Dec. 27, 1938. S. F. OSSING 2,141,663

SEWAGE SHREDDER

Filed Dec. 28, 1936 3 Sheets-Sheet 1

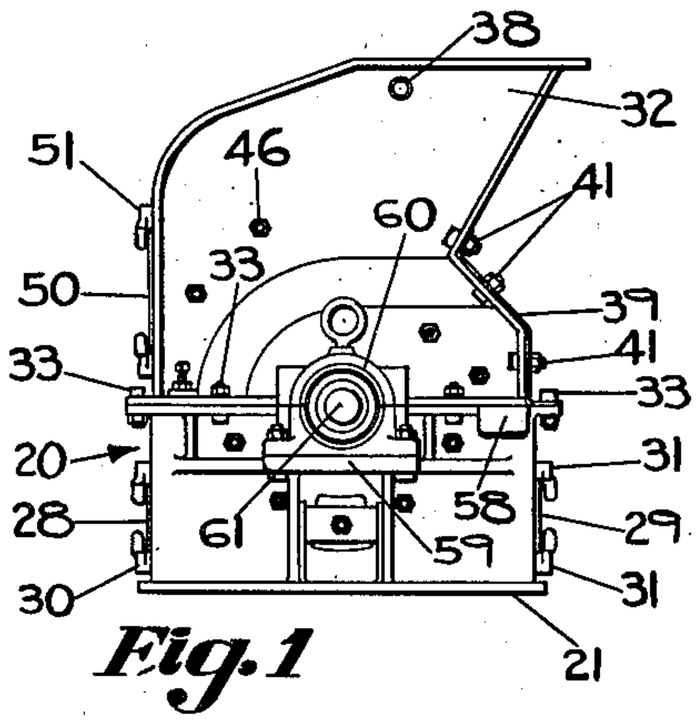


Fig. 1

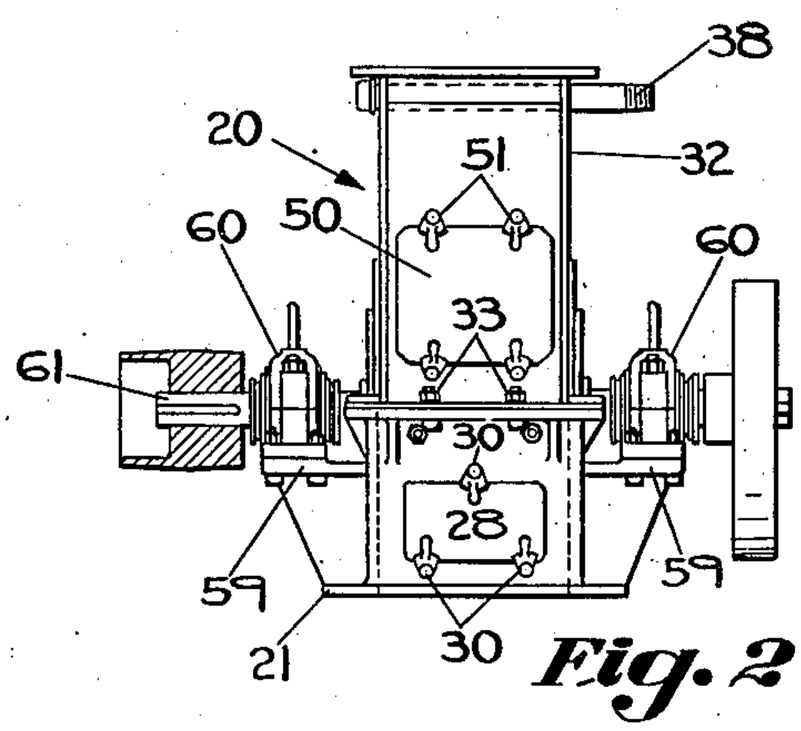


