

Dec. 8, 1964

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3,160,351

DISINTEGRATORS AND FEEDING MEANS THEREFOR

Filed April 23, 1962

5 Sheets-Sheet 1

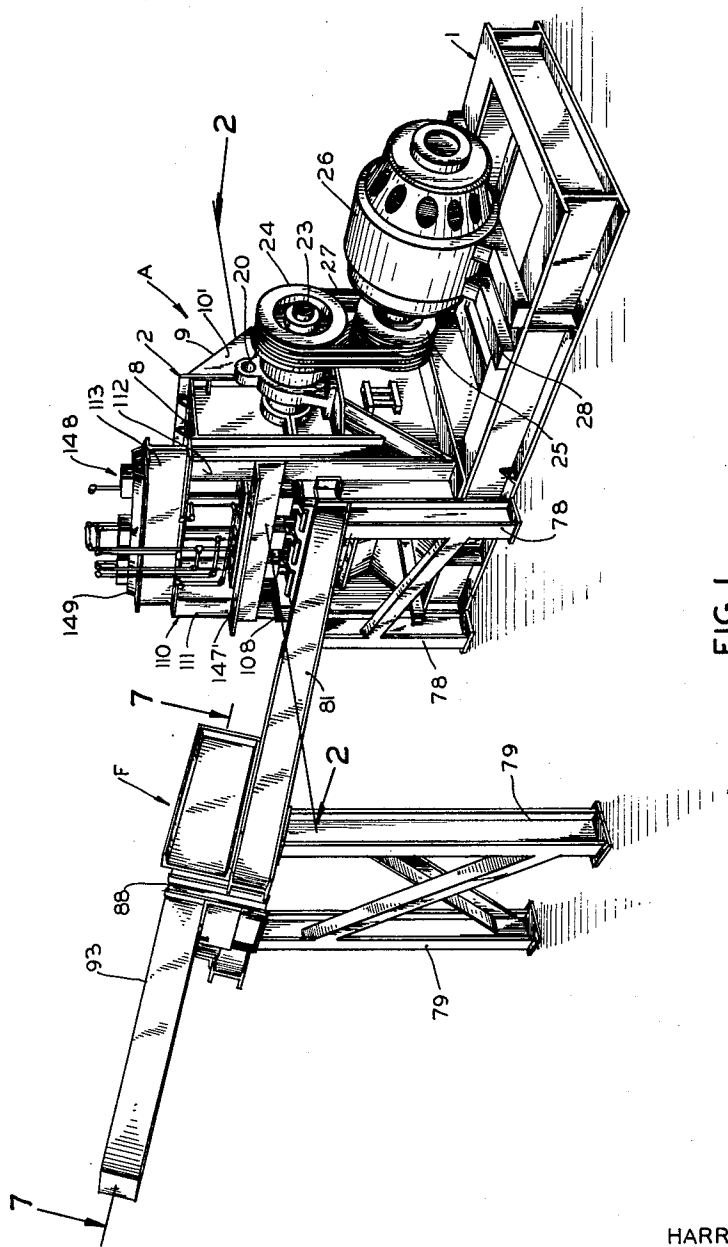


FIG. 1

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5 Sheets-Sheet 2

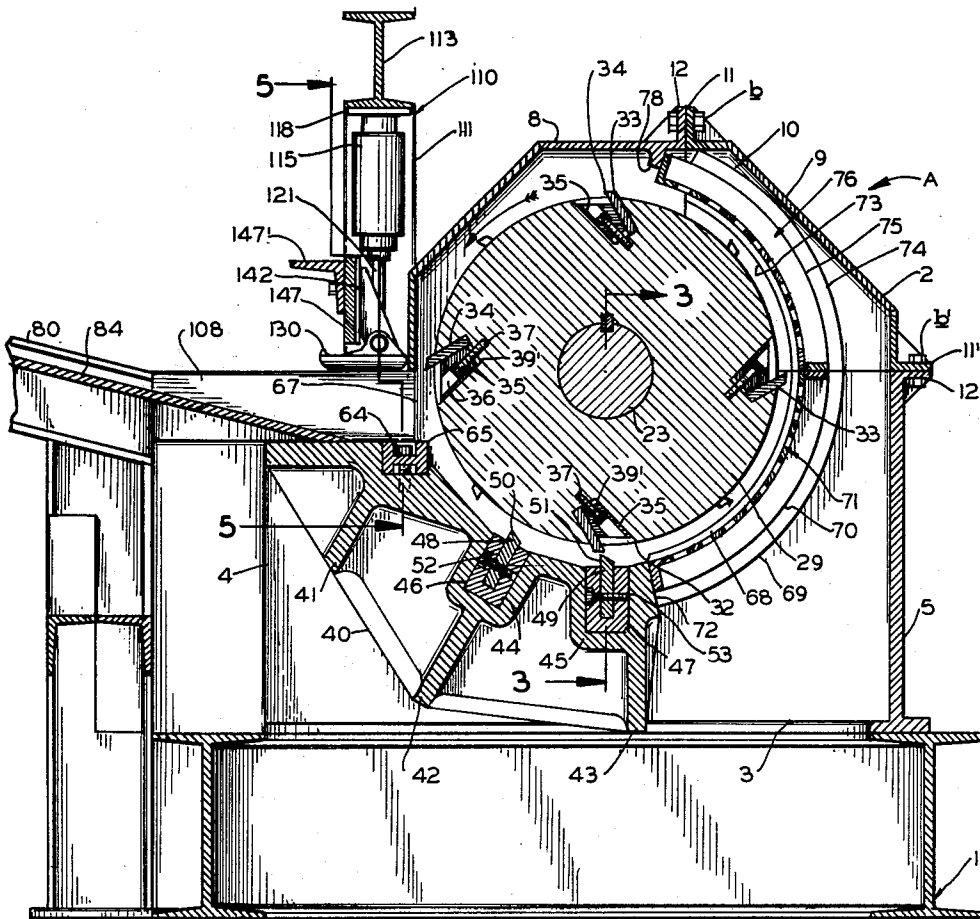


FIG. 2

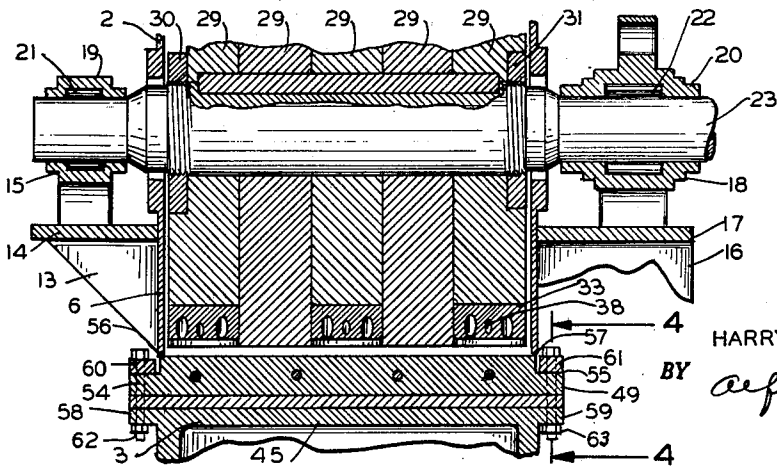


FIG. 3

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5 Sheets-Sheet 3

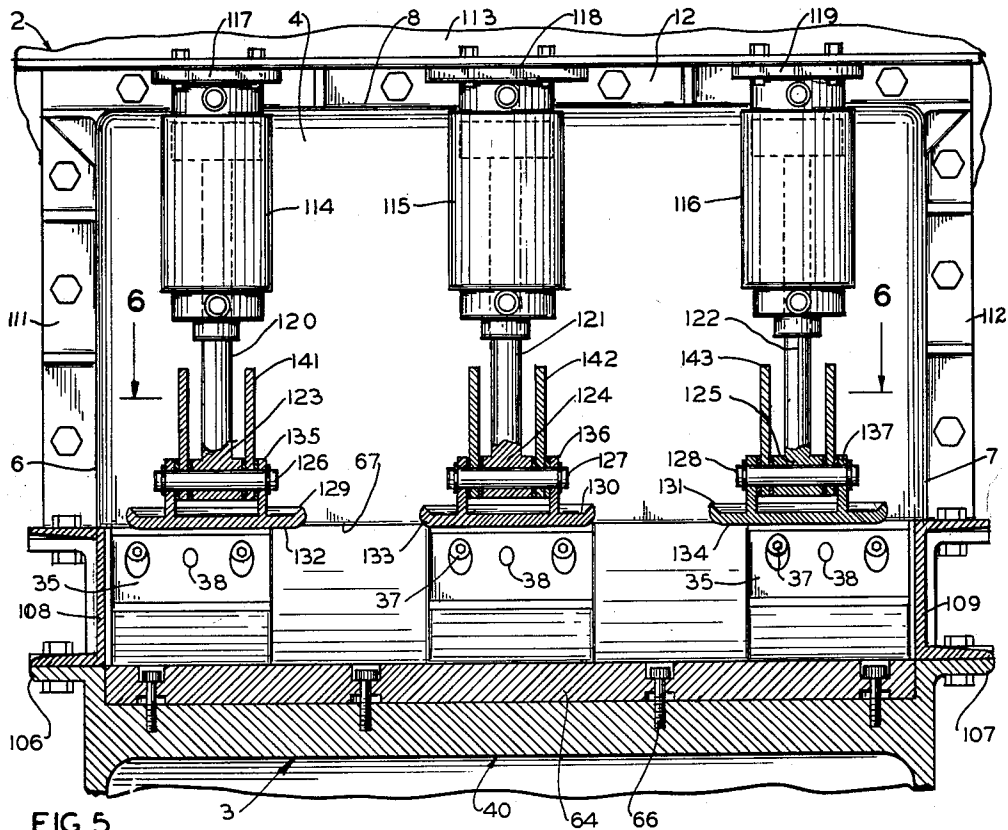


FIG. 5

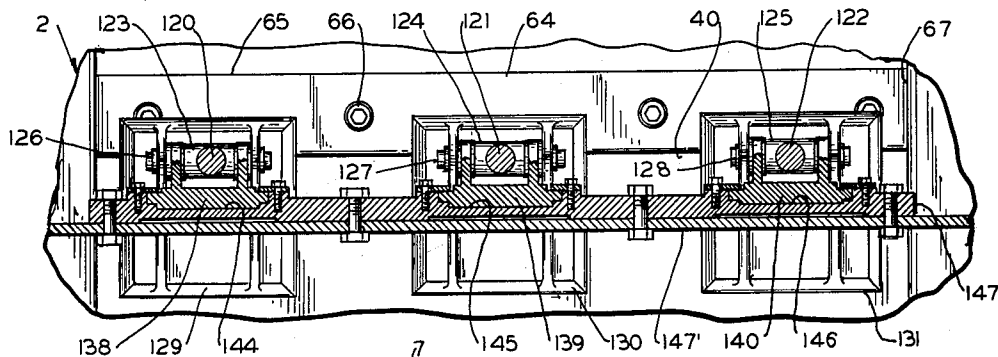


FIG. 6

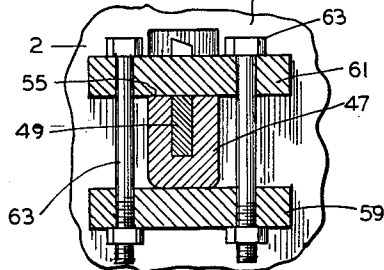


FIG. 4

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DISINTEGRATORS AND FEEDING MEANS THEREFOR

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5 Sheets-Sheet 4

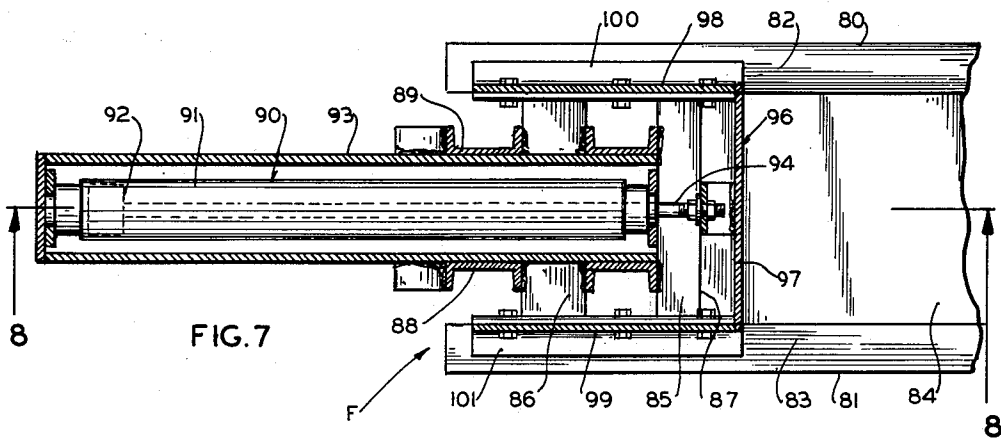


FIG. 7

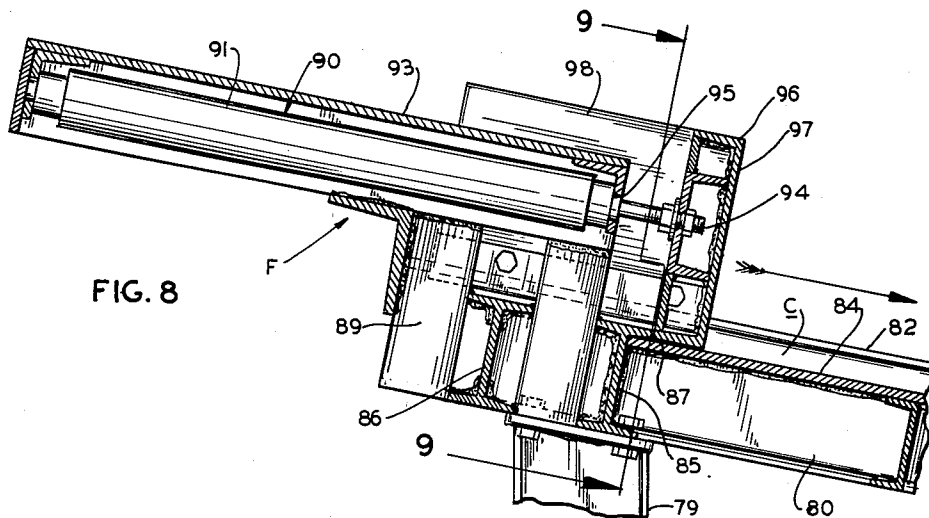


FIG. 8

