

No. 684,152.

Patented Oct. 8, 1901.

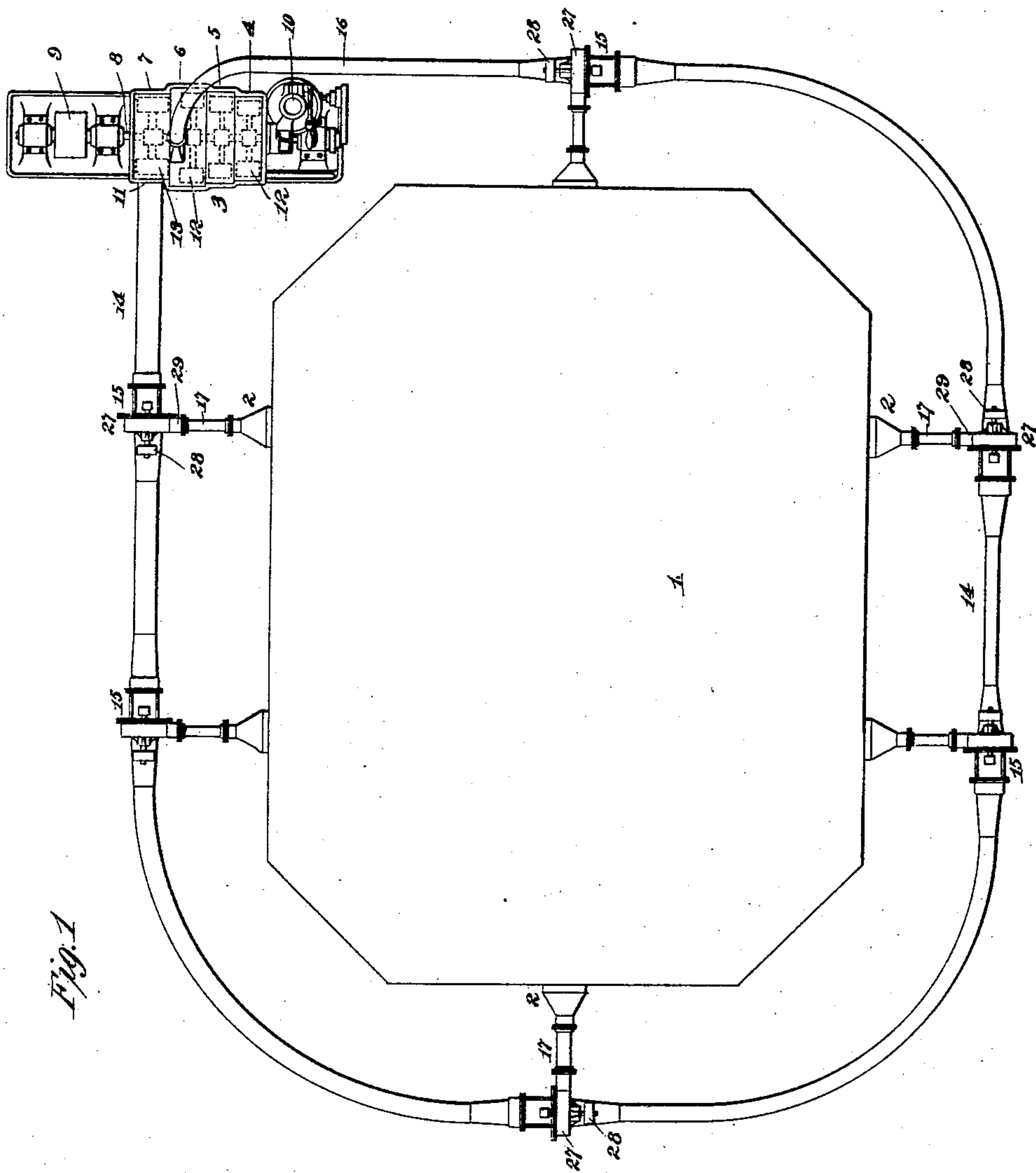
W. M. WHEILDON.

APPARATUS FOR FEEDING PULVERIZED FUEL TO A PLURALITY OF FIRE BOXES.