Fig. 2

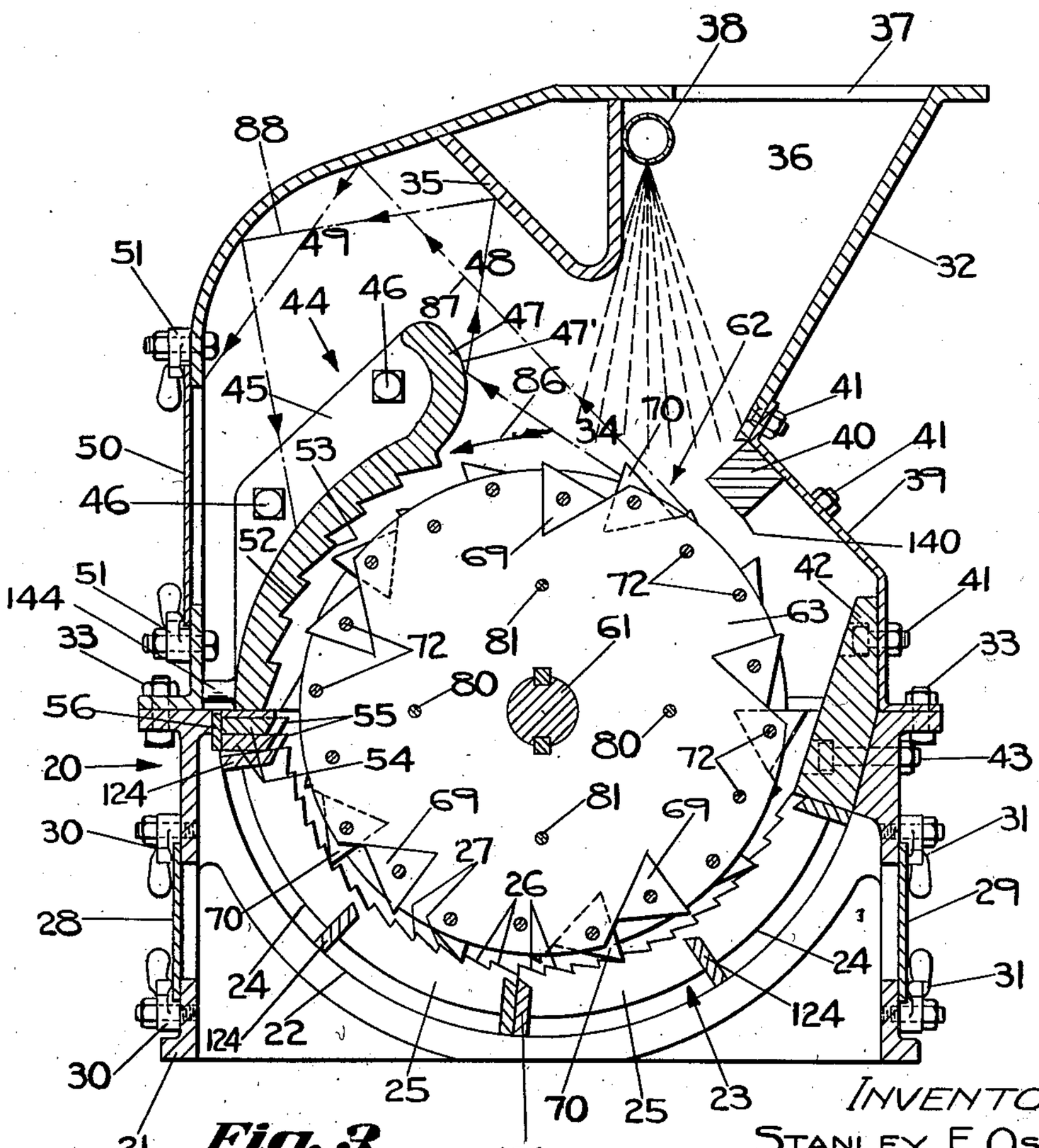


Fig. 3

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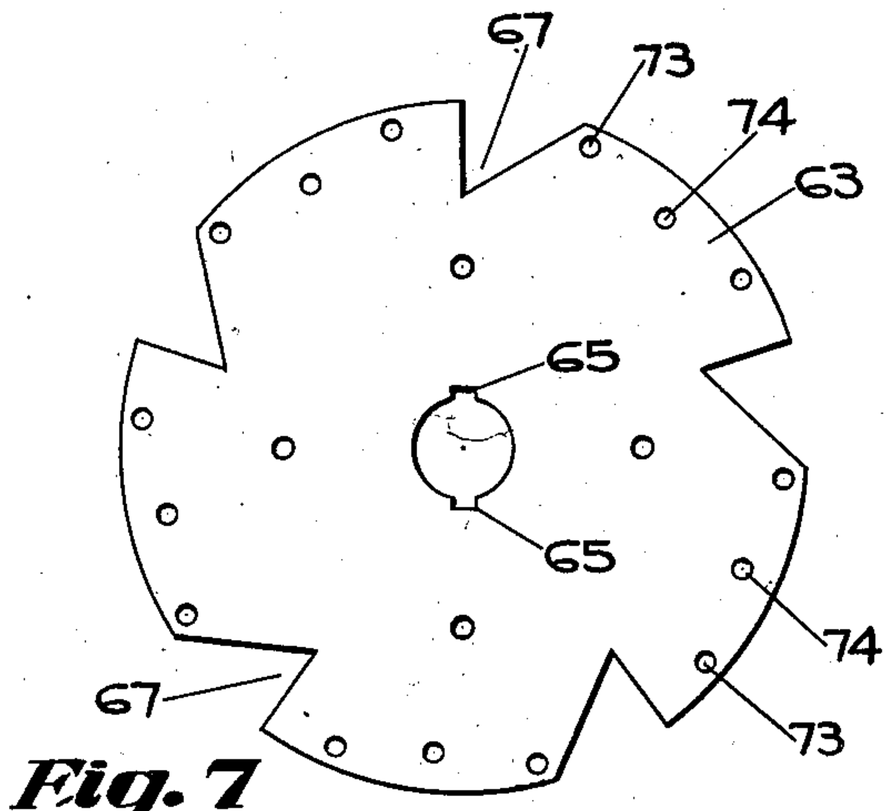


