

Nov. 1, 1927.

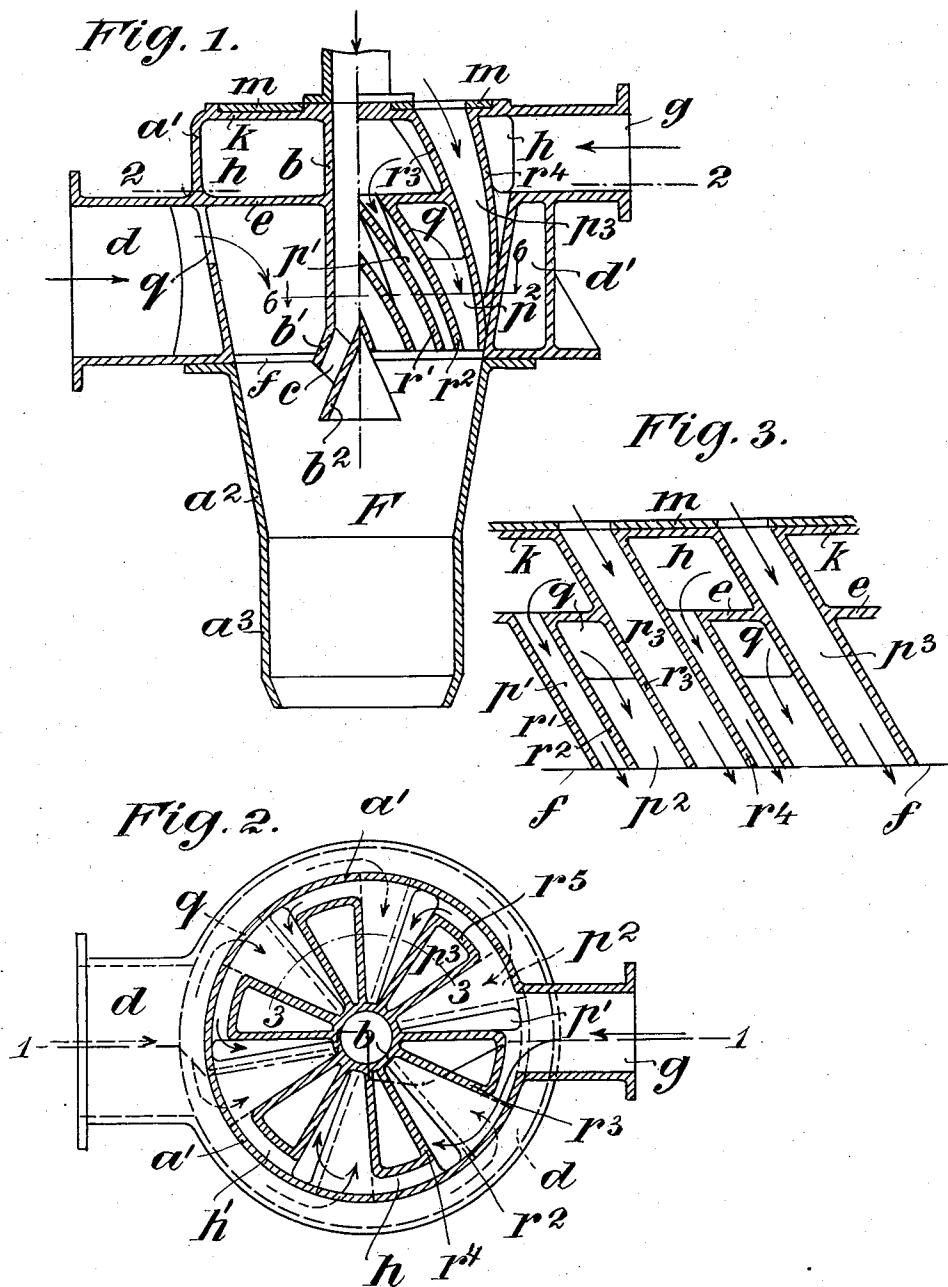
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BURNER FOR GASEOUS AND POWDEROUS SOLID FUEL

