No. 684,153. Patented Oct. 8, 1901.

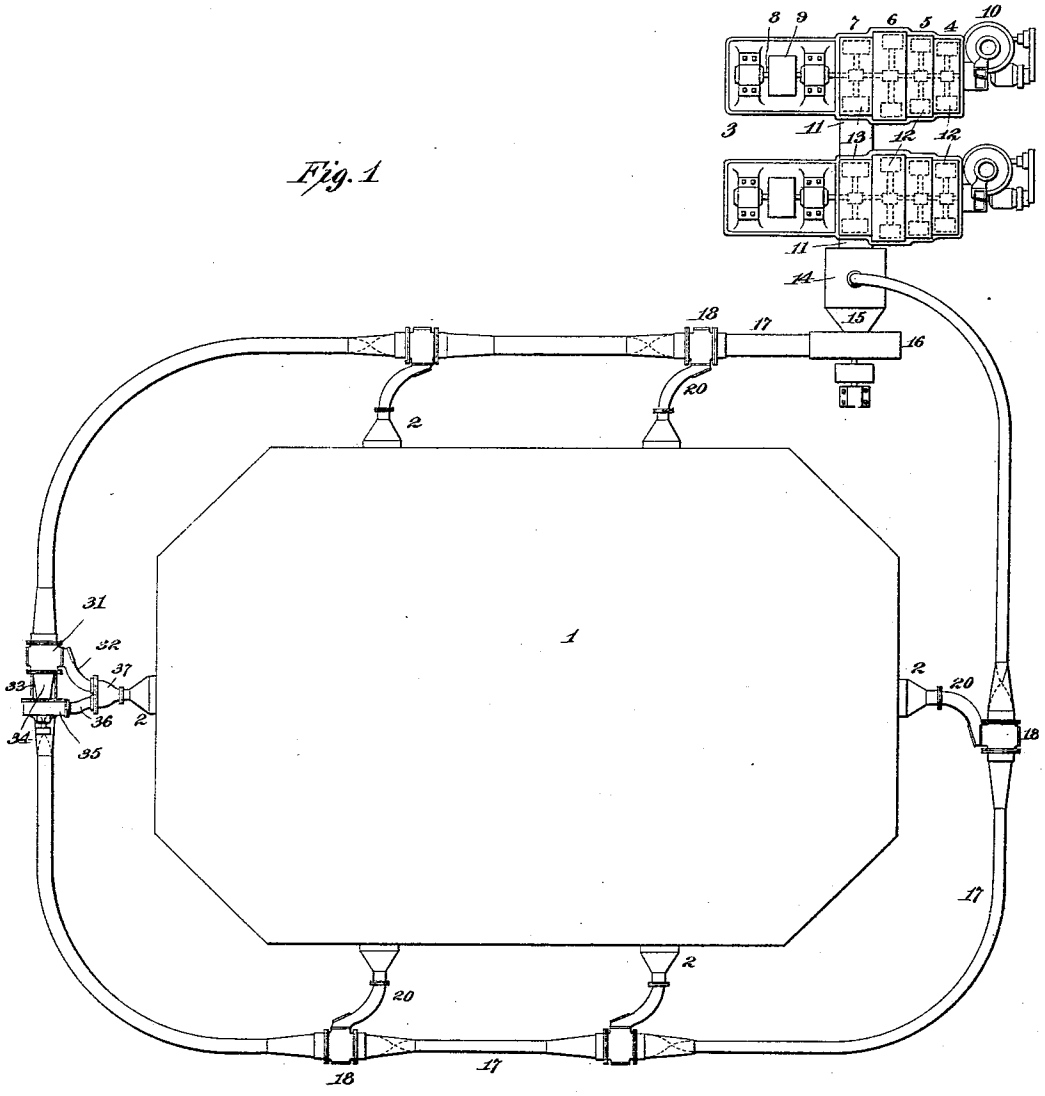
W. M. WHEILDON.