(Application filed Aug. 2, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:

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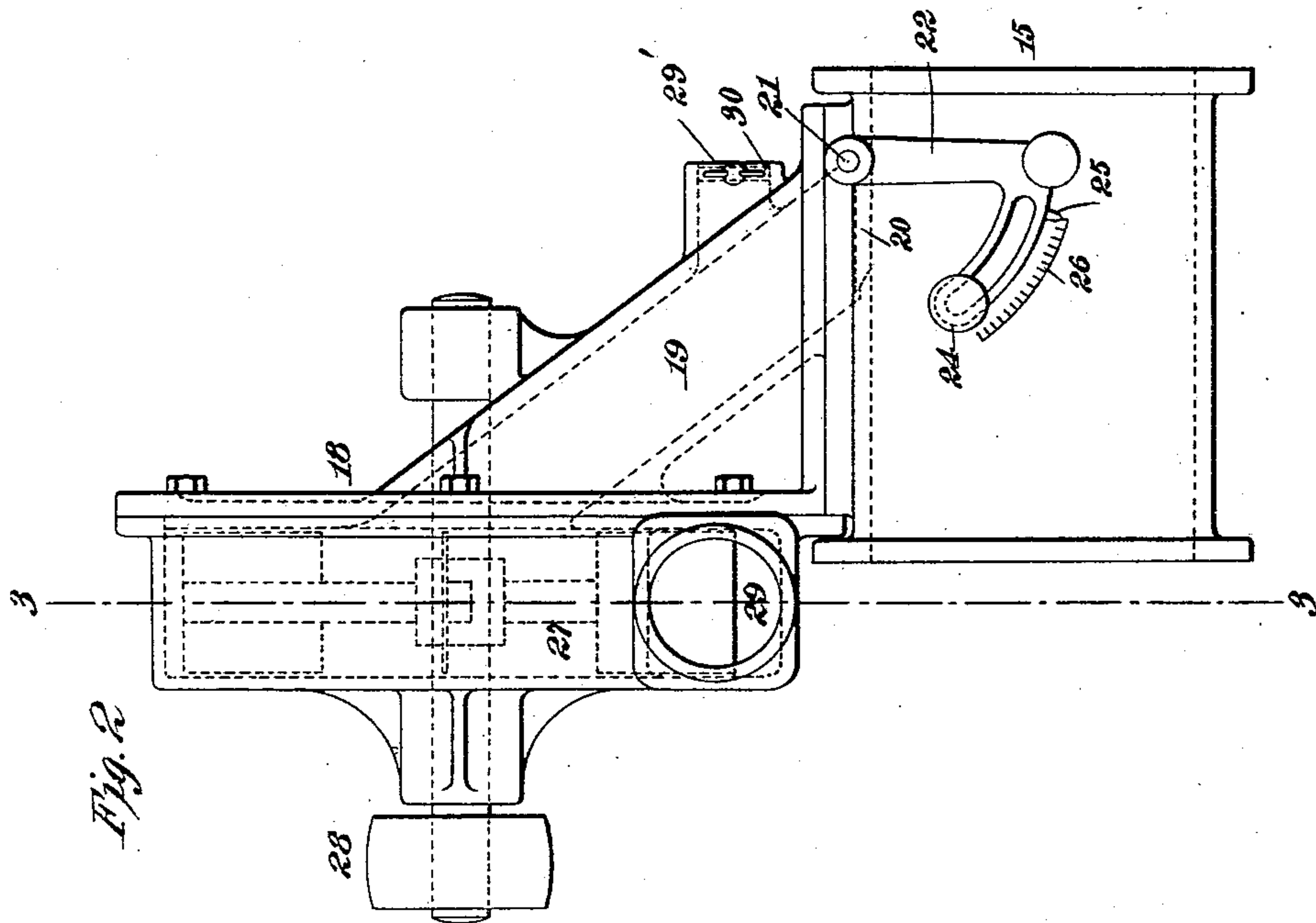