Fig. 7

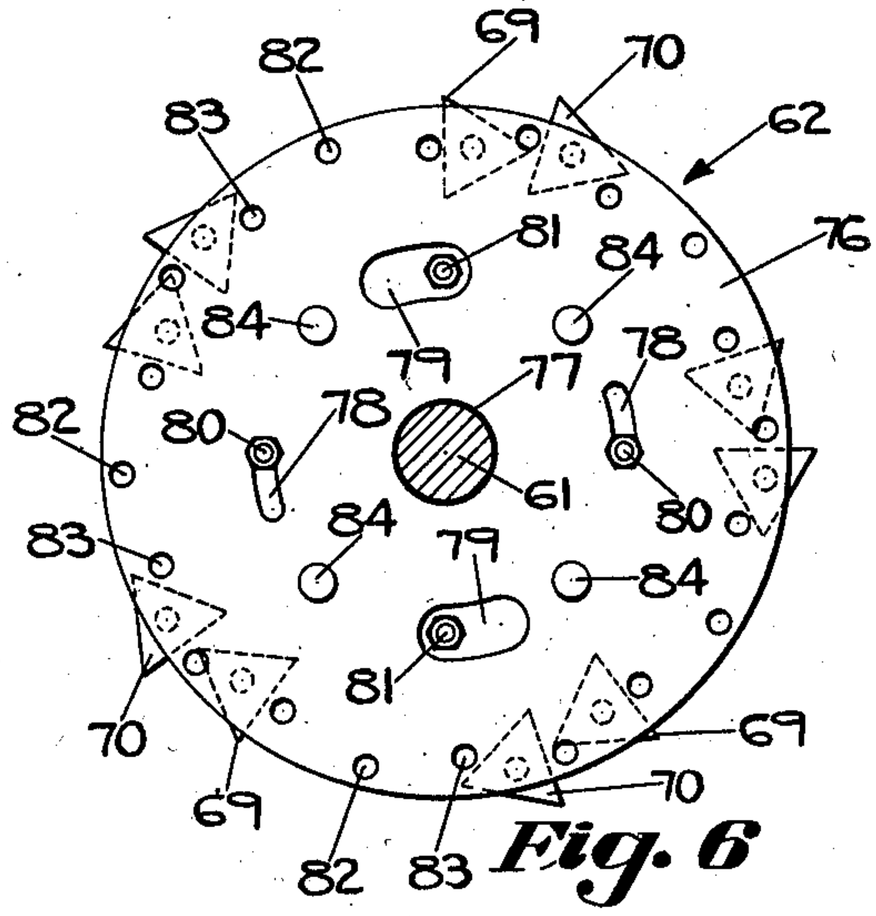


Fig. 6

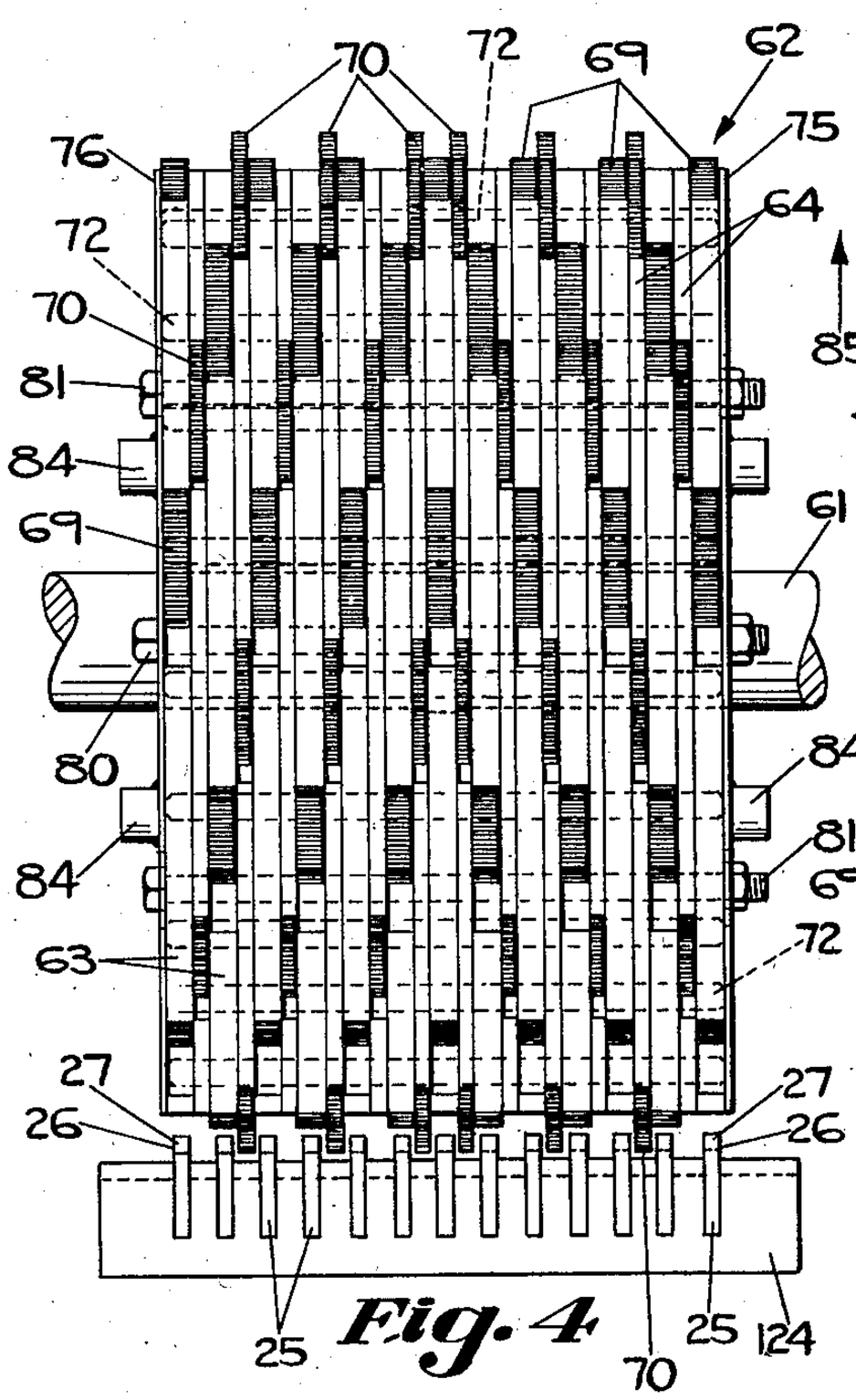


Fig. 4

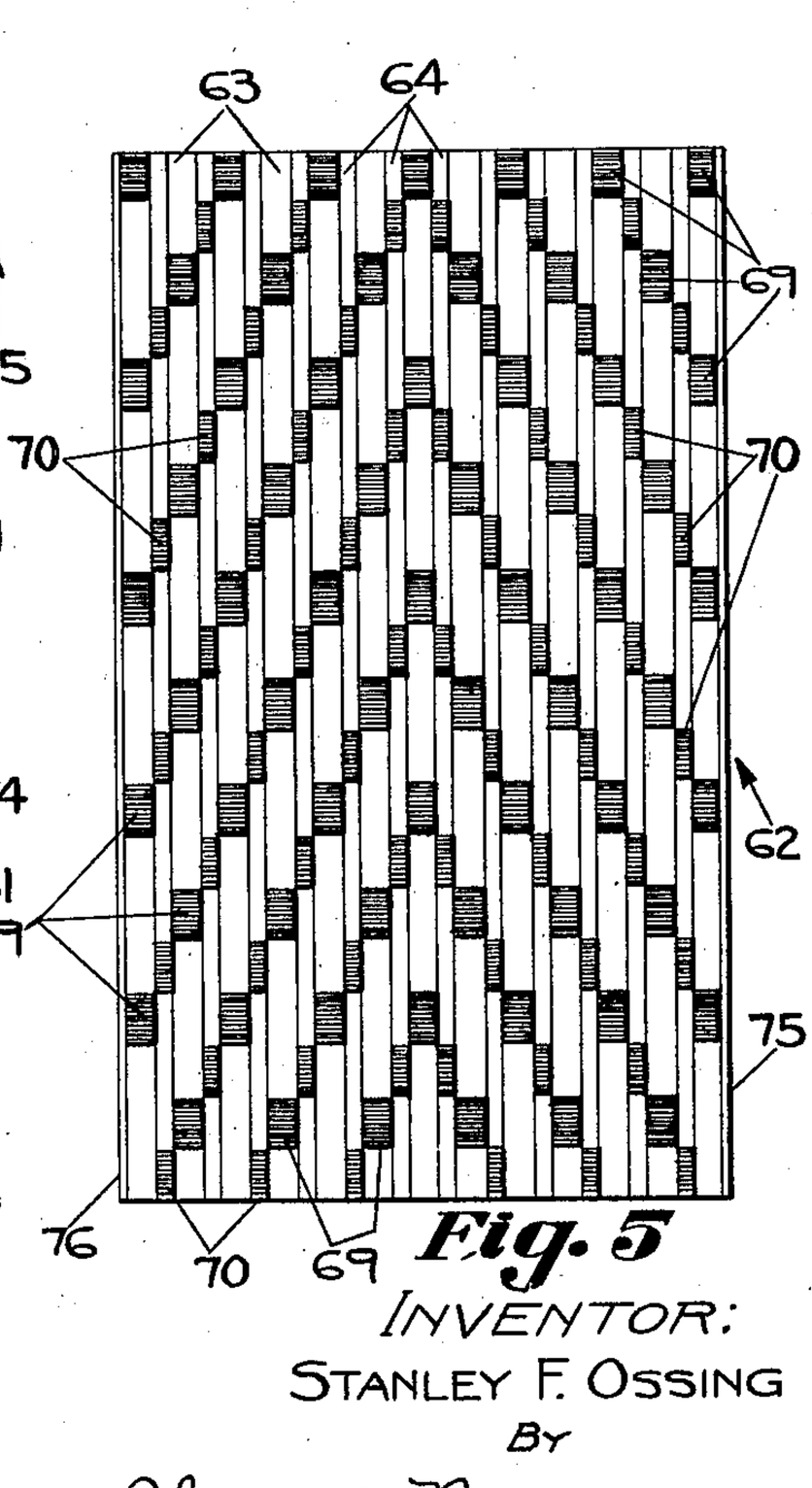


Fig. 5