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

(Application filed Aug. 2, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1



Witnesses:

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Att'ys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 2

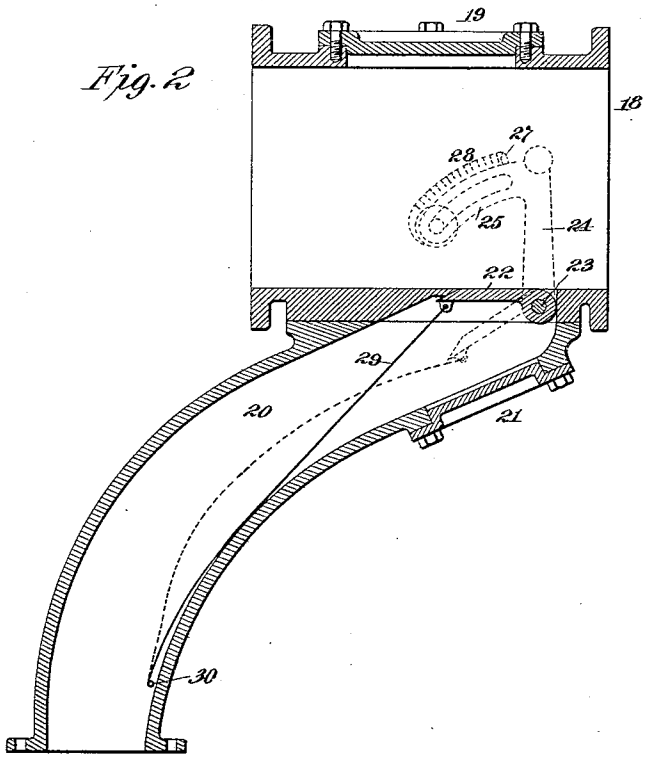
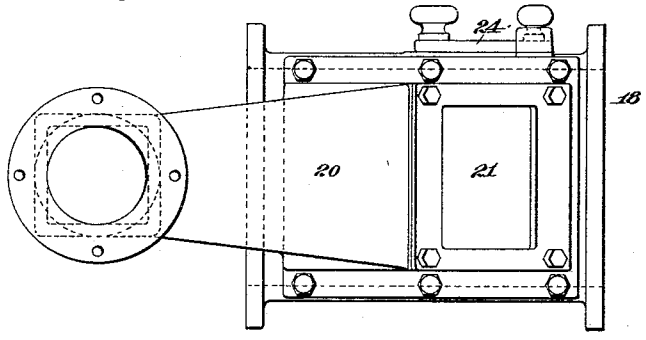


Fig. 3



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Fig. 4

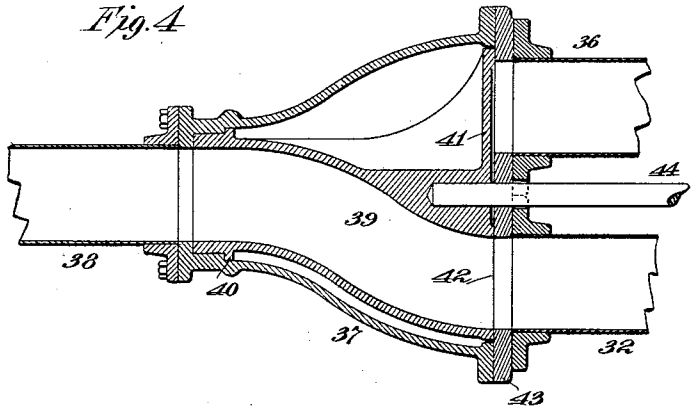
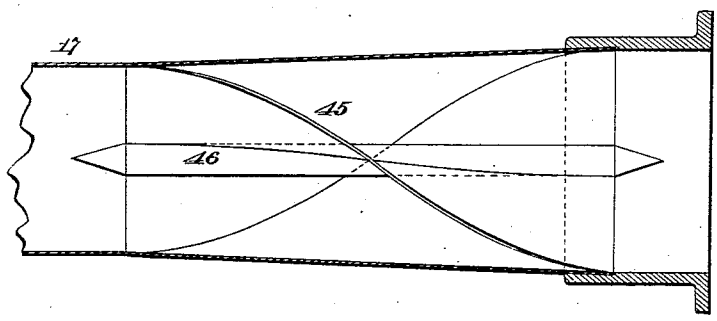


Fig. 5



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UNITED STATES PATENT OFFICE.

WILLIAM MAXWELL WHEILDON, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO AERO-PULVERIZER COMPANY, OF JERSEY CITY, NEW JERSEY.

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

SPECIFICATION forming part of Letters Patent No. 684,153, dated October 8, 1901.

Application filed August 2, 1900. Serial No. 25,656. (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 Improved Apparatus for Feeding Pulverized Fuel to a Plurality of Fire-Boxes, (Case B,) of which the following is a description.

