

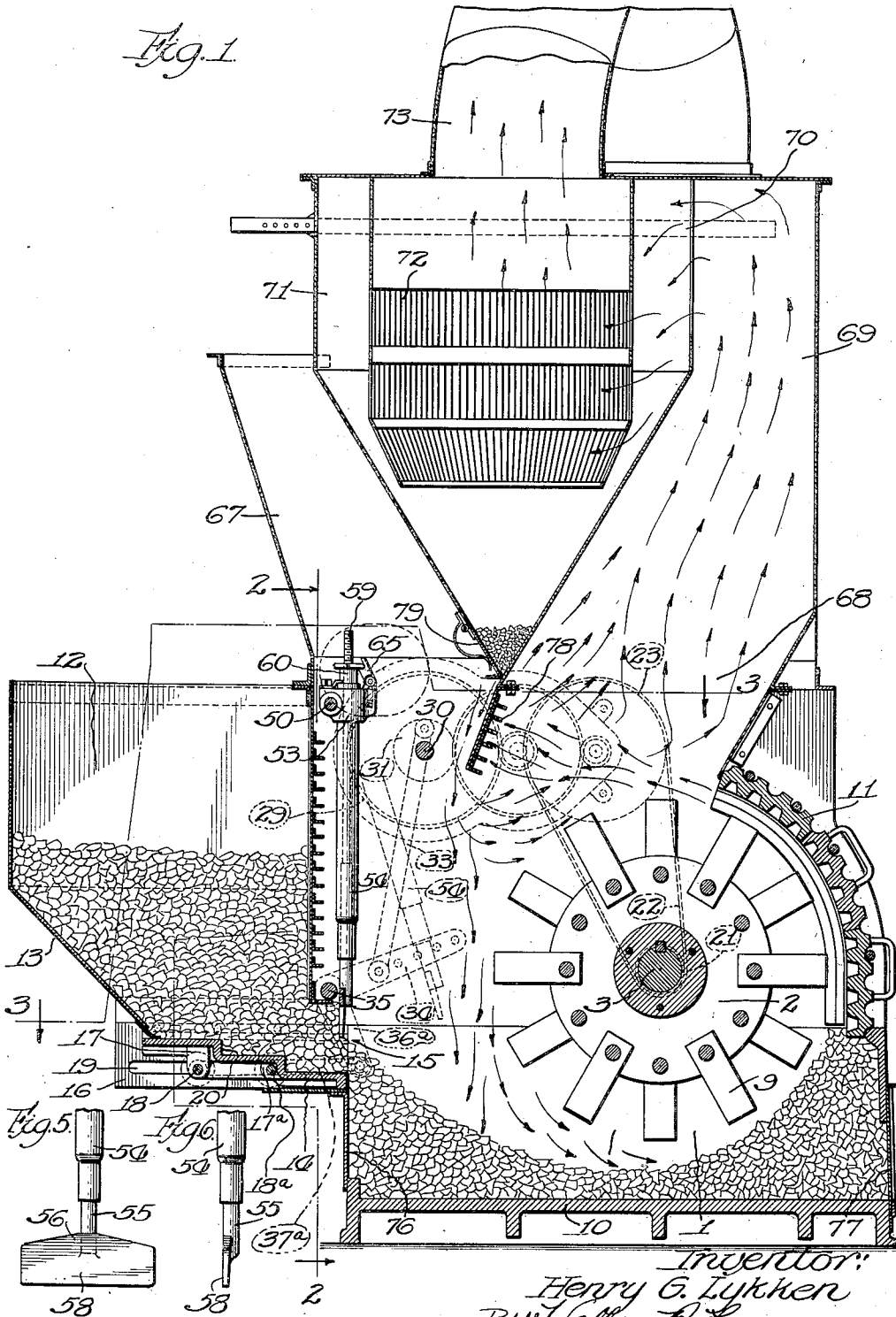
June 2, 1931.

H. G. LYKKEN

1,807,923

MATERIAL TREATING DEVICE

Filed Aug. 19, 1927 4 Sheets-Sheet 1



June 2, 1931.