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SEWAGE SHREDDER

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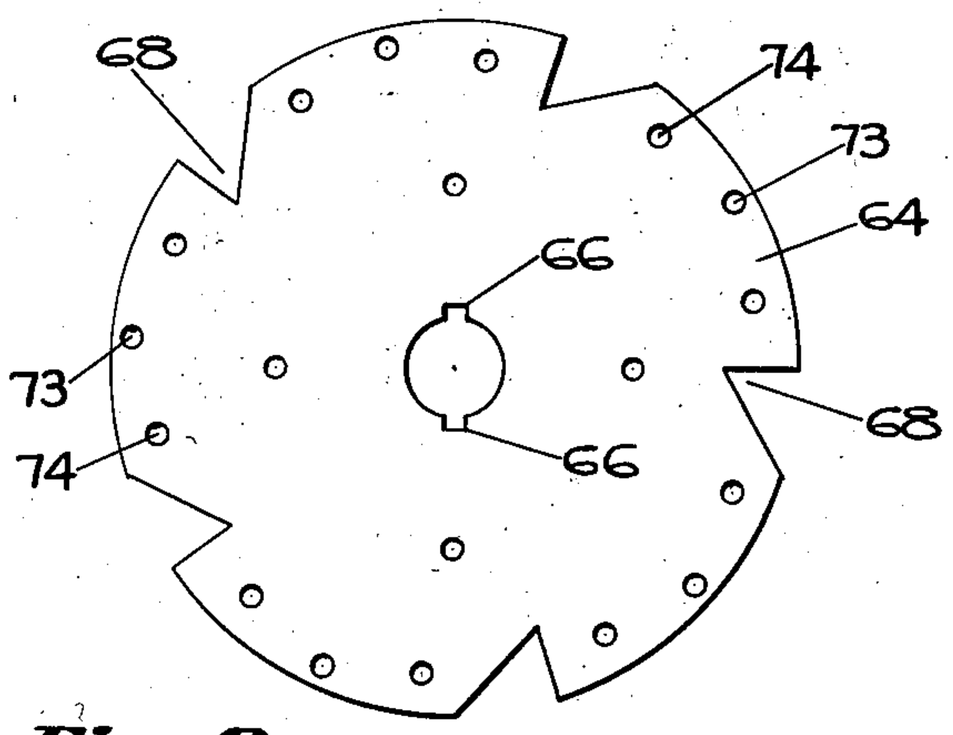


