No. 706,495. Patented Aug. 5, 1902.

F. M. REED.

PULVERIZED FUEL BURNER.

(Application filed Oct. 19, 1901.)

(No Model.) 3 Sheets—Sheet 1.

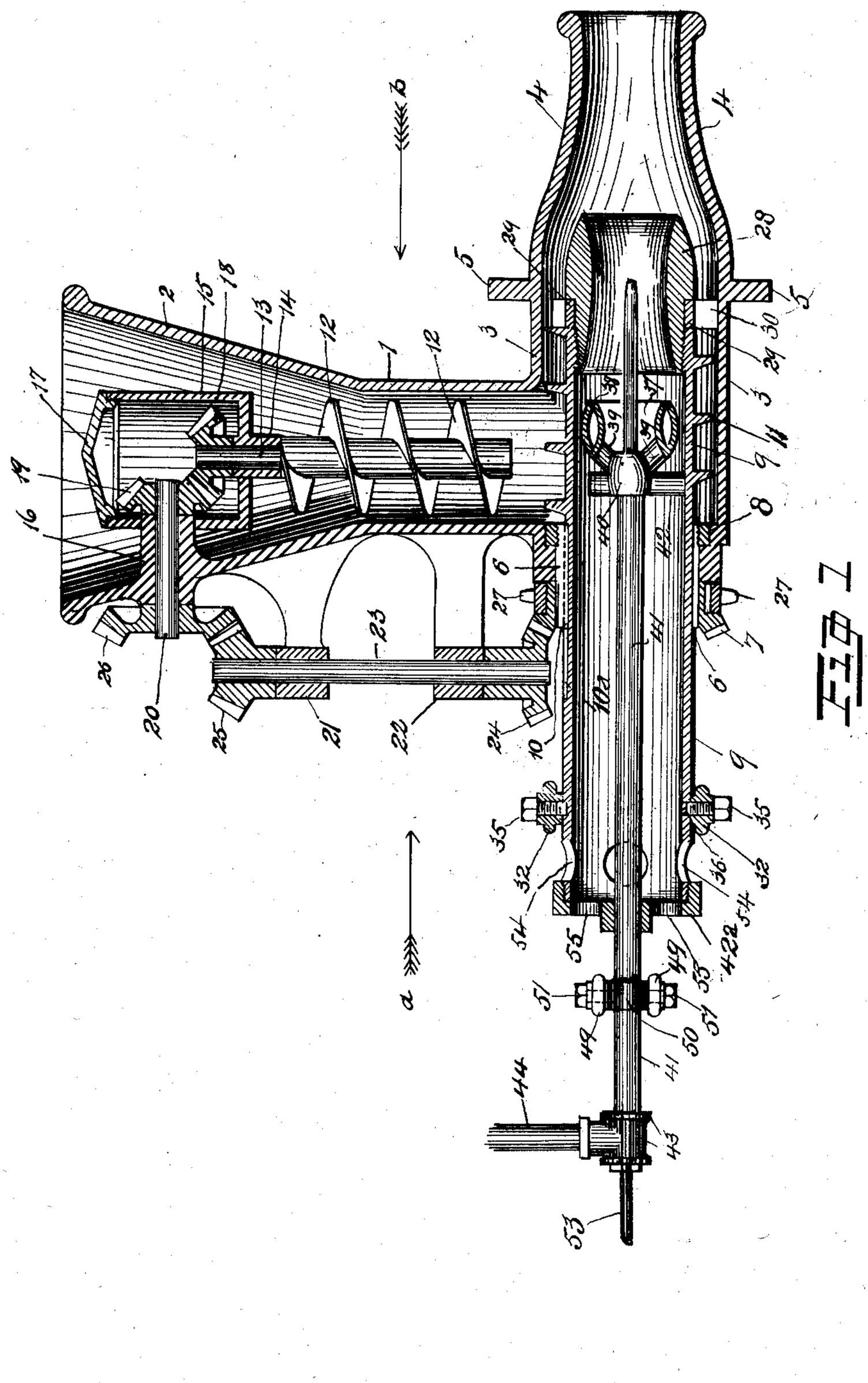

FIG 1

WITNESSES:
John Elliott
Harry H. Roll

INVENTOR.
Franklin M. Reed
BY
Thompson & Reed
ATTORNEY.