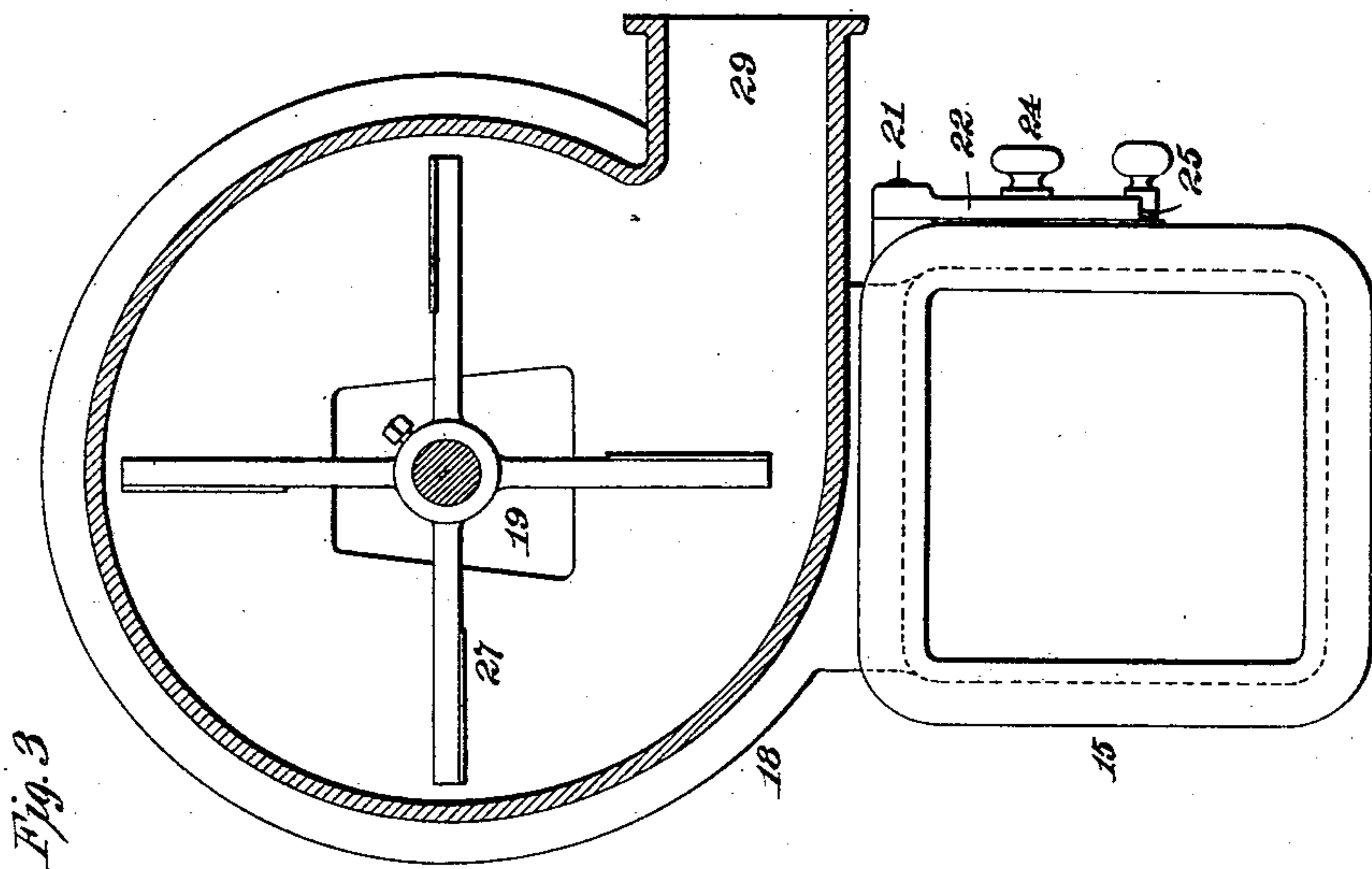
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2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR FEEDING PULVERIZED FUEL TO A PLURALITY OF FIRE-BOXES.