Fig. 8

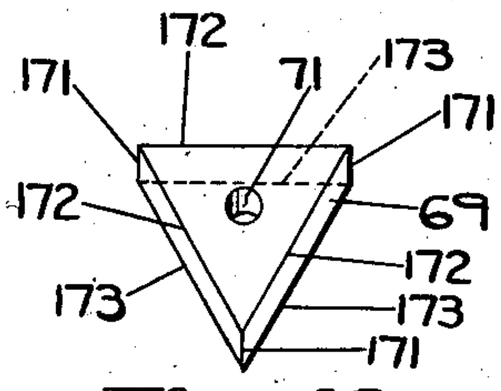


Fig. 10

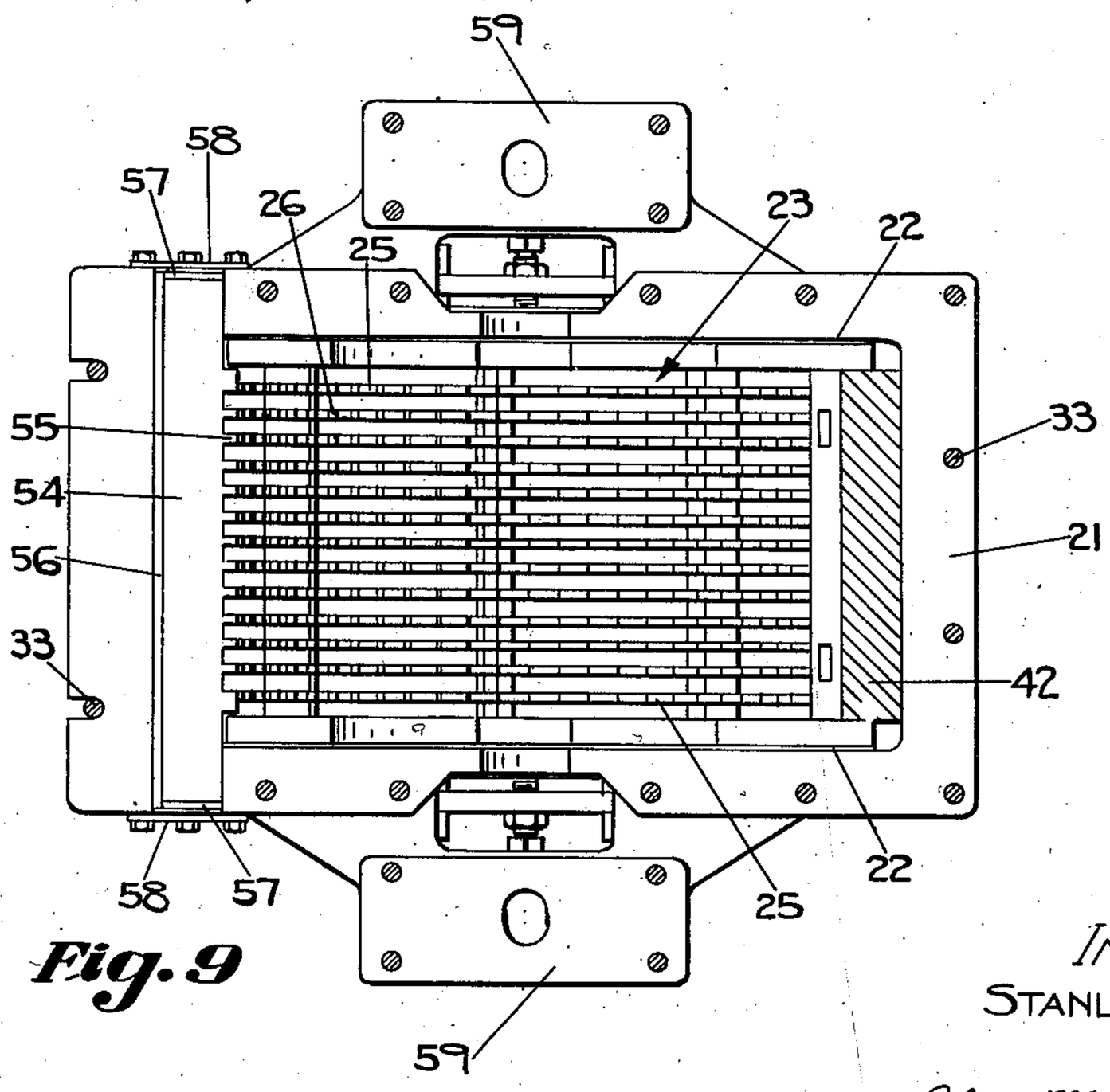


Fig. 9

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UNITED STATES PATENT OFFICE

2,141,663

SEWAGE SHREDDER

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Application December 28, 1936, Serial No. 117,844

8 Claims. (Cl. 83—6)

This invention relates to a sewage shredder and is particularly adapted to reduce sewage or similar material, such as garbage, which may include an appreciable amount of fibrous material, such as rags, which are very difficult to reduce or shred and which tend to clog the ordinary shredder or grinder.

An object of the invention is to provide a device of the above mentioned class in which the reducing operation is very efficiently performed on sewage or garbage containing fibrous material.

Another object of the invention is to provide a built up rotor in which a plurality of stacked discs are employed which carry removable teeth.

Still another object of the invention is to provide a rotor which may be formed by a minimum number of discs to provide a maximum number of transverse rows of teeth.

Still another object of the invention is to provide an improved rotor construction for a shredder.

Another object of the invention is to provide an improved disc for a shredder rotor.

A further object of the invention is to provide a shredder rotor having a plurality of triangular teeth which may be adjusted in any one of a plurality of positions to bring into operation any one of a plurality of cutting edges.

Still another object of the invention is to provide an improved tooth for a sewage shredder.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings,

Fig. 1 is a side elevational view of the shredder comprising my invention;

Fig. 2 is a rear elevational view of the device of Fig. 1;

Fig. 3 is a longitudinal sectional elevational view of the device of Figs. 1 and 2;

Fig. 4 is an elevational view of the shredder rotor showing its relation to the shredder grating;

Fig. 5 is a plan development of the peripheral surface of the rotor;

Fig. 6 is a side elevational view of the rotor with the shaft shown in section;

Fig. 7 is a side elevational view of one of the raking discs of the rotor;

Fig. 8 is a side elevational view of one of the hammer discs of the rotor;

Fig. 9 is a plan view of the lower portion of the shredder showing particularly the base casting and the grating thereof; and

Fig. 10 is a perspective view of one of the shredder teeth.

The shredder comprising my invention comprises a casing or housing 20 formed by a base casting 21 provided with a pair of side arcuate flanges 22 which support a combination screen and grating 23 formed by a pair of similar arcuate grating sections 24, 24. Each of said grating sections 24, 24 comprises a plurality of arcuate longitudinally extending toothed bars 25 having teeth 26 on their inner arcuate surfaces which have radially extending reducing surfaces providing shredding edges 27. As will be hereinafter described in full detail, the teeth 26 cooperate with the rotor of the shredder to reduce the material being treated, such as sewage or garbage. Said bars 25 are rigidly connected together by transverse bars 124 having top shredding edges.

To provide access to the bottom of the grating 23, both forwardly and rearwardly of the shredder, I provide a removable rear door 28 and a removable front door 29. Appropriate locking means 30 and 31 are provided for said doors 28 and 29, respectively.

Mounted upon and rigidly attached to the base casting 21 is an upper member 32 held in place by a plurality of nuts and bolts 33. The upper member 32 and the base casting 21 cooperate to provide a reducing chamber 34 within which the hereinafter described rotor is adapted to rotate. Said upper member 32 carries a transversely extending V-shaped partition 35 which cooperates to form a material receiving hopper 36 by which access is provided to the reducing chamber 34 through a top opening 37. Extending transversely of and adjacent the top of the hopper 36 is a spray pipe 38 adapted to supply water to the hopper 36 and to the reducing chamber 34.

Adjacent its forward and bottom portion the top member 32 forms an opening closed by a cover plate 39. Below the cover plate 39 and adjacent its top, the member 32 carries a transversely extending bar 40 which prevents the material from entering the reducing chamber 34 adjacent the forward end of the shredder where it would not be properly reduced and at the same time prevents any material from being thrown upwardly into the hopper 36 or out through the opening 37. In addition, the bar 40 has a lower shearing edge 140 which cooperates with the rotor, as hereinafter described, to reduce any large particles of material which have improperly gained entrance into the forward portion of the reducing chamber. Said cover plate 39 is removably attached to the upper member 32 by appropriate nuts and bolts 41 and in fact forms a removable part of said upper member 32. Said

cover plate 39 also carries a transversely extending casting 42 which rests upon one end of one of the grating sections 24 to hold it down in proper position. To insure a proper holding down of said grating section 24 by the casting 42, bolts 43 provided with appropriate nuts also rigidly attach said casting 42 to the base casting 21.

Adjacent its rear end the upper member 32 carries a transversely extending casting 44 forming a stationary preliminary breaker plate provided with side flanges 45 by which it is removably attached to said upper member 32, as by appropriate nuts and bolts 46. The casting 44 is provided with an upper curved lip 47 which cooperates with the partition 35 to provide a throat 48 leading to a tramp material compartment 49. Access to said tramp material compartment 49 is gained through a removable rear door 50 removably held in place by locking means 51.