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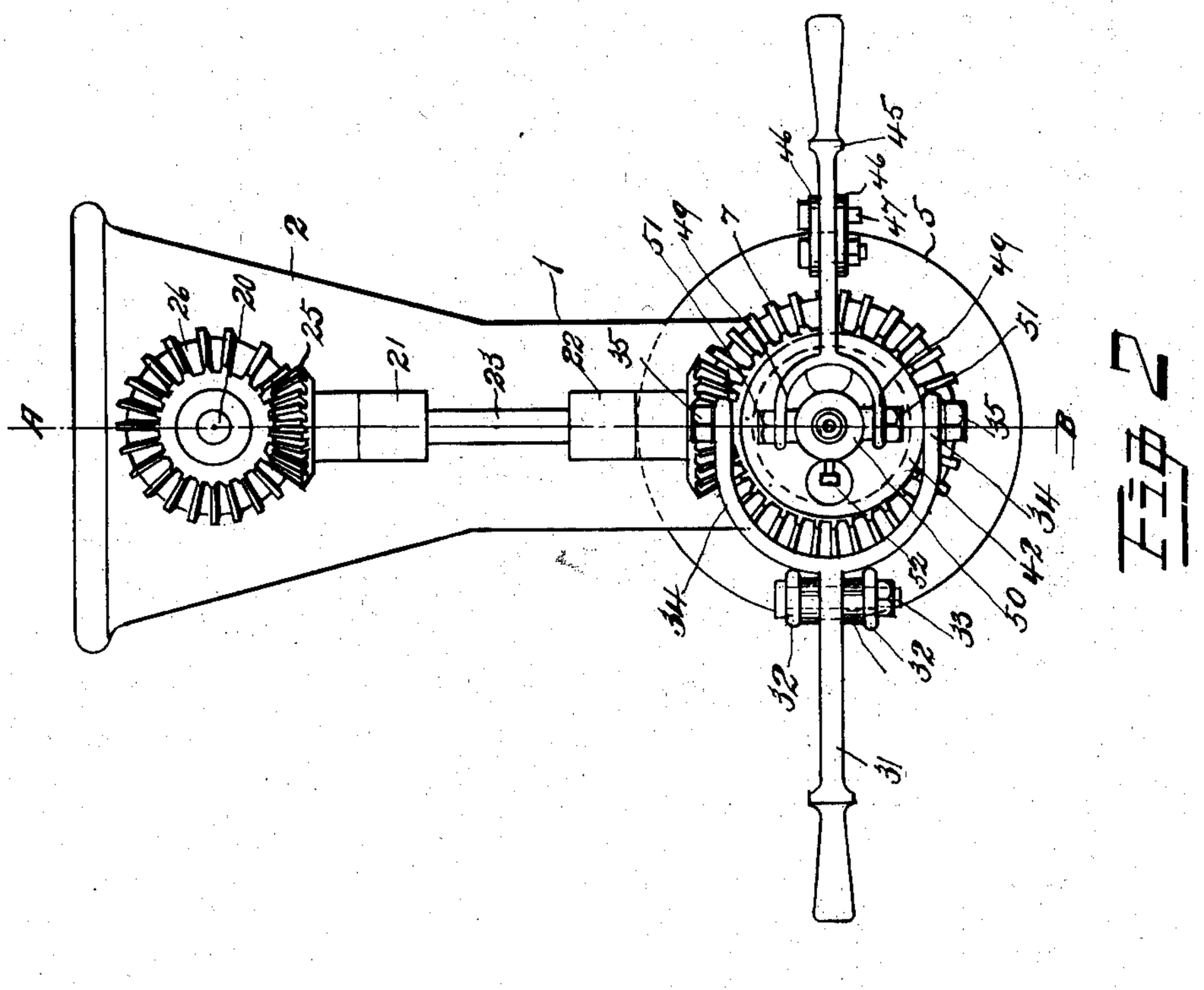