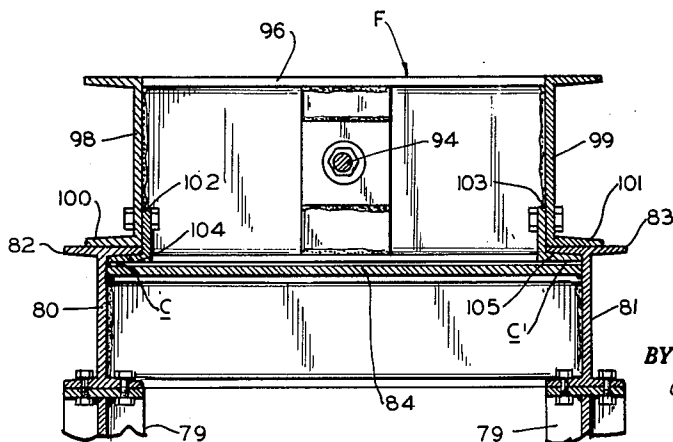


FIG. 9

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DISINTEGRATORS AND FEEDING MEANS THEREFOR

Filed April 23, 1962

5 Sheets-Sheet 5

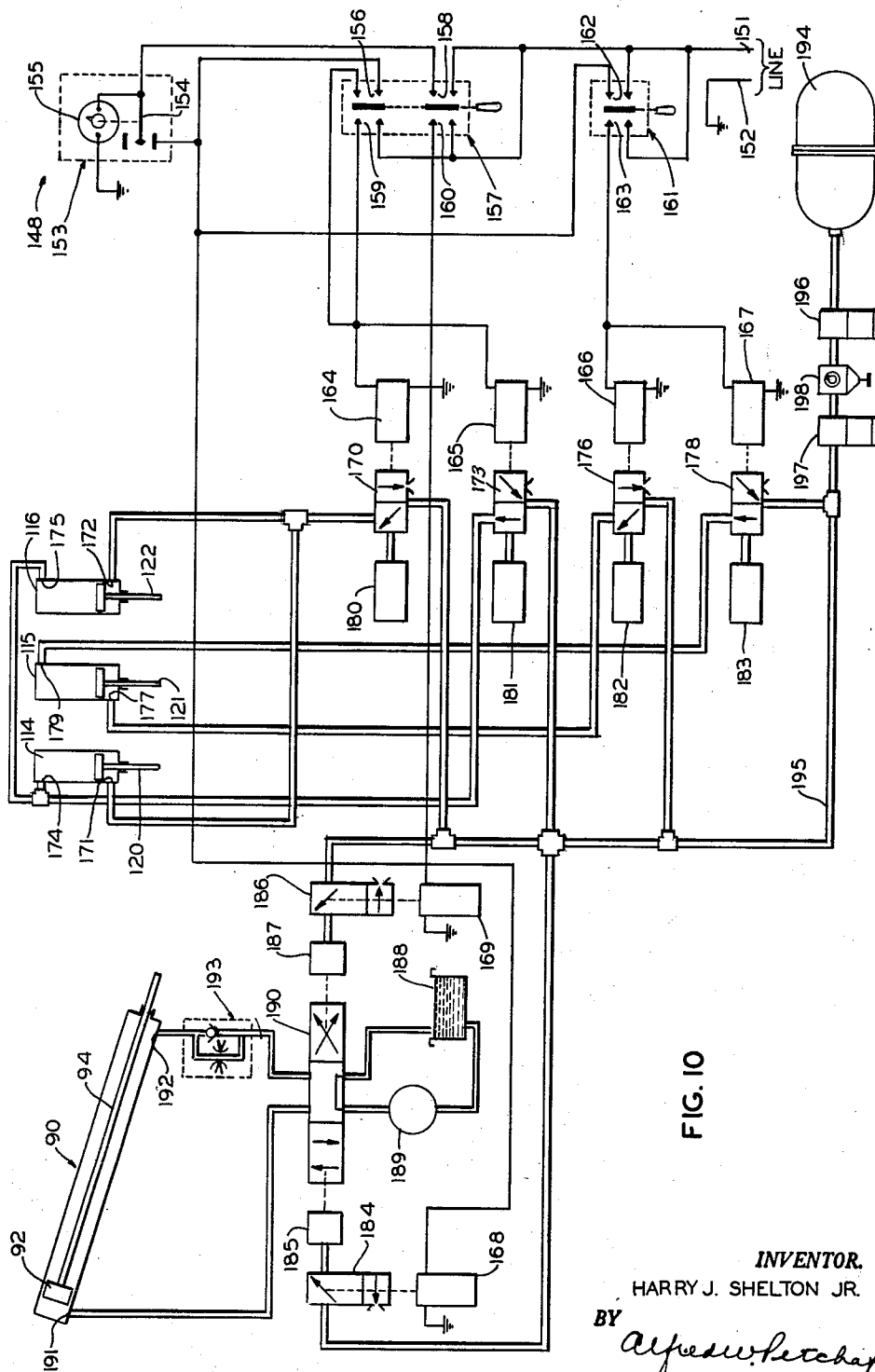


FIG. 10

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DISINTEGRATORS AND FEEDING MEANS THEREFOR

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Filed Apr. 23, 1962, Ser. No. 139,412
16 Claims. (Cl. 241—34)

This invention relates in general to comminuting devices and, more particularly, to an improved type of disintegrator and associated feeding means.

Pulverizers, disintegrators, and especially the hammer-mill type of pulverizer are commonly employed in many of the operations presently performed in the chemical and related industries. Ordinarily, in such devices, the hammers are rotated at great speed and with a great force against incoming large particles of material and reduce the size thereof. Some types of materials, however, such as certain kinds of waxes, synthetic resins, and the like are formed in large rectilinear blocks which cannot be dropped into a grinder cage and fed by gravity to the hammers. Consequently, such materials must be broken up into at least coarse lumps by hand or by some preliminary breaking machine. In addition to this, many such materials are tough and slightly malleable rather than brittle and frangible so that they do not readily lend themselves to impact-disintegration but must be broken down into smaller-particle size by a procedure more nearly resembling shredding or chopping.

It is, therefore, the primary object of the present invention to provide a disintegrator or comminutor adapted for the reduction of large block-like masses of relatively non-frangible materials such as waxes, synthetic resins, and the like.