SPECIFICATION forming part of Letters Patent No. 684,152, dated October 8, 1901.

Application filed August 2, 1900. Serial No. 25,655. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MAXWELL WHEILDON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Apparatus for Feeding Pulverized Fuel to a Plurality of Fire-Boxes, (Case A,) of which the following is a specification.

My invention relates to an improved apparatus by means of which pulverized fuel can be practically and economically fed from one or more pulverizers to a plurality of fire-boxes, burners, or other fuel-consuming devices; and the object of my invention is to provide a simple and effective apparatus for the purpose wherein the desired proper distribution of the fuel will be secured and wherein one or more of the fuel-consuming devices can be connected to or disconnected from the supply of pulverized fuel without affecting to an objectionable extent the proper supply of fuel to the other fuel-consuming device or devices of the system. Pulverizers of many types have been suggested for reducing coal or other fuel into finely-comminuted condition and mixing the powdered product with air, and my present invention is not limited to use with a pulverizer of any specific type. A convenient form of pulverizing device, however, and one which I preferably use is that suggested in the patent to Storer, Martin, and Eaton, No. 580,909, dated April 20, 1897, employing a series of concentric pulverizing-chambers of gradually-increasing diameter from the feed to the discharge end, a fan-chamber being connected to the pulverizing-chamber of the largest diameter and a shaft being mounted centrally in the pulverizing and fan-chambers and carrying a series of paddles working in the pulverizing-chambers and a series of fan-blades working in the fan-chamber, a suitable feeding device being ordinarily employed to secure a uniform feed of material around the shaft and within the first pulverizing-chamber. The employment of a single pulverizer or of a plurality of pulverizers for feeding a mixture of air and pulverized fuel to a plurality of fuel-consuming devices has been before suggested, but so far as I am aware with the prior devices a plurality of

feed-pipes have led directly from the discharge end of the pulverizer to the fuel-consuming devices, so that variations in the feed of fuel to one resulted in corresponding variations in the feed of the fuel to the other. With such a device if it were assumed, for example, that the pulverizer was used to feed pulverized fuel through two branch pipes to two fuel-consuming devices the shut-off of one device would result in the doubling of the supply of fuel to the other. For this reason it has been practically impossible up to the present time to satisfactorily feed pulverized fuel from a single pulverizer to a plurality of fuel-consuming devices. By means of my present apparatus I secure this desired result.

In carrying my invention into effect I employ a trunk or fuel-pipe which leads from the discharge end of a pulverizer or a series of pulverizers and extends more or less adjacent to all of the fuel-consuming devices which are to be supplied with the pulverized fuel, said trunk or fuel-pipe returning to the pulverizer at the inlet side of the fan-chamber thereof and preferably between the fan-chamber and the pulverizing chamber or chambers, and I lead a branch from the trunk or fuel-pipe into each fuel-consuming device, whereby fuel from the trunk or fuel-pipe will be permitted to enter the branch pipe and be directed with the desired pressure into each fuel-consuming device. When the pulverizer is not provided with a fan-chamber, but material is caused to pass therethrough and to be mixed with air by an independent fan, then the trunk or fuel-pipe may be returned to such a fan-chamber instead of to the pulverizer itself. In this way I am enabled to produce a constant circulation of air and pulverized fuel from the exit ends of the pulverizer or from the fan-chamber if an independent fan be used and to return to such pulverizer or independent fan-chamber the surplus air or pulverized fuel not drawn off into the fuel-consuming devices, whereby a very high velocity of air and fuel may be maintained in the trunk or fuel-pipe and a uniform feed of material to the several fuel-consuming devices be secured and any possibility of a back pressure being imposed upon the pulverizer be overcome. It is important that the pulverizer should not work

against a back pressure, since in that case the proper flow of material to be pulverized through the pulverizer would be affected. In the preferred embodiment of my invention I

5 make the trunk or fuel-pipe of reduced cross-section beyond each branch leading to the several fuel-consuming devices in order to compensate for the normal withdrawal of material through said devices and to thereby maintain a practically uniform velocity of air in the trunk, and I also preferably so regulate the normal feed of pulverized material from the pulverizer as to approximately secure the

10 full volume necessary for all the fuel-consuming devices to be fed, so that there will always be sufficient fuel in transit in the trunk to feed the maximum number of such devices, while any air or fuel returning to the pulverizer or its draft-producing device will

15 be of minimum quantity. If then one or more of the fuel-consuming devices be disconnected from the trunk or fuel-pipe, the quantity of air and fuel returning to the pulverizer will be increased, so that the conditions can be immediately adjusted by lowering the feed of material introduced to the pulverizer. The material can be drawn off from the trunk or fuel-pipe into the several fuel-consuming devices in any suitable way, either by means of

20 a small auxiliary fan at each branch pipe or by the pressure of the air therein, or by both of such expedients.