FIG 2

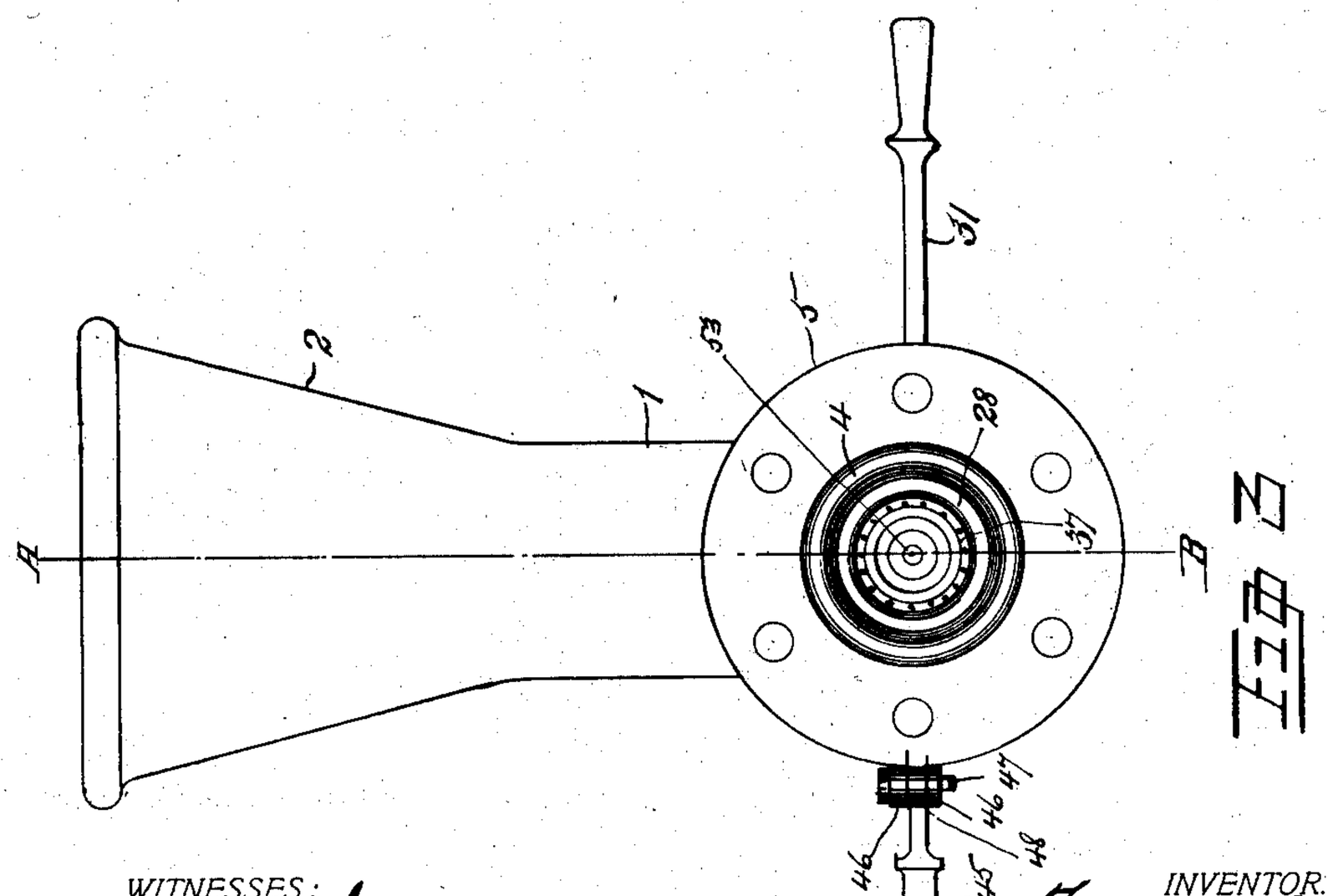

FIG 3

WITNESSES:
John Elliott
Harry H. Roll

INVENTOR.
Franklin M. Reed
BY Thompson & Bell
ATTORNEY.

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F. M. REED.

PULVERIZED FUEL BURNER.

(Application filed Oct. 19, 1901.)

(No Model.) 3 Sheets—Sheet 3.