My invention relates to improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices. In an application filed of even date herewith and numbered serially 25,655 I describe and claim an improved apparatus for this purpose, comprising a continuous trunk or fuel-pipe into which the fuel is delivered by a suitable pulverizing apparatus and through which the fuel may continuously circulate, a series of branch pipes being led therefrom to the several fuel-consuming devices.

My present invention relates to an apparatus of this kind; and my object is to provide a simple and effective apparatus for the purpose, whereby fuel can be uniformly and practically distributed to a plurality of fuel-consuming devices, wherein any possibility of back pressure on the pulverizing apparatus is overcome, wherein a plurality of pulverizers may be effectively used to supply a single system, and wherein the stream of pulverized material in transit through the trunk or fuel-pipe will be prevented from settling, so as to deposit the heavier particles.

In carrying my invention into effect I employ a continuous trunk or fuel-pipe extending, preferably, contiguous to the fuel-consuming devices which are to be supplied and which are connected to the fuel-pipe by means of branches, and I provide for the circulation of the material in the fuel-pipe by means of a centrifugal fan to the inlet of which the pulverized fuel is supplied from one or more pulverizing devices of any suitable type. By employing an independent fan for circulating the material through the fuel-pipe I can thus effect the circulation independent of the pulverizing apparatus and can maintain a very much higher velocity of the stream in the trunk or fuel-pipe than in the pulverizing apparatus itself, whereby the latter can be operated to produce the best pulverizing effect. The use of such an independent fan also enables me to very effectively utilize the apparatus in connection with a series of pulverizers feeding into a single chamber with which said fan is connected, whereby the pulverizers will operate practically independent of each other and independent of the circulation of the material in the trunk or fuel-pipe. With my present apparatus I effect the withdrawal of the material through the branches in any suitable way—as, for instance, by means of a small auxiliary fan at each branch—as I describe in my said application, or by means of a curved pipe connecting each branch with the trunk and supplied with material by the pressure in the trunk, and I shall specifically claim the latter construction herein.

In operation with a device employing simply branch pipes leading out of the trunk and permitting a flow of material from the trunk by reason of the pressure in the latter there may be times in the operation when only a few fuel-consuming devices are being supplied where the pressure in the trunk will be insufficient to properly feed such devices, and under these conditions it may be desirable to effect the feed of material from the trunk to the fuel-consuming devices by means of an auxiliary fan at each branch. My present invention contemplates also means by which this result can be secured. In order to prevent the heavier particles in the stream from settling and accumulating in the trunk, I interpose therein one or more spiral or helical diaphragms, which offer no material retardation to the stream, but which twist the stream spirally, so as to elevate any of the heavier particles to the center of the stream, and thereby overcome the objection noted.

Other specific details of construction characterize my present invention and will appear from the more detailed description thereof which follows, reference being had to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view illustrating an ordinary kiln having six fireplaces supplied with pulverized fuel from a pair of pulverizers of a well-known type; Fig. 2, a longi-

tudinal sectional view of one of the take-off boxes and the curved branch connected therewith; Fig. 3, a front view of the same; Fig. 4, a longitudinal sectional view of the preferred construction of shunting device for connecting a single branch with one of a plurality of flues leading from the trunk or fuel-pipe, and Fig. 5 an enlarged longitudinal sectional view showing a double helical diaphragm for giving a spiral twist to the moving stream of material to prevent settling of the heavier particles thereof.

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

Although I illustrate my present apparatus employed in connection with a kiln, it will be understood that the invention may be made use of in any art where a plurality of fuel-consuming devices require to be supplied—as, for instance, a battery of boilers, a series of cement-roasters, &c.

1 represents a kiln of ordinary construction, the six boxes of which are fed by means of twyers 2 2 or other forms of burner wherein pulverized fuel may be consumed.

3 represents a pair of pulverizers of any suitable type, that indicated being of the kind described and claimed in the patent to Storer, Martin, and Eaton, No. 580,909, dated April 20, 1897, wherein three pulverizing-chambers 4, 5, and 6 are used of increasing diameters, a fan-chamber 7 being attached at the side of the largest pulverizing-chamber, a shaft 8 being mounted concentrically within the chambers driven from a pulley 9, material being supplied to the interior of the first pulverizing-chamber by an automatic regulable feeding device 10, the pulverized material being forced out of the fan-chamber through the exit-opening 11, a plurality of paddles 12 being carried on a spider-frame from the shaft within each pulverizing-chamber to reduce the material therein, and fan-blades 13 being carried on a corresponding spider-frame within the fan-chamber to provide for a circulation of air through the apparatus, whereby the material will not only be reduced to the proper size, but will be mixed with air for its combustion.