It is another object of the present invention to provide a disintegrator or comminutor having feeding means which will positively feed material in successive predetermined increments to the size-reduction mechanism.

It is another object of the present invention to provide a feeding means for use with disintegrators which is substantially automatic in operation.

It is a further object of the present invention to provide a disintegrator and feeding means therefor of the type stated which can be readily disassembled for replacement of parts or other repairs whenever necessary.

It is also an object of the present invention to provide a feeding device for use with hammermills which is sturdy in construction and economical in cost.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (five sheets)—

FIG. 1 is a perspective view of a disintegrator and a feeding means therefor which is constructed in accordance with and embodying the present invention;

FIG. 2 is a fragmentary sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is a fragmentary sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a fragmentary sectional view taken along line 7—7 of FIG. 1;

FIG. 8 is a fragmentary sectional view taken along line 8—8 of FIG. 7;

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FIG. 9 is a fragmentary sectional view taken along line 9—9 of FIG. 8; and

FIG. 10 is a schematic view of an electrical and hydraulic circuitry forming part of the present invention.

Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of the present invention, A designates a disintegrator or comminutor comprising a substantially rectilinear base 1 formed preferably as a heavy malleable iron casting. Mounted on the base 1 is an outer housing 2 including a cage base 3 which is integrally connected at its forward margin to a front wall 4 and at its rearward margin to a back wall 5. The front and back walls 4, 5, are integrally connected at their transverse margins by left and right end walls 6, 7, respectively. The front wall 4 integrally merges into a top wall 8 which is spaced upwardly and forwardly from the back wall 5, providing access to the interior portions of the disintegrator A for accomplishing necessary repairs. Provided for closurewise disposition across this access is a cover plate 9 having depending side walls 10, 10', which integrally merge into extended flanges 11, 11', which are sized for matching engagement with flanges 12, 12', integrally formed on the top and back walls 8, 5, respectively. Each of the flanges 11, 11', and 12, 12', are provided with apertures or so-called "bolt-holes" for accommodating bolts b, b', in which manner the cover plate 9 is removably secured to the top wall 8 and back wall 5, respectively.

Welded to the outer face of the end wall 6 is a pair of laterally spaced gusset plates 13 which are, in turn, welded to the underface of and support a horizontal bracket plate 14 for supporting the lower half of a pillow block 15 secured thereon by bolts or suitable attachment means. Similarly, welded to the outer face of the end wall 7 is a pair of gusset plates 16 which are, in turn, welded to the underface of and support a horizontal bracket plate 17 for supporting the lower half of a pillow block 18 secured thereon by bolts or other suitable fastening means, the pillow blocks 15, 18, being in axial alignment with each other. Operatively mounted within the pillow blocks 15, 18, and held in place by arcuate bearing caps 19, 20, are conventional roller bearings 21, 22, respectively. Held in and extending horizontally through the roller bearings 21, 22, is a rotor shaft 23 which is provided at one end with a V-grooved pulley 24. The V-grooved pulley 24 is connected to a driving pulley 25 and a conventional electric motor 26 by means of a series of V-belts 27, the electric motor 26 being mounted externally of the housing 2 by support brackets 28 which are, in turn, welded to the base support 1.

Rigidly keyed to the rotor shaft 23 is a series of axially aligned disks 29 which are held in endwise abutment and in locked position upon the shaft 23 between a pair of threadedly mounted locking rings 30, 31. Each of the disks 29 are provided on their periphery with four uniformly spaced elongated grooves 32 which are positioned at a dihedral angle with respect to the normal radius of the disk 29. By reference to FIG. 2, it can be seen that the four grooves 32 are located 90° apart in terms of circular measure around the disks 29. Each of the disks 29 is rotated approximately 45° with respect to the next axially aligned disk so that the grooves 32 of one disk will be rotated with approximately 45° with respect to the grooves 32 of the next axially aligned disk 29. In other words, the grooves 32 of every other disk 29 on the shaft 23 are arranged in four axially aligned sets which are sized for accommodating rotor knives 33 having a sharpened cutting edge 34 and which are further retained within the grooves 32 by means of a rotor wedge 35. By reference to FIG. 2, it can be seen that the wedge 35 bears against the knives 33 and is provided with aper-

tures 36 for accommodating standard bolts 37 whereby the wedge 35 is rigidly secured within the groove 32 of the disk 29. By means of this construction, it should be obvious that the rotor knives 33 can be easily removed for replacement by removing the bolts 37 from the apertures 36 and thereupon withdrawing the wedge 35. Oftentimes, the wedge 35 becomes firmly embedded within the grooves 32 and is not easily removed therefrom. Consequently, the wedge 35 is provided with a second aperture or so-called "bolt-hole" 38 for accommodating an elongated bolt (not shown) which will bear against the disk 29 when threaded within the aperture 39 and force the wedge 35 out of the groove 32. In this connection, it should also be noted that a suitable shim 39' can be interposed between the lower edge of the groove 32 and the knife 33 for regulating the depth of projection of the knife 33. Thus, after continuous use, the knives 33 can be conveniently removed and milled to a sharpened edge 34. However, to maintain proper cutting edge depth, it is often necessary to insert a shim such as the shim 39'.

Integrally formed with the base 3 and extending between each of the left and right end walls 6, 7 respectively, is a bed plate 40 which integrally includes three upstanding flanges 41, 42, 43. The flanges 42, 43, integrally merge into knife-retaining cups 44, 45, respectively, which extend the axial length of the endwise abutting, axially aligned disks 29, all as can best be seen in FIG. 2. Suitably mounted within each of the cups 44, 45, are U-shaped knife holders 46, 47, each of which are lengthwise grooved for accommodating bed knives 48, 49, having cutting edges 50, 51, and which are retained in the knife holders 46, 47, by means of conventional bolts 52, 53, respectively. Each of the knife holders 46, 47, have reduced extended ends 54, 55, which extend outwardly of the housing 2 through apertures 56, 57, formed within each of the end walls 6, 7 respectively. The extended ends 54, 55, are disposed over lower locking bars 58, 59, which are integrally formed with the end walls 6, 7, and the extended ends 54, 55, are transversely grooved at their upper ends for the accommodation of upper locking bars 60, 61. The locking bars 58, 60, and the extending end 54 are vertically drilled to receive removable bolts 62 and the locking bars 59, 61, and the extended end 55 are similarly drilled to receive removable bolts 63, all as can best be seen in FIG. 3.

The upper edge of the bed plate 40 is lengthwise grooved to accommodate a breaker plate or anvil 64 having a sharpened cutting edge 65. The breaker plate 64 is secured to the bed plate 40 by means of bolts 66 and is located immediately beneath an intake aperture 67 formed within the front wall 4. The cutting edge 65 is spaced from the cutting edge 34 of each of the knives 33 to provide initial crushing or pulverizing action when the input is sent through the aperture 67.