In my present application for patent I will describe and claim specifically the employment of a centrifugal fan at each branch

35 pipe for effecting the proper feed of material to the several fuel-consuming devices, and I shall describe and claim in a separate companion application filed on even date herewith and numbered serially 25,656 the employment of branch pipes, the flow in which is derived solely from the pressure in the trunk; but in its generic aspect my present invention is not limited to any particular device for securing the proper feed of the material from the trunk or fuel-pipe to the fuel-consuming devices, and I desire to have my claims so considered unless specifically limited in terms.

50 In order that my invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and wherein—

Figure 1 is a top view showing a pulverizer

55 of the type described supplying pulverized fuel to six fire-boxes of an ordinary kiln and illustrating the employment of an auxiliary centrifugal fan for effecting the feed from the trunk or fuel-pipe into such fire-boxes; Fig.

60 2, an enlarged view showing one of the take-off casings and fan, and Fig. 3 a section on the line 3 3 of Fig. 2.

In all of the above views corresponding parts are represented by the same numerals of reference.

Although I describe my present apparatus

in connection with the fire-boxes of a kiln, it will be understood, of course, that it may be applied in any art wherein a plurality of fuel-consuming devices are employed—as, for instance, with a battery of boilers, with a series of cement-roasters, &c. 70

1 represents a kiln having six fire-boxes adapted to be supplied with pulverized fuel by means of twyers 2 2, as shown. 75

3 represents the pulverizer, which may be of any suitable type, that shown being the pulverizer claimed in the patent to Storer, Martin, and Eaton before referred to, comprising three concentric pulverizing-chambers 4, 5, and 6, a fan-chamber 7, connected to the pulverizing-chamber 6, a main shaft 8, driven by a pulley 9, a suitable feed device 10 for feeding material to the chamber 4, an exit 11 from the fan-chamber, through which the

80 pulverized material and air are directed, the paddles 12, carried by spider-arms connected to the shaft 8 and working in the several pulverizing-chambers, and the fan-blades 13, connected to said shaft and working in the

85 fan-chamber. Material introduced by the feed device 10 into the pulverizing-chamber 4 will be gradually reduced in size by the action of the paddles 12 and be fed slowly through the pulverizer, so as to be mixed with

90 air and be forced by the fan through the discharge-opening 11. 95

14 is the main trunk or fuel-pipe, one end of which connects, as shown, with the discharge-opening 11 of the pulverizer, whereby

100 the material from the pulverizer will be forced through said trunk. The trunk extends, as shown, adjacent to all the fire-boxes which are to be supplied with pulverized fuel. Opposite to each of the twyers 2 I connect the

105 trunk with a take-off box 15, which may be conveniently and economically made of the same size throughout. The trunk 14 is preferably, however, reduced in area beyond each of the take-off boxes, so as to compensate for

110 the normal withdrawal of material to each of the twyers, whereby the velocity of flow of the material in the trunk will be maintained practically uniform. The end 16 of the trunk leads, as shown, back to the pulverizer, so

115 that a constant flow of pulverized material and air can be maintained between the pulverizer and the trunk. When a pulverizer of the type described is used, the end 16 of the trunk or fuel-pipe may lead to the pul-

120 verizer, as shown, between the pulverizing-chamber of the greatest diameter and the fan-chamber, so that any excess of air and fuel will be returned only to the fan-chamber and be again forced out of the pulverizer by

125 the fan. 130

If the pulverizer used with my apparatus is not of the type employing a fan-chamber mounted concentric to the pulverizing chamber or chambers, then the trunk or fuel-pipe may be returned to an independent fan-chamber, if used, so as to secure the desired circula-

tion. Connected with the trunk or fuel-pipe at each fire-box is a branch pipe 17, through which fuel may be diverted from the trunk into any one of the fire-boxes it is desired.

5 When an auxiliary centrifugal fan is employed at each branch to effect the feed therethrough, a convenient construction for the purpose is shown in Figs. 2 and 3, to which attention is now particularly directed.

10 Bolted to the top of each take-off box is a casting 18, having a flue 19 therein, which connects with the interior of the take-off box, as shown. Said flue is adapted to be closed at its lower end by means of a flap or damper 20, 15 pivoted to a shaft 21 and opening upwardly, as shown, so as not to project within the take-off box to permit the formation of eddy-currents therein. The shaft 21 may connect with a regulating-arm 22 for adjusting the 20 position of the damper 20. Said arm may be provided with a slotted segment, with which a locking-screw 24 engages, said segment carrying an index 25, which coöperates with the scale 26. Bolted to the vertical face of the 25 casting 18 is a small centrifugal fan 27 of any desired type, driven from a pulley 28, from an auxiliary engine, or from the line-shafting. The flue 19 connects axially with the fan, as is common. The discharge-opening 29 of the 30 fan 27 connects with the branch 17.