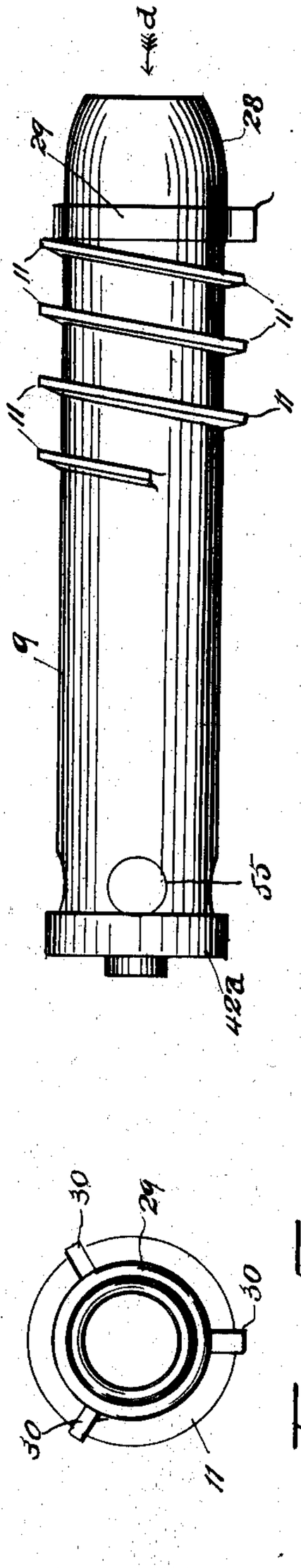

FIG 4

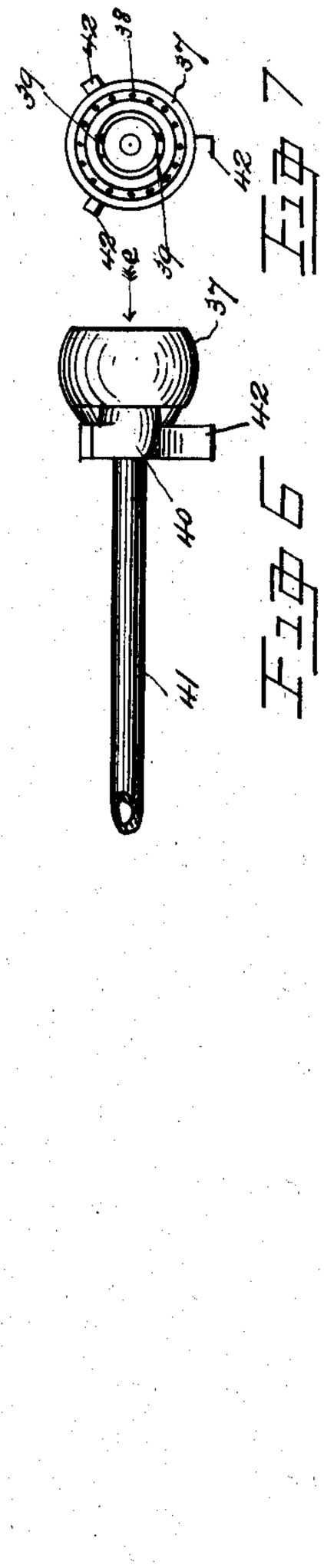

FIG 7

FIG 6

FIG 5

WITNESSES:
John Elliott
Harry W. Rose

INVENTOR.
Franklin M. Reed
BY
Thompson & Bell
ATTORNEY.

UNITED STATES PATENT OFFICE.

FRANKLIN M. REED, OF INDIANAPOLIS, INDIANA, ASSIGNOR OF ONE-THIRD TO HARRY W. ROLL, OF INDIANAPOLIS, INDIANA.

PULVERIZED-FUEL BURNER.

SPECIFICATION forming part of Letters Patent No. 706,495, dated August 5, 1902.

Application filed October 19, 1901. Serial No. 79,204. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN M. REED, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented new and useful Improvements in Pulverized-Fuel Burners, of which the following is a specification.

My invention relates to certain new and useful improvements in pulverized or dust fuel burners; and it consists in an apparatus whereby the finely-divided fuel or dust is sprayed into a furnace to be consumed therein.