Welded or otherwise rigidly secured to the interior faces of the left and right end walls 6, 7, is an arcuate inner rail 68 and a rearwardly spaced concentric channel forming back rail 69 which defines a transversely registering screen-receiving channel 70. Slidably disposed within the channel 70 is a conventional lower screen or grate-bar assembly 71, the lower end of which abuts a flange 72 integrally formed with the bed plate 40. Welded or otherwise rigidly secured to the interior faces of the lateral side walls 10, 10', is an arcuate bottom rail 73 and a rearwardly spaced concentric channel forming top rail 74 which defines a transversely registering screen-receiving channel 75. Slidably disposed within the channel 75 is an upper conventional screen or grate-bar assembly 76, the upper end of which abuts a flange 77 integrally formed on the interior face of the top wall 8. It will be noted, by reference to FIG. 2, that the upper and lower screens 76, 75, respectively, lie outwardly beyond the outermost peripheral limits of the cutting knives 33 so that there is a proper amount of clearance between the cutting edges 34 and the screens 75, 76.

The sheet of plastic or other similar material which is to be pulverized in the disintegrator A is carried by and fed to the disintegrator by means of a feeding device F substantially as shown in FIGS. 7-9 and which includes a pair of forward legs 78 and a pair of rearward legs 79, the latter of which have a vertical height slightly greater than the forward legs 78. Bolted to and extending between each of the pairs of legs 78, 79, are guide-forming brackets 80, 81, preferably formed of any standard rolled I-beam, which integrally include extended flanges 82, 83, respectively, at their upper margins. Secured to and extending between each of the brackets 80, 81, the entire length thereof, is a horizontal feed support shelf or ramp 84 which is spaced downwardly from the flanges 82, 83, substantially as shown in FIG. 9, defining a pair of guide channels c, c'. It can be seen that the ramp 84 is inclined downwardly toward and abuts the lower margin of the intake aperture 67 for supplying the feed input to the disintegrator A. The guide-forming brackets 80, 81, are inter-connected by lengthwise cross-supports 85, 86, preferably formed of any standard rolled I-beam, the cross-support 85 having an integrally formed upper flange 87 which serves as a rear stop, all for reasons which will presently more fully appear.

Welded or otherwise rigidly secured to the cross-supports 85, 86, extending upwardly therefrom are two pairs of spaced cylinder support beams 88, 89, and rigidly secured to the other end thereof is a hydraulic feeding ram 90, which includes a feeding cylinder 91 and slidably disposed in the cylinder 91 is a piston 92. The cylinder 91 is suitably mounted in a casing 93, and secured to the piston 92 is a piston-rod 94 which extends outwardly of the casing 93, through an aperture 95 formed within one of the end walls thereof. Bolted to the forward end of the piston-rod 94, reference being made to FIG. 8, is a shoe 96 having a forwardly presented ramming plate 97. Integrally formed with the plate 97 at each of its transverse ends and extending rearwardly and upwardly therefrom are side walls 98, 99, preferably formed of U-shaped channels, and which include guide flanges 100, 101, integrally formed at their lower ends. The flanges 100, 101, are adapted to ride on the upper surface of the flanges 82, 83. Welded to the interior lateral faces of the walls 98, 99, are guide-brackets 102, 103, which integrally include outwardly extending guide channels 104, 105, which are sized for slidable guide-forming movement within the guide channels c, c'. Thus, by reference to FIGS. 8 and 9 it can be seen that the shoe 96 is slidable along the ramp 84 in the guide-channels c, c', as the piston-rod 94 is extended and retracted within the cylinder 91. It can be seen that the shoe 96 is limited in its rearward movement by means of the flange 87 which serves as a rear stop.

Integrally formed with each of the transverse side walls of the bed plate 40 adjacent its upper margin are support flanges 106, 107, and bolted or otherwise rigidly secured thereto are mounting channels 108, 109, which are disposed on each transverse end of the intake aperture 67. Bolted to the mounting channels 108, 109, and extending upwardly therefrom, is a support frame 110 including a pair of uprights 111, 112, which are cross-connected at their upper margins by a transversely extending support bar 113.

Suitably mounted on the support bar 113 and extending downwardly therefrom are three spaced aligned pneumatic cylinders 114, 115, 116, and which are secured to the support bar 113 by means of mounted plates 117, 118, 119, respectively. Operatively mounted within each of the cylinders 114, 115, 116, are piston-rods 120, 121, 122, which terminate in cylindrical heads 123, 124, 125, respectively. Each of the heads 123, 124, 125, are axially bored to accommodate pivot pins 126, 127, 128, and rockably mounted on each of the pivot pins 126, 127, 128, are clamping shoes 129, 130, 131 which include flat rectilinear plates 132, 133, 134, integrally formed with

pairs of upstanding flanges 135, 136, 137, the flanges 135, 136, 137, being rockably mounted on the pins 126, 127, 128, respectively.

The piston-rods 120, 121, 122, are guided during their vertical movement by vertical guide-bars 138, 139, 140, which are integrally formed with upstanding flanges 141, 142, 143, the flanges 141, 142, 143, being secured to each of the pins 126, 127, 128, respectively. By reference to FIG. 6, it can be seen that the guide-bars 138, 139, 140, are movable within guide channels 144, 145, 146, formed within a vertical guide plate 147, the plate 147 being bolted or otherwise rigidly secured to a horizontal bracket 147' which, in turn, extends transversely between and is secured to the uprights 111, 112. Thus, by reference to FIG. 5, it can be seen that the clamping cylinders 114, 115, 116, maintain the slab of feed material in a rigid position, while the feeding ram 90 forces the feed into the pulverizer A. Moreover, when the piston 92 of the ram 90 is withdrawn into the cylinder 91, the pneumatic cylinders 114, 115, 116, will hold the slab of feed material in a rigid position and maintain the feed in a cutting position.

Each of the cylinders 114, 115, 116, are operated in a pre-timed relationship to the feeding cylinder or hydraulic ram 90 by suitable control means 148 which are mounted on a control panel 149, the panel 149 being supported by and rigidly secured to the support frame 110.

The control means 148 is schematically shown in FIG. 10 and includes a pair of current-carrying conductors 151, 152, which are suitably connected to a three-hundred-eighty volt source of alternating current (not shown), the conductor 152 additionally being grounded. A two pole recycling-on-and-off timer 153, which includes a single pole switch 154 and a conventional timer motor 155, has one pole connected to a set of contacts 156 on a three-position wing-lever switch 157, which has "open," "off," and "automatic" positions. The switch 157 has a second set of contacts 158 which is connected to the conductor 151 and also to the timer motor 155. The switch 157 also includes a set of contacts 159 and a set of contacts 160 on the "open" position. The control means 148 also includes a second three-position wing-lever switch 161 which has "open," "off," and "feed" positions. The switch 161 is provided with a set of contacts 162 on the "feed" position and a set of contacts 163 on the "open" position. The contacts 156 of the three-position switch 157 are electrically connected to the pole switch 154 and to one terminal of a pilot solenoid 164 and a pilot solenoid 165, the other terminals of the solenoids 164, 165, being grounded. The contacts 163 of the three-position switch 161 are connected to one terminal of the pilot solenoids 166, 167, the other terminals of the solenoids 166, 167, being grounded. The contacts 156 and the contacts 162 are further connected to a pilot solenoid 168 and the contacts 160 are connected to a pilot solenoid 169, the solenoids 168, 169, having their other terminals grounded, all as schematically shown in FIG. 10.

