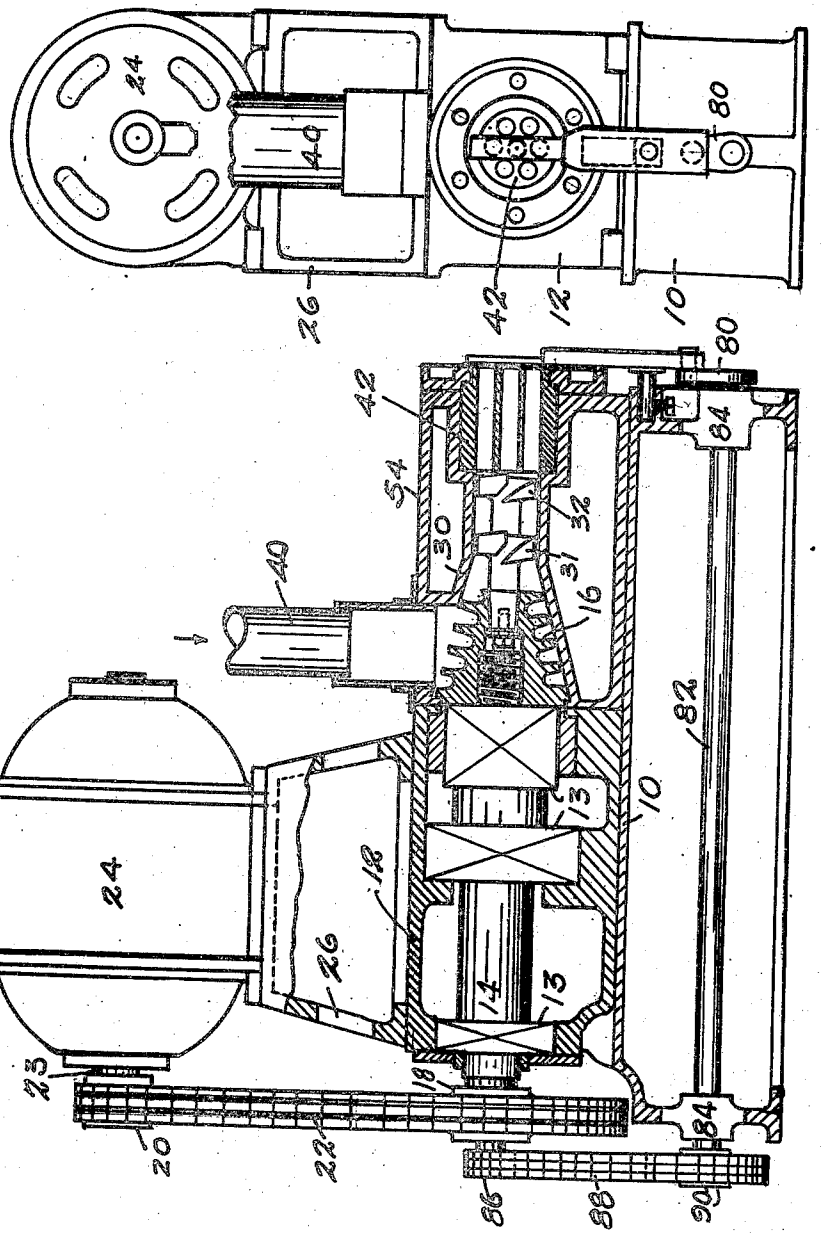


Fig-2

Fig-1

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BRIQUETTING MEANS

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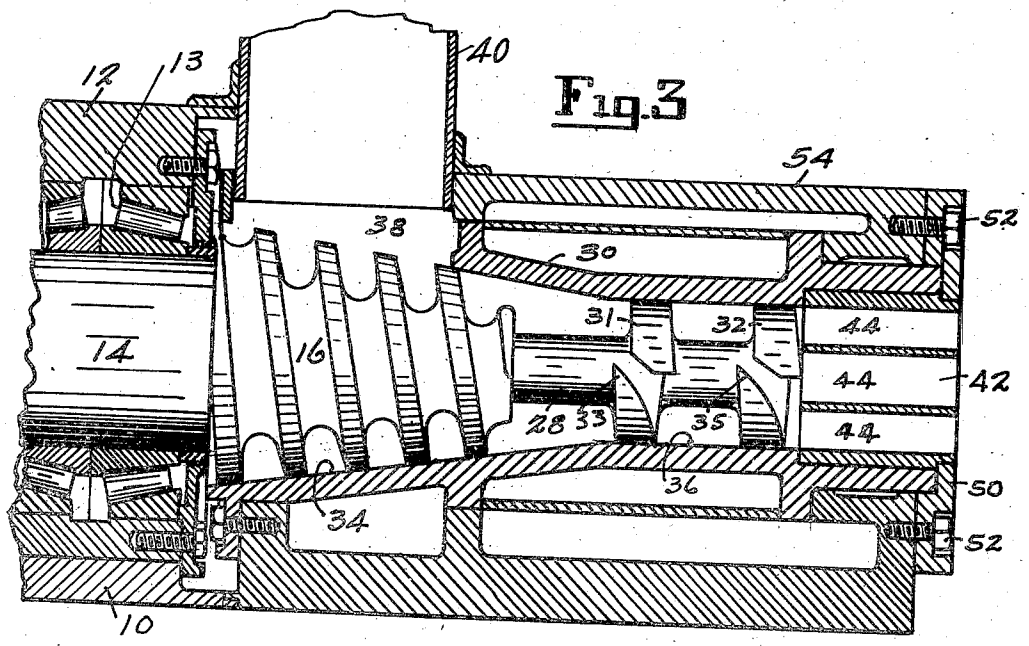
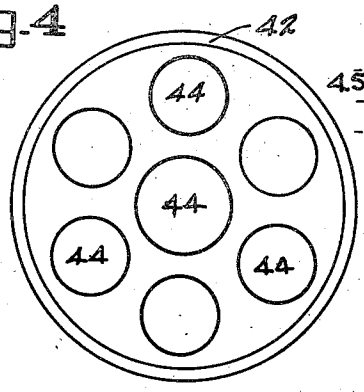


Fig. 3

Fig. 4



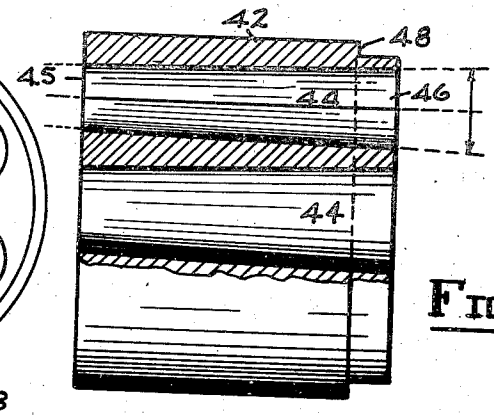


Fig. 5

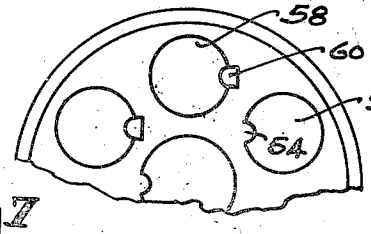
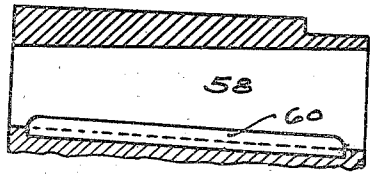


Fig. 6

Fig. 7



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BRIQUETTING MEANS

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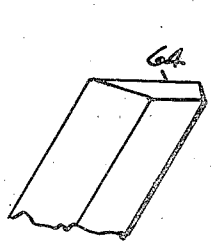


Fig 12



Fig 13

Fig 8

Fig 9

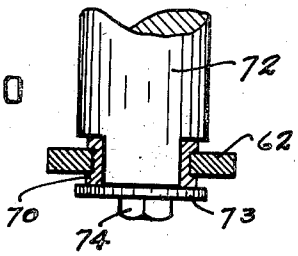


Fig 10

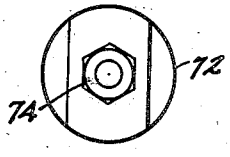


Fig 11

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Patented Dec. 17, 1946

2,412,709

UNITED STATES PATENT OFFICE

2,412,709

BRIQUETTING MEANS

Robert T. Bowling, Lewiston, Idaho, assignor to Wood Briquettes, Inc., Lewiston, Idaho

Application August 24, 1943, Serial No. 499,794

5 Claims. (Cl. 18—12)

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This invention relates to improvements in briquetting means in which finely comminuted vegetable fibers are compressed into a homogeneous mass of a size and density suitable for burning as fuel.

It is well known in the prior art that finely divided wood and other fibers have been compressed under the action of an inclined plane, such as a screw, into a dense briquette having great inherent structural strength and suitable for burning as a wooden log. These developments are fully disclosed in my prior Patents No. 1,990,631, issued February 12, 1935; No. 1,990,632, issued February 12, 1935; and No. 2,013,026, issued September 3, 1935. In these earlier developments the comminuted material is fed to a rotating tapered screw in a gradually decreasing chamber and thence in the form of a laminated ribbon to a cylindrical chamber terminating in a rotating screw segment which divides the ribbon from the following mass and passes it into the final compression chamber where, against a receding force, the finished laminated briquette is produced. In these earlier developments high heats were incident to the briquette formation and cooling means were necessitated to permit the setting of the briquetted material in the solid and final form. The practical applications of my prior inventions produced briquettes of approximately four inches diameter and having a length of about twelve inches. In this form the fuel simulated logs and were useful for fireplace, stove or furnace burning. Many attempts have been made to produce in a similar manner smaller briquettes suitable for stoker feeding. I have sliced the larger briquettes to produce the proper size but such attempts have not proven fully satisfactory due to the labor involved, the slowness of the operation, and other circumstances that could not be surmounted.