The object of my invention is, first, to provide an apparatus whereby refuse coal, a finely-divided combustible, may be effectually used as a fuel in furnaces; second, to provide means whereby the fuel is regularly and positively fed to the fuel-receiving-chamber of the apparatus and means for positively and regularly conveying the fuel toward the discharging or nozzle end of said apparatus; third, to provide an air-conveying means or duct whereby the atmospheric air is conveyed centrally through the fuel-receiving chamber of the apparatus whereby the finely-divided fuel is caused to commingle with the air as it is discharged through the nozzle of said fuel-receiving chamber, and, fourth, to provide a central blast or blowing means whereby the finely-divided fuel is discharged or sprayed through the nozzle or discharging end of the apparatus. I attain these objects by means of the apparatus illustrated in the accompanying drawings, in which similar numerals of reference designate like parts throughout the several views.

Figure 1 is a longitudinal sectional elevational view of the burner taken through the line A B. (See Figs. 2 and 3.) Fig. 2 is an end elevational view of the same looking in the direction indicated by the arrow *a*. (See Fig. 1.) Fig. 3 is a similar view looking in the direction of the arrow *b*. (See also Fig. 1.) Fig. 4 is a longitudinal detail view of the inner air-tube and showing the spiral conveyer thereof. Fig. 5 is an end view of the same looking in the direction of the arrow *d*. (See Fig. 4.) Fig. 6 is a longitudinal detail view of the blower, and Fig. 7 is an end view of the same looking in the direction indicated by the arrow *e*. (See Fig. 6.)

The vertically-extending feed-hopper 1, having the upper cone-formed top 2, is formed integral on the upper side of the fuel-receiving chamber 3, at or near the closed end thereof. The fuel-receiving chamber 3 is cylindrical in form and terminates in a reduced open-ended portion or ejecting-nozzle 4, and intermediate between said nozzle or reduced portion 4 and the hopper 1 is formed the supporting-flange 5, which latter is provided to form the supporting means of the apparatus and may be bolted to the front of the furnace to which the apparatus is applied. The rear or closed end of the fuel-receiving chamber 3 is bored to receive the sleeve 6, which latter is adapted to freely rotate therein. A bevel-wheel 7 is keyed or secured on the outer projecting end of said sleeve 6 to turn therewith, and a retaining-collar 8 is firmly screwed or otherwise secured on the inner prolonged end of said sleeve 6 and is provided for the purpose of preventing a longitudinal movement of the latter.

The air duct or tube 9 is situated centrally within the fuel-receiving chamber 3, and the said tube has the surface of its rearwardly-extending end truly turned to accurately fit and to slide longitudinally in the bore of the sleeve 6, and the said air duct or tube is held to turn with said sleeve 6 by a suitable key 10, which is secured to said sleeve 6 and adapted to fit in the spline 10^a, formed longitudinally in the peripheral surface of the air duct or tube 9. A spiral or helical conveyer 11 is formed integral on the outer surface of that portion of the tube 9 inclosed in the fuel-chamber 3, and the same is provided for the purpose of conveying or positively moving the pulverized fuel in regular and uniform quantity toward and to the mouth of the nozzle 4 to be ejected therethrough. A vertically-extending feed-conveyer 12 is secured on the depending end of the feed-shaft 13, and the latter shaft is journaled in the bearing 14, formed integral on the bottom portion of the gear-inclosing box 15. The gear-inclosing box 15 is formed integral on the inner end of and supported in position in the top portion 2 of