The casting 44 is also provided with a plurality of teeth 52 having radially extending surfaces providing shearing edges 53 which extend transversely the entire width of the shredder within the reducing chamber 34, which casting 44 is provided with a pair of spaced abutment bosses 144 to space it from door 50. The bottom of said casting 44 rests upon a plurality of transversely extending bars 54, the bottom one of which rests directly upon the end of the rear grating section 24 and holds it down.

Said bars 54 are provided with a plurality of teeth 55 which are in longitudinal alignment with the teeth 26 of the grating 23, as best seen in Fig. 9 of the drawings. A rear spacer 56 and end spacers 57 (see Fig. 9) are preferably provided to maintain the bars 54 in adjusted position. The ends of the bars 54 rest in appropriate recesses in the sides of the base casting 21 which are closed by removable plates 58.

Adjacent each side, the base casting 21 is provided with an integral standard 59 carrying a bearing box 60 housing anti-friction bearings for supporting the shaft 61 of the rotor 62. Rotor 62 is adapted to rotate in the reducing chamber 34 and to reduce material to such a fine state that it will pass through the grating 23 in a manner hereinafter described in full detail.

Attention is now directed to the particular construction of the rotor 62 comprising my invention. Said rotor 62 is formed by two groups of identical discs which are alternately mounted upon the shaft 61 in a stacked relation, alternate identical discs being positioned 180 degrees apart on said shaft 61.

Before describing the entire rotor assembly attention is directed to the construction of the discs of said groups. In Fig. 7 there is illustrated a disc 63 comprising one of the raking discs. In Fig. 8 of the drawings there is illustrated one of the discs 64 comprising one of the hammer discs. The raking discs 63 will all be alike and the hammer discs 64 will all be alike. The discs 63 and 64 will have substantially the same diameter.

Furthermore, each of said discs will be provided with a pair of keyways spaced 180 degrees apart, seen at 65, 65 in discs 63 and at 66, 66 in disc 64. In addition, each of said discs 63 and 64 will be provided with an odd number of V-shaped notches seen at 67 and 68 in discs 63 and 64, respectively. As illustrated in Figs. 7 and 8 of the drawings, there are five of said notches 67 and 68 which are equally spaced about the peripheries of the discs 63 and 64, respectively. This number may be increased or decreased, but it is preferred that it always be an odd number and the notches should be equally spaced about the disc periphery. It is also preferred that each of said notches 67 and 68 have one edge radial and each form an angle of 60 degrees whereby the inner walls of such notches will form V-shaped seats to receive and contact the edge surfaces of the equilateral triangular shaped teeth 69 or 70 of which the teeth designated 69 are adapted to act as raking teeth and the teeth designated 70 are adapted to act as hammer teeth for reasons hereinafter pointed out in full detail. Each tooth 69 or 70 is provided with three equally spaced shearing edges extending parallel to the axis of the motor.

In Fig. 10 I have illustrated one of the teeth 69. This representation will also apply for a hammer tooth 70 except for the thickness or width thereof. In practice a raking tooth 69 preferably has a width or thickness approximately twice that of a hammer tooth 70; as an example, the former may be one-half inch in thickness and the latter one-quarter inch in thickness. Both the raking teeth 69 and the hammer teeth 70 are formed in the shape of equilateral triangles and each has an aperture 71 at its center, the aperture 71 being seen for a tooth 69 in Fig. 10.

As also seen in Fig. 10, each tooth 69 has nine cutting or shearing edges, three of which are seen at 171, three at 172 and three at 173. When the device is in operation, the edges 171 are parallel with the axis of rotation of rotor 62 and the edges 172 and 173, are perpendicular thereto. Teeth 70 are similarly formed. Edges 171 of teeth 70 cooperate particularly with shearing edges 53 of stationary breaker plate 44, bars 54, bars 124 and edge 140 of bar 40, to effect a shredding action. Edges 172 and 173 cooperate particularly with teeth 55 of bars 54, and with the radial shredding edges 27 of teeth 26 on bars 25 to effect the greater amount of final shredding action. Edges 171 of teeth 69 operate particularly to remove fibrous material which tends to build up on bars 25 and cover the shearing edges 27 thereof, thus insuring that said cutting or shearing edges 27 will be exposed at all times to provide a maximum efficiency of shredding action on the sewage or garbage being reduced.

By a comparison between Figs. 7 and 8 of the drawings, it will be noted that the notches 67 are deeper, or in other words, have a greater radial dimension, than the notches 68. In view of this fact the hammer teeth 70, associated with the discs 64, will project out farther beyond the periphery of the entire rotor 62 than will the raking teeth 69 associated with the discs 63. There is another difference between the discs 63 and 64 in that said discs 63 have a greater thickness than the discs 64. This, of course, is to provide for the accommodation of the difference in thickness or width of the teeth 69 or 70, and for another important reason hereinafter set forth.

There is still a further difference between the discs 63 and 64. As clearly seen by a comparison of Figs. 7 and 8 of the drawings, with two discs 63 and 64 keyed on a shaft 61, the notches 68 will be angularly displaced from the notches 67 a predetermined amount. This amount will be a function of the number of notches 67 and 68 provided in the discs 63 and 64, respectively. In the illustration given, displacement will be 18 degrees, or one-twentieth of a complete circle. The displacement desired will be determined in any case by multiplying the number of notches in any disc by four and dividing the product

into 360, since there two different kinds of discs and each kind is alternately reversed.

As clearly illustrated in Fig. 4 of the drawings, the complete rotor 62 is formed by stacking a plurality of discs 63 and 64 and keying them to the shaft 61. The discs 63 and 64 are alternately placed upon the shaft 61. In addition, alternate similar discs are placed on the shaft 61 180 degrees apart. That is, in a typical illustration, a raking disc 63 will first be placed on the shaft 61 in the position illustrated in Fig. 7. A hammer disc 64 will then be placed on the shaft 61 in the position illustrated in Fig. 8. This will be followed by another raking disc 63 being placed on the shaft 61, but before being placed on said shaft 61 it will be rotated 180 degrees from the position illustrated in Fig. 7. A similar procedure will be followed in placing the next hammer disc 64 on the shaft 61. This procedure will be repeated until the entire rotor 62 is built up to a desired axial length.

It is preferred that a raking disc be on each extreme end of the stacked rotor discs excluding, of course, the end discs hereinafter described.