In accordance with my present invention I feed comminuted wood fiber to a tapered screw in a close fitting chamber for initial compression, then deliver the partially compressed material to a die head that comprises a segment of screw thread where the material is intermediately compressed before passage to a similar second die head that delivers the material to a plurality of pressure producing dies that divide the stream of material and from which simultaneously extrude several strings of briquettes that are severed periodically into fragments of the desired length for stoker feeding. By so doing I am permitted to eliminate the receding back pressure formerly used and to also avoid the difficulties of slicing the larger briquette.

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One of the results of the high pressures and the periods to allow setting in the former practices was that finished briquettes adhered together due to the binding action of the resin and other fluid constituents in the material. It was previously deemed necessary that these high pressures produced by mechanical means, which approached 40,000 pounds to the square inch, were an absolute requirement that could not be avoided in briquetting. Naturally the production of such pressure necessitated elaborate equipment and massive structures. I have now devised means forming a part of this invention that produce comparable results without utilizing such high pressures in the production of stoker fuel.

Thus it can be seen that among the objects of this invention are the production of briquettes at relative high speed in large quantities, to do so with relatively simple equipment that can operate in an economical manner; to continuously receive and divide for compression a large stream of partially compressed material into several smaller streams while avoiding the difficulties of splitting previously encountered; and to periodically sever the smaller streams into many fragments in a rapid and economical manner.

The accompanying drawings illustrate a preferred embodiment of my invention as well as certain modifications of detail that may variously be employed.

In the drawings:

Figure 1 is a view in side elevation showing my briquetting machine, with portions in section for convenience of illustration;

Figure 2 is an end elevational view of the machine of Figure 1;

Figure 3 is an enlarged sectional view of the compression means of Figure 1;

Figure 4 is an end view of the extrusion die;

Figure 5 is a side view with portion in sections of the die;

Figure 6 is a fragmentary end view of a modified form of die;

Figure 7 is a detailed sectional view of a die passage of Figure 6;

Figure 8 is an enlarged detail view of cut-off mechanism shown in Figure 1;

Figure 9 is an enlarged end view of the same cut-off mechanism;

Figures 10 and 11 are, respectively, details of a guide element of the cut-off mechanism;

Figure 12 is fragmentary perspective view of the cut-off knife, and

Figure 13 shows the knife grip and securing means.

I mount my briquetting mechanism upon a base 10 which supports the superstructural housing 12 that provides bearings 13 to mount for rotation the arbor 14 that carries the tapered feed screw 16. Arbor 14 is rotated by power applied to sprocket 18 from drive sprocket 20 by means of the drive belt 22. Sprocket 20 is here shown as rotatable with the shaft 23 of motor 24. Supplemental base 26 supports the motor above base 12.

As can be seen in Figure 3, the screw 16 has a forward extension shank 28 which rotates therewith and carries the initial die head 31 and the terminal die head 32.

The screw 16 and the heads 31 and 32 are enclosed in a suitable compression housing 30, which has a tapered portion 34 and a cylindrical portion 36. An opening 38 permits the introduction of a comminuted fibre into the housing 34 to which it is conducted by a feed tube 40.

In line with and closely adjacent the delivery end of the die head 32, is a die 42 which has a plurality of passages 44 through which the compressed material being discharged by the die head 32 is extruded. As can be seen in Figure 5, the passages 44 flare gradually from the receiving ends 45 to the delivery ends 46.

The delivery end of the die 42 has an annular shoulder 48, which is engaged by a retainer plate 50 that is secured by bolts 52, 52 to the casing 54, which encloses the feed screw and die head housing 30.

As material is gradually compressed by the screw 16, relatively thick laminations of material are formed in the chamber surrounding that portion of shaft 38 between the screw 16 and the head 31. This material is divided according to these laminations by the pointed cutting end 33 of the head 31, and pass through the slot that may be seen in Figure 3 to the space between the heads 31 and 32. Due to the action of the inclined face of head 31, an additional compression is produced in the material. Similarily, the material is again divided by the pointed cutting end 35 of head 32, and it passes through the slot of the head 32. Under the force of the inclined planar face of head 32 the material is immediately delivered to the passages 44 of the die 42. Additional compression takes place in these passages due to the cross-sectional area of the entire group of passages 44 being slightly less than the cross-sectional area of the material being delivered thereto. The material under this high compression is in a semi-fluid state and is wiped into the various openings 44 in a continuous manner. As it passes through these passages 44, the material is extruded outwardly and permitted to gradually expand due to the reduction of the pressure permitted by the increased cross-section of the individual passages.