said hopper 1 by the journal-bearing 16, which latter is also formed integral with the top portion 2 of said hopper 1. A cap 17 is adapted to be screwed or otherwise fitted or removably secured in the top open end of said gear-box, and the said gear-inclosing box 15, having the cap 17, is provided for the purpose of protecting the gears 18 and 19, inclosed therein, from the coal-dust or fuel passing into said hopper 1. The gear 18 is securely keyed on the top end of the shaft 13 and is adapted to mesh with the bevel-wheel 19, which latter is keyed on the shaft 20. The upper bearing 21 and the lower bearing 22 are formed integral on the side of the hopper 1 and are adapted to receive the vertically-extending shaft 23, which is adapted to turn freely therein. A bevel-gear 24 is keyed on the bottom end of the shaft 23 and is adapted to mesh with the bevel-gear 7 to be driven thereby, and a bevel-gear 25 is keyed on the upper end of said shaft 23 and is adapted to mesh with the bevel-gear 26, keyed on the outer projecting end of the shaft 20, to rotate the latter to drive or rotate the spiral conveyer 12, and the said train of gears is proportioned to impart the proper rate of speed to the said conveyer 12 to regularly and uniformly and positively feed the proper quantity of fuel into the chamber 3 to be discharged through the nozzle thereof. A sprocket-wheel 27 is secured on the hub of the bevel-wheel 7, and a suitable sprocket drive-chain (not shown) extending from the source of power surrounds said sprocket-wheel to drive the same and to impart rotative motion to the spiral 12 and the tube 9 through the train of connecting-gearing previously described. A nozzle or blast-tip 28, having its area contracted at or near its central portion, is provided to concentrate the air-blast passing therethrough and through the nozzle 4 to the more effectually lift up the particles of coal-dust as the latter is fed to the tip of said nozzle 28 to be discharged through said nozzle 4. The tip or nozzle 28 is reduced for a portion of its length to receive the bearing-ring 29, and a portion of this reduced portion is threaded to be screwed into the end of the tube 9 and held securely therein to turn therewith. The bearing-ring 29 loosely fits on the reduced portion of the nozzle 28, and suitable arms 30 are formed integral on said ring and extend radially therefrom to bear against the inner surface of the fuel-receiving chamber 3 to maintain the said tube 9 and its nozzle 28 centrally therewith. The exterior surface of the nozzle 28 is gradually reduced toward its discharging end, and the curvature of the profile of said surface is preferably made concentric with the curvature of the interior surface of the enlarged portion or base of the nozzle, so that when the tube is in normal position or situated at or near the position shown in Fig. 1 the area of the opening of the nipple or nozzle 28 will be equal to the area of the annular space between the air-tube 9 and the inner surface of the fuel-receiving tube 3. An adjusting-lever 31 is fulcrumed in the end bifurcations of the arm 32 by a pin 33, which latter is formed integral on the end of the chamber 3, and the bifurcated ends 34 of said lever 31 extend centrally over and under the top and bottom sides of the tube 9. The ends of said bifurcations are drilled and tapped to receive the bolts 35, the ends of which are reduced to fit into the grooves 36, formed in the tube 9, and thus when it is required to move said tube 9 longitudinally either forwardly or backwardly said lever is operated to move the nozzle 28 nearer to or farther from the nozzle 64 to adjust the supply of fuel to the latter nozzle to be carried therethrough by the central blast.

The central blast is induced by means of the blower-ring 37, which is situated within the tube 9 slightly to the rear of the nozzle 28. The blower-ring 37 is provided with the jet-openings 38, and said blower is connected with the branch pipes 39, which connect it with its central hub 41, which latter is drilled centrally to receive the steam-supply pipe 41, on which it is secured and whereby the blower-ring 37 is supplied with steam. The radially-extending supporting-arms 42 are formed integral on the hub 41 and are provided to maintain the blower-ring in position centrally within the air duct or tube 9. The steam-supply pipe 41 is fixed and extends backwardly through the central bore of the end cap 42^a of the tube 9, in which bore it loosely fits, and the said pipe has its outer projecting end connected to the T-piece 43, which latter is connected to the steam-supply pipe 44. A manipulating-lever 45 is fulcrumed on and between the outer ends of the supporting-links 46 by a pin 47, and these latter are hinged to a suitable lug 48, formed integral on the fuel-receiving chamber 3, and the bifurcated ends 49 of said lever 45 fit over the ends of the yoke 50, and the ends of the said bifurcations are drilled to loosely receive the screws 51, which are securely screwed into the ends of the yoke 50. The yoke 50 is secured fast on the steam-pipe 41 by a suitable set-screw 52, and thus it is clear that while the air tube or duct 9 is rotated the steam-pipe is maintained in its fixed position.