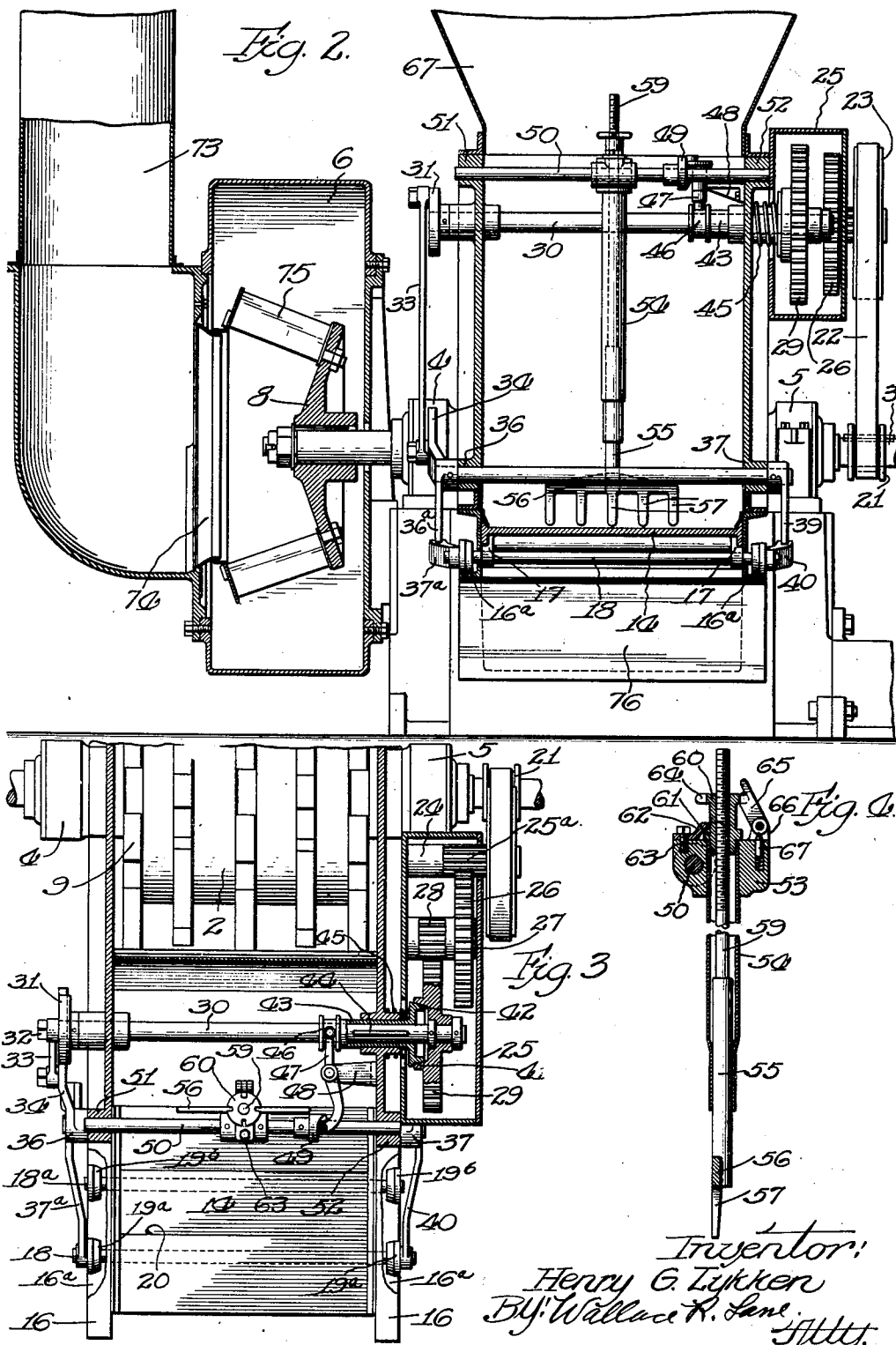
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4 Sheets-Sheet 2