Assuming an auxiliary centrifugal fan to be used at each branch for effecting the feed from the trunk or flue to the several fuel-consuming devices, the operation of my improved 35 apparatus will be as follows: Assuming that no one of the fuel-consuming devices is in operation, but that all require to be started, the pulverizer is actuated to reduce the fuel to a pulverulent condition and to force the pulverized fuel, with the proper air to create the 40 draft, through the trunk or fuel-pipe 14. All the dampers 20 will be closed, so that a continuous passage will be afforded through the trunk, and the material and air will return to the fuel-pipe, so as to be maintained in active 45 circulation. As soon as the stream of fuel and air has been thus circulated through the trunk the supply of fuel to the pulverizer is substantially cut off at the feed 10. At the 50 first fire-box the damper 20 is opened to the desired extent and the centrifugal fan 27 is started thereat, so as to draw the material and air from the trunk or flue and force such mixture to the twyer or other burner, which will 55 then be ignited. The supply of material to said burner will be regulated by the damper 20 or by the speed of the centrifugal fan, or by both. If it is found that the proportion of air thus introduced into the burner with 60 the pulverized material is insufficient to produce perfect combustion, an auxiliary air-supply may be secured through an opening 29', as shown in Fig. 2, leading into the flue 19 and having a regulable damper 30. The 65 employment of such an auxiliary air-supply may be desirable in instances where a more

perfect pulverization of the material is secured at the pulverizer by reducing the air-feed therethrough below that necessary to secure perfect combustion of the mixture. In 70 such an instance the pulverizer may be operated to secure the best condition of pulverization, while the additional air necessary to obtain perfect combustion will be added to the fuel through the auxiliary air-supply openings 29'. The deflection of the mixture at the 75 first fire-box from the trunk will be compensated at the pulverizer by a recommencement of the adjustable feed 10 or by increase in such feed, assuming the latter not to have been entirely cut off. The succeeding fuel-consuming 80 devices are then started, preferably successively, in the same way, the feed 10 being properly regulated to effect the supply of fuel to be pulverized by the pulverizer. When all 85 the devices are in operation, substantially all the pulverized material will be withdrawn from the trunk or fuel-pipe through the several branch pipes 17, so that only a minimum quantity of material will be returned to the 90 pulverizer. If any one of the fuel-consuming devices requires to be extinguished, the damper 20 therefor is closed and the fan stopped. This does not appreciably affect the supply 95 to the other devices, but results only in the return to the pulverizer of an additional quantity of material and necessitating the cutting down of the feed of material to the pulverizer.

In systems heretofore suggested for feeding 100 pulverized fuel to a plurality of burners the greatest difficulty was found in overcoming the tendency to deliver the bulk of the material at the first take-offs at the expense of the others and also in maintaining the required percentage of fuel and air throughout 105 the entire travel of the fuel. By the employment of auxiliary fans, as I have described, this difficulty is entirely overcome. As the currents of air and fuel naturally follow the paths of least resistance, the regulable operation of the auxiliary fans provides for a 110 perfectly-uniform distribution to the several burners.

Having now described my invention, what I claim as new, and desire to secure by Letters 115 Patent, is as follows:

1. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices comprising a pulverizing apparatus, a trunk or fuel-pipe extending therefrom, and to 120 which a mixture of pulverized fuel and air is supplied, the fuel-pipe being continuous to provide for a constant circuit of material through the same, a branch leading from the trunk or fuel-pipe to each fuel-consuming device, and means for cutting out a portion of 125 the fuel from the trunk and directing it into the branches, substantially as set forth.

2. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizer, a series of 130 fuel-consuming devices, a trunk leading from

the discharge of the pulverizer adjacent to such devices and returning to the pulverizer, branch pipes leading from the trunk to the fuel-consuming devices, and means for cutting out a portion of the fuel from the trunk and directing it into the branches, substantially as set forth.

3. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizing apparatus, a series of fuel-consuming devices, a trunk or fuel-pipe connected with the discharge from said pulverizing apparatus, said trunk or fuel-pipe being continuous to provide for a constant circuit of material therethrough, a branch leading from the trunk or fuel-pipe to each fuel-consuming device, said trunk decreasing in cross-section beyond each branch, and means for cutting out a portion of the fuel from the trunk and directing it into the branches, substantially as set forth.

4. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizer, a series of fuel-consuming devices, a trunk or fuel-pipe leading from the discharge of the pulverizer and returning to the pulverizer, whereby a continuous flow of material through said trunk or fuel-pipe can be effected, a branch leading from said trunk or fuel-pipe to each fuel-consuming device, and means for cutting out a portion of the fuel from the trunk and directing it into the branches, substantially as set forth.

5. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizer employing a pulverizing-chamber and a concentric fan-chamber, a fuel-pipe leading from the discharge of the fan-chamber and returning to the inlet thereof, a series of fuel-consuming devices, branches connecting the trunk or fuel-pipe with said devices, and means for cutting out a portion of the fuel from the trunk and directing it into the branches, substantially as set forth.

6. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizing apparatus, a trunk or fuel-pipe leading therefrom and to which the pulverulent fuel is supplied, a series of fuel-consuming devices, a branch leading from the trunk or fuel-pipe to each of said devices, and an auxiliary fan in each branch for forcing material therethrough, substantially as set forth.

7. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizer, a trunk or fuel-pipe connected with the discharge of said pulverizer, a series of fuel-consuming devices, branches connecting the trunk or flue with said devices, and an auxiliary fan in each branch for maintaining a circulation therein, substantially as set forth.

8. An apparatus for feeding pulverized ma-

terial to a plurality of fuel-consuming devices, comprising a pulverizing apparatus, a continuous trunk or flue leading from the discharge of said pulverizing apparatus so that a constant flow of material through said fuel-pipe can be maintained, a plurality of fuel-consuming devices, a branch leading from the trunk or flue to each device, and an auxiliary fan in each branch for maintaining a circulation therein, substantially as set forth.

9. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizer, a fuel-pipe leading from the discharge of said pulverizer and returning to the pulverizer, a series of fuel-consuming devices, a branch leading from the trunk or fuel-pipe to each device, and an auxiliary fan in each branch for maintaining a circulation therein, substantially as set forth.

10. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizing apparatus, a trunk or flue supplied with pulverized material therefrom, a plurality of fuel-consuming devices, a take-off box connected with the trunk or flue adjacent to each device, all of such take-off boxes being of the same size, and the trunk or flue being reduced in cross-section beyond each box, a branch leading from the take-off boxes to the fuel-consuming devices, and means for cutting out a portion of the fuel from the trunk and directing it into the branches, substantially as set forth.

11. An apparatus for feeding pulverized material to a plurality of fuel-consuming devices, comprising a pulverizing apparatus, a trunk or flue supplied with pulverized material therefrom, a plurality of fuel-consuming devices, a take-off box connected with the trunk or flue adjacent to each device, all of such take-off boxes being of the same size, and the trunk or flue being reduced in cross-section beyond each box, a branch leading from the take-off boxes to the fuel-consuming devices, and an auxiliary fan in each branch for maintaining a circulation therein, substantially as set forth.

12. The combination with a trunk or fuel-pipe in which pulverized material is forced by air-currents, of a branch connected therewith, and an auxiliary fan in said branch, substantially as set forth.

13. The combination with a trunk or fuel-pipe in which pulverized material is forced by air-currents, of a branch connected therewith, an auxiliary fan in said branch, and a damper opening into said branch and away from the trunk or fuel-pipe, substantially as set forth.

14. The combination with a trunk or fuel-pipe in which pulverized material is forced by air-currents, of a branch connected therewith, an auxiliary fan in said branch, and means for admitting an additional air-supply to said branch, substantially as set forth.

15. The combination with a trunk or fuel-
pipe in which pulverized material is forced
by air-currents, of a branch connected there-
with, an auxiliary fan in said branch and
5 means for admitting an additional and regu-
lable air-supply to said branch, substantially
as set forth.

This specification signed and witnessed this
14th day of June, 1900.

WILLIAM MAXWELL WHEILDON.

Witnesses:

FRANK L. DYER,
JNO. R. TAYLOR.