Filed Oct. 28, 1925

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

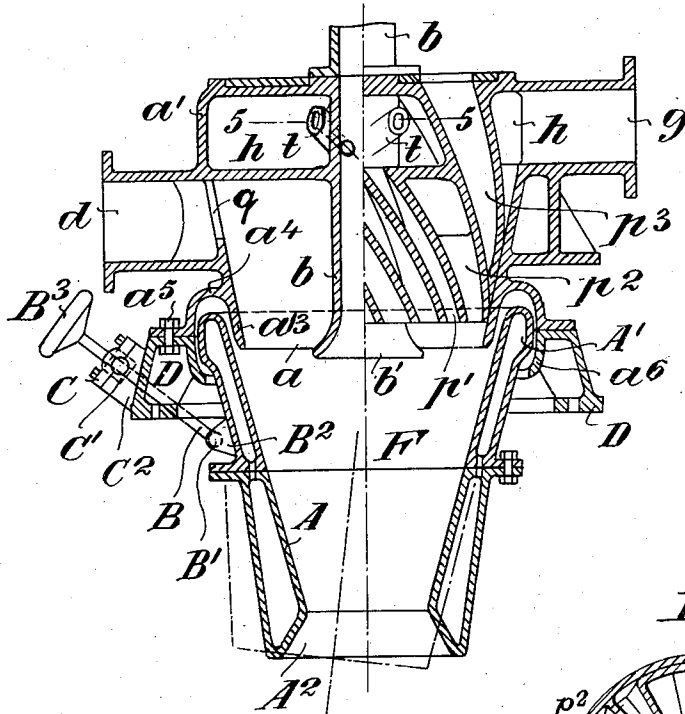


Fig. 5.

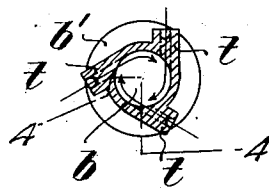
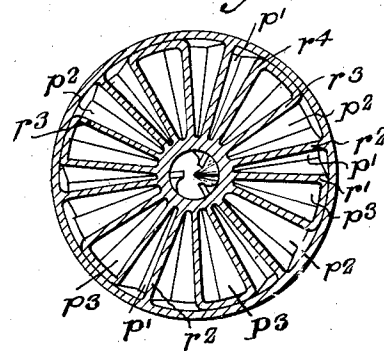


Fig. 6.



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UNITED STATES PATENT OFFICE.

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BURNER FOR GASEOUS AND POWDEROUS SOLID FUEL.

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My invention relates to improvements in burners for powderous solid fuel, and the object of the improvements is to provide a burner by means of which low grade solid fuel may be economically burnt. With this object in view my invention consists in providing a burner having a supply of a combustible gas or gases in addition to the supply of powderous solid fuel. I have found that when thus burning gaseous fuel together with solid fuel the solid fuel is completely burnt and produces a short flame thus insuring economy in the combustion of the fuel.

For the purpose of explaining the invention two examples embodying the same have been shown in the accompanying drawings, in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1, is a sectional elevation showing the burner the section being taken along the line 1—1 of Figure 2,

Fig. 2, is a sectional view taken on the line 2—2 of Fig. 1,

Fig. 3, is a development in section of the gas and air passages of the burner, the said section being taken on the line 3—3 of Fig. 2,

Fig. 4, is a sectional elevation showing a modification of the burner, the section being taken in the same manner as Figure 1, and along the line 4—4 of Figure 5, and

Fig. 5, is a detail sectional view taken on the line 5—5 of Fig. 4 and showing the arrangement of the tangential passages for supplying compressed air to the passage for supplying solid fuel to the burner.

Figure 6 is a horizontal cross-section taken along the line 6—6 of Figure 1, and showing the helical arrangement of the passages.

The burner shown in the drawings is particularly adapted for burning solid fuel, such as powderous coal containing little gas, partly coked coal, the combustible deposit from flues of locomotives and other fire places, and the like. But I wish it to be understood that the burner may also be used for burning poor or rich gas without supplying solid fuel thereto.

In the example shown in Figs. 1 to 3, and 6, my improved burner consists of a hollow member composed of a comparatively short cylindrical portion a^1 , a tapering portion a^2 and a cylindrical portion a^3 . At its top the said member is closed by a head k , and below the said head it is provided with a transverse

partition e , the head k and the partition e including an annular chamber h . Further, the hollow member is provided with an axial passage b having an outwardly flaring delivery end b^1 . The delivery end of the passage b is partly closed by a cone b^2 connected with the portion b^1 by spiral or helical ribs c . The passage b is used for the supply of the solid powderous fuel, and the said fuel is delivered from the passage towards the wall a^2 of the hollow member and into the combustion chamber F thereof. By providing the spiral or helical ribs the fuel delivered from the passage b is whirled around thus insuring complete mixture of the solid fuel, the gaseous fuel and the air for supporting combustion delivered into the combustion chamber in the manner now to be described.

The annular chamber h is made integral with a tubular inlet g , and the top part of the tapering portion a^2 of the hollow member is provided with an annular chamber d^1 having a tubular inlet d . The annular chamber included between the wall a^2 of the hollow member is provided with helical ribs r^1, r^2, r^3, r^4 extending from the pipe b to the wall a^2 and dividing the said annular chamber into three sets of helical passages p^1, p^2, p^3 . The ribs r^3, r^4 are extended upwardly and through the annular chamber h , and the passages p^3 included between the said ribs are open to the outer air, and they are adapted to be closed more or less by means of an annular slide m provided on the head k . Thus atmospheric air can be taken in through the passages p^3 , the supply being controlled by the valve m . In some cases the passages p^3 are entirely closed, as will be described hereinafter. As is shown in Fig. 2 the parts of the helical ribs r^3, r^4 passing through the chamber h do not extend to the wall a^1 of the hollow member, but to points a suitable distance away therefrom, and the said ends are connected by arcuate walls r^5 thus providing arcuate passages h^1 through which the parts of the annular chamber h communicate with the inlet passage g .