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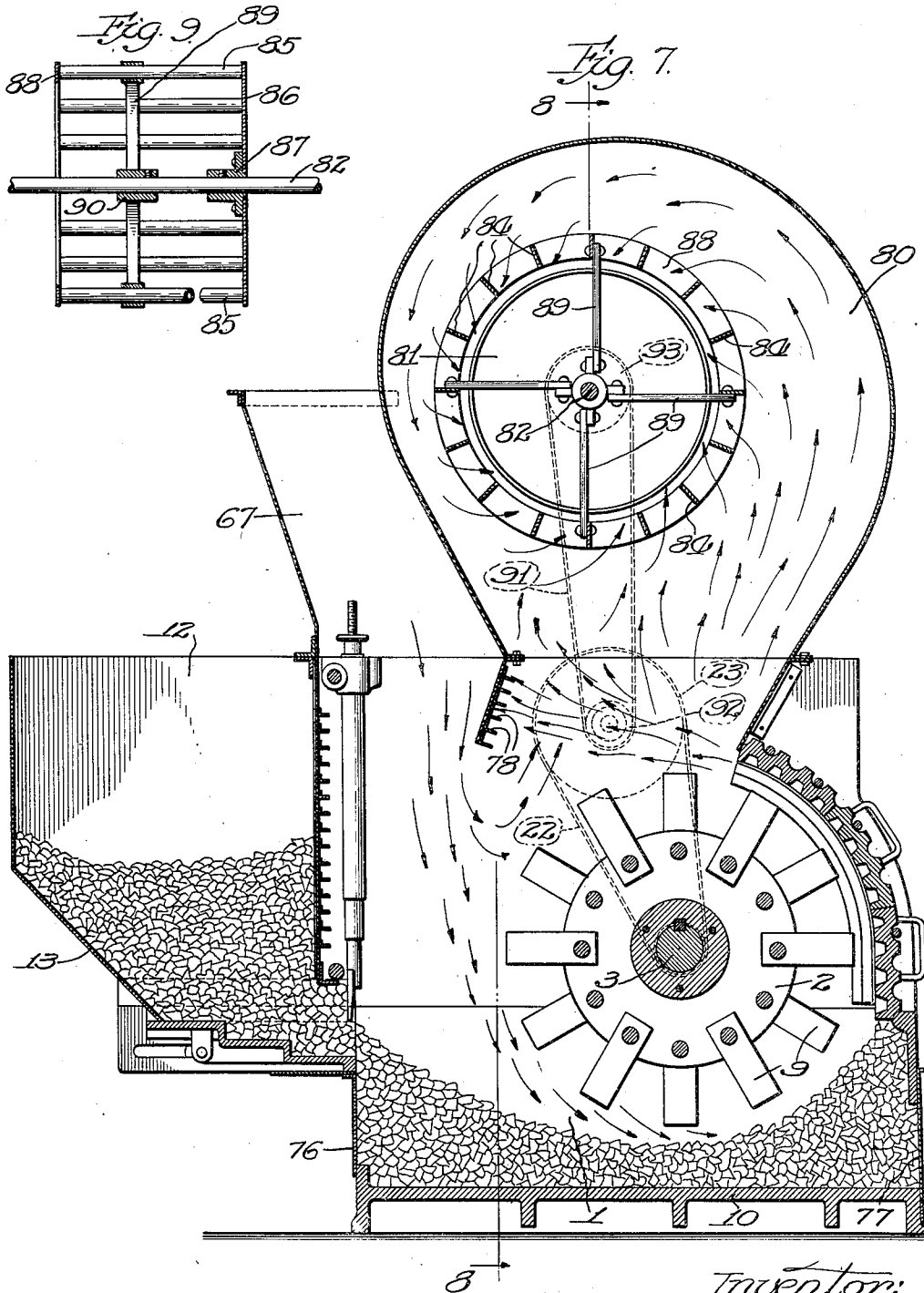
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4 Sheets-Sheet 3



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June 2, 1931.