After the discs 63 and 64 have been stacked, as above described, a row of teeth 69 or 70 will be dropped into a laterally extending aligned row of notches 67 or 68.

To hold said teeth 69 and 70 in place I provide a plurality of transversely extending round rods 72 which project through the aligned apertures of the teeth 69 and 70, such as the apertures 71 of the teeth 69. These rods 72 also project through aligned openings 73 or 74 in the discs 63 and 64. Due to the fact that the hammer teeth 70 are positioned to travel in a circle having a greater diameter than that described by the raking teeth 69, it is evident that the distance of the openings 73 from the axis of the shaft 61 will be greater than the distance of the openings 74 from the axis of said shaft 61. It will thus be seen that the rods 72 maintain the teeth 69 and 70 in the peripheral notches 67 and 68 formed in the discs 63 and 64, respectively. In addition, it will be evident that each of the teeth 69 and 70 will be clamped between a pair of adjacent discs 63 or 64 to hold them rigidly in position.

To provide for the maintenance of the rods 72 in tooth locking position and to prevent longitudinal movement thereof in the assembled rotor, yet to provide for the removal of said rod 72 to permit removal of the teeth 69 or 70, which may be desired either to renew said teeth or to rotate them to present a new cutting edge, of which there will, of course, be three, provided by each tooth 69 and 70, I provide a pair of end discs 75 and 76, which are of similar but of reverse construction. As said end discs 75 and 76 are similar, a description of the disc 76 will suffice for an understanding of the construction of disc 75. Said disc 76 has a diameter substantially equal to the diameter of the discs 63 and 64. It is provided with a central aperture 77 whereby it may slide over the shaft 61. Said disc 76 is mounted for free rotation on said shaft 61. It is provided with a pair of arcuate elongated apertures 78, 78 and a second pair of elongated arcuate apertures 79, 79.

Extending entirely through the series of stacked discs 63, 64, 75 and 76 are a pair of elongated bolts 80, 80 provided with appropriate nuts which, when screwed home, clamp all of said plates rigidly together. A second pair of elongated bolts 81, 81 provided with appropriate nuts are provided which clamp the discs 63, 64 together. Due to the width of the apertures 79, 79, the bolts 81, 81 do not clamp the end plates 75, 76.

The elongated slots 78 and 79 provide for limited angular rotation of the end discs 75 and 76 so that in one position of adjustment the rods 72 will abut the discs 75 and 76 and thus be held against longitudinal movement, while in another position of adjustment said rods 72 will be positioned opposite two series of apertures 82 and 83 which will provide for the ready insertion or removal of said rods 72. That is, the series of apertures 82 will align with the apertures 73, and the series of apertures 83 will align with the apertures 74 in one position of adjustment of the discs 75 and 76. It will be evident that when this alignment is effected rods 72 may be readily inserted or removed. It is also evident that upon rotation of the plates 75 and 76 so that the apertures 73 and 74 are no longer aligned with the apertures 82 and 83, respectively, said rods 72 will be held against longitudinal movement.

To provide for the ready turning of the discs 75 and 76 through the limited extent, as above indicated, said discs are provided with appropriate bosses seen at 84 on disc 76. These bosses 84 may comprise short tubes with closed tops which are welded rigid with the plates 75 and 76. It is evident that by hitting one of said bosses with a hammer, a plate 75 or 76 may be rotated in either direction.

Attention is now directed particularly to Fig. 5 of the drawings which illustrates a preferred arrangement of the teeth. It is to be noted that any row of transversely aligned teeth is formed by teeth of one class, that is, by hammer teeth 70 or by raking teeth 69.

It is also to be noted that except for the two central hammer teeth of any transverse row, each tooth is spaced transversely from an aligned tooth by a space equal to the width of three teeth, one of like character and two of unlike character. This is particularly desirable because it provides an appreciable spacing between the teeth to allow material to drop down into a space where it will be disintegrated. If the teeth are too close together there will be a tendency for the material to ride on top of the rotor 62 in which case it will not be effectively disintegrated.

The direction of rotation of the rotor may be selected as desired, though said rotor is normally rotated in the direction illustrated by the arrow 85, as seen in Figs. 4 and 5. As seen in Fig. 3 of the drawings, it is essential that the rotor rotate in the direction of the arrow 86.

In the operation of the device comprising my invention, material to be reduced, such as sewage or garbage, which contains fibrous material such as cloth or rags, will be fed to the hopper 36 through the top opening 37. A liberal amount of water will be supplied to the hopper 36 and to the reducing chamber 34 by the spray pipe 38. The rotor 62 will be rotated in the direction of the arrow 86. The material will enter the reducing chamber 34 where it will be encountered by the rotating teeth 69 and 70.

It will be evident that the leading face of each of said teeth 69 and 70 will be on a radial line passing through the axis of rotation of the rotor 62 as are the reducing surfaces having edges 27 and 53 of the grating 23 and the stationary breaker plate 44, respectively. The preliminary

reduction of the material will take place due to the shredding or grinding action between the edges 171 of teeth 69 and 70 and the teeth 52 of the stationary breaker plate 44. Due to the fact that the hammer teeth 70 are positioned closer to the teeth 52 they will perform the principal reducing operation in this initial stage.

After the material is so reduced it is carried into the bottom of the reducing chamber 34 and acted upon first by the teeth 69 and 70, particularly the shredding edges 172 and 173 thereof, in cooperation with the radial edges of teeth 55 of bars 54, then in cooperation with the radial edges of teeth 26 of the screen and grating 23. In this operation the radial edges 27 of the teeth 26 will, of course, cooperate with the radial edges 172 and 173 of the teeth 69 and 70 to effect a thorough shredding and reducing of the material. The principal shredding and reducing will be effected by the hammer teeth 70 which extend between the teeth 26 of the bars 25.

The transverse edges 171 of raking teeth 69 are particularly effective to prevent a building up or accumulation of material on said bars 25 which, if allowed, would soon effectively cover their sharp shearing or shredding edges and reduce appreciably their shredding action in cooperation with said teeth 70. As a consequence, the grating 23 is maintained clear of accumulated and built up material at all times whereby the sharp edges of the teeth 26 will be most effectively exposed to perform the shredding operation.

It may be noted that the hammer teeth 70 have substantially the same thickness as the grating bars 25 and the raking teeth 69 have substantially the same thickness as the spaces between said bars 25.

Any material which reaches the forward portion of the reducing chamber 34 without being properly reduced will be reduced by the action of the edges 171 of hammer teeth 70 in cooperation with the shearing edge 140 of transverse bar 40.