It will be obvious that more than two pulverizers can be employed, that pulverizers of different types may be used, and that a single pulverizer of sufficient capacity may be made use of. When more than one pulverizer is used, the exit-pipes 11 thereof connect, preferably, with a chamber 14, from which a flue 15 extends to a large centrifugal fan 16 of common construction.

17 represents a trunk or fuel-pipe which leads from the discharge end of the fan 16 and extends contiguous to the several fuel-consuming devices, said trunk being continuous, as shown, and returning to the inlet end of the fan. Obviously a stream of air carrying pulverized fuel delivered by the fan 16 will be returned thereto at its inlet end, so as to be kept in constant circulation through the trunk.

Opposite all the fuel-consuming devices except that at the left in Fig. 1, which illustrates a modification to be described, is a single take-off box 18, made, preferably, rectangular in cross-section and all the take-off boxes being made of the same dimensions and from the same castings, so as to reduce cost of manufacture and installation. Each of these take-off boxes supplies the proper proportion of fuel to the adjacent fuel-consuming device by reason of the pressure within the trunk or fuel-pipe. The details of construction of these take-off boxes are more clearly shown in Figs. 2 and 3, to which attention is specifically directed. Each take-off box may be provided at its bottom with a removable hand-hole 19, by means of which any pulverized material accumulated therein may be removed from time to time. At the side of each box is an opening with which connects a curved flue 20, bolted in place to the box, as shown, said flue being preferably rectangular in cross-section, but tapering toward its exit end, as shown more clearly in Fig. 3. The flue may also be provided with a hand-hole 21 for the removal of accumulated material. The opening leading from the take-off box into the flue 20 is provided with a damper 22 therein, mounted on a shaft 23, to which is connected outside of the take-off box an operating-lever 24, carrying a slotted segment 25, with which a locking-screw 26 engages, said segment being provided with a pointer 27, coöperating with a scale 28. The end of the damper 22 connects with a diaphragm 29, made of flexible sheet metal and connected within the flue near its exit end to a rod 30. By employing a flexible diaphragm of this character it will be seen that a practically-continuous passage for the flow of the material through the flue 20 is provided irrespective of the position occupied by the damper 22, so that no eddy currents can be produced within said flue behind the damper, as would be the case if such diaphragm were not used. When the damper 22 is moved to its full-open position, as shown in dotted lines in Fig. 2, the area at the inlet of the flue 20 will be substantially equal to that of the exit thereof, owing to the tapered side walls of the flue, so that the velocity of the material through the flue will be maintained substantially throughout. Material forced through the trunk or fuel-pipe by the fan 16 will be permitted to pass into the flues 20 to an extent dependent upon the position of the dampers 22 thereof, so that the proper supply to the individual fuel-consuming devices will be secured. If it is desired to employ in addition to a simple shunt of this kind a positive auxiliary feed, as I describe in my said application, the arrangement shown at the left of Fig. 1 can be used. With this modification a take-off box 31 is provided with a flue 32, constructed

as described, for deflecting a part of the stream into the fuel-consuming device. Adjacent to the take-off box 31 is a corresponding take-off box 33, connected by a flue 34 with an auxiliary centrifugal fan 35, the outlet of which is connected with a branch 36. Fuel is directed to the fuel-consuming device through either of the branches 32 or 36 by means of a shunting apparatus located in a casing 37 and illustrated particularly in Fig. 4. Connected to the inner end of the casing 37 is a pipe 38, which leads to the fuel-consuming device. Mounted within the said casing 37 is a curved pipe 39, the lower end of which turns with respect to the center of the pipe 38, as shown, and is provided with a collar 40, seated on a shoulder within the casing. The pipe 39 is cast with a disk 41, which has an opening 42 therein, which opening rotates in line with the inner ends of the branch pipes 32 and 36, as shown. The casing 37 is provided with a cover 43, to which said branch pipes are connected. The curved pipe 39 is rotated so as to present its inlet in line with either of the branches 32 or 36 in any suitable way—as, for instance, by means of a shaft 44, connected to the disk 41. In order to prevent the stream from settling to an objectionable extent when passing through the trunk or fuel-pipe, and thereby permitting the heavier particles to deposit, I prefer to arrange one or more single or double helical diaphragms 45 within the trunk, whereby a spiral twist will be given the stream to carry the heavier particles centrally, and the preferred construction of such diaphragms is shown in Fig. 5, the diaphragms being connected to a suitable central supporting shaft or rib 46, by which they are rigidly sustained in position within the trunk or fuel-pipe. The presence of these helical diaphragms in the trunk or fuel-pipe does not offer a material retardation to the flow of the stream, owing to the thinness of their walls and easy angle.