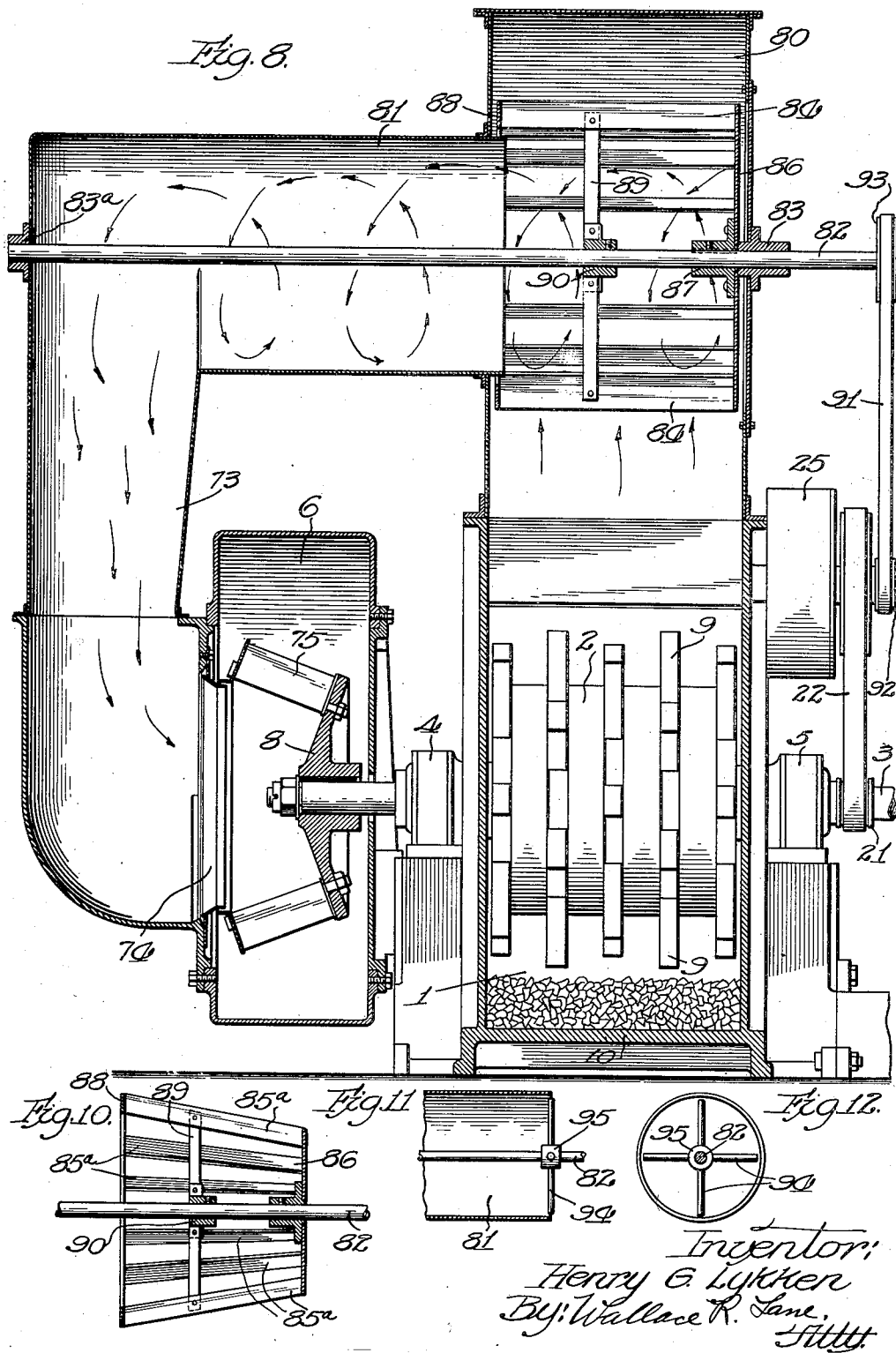
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MATERIAL TREATING DEVICE

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

HENRY G. LYKKEN, OF MINNEAPOLIS, MINNESOTA

MATERIAL TREATING DEVICE

Application filed August 19, 1927. Serial No. 214,064.

The present invention relates to devices for treating materials to be prepared and supplied to a place of use. In the specific illustrative embodiment of the invention, the material may be coal or similar fuels, and the device is in the nature of a reducing means with means for holding the material, means for controllably feeding the material to a reducing means, means to reduce the fed material, means to grade or classify the reduced material as desired, and means to supply the separated or classified material to the place or locus of use.

Among the objects of the invention is to provide a novel device of the nature above indicated with novel means for feeding the material; also novel means for controlling the feed automatically; also novel means for separating the reduced material, such as the coarser from the finer particles, and also a novel unitary device with separating means above the reducing means for the ready return of the separated coarser particles for re-reduction.

Other objects, capabilities, advantages and features are comprehended by the invention as will later appear and are inherently possessed thereby.

Referring to the drawings, Fig. 1 is a vertical sectional view through an illustrative embodiment of the invention.

Fig. 2 is a vertical transverse sectional view taken in a plane represented by line 2—2 in Fig. 1 of the drawings.

Fig. 3 is a horizontal sectional view of a part of the machine and taken in planes represented by line 3—3 in Fig. 1 of the drawings.

Fig. 4 is a sectional view in detail showing the controlling means for the feeding mechanism of the device.

Fig. 5 is a fragmentary elevational view of an alternative form of the control member.

Fig. 6 is a side view of the same.

Fig. 7 is a vertical sectional view through an alternative embodiment.