It is extremely important that resistance of the passage of this material through an opening 44 be accurately proportioned with respect to the delivery rate from the die head 32. I have found that, since a perfectly cylindrical shape in the finished product is unimportant, that I can regulate the back pressures applied to the material in the die 42 by either applying by welding a bead 54 shown in the passage 56 of Figure 6, or by slotting the wall of the passage as 58, and placing in that slot a key member 60. The size of the bead 54 or of the key 60 governs the dimension of the cross-sectional area of the passages and in increase or decrease controls the back-pressure, applied to the incoming material.

In Figures 8 and 9 I illustrate a cut-off mechanism useful to periodically shear the extruding streams of compressed material as they leave the die 42. This cut-off mechanism comprises a reciprocal guide member 62 which has a knife blade 64 secured in its upper end by means of bolts or set screws 66. Member 62 is slotted longitudinally as at 68, and both sides of the slot are provided with guide ways 70, which engage on opposed flat surfaces on the pivoted guide pin 72. A washer 73 and nut 74 secure this assembly in position and pin 72 is mounted to swivel in the base 10 where it is secured by the bolt 76.

On its lower end member 62 is connected to crank 80 that is rotated by shaft 82 in suitable bearings 84, 84 in the base 10. Shaft 82 is driven in rotation by power taken off the arbor 14 by means of sprocket 86, belt 88 and the driven sprocket 90 in a manner timed to operate and swing the knife 64 in a certain and predetermined cyclic operation, during which it is wiped across the discharge end of die 42 in a sweeping motion, and then withdrawn downwardly therefrom, swung under the extruding material, and again brought up into a position where it can sweep and shear the material as it comes out of the die 42.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A briquetting mechanism, comprising: a tapered feed screw adapted to receive and gradually compress material for briquetting, a shank on said feed screw in extension thereof, a die head having front and back spiral faces and a radial slot on said shank and spaced from the screw end, a second similar die head on said shank spaced in advance of the first mentioned die head, and a die having an end face perpendicular to the shank axis and in juxtaposition to the face of the second die head whereby the material advanced through the second die head is compressed in a thin stream between the die head and the end face, the die having separate passages leading therethrough from said end face and positioned to receive material under compression from said second mentioned die head to divide and conduct the briquetting material outwardly.

2. A briquetting mechanism, comprising: a tapered feed screw adapted to receive and gradually compress material for briquetting, a shank on said feed screw in extension thereof, a die head having front and back spiral faces and a radial slot on said shank and spaced from the screw end, a second similar die head on said shank spaced in advance of the first mentioned die head, and a die having an end face perpendicular to the shank axis and in juxtaposition to the face of the second die head whereby the material advanced through the second die head is compressed in a thin stream between the die head and the end face, the die having separate passages leading therethrough from said end face and positioned to receive material under compression from said second mentioned die to divide and conduct the briquetting material outwardly, the passages of said die being flared from their receiving toward their discharge ends.

3. A briquetting mechanism, comprising, a tapered feed screw adapted to receive and gradually compress material for briquetting, a shank on said feed screw in extension thereof, a die head having front and back spiral faces and a radial slot on said shank and spaced from the

screw end, a second similar die head on said shank spaced in advance of the first mentioned die head, a die having an end face perpendicular to the shank axis and in juxtaposition to the face of the second die head whereby the material advanced through the second die head is compressed in a thin stream between the die head and the end face, the die having separate passages leading therethrough from said end face and positioned to receive material under compression from said second mentioned die to divide and conduct the briquetting material outwardly, and means to sweep the face of the die to sever the streams of material as it is extruded therefrom.

4. In a briquetting mechanism of the screw type wherein a compressed stream of material being briquetted is pressed forwardly for extrusion, a die to receive said material and comprising a member having a plurality of outwardly flared extrusion passages, the cross-sectional area of the forwardly pressed stream being greater than the total cross-sectional area of the several extrusion passages, and a rib longitudinally of the extrusion passages.

5. In a briquetting mechanism of the type employing a tapered feed screw; die head compression means, comprising: a shank supported in advance of said screw and having a head comprising a screw segment slotted from the rear to the front face, a second similar die head supported in advance of said first mentioned die head, and a die to receive material from said last mentioned die head and including a plurality of extrusion passages.

ROBERT T. BOWLING.