The operation of an apparatus of the specific type described, assuming a plurality of pulverizers of the kind indicated to be used, is as follows: Material is supplied to the automatic feeding devices 10 of the pulverizers and by such feeding devices is fed to the first pulverizing-chamber 4 and successively through the apparatus, being acted upon by the paddles 12, so as to be effectively pulverized and mixed with the desired proportion of air to secure the best pulverizing effect. The mixture of pulverized material and air is forced out of the pulverizer by the fan-blades 13 and passes into the chamber 14, being drawn therefrom by the fan 16 and forced by the latter at any desired velocity through the trunk or fuel-pipe. By using an independent circulating-fan 16 it therefore becomes possible to pass the material through the pulverizers as slowly as desired to secure the best pulverizing effect and to circulate the material through the trunk or fuel-pipe at any velocity desired to secure the best feed of material therefrom into the several fuel-consuming devices, the circulation of the material in the trunk being therefore independent of the feed of material from the pulverizer or pulverizers. As soon as the material circulates in the trunk or fuel-pipe the damper 22 of one or more of the fuel-consuming devices is opened and material from the trunk or fuel-pipe will be permitted to pass through the curved flue 20 into the several burners and there be ignited. This starting of the fuel-consuming devices may take place either substantially simultaneously or in succession, as may be desired, the feed of material to the pulverizer or pulverizers being so regulated as to furnish to the trunk or fuel-pipe approximately the quantity of fuel necessary to supply the burners in operation. When in normal operation, the material supplied by the pulverizers to the trunk or fuel-pipe will be preferably slightly in excess of the normal amount necessary to supply the several fuel-consuming devices, the surplus from the latter returning to the fan 16, as explained. When the amount of fuel thus in circulation in the trunk or fuel-pipe increases beyond the desirable quantity, the feed of fuel to the pulverizer or pulverizers will be reduced. If one or more of the fuel-consuming devices is cut off by shutting the damper 22 thereof, the other burner or burners will not be affected, since the surplus fuel will circulate directly to the fan 16. It will be understood, however, that as the fuel-consuming devices are cut off the supply of material to the pulverizer or pulverizers will be correspondingly reduced. When only one or more of the fuel-consuming devices is to be used and the stream of material in circuit through the trunk or fuel-pipe is reduced, it may be desirable to effect a direct positive feed from the trunk into the burner or burners in operation by means of the auxiliary fans 35. When this is necessary, the curved pipe 39 is turned so as to be connected with the discharge end of the branch 36, and the fan 35 is then started, so as to withdraw material positively from the trunk or fuel-pipe and force said material into the burner, as I describe in my said companion application. It is preferable in practice to gradually contract the area of the trunk or fuel-pipe beyond each of the take-off boxes, so as to compensate for the reduction in volume of the fuel passing through the same, as shown, whereby a practically constant velocity of the stream will be secured, notwithstanding its reduction in bulk.

In maintaining a cycle or continuous stream, such as herein described, where it is absolutely essential that the ratio of air and combustible material should be kept not only constant, but that the mass as a whole should be perfectly homogeneous, it is of high importance that the current should be always

smoothly continuous without short turns or eddies. Eddies and sudden expansions and changes of velocity are almost sure to result in separation and depositing of the pulverized material carried in suspension, thereby destroying the uniformity of the currents. By employing helices, as described, placed just beyond each take-off, I offset any disturbance caused by the deflection of the material, and by giving a strong twist to the stream to create a centripetal action, causing the heavier particles to be thrown toward the center, I thus prevent settling.

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

1. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices connected with said trunk or fuel-pipe, means by which portions of such material may be deflected from said trunk to the fuel-consuming devices, and a plurality of pulverizers feeding pulverized material to said trunk or fuel-pipe, substantially as set forth.

2. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices connected with said trunk or fuel-pipe, means by which portions of such material may be deflected from said trunk to the fuel-consuming devices, an independent fan connected at its inlet and discharge ends with the ends of said trunk or fuel-pipe, and a pulverizer supplying pulverized material to the inlet of said fan, substantially as set forth.

3. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices connected with said trunk or fuel-pipe, means by which portions of such material may be deflected from said trunk to the fuel-consuming devices, an independent fan connected at its inlet and discharge ends with the ends of said trunk or fuel-pipe, and a plurality of pulverizers supplying pulverized material to the inlet of said fan, substantially as set forth.

4. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices connected with said trunk or fuel-pipe, means by which portions of such material may be deflected from said trunk to the fuel-consuming devices, an independent fan connected at its inlet and discharge ends with the ends of said trunk or fuel-pipe, a chamber connected to the inlet of said fan, and a plurality of pulverizers supplying pulverized material to said chamber, substantially as set forth.

5. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices, a pulverizing apparatus supplying pulverized material to said trunk or fuel-pipe, open continuous branch flues connecting the fuel-pipe with said fuel-consuming devices and means by which portions of such material will be deflected from said trunk to the branch flues, substantially as set forth.

6. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices, a pulverizing apparatus supplying pulverized material to said trunk or fuel-pipe, open continuous branch flues connecting the fuel-pipe with said fuel-consuming devices, and a damper in each of said flues, substantially as set forth.

7. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices, a pulverizing apparatus supplying pulverized material to said trunk or fuel-pipe, open continuous branch flues connecting the fuel-pipe with said fuel-consuming devices, a damper in each of said flues, and a flexible diaphragm connected with each of said dampers, substantially as set forth.

8. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices, a pulverizing apparatus supplying pulverized material to said trunk or fuel-pipe, open continuous branch flues connecting the fuel-pipe with said fuel-consuming devices, a damper in each of said flues, a flexible diaphragm connected with each of said dampers, an arm for moving said diaphragms, and means for locking said arm in any position of adjustment, substantially as set forth.

9. An improved apparatus for feeding pulverized fuel to a plurality of fuel-consuming devices, comprising a continuous trunk or fuel-pipe through which the material may be maintained in constant circuit, a plurality of fuel-consuming devices, a pulverizing apparatus supplying pulverized material to said trunk or fuel-pipe, open continuous branch flues connecting the fuel-pipe with said fuel-consuming devices, each of said flues being tapered from its entrance to its exit end, a

damper opening into said flue at its entrance end, and a flexible diaphragm connected to said damper, substantially as set forth.

10. The combination with a trunk or fuel-pipe supplied with pulverized material and a fuel-consuming device, of an open continuous branch flue leading from said fuel-pipe, a second flue leading from said fuel-pipe, an auxiliary fan in the second flue for maintaining the circulation therein, and means for connecting either of said flues with the fuel-consuming device, substantially as set forth.

11. The combination with a trunk or fuel-pipe supplied with pulverized material and a fuel-consuming device, of an open continuous branch flue leading from said fuel-pipe, a second flue leading from said fuel-pipe, an auxiliary fan in the second flue for regulating the circulation therein, and a curved pipe connected at one end to the fuel-consuming device and adapted to be connected at the other end with either of said flues, substantially as set forth.

12. The combination with a pulverizer, a trunk or fuel-pipe connected therewith through which a stream of pulverized material and air is forced, a series of fuel-consuming devices connected by branches to said trunk or fuel-pipe and means by which portions of such material will be deflected from said trunk to the branch flues, of a helical diaphragm mounted within said trunk or fuel-pipe for giving a spiral twist to the stream of material, substantially as set forth.

13. The combination with a pulverizer, a trunk or fuel-pipe connected therewith through which a stream of pulverized material and air is forced, a series of fuel-consuming devices connected by branches to said trunk or fuel-pipe and means by which portions of such material will be deflected from said trunk to the branch flues, of a double helical diaphragm mounted in the fuel-pipe for giving a spiral twist to the moving stream of material, substantially as set forth.

14. The combination with a pulverizer, a trunk or fuel-pipe connected therewith through which a stream of pulverized material and air is forced, a series of fuel-consuming devices connected by branches to said trunk or fuel-pipe and means by which portions of such material will be deflected from said trunk to the branch flues, of a double helical diaphragm mounted in the fuel-pipe for giving a spiral twist to the moving stream of material, and a central supporting-rib to which the helical diaphragms are secured, substantially as set forth.

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

WILLIAM MAXWELL WHEILDON.

Witnesses:
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JNO. R. TAYLOR.