Fig. 8 is a vertical sectional view transverse to the showing in Fig. 7 and taken

substantially in planes represented by line 8—8 in Fig. 7 of the drawings.

Fig. 9 is a longitudinal sectional view of part of the separating means.

Fig. 10 is a similar view of an alternative form of separating means.

Fig. 11 is a fragmentary similar view of another form.

And, Fig. 12 is an end view thereof.

Referring now more in detail to the drawings, the embodiments selected to illustrate the invention are shown as comprising a reducing means having a reducing chamber 1 in which is adapted to rotate a rotor 2 secured to a shaft 3 extending through the side walls of the chamber and rotatably supported in suitable bearings 4 and 5, one end of the shaft being connected to a suitable power source (not shown), and the other end of the shaft extending into a fan casing 6 and secured to a suction fan device 8, as clearly shown in Fig. 2 of the drawings. The rotor 2 carries a number of arms 9 which may extend radially and the rotor is located so as to provide a substantial space beneath the same and the bottom 10 of the reducing chamber. At one side of the rotor the chamber may be provided with replaceable grooved or corrugated plates 11 spaced from the peripheral ends of the arms 9 a substantial distance so as to provide a reducing region between the ends of the arms 9 and the inner surfaces of the plates 11, for a purpose hereinafter more fully described.

At the other side or the front of the machine or chamber 1 is located a hopper 12 in which may be received and adapted to be contained the material to be reduced or treated. This hopper is located as low as possible to permit the ready introduction of the material therein, and at its lower portion is provided with an inclined wall 13 and a lower opening in which is located a slidable member 14 which acts as a bottom for the hopper as well as a means for feeding the material from the hopper through an opening 15, thus establishing communication between the hopper and the chamber 1 of the reducing means. The member 14 is reciprocably mounted on flanges of a pair of track

members 16 suitably secured to the sides of the hopper 12. The member 14 is provided with rigid lugs 17 and 17a carrying cross pins 18 and 18a extending through slots 19 of the track members 16 and carrying rollers 19a and 19b adapted to roll on the flanges 16a of track member 16. The member 14 is preferably stepped or formed with a plurality of shoulders 20 or the like adapted to engage with some of the material in the hopper and force the same in the direction of movement of the member 14 for feeding purposes. For the purpose of controlling the amount or rate of feed of the material from the hopper to the reducing chamber, a control device is provided which is operated from the shaft 3. A portion of the shaft outside the chamber 2 is provided with a driving pulley 21 over which rides a belt 22 leading to a pulley 23 connected to a counter shaft 24 rotatably supported in a gear housing 25 attached to the side of the chamber wall 1. The shaft 24 has a driving pinion 25a in meshing driving engagement with a gear 26 on a stud shaft 27 carrying a driving pinion 28 in driving engagement with a gear 29. The latter loosely rotates upon a cross-shaft 30 supported in suitable bearings in the upper parts of the side walls of the chamber 1, and as clearly shown in Fig. 3 of the drawings. To the opposite end of the shaft 30 from that upon which the gear 29 is mounted, is secured a crank disk 31 carrying a crank pin 32 to which is pivotally connected a connecting rod or pitman 33, the lower end of which is adjustably or selectively connected to any one of a series of apertures provided in an arm 34 of a bell crank lever secured to a fulcrum shaft 35 rotatably supported in bearings 36 and 37 provided in the side walls of the chamber 1. The bell crank lever has a depending crank arm 36a, the lower end of which is pivotally connected to a link 37a extending to and connected to one of the cross rods 18 which is fastened to the sliding member 14. To the other end of the shaft 35 is secured a crank arm 39, the lower end of which is pivotally connected to a link 40 leading to and connected to one of the cross rods 18 secured to the sliding member 14.

For the purpose of driving the shaft 30, the gear 29 has a clutch portion 41 with which cooperates a clutch member 42 having a hub 43 splined by a spline means 44 to the shaft 30, and also slidably as well as rotatably supported in the bearing in one of the side walls of the chamber 1. A helical spring 45 reacts between the side wall of the chamber and the clutch member 42 to normally urge or maintain the clutch member 42 in engagement with the clutch portion 41 of the gear 29. At the inner end of the hub 43 is provided a grooved

yoke member 46 with which cooperates a yoke lever 47 fulcrumed upon a bracket 48 secured to the side wall of the chamber 1, the other end of the lever 47 extending to and in engagement with a cam 49 secured to a rock shaft 50 rotatably supported at its ends in suitable bearings 51 and 52 provided in the side walls of the chamber 1.