When it is desired to burn oil in connection with this apparatus, a tube 53 of much smaller diameter than the steam-pipe 41 is passed centrally therethrough and through a central bore formed in the hub 40 of the blower-ring 37, and the end of said oil-supplying tube is projected sufficiently beyond said hub to discharge the fuel-oil at a point within the nozzle 28, at which point the oil will be lifted up by the outgoing air and steam blast to be thoroughly atomized before being discharged from the nozzle 4 of the apparatus.

In the outer projecting end of the tube 9 suitable air-vent openings 54 are formed, and also in the cap 42^a inner air-inlet openings 55 are formed, and the same are provided for

the free passage of the exterior or atmospheric air into the interior of the central or air tube 9.

The operation of my invention is as follows: The fuel having been previously pulverized or reduced to a fine state is discharged by any suitable conveying means into the top open end 2 of the hopper 1. Rotative motion is now imparted to the central air-tube 9 and the feed-conveyor 12, situated in the hopper 1, and the fuel is thus positively fed from the top of said hopper 1 to and into the fuel-chamber 3, from whence it is again positively and regularly conveyed by the spiral or helical conveyer 11, formed on the central rotating air tube or duct 9, to and in front of the air-blast nozzle 28 to be mixed with the air-blast passing therethrough and carried by said blast through the ejecting-nozzle 4 to be discharged into the furnace to which the apparatus is connected to be consumed therein.

Having thus fully described this my invention, what I claim as new and useful, and desire to cover by Letters Patent of the United States therefor, is—

1. In a pulverized-fuel burner, the combination with a fuel-receiving chamber having a closed end and an open reduced ejecting or nozzle end, of an air-conducting tube situated centrally and extending longitudinally within said fuel-receiving chamber, and having its open ejecting or nozzle end directed toward the reduced or nozzle end of said fuel-receiving chamber, and means, adapted to operate in line with and between said air-conducting tube and the interior surface of said fuel-receiving chamber, to feed the fuel positively to the discharging-nozzle.

2. In a pulverized-fuel burner, the combination with a fuel-receiving chamber having a closed end and an open reduced ejecting or nozzle end, and a feed-hopper situated at or near the closed end of said fuel-receiving chamber, of an air-conducting tube situated centrally and extending longitudinally within said fuel-receiving chamber and having its open ejecting or nozzle end directed toward the reduced or nozzle end of said fuel-chamber, a spiral conveyer integral with and encircling said air-tube and means for rotating the air-tube and conveyer.

3. In a pulverized-fuel burner, the combination with a fuel-receiving chamber having a closed end and an open reduced ejecting or nozzle end, a vertically-extending feed-hopper situated at or near the closed end of said feed-receiving chamber of an air-conducting tube situated centrally and extending longitudinally within said fuel-receiving chamber and having its open ejecting or nozzle end directed toward the reduced or nozzle end of said fuel-chamber, a spiral conveyer integral with and encircling said air-tube and means for rotating said tube and spiral conveyer and for operating said hopper-conveying means simultaneously.

4. In a pulverized-fuel burner, the combination with a fuel-receiving chamber having a closed end and an open reduced ejecting or nozzle end, a vertically-extending feed-hopper connected to said fuel-receiving chamber, an air-conducting tube situated centrally and extending longitudinally within said fuel-receiving chamber and having its open ejecting or nozzle end directed toward the reduced or nozzle end of said fuel-receiving chamber, a spiral conveyer integral with and surrounding said air-tube, a depending spiral conveyer situated in said hopper and means for simultaneously rotating said air-tube and conveyers whereby equal and regular quantities of fuel are supplied to said fuel-receiving chamber as it is discharged from the nozzle of the latter.

5. In a pulverized-fuel burner, the combination with a fuel-receiving chamber having a closed rear end and an open reduced ejecting or nozzle end, of an air-tube situated centrally and extending longitudinally within said fuel-receiving chamber and having its ejecting or nozzle end directed toward the reduced or nozzle end of said fuel-receiving chamber, a steam or blast pipe extending centrally and longitudinally within said air-tube, and a liquid-fuel-conveying pipe within said steam-pipe and projecting beyond the open end thereof to a point at or near the ejecting-nozzle of said air-tube.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRANKLIN M. REED.

Witnesses:
THOMPSON R. BELL,
HARRY W. ROLL.