After the material is reduced to a very fine state and the fibrous material is cut into short threads, it will pass easily through the screen and grating 23 in a finely reduced state. It is preferred that this state be of such fineness that the material will readily pass through pumps as it is desired to feed said material to a sewage stream where it will be conveyed for treatment to a sewage disposal system of the digester type.

It is also to be noted that the water supplied by the pipe 38 will be effective to flush the entire grinder to keep it free of any adhering material and to aid in the grinding operation. In addition, said water will be effective to carry the reduced material through the screen and grating 23 after it is reduced to the desired state of fineness.

Any irreducible material, such as tramp iron, which enters the hopper 36 is deflected toward the left, as seen in Fig. 3, by the upper side of the bar 40 and then thrown by the teeth 69 or 70 into the throat 48 along any one of a number of paths, as illustrated by the lines 87, 88. The path illustrated by line 87 leads directly through throat 48 to the tramp material compartment 49. The face 47′ of the curved lip 47 preferably has the shape of a segment of a cylinder and is located under the inclined roof of the deflector 35. As a consequence any material thrown to strike lip 47, as illustrated by the line 88, will be deflected by face 47′ to strike the inclined roof of deflector or partition 35 by which it is directed to tramp material compartment 49.

It is to be particularly noted that the tramp material is thrown out of reducing chamber 34 as soon as it enters and does not travel around with rotor 62, even for a single revolution. It is also to be noted that said tramp material compartment 49 is at the rear of the machine, toward which tramp material is thrown directly from the rotor 62. This results in a direct removal of the tramp material without it crossing the path of feed to reducing chamber 34, which would present the danger of its again falling into the reducing chamber 34 under the influence of the feed from hopper 36.

It is to be noted that each of the teeth 69 and 70 has three operative positions in each of which different edges 171 and different portions of edges 172 and 173 are in a working position at one time. Therefore, when one set of shearing edges becomes dull from use, teeth 69 and 70 may be removed and rotated 120 or 240 degrees thereby presenting new shredding edges. In addition, the teeth 69 and 70 may be turned over, face for face, in which case previously trailing edges 172 and 173 become leading edges.

It is therefore evident that the rotor 62 with the hammer teeth 70 and the raking teeth 69 are effective to shred and reduce material in cooperation, first with the edges 53 of teeth 52 of the stationary breaker plate 44 and then with the teeth 55 of bars 54, after which the material is thoroughly shredded and reduced by said teeth 69 and 70 in cooperation with shredding edges 27 of bars 25, and 124, a final reduction of any material reaching the bar 40 being effected by the cooperation of teeth 70 and edge 140 of said bar 40. The water added by spray pipe 38 will assist the reducing action and wash reduced material through grating 23. As before indicated, teeth 69 operate to maintain the shredding edges 27 of bars 25 exposed to insure a maximum shredding action.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. A rotor for a shredder comprising a shaft, a plurality of stacked discs keyed to said shaft, at least one of said discs having a wide mouth angular notch formed to receive a tooth in the form of an equilateral triangle while said discs are in stacked relation and contact two sides thereof over an extended area, an equilateral triangularly formed tooth in said notch having a central aperture, and a rod extending through said aperture and through aligned apertures in some of said discs to hold said tooth in place, said tooth being adjustable to present any apex thereof in cutting position.

2. A shredder rotor comprising a shaft, a plurality of stacked discs keyed on said shaft, at least some of said discs having peripheral notches, removable teeth in said notches having apertures, rods extending through said apertures and through aligned apertures in some of said discs and operating to hold said teeth in place, said rotor also including a pair of end discs rotatably mounted on said shaft, means for clamping said end discs in place, said end discs having apertures which align with said tooth holding rods to per-

mit their removal by longitudinal movement when said end discs are in one position of adjustment, said end discs being adjustable to another position to maintain said tooth holding rods against longitudinal movement.

3. A shredder rotor comprising a shaft, a pair of groups of identical discs keyed on said shaft, each group of discs being formed by identical discs and the discs of the two groups having substantially equal diameters and having peripheral notches, the discs of one group having notches of greater depth than those of the other group, and removable teeth having equal heights mounted in said disc notches whereby the tips of the teeth associated with one group of discs will travel in a greater circle than those of the other group.

4. A shredder rotor comprising a shaft, a pair of groups of identical discs keyed on said shaft, each group of discs being formed by identical discs and the discs of the two groups having substantially equal diameters and having peripheral notches, the discs of one group having notches of greater depth than those of the other group, and removable teeth formed as equilateral triangles of equal heights and mounted in said disc notches whereby the tips of the teeth associated with one group of discs will travel in a greater circle than those of the other group.

5. In a shredder, the combination with a casing having a bottom comprising a tooth grating formed by spaced toothed bars extending longitudinally thereof, of a rotor mounted in said casing, said rotor having a plurality of removable teeth of unequal thickness, the thicker teeth being positioned to run radially opposite said grating teeth and the thinner teeth being positioned to run between said grating teeth, said teeth being so spaced that a development of said rotor shows them in transverse aligned rows formed by teeth of the same thickness in each row and each tooth spaced transversely from an aligned tooth by a space equal to the width of three teeth, one of like character and two of unlike character.

6. A shredder rotor assembly comprising a shaft, a cylindrical member on said shaft, adjustable teeth carried on said cylindrical member, rods extending axially through said teeth and cylindrical member, an end plate rotatably adjustable relative to said cylindrical member, said plate having openings through which said rods may slide, said plate being adjustable to hold said rods in place after being inserted through said openings.

7. A shredder rotor assembly comprising a rotatable frame member, removable teeth carried by said frame member and projecting radially therefrom, rods extending axially through said teeth and frame member and attaching them together, an end plate rotatably adjustable relative to said frame member, said plate having openings through which said rods may slide axially, said plate being adjustable to hold said rods in place against axial movement after being inserted through said openings.

8. A shredder rotor comprising a shaft, a frame mounted on said shaft, apertured removable teeth carried by said frame, rods extending through said apertured teeth and through aligned apertures in said frame and operating to hold said teeth in place, said frame carrying an end disc rotatably mounted thereon, means for clamping said end disc in place, said end disc having apertures which align with said tooth holding rods to permit their insertion or removal by longitudinal movement when said end disc is in one position of adjustment, said end disc being adjustable to another position to maintain said tooth holding rods against longitudinal movement.

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