Upon the shaft 50 is adjustably secured a block 53 having a vertical bore in which is secured a tubular member 54 which extends downwardly a substantial distance from the block. In this tubular member is slidably carried a control element 55 to the lower end of which is fastened a feeler member 56 which may have a number of projections 57 more or less in the shape of a comb, or the same may be in the form of a flat member 58 as shown in Figs. 5 and 6 of the drawings. To the upper end of the member 55 is provided a shank 59 which may be threaded to be received in a hand nut 60 rotatably supported upon the block 53, the nut 60 having a circular flange 61 rotatable under a guard 62 secured to the block 53 by a suitable screw 63. By rotating the nut 60 the shank 59 and the member 55 may be caused to rise or fall as desired, thus providing for an adjustment of the height or position of the projections 57 or the flat member 58 for a purpose later described. In order to hold the nut 60 in adjusted position, the upper end of the nut is provided with a slotted rim portion 64 with which cooperates a latch 65 adapted to be engaged in any one of the notches of the rim portion 64, the latch 65 being pivotally connected to an ear 66 provided on the block 53, and normally held in position by a spring pressed locking element 67 cooperating with depressions formed in the latch 65, as clearly shown in Fig. 4 of the drawings.

It will be noted that the feeler members 57 or 58 are located in the path of the material being discharged from the hopper 12 so that as the material is being forced from the hopper by the sliding member 14, the control member 55 and connected parts may be swung from the position shown in full lines in Fig. 1 of the drawings, to a position such as that shown in dotted lines thereof in the same figure. When the material has been fed to the extent so as to pile up in the chamber 1 near the exit of the hopper 12 so as to move the feeler and control member to the dotted line position, the shaft 50 will be rocked angularly accordingly and thus turn the cam 49. The shape of the cam is such that it will cause a swing of the yoke lever 40 and hence a sliding of the clutch hub 43 and the clutch member 42 to disengage the same from the clutch portion 41 of the gear 29, thus disconnecting the driving connection through the shaft 30. This will stop the operation of the sliding member 14.

When the material in the chamber 1 which has moved the feeler to the dotted line position, has been reduced as the reducing action continues, the feeler will return toward or to its original position, such as that shown in the full line representation thereof in Fig. 1, and the return of the cam 49 will permit the yoke lever 47 to move in an opposite direction under the influence of the spring 45, the latter causing a re-engagement of the clutch 42 with the clutch portion 41 of the gear 29. When this is effected the gear 29 will then drive through the clutch and spline to operate the shaft 30, and hence the bell crank means 44, shaft 35 and cranks 36 and 39 which are connected to the sliding member 14. The latter will be caused to reciprocate and owing to the shape of the same, the latter will feed more of the material from the hopper 12 into the space in the chamber 1. By adjusting the height of the feeler member 57 or 58 by the turning of the nut 60, the control may be made greater or less as desired. If the feeler is at a high point, it will require a greater amount of material piled up in the chamber 1 to bring it to the position so as to disconnect the drive to the sliding member 14, whereas if the feeler is at a lower point, the control member will be brought to disconnecting position earlier.

The chamber of the pulverizing device is open at the upper part thereof and has at one side an air inlet passage 67 and an outlet passage 68 leading into a chamber 69 which has an outlet 70 into an inner chamber 71. Within the latter is provided a separating means having slots or louvers 72 so that the mixture of air and reduced particles passes therethrough. The device 72 has an outlet passage 73 which extends to an opening 74 provided in the side of the fan chamber 6. Within this chamber is located a fan device having blades 75 adapted to act upon the mixture of air and separated particles to create a suction through the passage 73 and the chamber 69 so as to cause an inflow of air through the inlet passage 67. The fan chamber 6 has a suitable discharge means for leading into a place of use such as a combustion chamber of a furnace or boiler or the like.