The solenoid 164 is operatively connected to a three-way normally closed solenoid operated pilot valve 170 having one port connected to lower fluid ports 171, 172, on each of the clamping cylinders 114, 116, respectively. The solenoid 165 is operatively connected to and adapted to actuate a three-way normally open solenoid operated pilot valve 173 having one port connected to an upper fluid inlet port 174 and an upper fluid port 175 on each of the cylinders 114, 116, respectively. The solenoid 116 is operatively connected to a three-way normally closed solenoid operated pilot valve 176 having one port connected to a lower fluid port 177 of the clamping cylinder 115. The solenoid 167 is operatively connected to a three-way normally open solenoid operated pilot valve 178 having one port connected to an upper fluid port 179, on the clamping cylinder 115. Each of the solenoid valves 170, 173, 176, 178, are connected to air returns

180, 181, 182, 183, respectively, for returning each of the valves to their normal position after actuation by the respective solenoids. Furthermore, the valves 170, 173, 176, 178, are provided with exhaust ports for dispelling the air under pressure from each of the clamping cylinders 114, 115, 116.

The solenoid 168 is operatively connected to and adapted to actuate a three-way normally closed solenoid pilot valve 184 which is, in turn, connected to an air operated servo-mechanism or air pilot 185. The solenoid 169 is operatively connected to and adapted to actuate a normally closed solenoid operated pilot valve 186 which is, in turn, connected to an air operated servo-mechanism or air pilot 187. The solenoid valves 184, 186, are also provided with exhaust ports for expelling the air from each of the servo-mechanisms 185, 187, respectively. The hydraulic feeding ram 90 is provided with hydraulic fluid from a reservoir 188 and a pump 189, and is regulated by means of a four-way three-position hydraulic valve 190, which is provided with a "feed" position, a "hold" position, and a "return" position. The valve 190 is further connected to each of the air operated servo-mechanisms 185, 187, respectively, as shown in FIG. 10. By reference to FIG. 10, it can be seen that the valve 190 is operatively interposed between the ram 90 and the reservoir 188, and pump 189. The fluid from the reservoir 188 is delivered to the ram 90 through an upper fluid port 191 and returned to the reservoir 188 through a lower fluid port 192. A pressure regulating valve 193 is interposed between the reservoir 188 and the lower fluid port 192 for regulating the flow of fluid from the ram 90 to the reservoir 188 and thereby regulating the speed of the piston 92.

Each of the valves 170, 173, 176, 178, 184, 186, are all operatively connected to a source of high-pressure air 194 through an air supply line 195. Interposed in the air supply line 195 is a lubrication reservoir 196 for supplying required lubricating oil to the various valves and cylinders of the feeding device F. A filter 197 is interposed in the air supply line 195 for removing any harmful foreign material in the air 194. A pressure regulating valve 198 is also mounted in the air supply line 195 for regulating the air pressure to the various valves from the source of air 194.

In use, the disintegrator A is connected to a suitable source of electrical current through its own internal electrical circuitry, not shown, and which is distinct and separate from the electrical circuitry and control means forming part of the feeding device F. As the electrical circuitry of the disintegrator A is conventional, and in no way forms part of the present invention, it is neither illustrated nor described in detail herein. The disintegrator A should preferably be mounted on a floor or similar support and over an opening so that pulverized material passing through each of the screens 70, 76, will drop into a conventional discharge bin (not shown). When the electric motor 26 is energized, the rotor shaft 23 and the axially aligned disks 29 which are keyed thereto will rotate in the direction of the arrow as shown in FIG. 2. The sheet or slab of plastic material or other similar relatively hard material is fed through the intake aperture 67 and initially crushed between the cutting edge 34 of the rotor knives 33 and the cutting edge 65 of the breaker plate 64. The material is further pulverized by the cutting action of each of the cutting edges 50, 51, and the rotor knives 33. Actually, as the first rotor knife 33 passes the anvil or breaker plate 64, it will initially sever a large chunk of plastic material from the slab and force the same between the various cutting bed knives 48, 49. As the material which is pulverized has reached the desired size, it will pass through each of the screen assemblies 70, 76, and into the discharge bin (not shown).

Each of the screens 71, 76, can be easily changed by removal of the cover plate 9 which is, in turn, accomplished by removing each of the bolts b, b', from the flanges 11, 11', and 12, 12', substantially as shown in

FIG. 2. Thereupon, the lower screen 71 is slidably removed from the screen channel 70 and the upper screen 76 is removed from the channel 75. It is also to be noted that when the cover plate 9 is removed each of the rotor knives 33 are readily accessible and can easily and conveniently be changed for sharpening or similar repairs. An elongated bolt (not shown) is inserted within the second aperture or bolt hole 38 and when turned will bear against the disk 29 forcing the wedge 35 out of the groove 32. At this point, the knife 33 can be sharpened to a fine cutting edge 34 and reinserted within the groove 32. As the depth of the knife may have been shortened in the cutting operation, a suitable shim 39 can be inserted between the lower edge of the groove 32 and the base of the knife 33. Thereupon, the rotor shaft 23 can be turned until the next set of knives 33 are accessible for repairing or sharpening. The bed knives 48, 49, can be conveniently removed from the sides of the housing 2 without completely disassembling or breaking down the pulverizer A. The bolts 62 are removed from the locking bars 58, 60, and the bolts 63 are removed from the locking bars 59, 61, thereupon, permitting removal of the upper locking bars 60, 61. The knife holders 46, 47, can then be removed from the housing 2 through the apertures 56, 57, and the bed knives 48, 49, can be removed from the knife holders 46, 47, by removing each of the bolts 52, 53, respectively. Thereupon, the bed knives 48, 49 can be sharpened and reinserted in the knife holders 46, 47, and retained by the bolts 52, 53, respectively. The knife holders 46, 47, are then reinserted into the housing 2 and retained in secured position by locking the same through the locking bars 58, 59, 60, 61, by means of bolts 62, 63, respectively.

The two electrical conductors 151, 152, are connected to a suitable source of three-hundred-eighty volt alternating current (not shown), for electrical actuation of the feeding circuit. For purposes of describing the operation of the various components of the feeding device F, it may be assumed that each of the switches 157, 161, are in the "off" position, each of the clamping cylinders 114, 115, 116, are in the normally "lowered" or "clamped" position and that the ram 90 is in the "open" or "withdrawn" position. The disintegrator A is then energized for rotating the rotor knives 33 in the manner previously described. The feed material, which may be a large slab of relatively hard synthetic resin or plastic material, is disposed upon the feed support shelf or ramp 84 in feeding position, in order to be inserted into the disintegrator A. It is to be noted that as the solenoids 164, 165, 166, 167, are unactuated, the pilot valves 170, 173, 176, 178, are in their normal positions, and thus the clamping cylinders 114, 115, 116, are in the "clamped" position, as shown schematically in FIG. 10. The wing lever of the switch 161 is moved to the "feed" position, thus closing the contacts 62. Through the circuitry, it can be seen that the solenoid 168 is actuated, thereby opening the normally closed valve 184 and permitting air to flow into the servo-mechanism 185. The actuation of the servo-mechanism 185 will force the valve 190 into the "feed" position, thus permitting fluid from the reservoir 183 to be pumped into the port 191 of the ram 90, and thus causing the piston 2 and the ramming plate 97 to move forwardly forcing the feed material toward the intake aperture 67. As the clamping cylinders 114, 115, 116, are in the "closed" position, there is no danger of the ram 90 forcing the feed into the disintegrator A. Thereupon, a wing lever of the switch 161 is moved to the "off" position.