The material fed from the hopper 12 forms a layer in the lower part of the chamber 1 and any non-reducible material being fed therewith, will sink by gravity in this bed or layer of material, and may then be removed when desired, through openings normally closed by doors 76 and 77. As material is fed into the chamber 1 and as the rotor is rapidly rotated, the same will create a whirl or vortex action of air so that the latter will act upon the surface of the bed of material and entrain a part thereof and set up a whirling mixture of material

and air beyond the periphery of the rotor and in the space between the same and the plates 11 of the chamber. The latter are grooved to provide retard means for holding the outer layers of the material or to retard their movement. The inner layers of the material travel faster than the outer layers and by reason of the centrifugal force or stresses acting thereon, the inner layers of material will rub over the outer layers with a reducing of particles. The mixture of reduced particles and air will then be projected tangentially from the rotor and against an impact means 78 which may have a plurality of ribs or the like as desired. This will cause the projected material to be scattered in the form of a cloud, and air being drawn by the suction means upwardly through the chamber 69 will pass through this cloud and carry up with it suspended particles of material. The air and suspended particles will then proceed into the separator means, where the stream will be retarded and caused to change its direction, such that the coarser and heavier particles may separate therefrom and descend into the lower part of the chamber 71 to be ejected through a spring pressed door or valve 79, these particles returning on the opposite side of the member 78 and drawn into the chamber 1 by the inflow of the air through the passage 67, for further reduction by the reducing means.

In the form of separating means shown in Figs. 7 to 12 inclusive, the rotor projects the reduced material into a chamber 80 to one side of which is connected a passage 81 leading to the fan chamber 6. Within the chamber is rotatably mounted a separating rotor upon a shaft 82 extending through a side wall of the chamber 80 and through a part of the passage 81, and having suitable bearings 83 and 83a as clearly shown in Fig. 8 of the drawings. The separating rotor is secured to the shaft 82 and comprises a series of blades 84 or bars 85 connected at one end to a plate 86 fastened to a hub member 87 secured to the shaft 82, and at the other end thereof to a ring 88. To hold the bars or blades in proper position, a web member 89 may be connected thereto and to a hub 90 secured to the shaft 82 as clearly shown in Figs. 8 and 9 of the drawings. The suction created by the fan in the fan chamber 6 will cause an upward flow of the reduced material with air into the chamber 80 and through the rotor and thence through the passage 81. The separating rotor may be rotated at a given rate of speed to partly counteract this suction effect so as to slow up the stream of material and permit the coarser and heavier particles to drop and return into the reducing chamber, as well as the blades 84 or rods 85 hitting against the larger or heavier particles

and casting the same centrifugally to the sides of the chamber 80 so that the particles may return to the reducing chamber. The rotor may be operated by means of a belt 5 91 from a pulley 92 connected to a shaft driven by the pulley 23, the belt also driving a pulley 93 connected to the shaft 82. The speed of rotation may be varied in any desired manner, as by changing the dimension 10 of the pulleys 92 and 93.

The rotary separating members shown in Figs. 8 and 9 are shown with parallel blades or bars, but the same may be provided with inclined blades or bars 85a such as that 15 shown in Fig. 10, or may be provided with radially extending rods or bars 94 secured to a hub 95 fastened to the shaft 82 and disposed in a plane at or proximate to the inlet of the passage 81, as clearly shown in 20 Figs. 11 and 12 of the drawings.

The structure of the device shown in these figures is similar to that shown in Figs. 1 to 6 inclusive and also operates similarly. The suction produced from the fan mechanism 6 causes an inflow of air through the 25 passage 67 into the reducing chamber 1 and the material is reduced by the entraining and vortex action above described, and projected against the impact means 78, the air carrying upwardly in the chamber 80 projected particles and carrying the same inwardly into the rotating separating means and then axially therefrom through the 30 passage 81 to the fan device 6.

While I have herein described and upon the drawings shown illustrative embodiments of the invention, it is to be understood that the invention is not limited thereto but may comprehend other constructions, details, arrangements of parts and features 40 without departing from the spirit thereof.

Having thus disclosed the invention, I claim:

1. In a material reducing device, a reducing chamber, a hopper having a lateral opening communicating with said chamber, a slidably mounted feeder member forming the bottom of said hopper and movable into and out of said opening so as to feed material into said reducing chamber, and feeder control means having an actuator member lying in the path of movement of the material being fed.

2. In a material reducing device, a reducing chamber, a hopper having a lateral opening communicating with said chamber, a slidably mounted feeder member forming the bottom of the hopper and movable into and out of said opening so as to feed material into said reducing chamber, stop mechanism for said feeder member, and controlling means for the stop mechanism operated by the material passing through said opening.

3. In a material reducing device, a re-

ducing chamber, a hopper open at the bottom and also at one side, a reciprocally mounted feeder member closing the bottom opening of said hopper and movable to feed material through said side opening, means for actuating the feeder member, stop mechanism for said feeder member, and a control member for said stop mechanism extended across said side opening so as to be operated by the material being fed.

4. In a material reducing device, a reducing chamber, a hopper having a lateral opening communicating with said chamber, a slidably mounted feeder member forming the bottom of said hopper and movable into and out of said opening so as to feed material into said reducing chamber, mechanism for reciprocating the feeder member, control means for starting and stopping the feeder operating mechanism, and an actuator for said control means lying in the path of the material being fed through said opening so that its operation is controlled by the volume of material being fed.

5. In a material reducing device, a reducing chamber, a hopper open at the bottom and one side, a reciprocally mounted feeder member closing the bottom opening of the hopper and movable to feed material through said opening, means for actuating said feeder member, control means for starting and stopping the feeder operating mechanism, and an actuator for said control means lying in the path of the material being fed through said opening so that its operation is controlled by the volume of material being fed.

6. In a material reducing device, a hopper having a lateral opening at its bottom, a slidably mounted feeder member positioned to move through said opening, said feeder member having stepped portions to engage material in said hopper and feed it through said opening, and means for actuating said feeder member.

7. In a material reducing device, a hopper having a lateral opening at its bottom, a feeder member slidably mounted within said hopper and positioned to move into and out of said opening, means for reciprocating said feeder member and means governed by the volume of material being fed through said opening for controlling the operation of the feeder member.

8. In a material reducing device, a hopper having a lateral opening at its bottom, a laterally reciprocable feeder member mounted in said hopper and movable through said opening, and means governed by the volume of material fed through said opening for controlling the operation of the feeder member.

9. In a material reducing device, a hopper having a lateral opening at its bottom, a feeder member reciprocally mounted with-

in said hopper and movable through said opening, said feeder member having stepped portions positioned to engage material within said hopper, and feeder control means mounted adjacent said opening so that its operation is governed by the volume of material fed through the opening.

10. In a material reducing device, a hopper having a lateral opening in its bottom, a slidably mounted feeder member mounted to move into and out of said opening and having means for engaging material so as to feed it through said opening, material reducing means positioned to receive material discharged through said opening, and means controlled by the capacity of said reducing means for regulating the operation of said feeder member.

11. In a material reducing device, a hopper having a lateral opening at its bottom, a reciprocally mounted feeder member within said hopper and movable through said opening so as to discharge material from the hopper, driving means for said feeder member, a control member for said driving means, said control member extending into the path of the material discharged through said opening so as to be controlled by the volume of material being fed, and means connecting the driving means with said control member to render said driving means inoperative or operative in accordance with the position of said control member.

12. In a material reducing device, a hopper having a lateral opening at its bottom, a reciprocally mounted feeder member within said hopper and movable through said opening so as to discharge material from the hopper, driving means for said feeder member, a control member for said driving means, said control member extending into the path of the material discharged through said opening so as to be controlled by the volume of material being fed, and means connecting the driving means with said control member to render said driving means inoperative or operative in accordance with the position of said control member, said control member being adjustable to vary the extent of projection thereof into the path of movement of the material being fed.

13. A material treating device comprising a reducing chamber, an operating element extending through said chamber, a reducing member in said chamber actuated by said operating element, a reciprocable member for feeding material into said chamber, and operating means directly connecting said operating element and said reciprocable member.

14. A material treating device comprising a reducing chamber, an operating element extending through said chamber, a reducing member in said chamber actuated by said operating element, a reciprocable mem-

ber for feeding material into said chamber, operating means directly connecting said operating element and said reciprocable member, and means controlled by the volume of material being fed for regulating the operation of said feeding means.

15. A material treating device comprising a reducing chamber, a shaft extending there-through, a reducing member mounted on said shaft, a reciprocable member for feeding material into said chamber, and operating means directly connecting said shaft and said reciprocable member.

16. A material treating device comprising a reducing chamber, a shaft extending there-through, a reducing member mounted on said shaft, a reciprocable member for feeding material into said chamber, operating means directly connecting said shaft and said reciprocable member, and means for regulating the volume of material being fed.

In witness whereof, I hereunto subscribe my name to this specification.

HENRY G. LYKKEN.

CERTIFICATE OF CORRECTION.**Patent No. 1,807,923.****Granted June 2, 1931, to****HENRY G. LYKKEN.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 10, claim 10, for the word "mounted" read movable; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of September, A. D. 1931.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.