In order to automatically operate the feeding device F, the wing lever of the switch 157 is moved to the "automatic" position. Thus, current from the conductor 151 will flow through the timer 153 actuating the timer motor 55. When the timer motor 55 sends an impulse, the pilot switch 154 will close, causing the impulse to actuate the solenoids 164, 165. The solenoid 164 will thereupon open the normally closed solenoid operated pilot

valve 170, maintaining communication between the air supply line 195 and the lower fluid ports 171, 172, and the clamping cylinders 114, 115. Air will thereupon flow into these cylinders 114, 116, raising each of the piston-rods 120, 122, to the "open" position. As this happens, the solenoid 165 will close the normally open solenoid operated pilot valve 173 permitting air to discharge from the upper ports 174, 175, of each of the cylinders, 114, 116. At this point, it is to be noted that the solenoid 165 has closed the normally open valve 173, thus cutting off communication with the air supply line 195, and in doing so, vents each of the cylinders 114, 116, to the exhaust port of the valve 173. It should also be noted that exhaust port of the valve 170 is closed to each of the cylinders 114, 116, thus maintaining each of the cylinders 114, 116, in the "open" position.

At the same time that each of the outside clamping cylinders 114, 116, are moved to the open position, the impulse from the timer 153 is delivered to the solenoid 168, actuating the solenoid 168 and thereby opening the normally closed valve 184. This will, in turn, actuate the air pilot solenoid 185 which will move the valve 190 to the "feed" position. As this happens, the fluid from the reservoir 183 will be pumped by the pump 189 into the port 191 of the ram 90. The piston 92 will be moved forward to a point where the ramming plate 97 will abut the rearward margin of the slab of feed material, thus forcing the feed material under the shoe 130 and in through the intake aperture 67. As the shoe 130 is rockably mounted on the piston-rod 120, it will pivot to a position to accommodate the slab material. In this connection, it should be noted that as the clamping cylinder 115 is always in the "clamped" position, this will prevent chattering of the slab feed material during the disintegrating operation.

After the timer 153 cuts the impulse to the solenoids 164, 165, the normally closed valve 170 will close and the normally open valve 173 will open, thus permitting the air within each of the cylinders 114, 116, to vent through the exhaust port of the valve 170. At the same time, communication between the ports 174, 175, of the cylinders 114, 116, and the air supply line 195 will be maintained through the now opened valve 173, thereby moving the pistons 120, 122, to the "closed" position. As the clamping cylinders 114, 116, are closed, the impulse to the solenoid 168 is also cut closing the normally closed valve 184 and thereby de-energizing the servo-mechanism solenoid 185. As a result thereof, the valve 190 is biased by means of springs (not shown), to its "neutral" or "hold" position. It can be seen that the fluid from the reservoir 183 is then continually recycled through the valve 190 and the fluid ports 191, 192, of the ram 90 will be closed to the reservoir 183 thus holding the piston 92 in a rigid position.

As another impulse is sent from the timer 153, the clamping cylinders 114, 116, will open and the valve 190 will be actuated to "feed" position for powering the ram 90. It can be seen that when the three-position wing-lever switch 157 is moved to the "automatic" position, the entire circuitry is automatic. The timer 153 is set in a predetermined time rate in which the piston 92 of the hydraulic ram 90 will advance in pre-timed relationship to the opening and closing of the clamping cylinders 114, 115, 116. By means of the above-outlined construction, it can be seen that the center clamping cylinder 115 will always remain in a closed position when the wing-lever switch 161 is in the "off" position, and the wing lever of the switch 157 is in the "automatic" position.

Referring to FIGS. 5 and 6, it can be seen that the downward movement of each of the piston-rods 120, 121, 122, is guided by means of the guide-bars 138, 139, 140. As the shoes 129, 130, 131, are rockably mounted on the piston-rods 120, 121, 122, by means of the pins 126, 127, 128, the shoes 129, 130, 131, will maintain the feed

in a rigid position on the ramp 84. It is also to be noted by means of the above-outlined construction, that as each of the piston-rods 120, 121, 122, move to the lower or clamped position, they will effectively block the passage of air to the lower ports 165, 170, respectively, thereby preventing the exhaust of high-pressure air from each of the inlet ports 167, 172, 168, respectively, to the atmosphere.

When it is desired to insert a new slab of feed material on the ramp 84, the wing lever of the three-position switch 161 is moved to the "open" position and the wing lever of the automatic three-position switch 157 is also moved to the "open" position. As this happens, the solenoids 166, 167, will be electrically connected to the conductor 151 thereby actuating the solenoids 166, 167. The solenoid 166 will open the normally closed valve 176 maintaining communication between the air supply line 195 and the lower port 177 of the cylinder 115, thereby permitting air to pass into the cylinder 115 and raise the piston-rod 121. Similarly, the solenoid 167 will close the normally open valve 178 and maintain communication between the upper port 179 and exhaust port of the valve 178 for exhausting the air in the cylinder 115. In this connection, it should be noted that the cylinder 115 is closed to the air supply line 195 as long as the solenoid 167 is electrically actuated. As the switch 157 is moved to the "open" position, the solenoids 164, 165, are actuated which, in turn, opens the normally closed valve 170 and closes the normally open valve 173, thereby raising the clamping cylinders 114, 116, in the manner as previously described. The moving of the wing lever of the switch 157 to the "open" position also energizes the return solenoid 169 which opens the normally closed valve 186 and actuates the servo-mechanism solenoid 187. This will move the valve 190 to the "return" position, causing fluid to flow into the port 192 and out of the port 191 of the cylinder 91. This will, in turn, withdraw the piston 92 within the cylinder 91. When the piston 92 is withdrawn and each of the cylinders 114, 115, 116, are in the upper position, a new slab of feed material can be placed on the ramp 84 for insertion into the disintegrator A. However, when each of the cylinders 114, 115, 116, are open, the disintegrator A should be turned off for safety purposes. If the clamping cylinders are in the "open" position, the rotation of the rotor knives 33 may cause the feed material to be forced out of the disintegrator A and could possibly cause a hazardous condition.

After the new slab of feed material is placed upon the ramp 84, the wing lever of the switch 161 is moved to the "off" position and the wing lever of the switch 157 is moved to the "automatic" position, for automatic operation in the manner previously described. In this connection, it should also be noted that the switch 161 should be constructed so that the wing lever is always biased away from the contacts 162, so that there is no danger of feeding a slab of feed material into the disintegrator A without at least one of the clamping cylinders being in a "clamped" position.

It should be understood that changes and modification in the form, construction, arrangement, and combination of the several parts of the disintegrators and feeding means therefor may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators having a feed-intake opening, said feeding device comprising first means located externally with respect to, and outwardly of the feed-intake opening for feeding a slab of feed material in a lengthwise direction into and through said feed-intake opening of the disintegrator, second means located externally of and proximate to the

feed-intake opening for clamping the slab of feed material during the feeding operation to prevent the feed material from being forced out of the disintegrator, and control means for operating the second means in pre-timed relationship to the first means.

2. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising means for feeding a slab of feed material to disintegrator, first clamping means for clamping the slab of feed material during the feeding operation to prevent the feed material from being forced out of the disintegrator, second clamping means operatively associated with the first clamping means, first control means for maintaining said first clamping means in clamping position during the entire feeding and disintegrating operation, second control means for maintaining said second clamping means in a non-clamping position when said feeding means is actuated and for maintaining said second clamping means in a clamping position when said feeding means is not actuated.

3. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising means for feeding a slab of feed material to the disintegrator, first clamping means for clamping the slab of feed material during the feeding operation to prevent the feed material from being forced out of the disintegrator, second clamping means operatively associated with the first clamping means, manual control means for maintaining said first clamping means in clamping position during the entire feeding and disintegrating operation, automatic control means for maintaining said second clamping means in a non-clamping position when said feeding means is actuated and for maintaining said second clamping means in a clamping position when said feeding means is not actuated.

4. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators having a feed-intake opening, said feeding device comprising support means for slidably supporting the slab of feed material, driving means for forcing the slab of feed material into the feed-intake opening of the disintegrator, first clamping means for holding the feed material against the support means during the entire feeding operation, second clamping means shiftable between a clamping position and a disengaged position and being adapted to hold the feed material against the support means when in said clamping position, and control means for moving said second clamping means to clamping position only when said driving means is not actuated.

5. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators having a feed-intake opening, said feeding device comprising support means for slidably supporting the slab of feed material, driving means for forcing the slab of feed material into the feed-intake opening of the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, first clamping means for holding the feed material against the support means during the entire feeding operation, second clamping means shiftable between a clamping position and a disengaged position and being adapted to hold the feed material, and control means for moving said second clamping means to clamping position only when said driving means is not actuated.

6. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first clamping cylinder having a first movable piston,

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first shoe means rockably mounted on said first piston, for holding the feed on the support means during the entire feeding operation, at least one second clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, and control means for actuating said second clamping cylinder and moving said second clamping shoe means to the clamping position when said driving means is not actuated.

7. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston, for holding the feed on the support means during the entire feeding operation, at least one second clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, and automatic control means for actuating said second clamping cylinder and moving said second clamping shoe means to the clamping position when said driving means is not actuated.

8. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston, for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston for guiding the first piston during its clamping movement, at least one second clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, and automatic control means for actuating said second clamping cylinder and moving said second clamping shoe means to the clamping position when said driving means is not actuated.

9. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, hydraulic driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first pneumatic clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston for guiding the first piston during its clamping movement, at least one second pneumatic clamping cylinder for holding the feed material during a portion of the feeding opera-

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tion, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, and automatic control means for actuating said second clamping cylinder and moving said second clamping shoe means to the clamping position when said driving means is not actuated.

10. The feeding device of claim 9 where the automatic control means includes a timer for actuating the driving means and raising and lowering the second clamping means at predetermined time intervals.

11. The feeding device of claim 9 wherein the manual control means includes normally closed valve means co-acting normally open valve means, and switch means operatively connected to said normally closed and normally open valve means for optionally raising and lowering said first clamping cylinder.

12. The feeding device of claim 9 where the automatic control means includes normally closed valve means and coacting normally open valve means, and timer means for actuating said driving means and actuating said normally closed and normally open valve means to raise and lower the second clamping cylinder responsive to impulses from said timer means.

13. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, hydraulic driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first pneumatic clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston for guiding the first piston during its clamping movement, at least one second pneumatic clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, timer means operatively connected to said second pneumatic cylinder and to said driving means, and normally closed valve means and coacting normally open valve means operatively connected to said second pneumatic cylinder and to said timer means for opening and closing said second pneumatic cylinder responsive to an impulse from said timer means.

14. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, hydraulic driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first pneumatic clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston for guiding the first piston during its clamping movement, at least one second pneumatic clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder

having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, timer means operatively connected to said second pneumatic cylinder and to said driving means, first normally closed valve means and first coacting normally open valve means operatively connected to said second pneumatic cylinder and to said timer means for opening and closing said second pneumatic cylinder responsive to an impulse from said timer means, and second normally closed valve means and coacting normally open valve means operatively connected to said driving means and timer means for actuating said driving means responsive to an impulse from said timer means.

15. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, hydraulic driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first pneumatic clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston for guiding the first piston during its clamping movement, at least one second pneumatic clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, timer means operatively connected to said second pneumatic cylinder and to said driving means, first normally closed valve means and first coacting normally open valve means operatively connected to said second pneumatic cylinder and to said timer means for opening and closing said second pneumatic cylinder responsive to an impulse from said timer means, second normally closed valve means and coacting normally open valve means operatively connected to said driving means and timer means for actuating said driving means responsive to an impulse from said timer means, and switch means operatively interposed between said timer means

and said first and second normally open and normally closed valve means.

16. A feeding device for feeding slabs of relatively hard material such as plastic and synthetic resins to disintegrators and the like, said feeding device comprising support means for containing the slab of feed material, hydraulic driving means for forcing the slab of feed material into the disintegrator, guide means operatively associated with said driving means for guiding said driving means along the support means when the driving means is actuated, at least one first pneumatic clamping cylinder having a first movable piston, first shoe means rockably mounted on said first piston for holding the feed on the support means during the entire feeding operation, first cylinder guide means operatively mounted on said first piston, for guiding the first piston during its clamping movement, at least one second pneumatic clamping cylinder for holding the feed material during a portion of the feeding operation, at least one second clamping cylinder having a second movable piston, a second shoe means rockably mounted on said second piston, second cylinder guide means operatively mounted on said second piston for guiding said second piston during its clamping movement, manual control means for actuating said first clamping cylinder and moving said first shoe means to the clamping position, timer means operatively connected to said second pneumatic cylinder and to said driving means, first normally closed valve means and first coacting normally open valve means operatively connected to said second pneumatic cylinder and to said timer means for opening and closing said second pneumatic cylinder responsive to an impulse from said timer means, second normally closed valve means and coacting normally open valve means operatively connected to said driving means and timer means for actuating said driving means responsive to an impulse from said timer means, and third normally closed valve means and third coacting normally open valve means operatively connected to said first pneumatic cylinder for opening and closing said first pneumatic cylinder.

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