The passages p^1 provided between the ribs r^1 and r^2 open into the annular chamber h , so that the said passages communicate with the tubular inlet g . The passages p^2 are closed at their top ends as against the chamber h , and they communicate through ports q made in the wall a^2 with the annular chamber d^1 and the inlet d .

As is best shown in Fig. 3, the passages p^1 are narrow as compared to the passages p^2 and p^3 .

If it is desired to burn low grade solid fuel and low grade gaseous fuel by means of the burner, the powdery solid fuel is supplied by means of compressed air through the axial passage b , the low grade gas is supplied through the inlet d , the annular chamber d^1 , the ports g and the passages p^2 , compressed air is supplied through the inlet g , the chamber h and the passages p^1 , and the passages p^3 are closed by means of the slide m . The gas delivered into the combustion chamber F is burnt and develops a heat sufficient to burn the low grade solid fuel delivered from the axial passage b , a rapid and complete combustion being insured by the whirling movement of the solid fuel, the gaseous fuel and the air for supporting combustion. Thus the fuel burns with a very short flame.

For burning coal dust or the like by means of a high grade gas, I supply the high grade gas through the inlet g , the annular chamber h and the narrow passages p^1 . The air is admitted under pressure through the inlet d and the passages p^2 , while the solid fuel is supplied through the pipe b . In case of a high grade gaseous fuel I may admit air under atmospheric pressure through the passages p^3 , in which case the inlet d and the passages p^2 communicating therewith are not used.

For operating the burner exclusively by means of gaseous fuel, the pipe b is closed, and the gas is supplied through the inlet d and the passages p^2 . In case of a low grade gas compressed air is supplied through the inlet g , the chamber h and the passages p^1 . But for burning a high grade gas I open the passages p^3 thus admitting air under atmospheric pressure to the burner, the said air being taken in by suction produced by the gas delivered from the passages p^1 .

The general construction of the modification shown in Figs. 4 and 5 is similar to the one described above, and similar letters of reference have been used to indicate corresponding parts, so that it is not necessary to repeat the general description of the burner.

The hollow member including the annular chamber h and the combustion chamber F is made in two sections, one section comprising the cylindrical wall a^1 and the top part of the tapering wall indicated in Fig. 4 by the letter a^{13} , and the other part comprising a jacketed tapering member A having an outwardly flaring delivery end A^2 . The tapering member A is adapted to be cooled by circulating cooling water through the annular chamber included between the inner tapering wall A and the jacket thereof the water inlet and outlet pipes not shown. I

have found that by thus cooling the member A providing the wall of the combustion chamber the wear of the said member by the heat of the flame is reduced, and further, by cooling the combustible mixture ignition of the gas flowing through the helical passages is avoided.

Near its bottom end the conical portion a^{13} is made integral with a rounded annular flange a^4 by means of which it is supported on a base frame D , bolts a^5 being provided for holding the flange a^4 in position on the frame D . The frame D is provided with a flange a^6 which is directed downwardly and curved inwardly, the flanges a^4 and a^6 providing an annular rounded seat for the top part of the member A . At its top the said member A is bulged outwardly so as to provide a rounded head A^1 adapted for bearing on the inner rounded face of the flanges a^4 and a^6 . By thus jointing the bottom part A to the top part a^1 , a^{13} I am enabled to direct the bottom part A in lateral direction, which is desirable for example when using the burner for internally heating rotary furnaces and for directing the flame to different parts of the said furnace. For setting the member A in the desired position the following mechanism is provided: A screw-threaded rod B is jointed by means of a spherical joint B^1 to an eye B^2 cast integral with the top part of the member A , so that the said rod can be rocked and rotated relatively to the said eye. The screw-threaded part of the said rod is passed through a nut C formed with laterally projecting trunnions C^1 mounted in a bearing C^2 cast integral with the frame D . The rod B carries a hand wheel B^3 . By turning the rod B by means of the said handwheel the member A can be rocked from the position shown in Fig. 4 in full lines for example into the position shown in broken lines. In Fig. 4 I have shown only one mechanism for rocking the member A , so that the member A can be rocked only in one direction. But I wish it to be understood that I do not limit myself to this construction, and that I provide two setting mechanisms, if it is desired to impart universal rocking movement to the member A .

In the construction shown in Figs. 4 and 5 the helical ribs c and the cone b^2 shown in Fig. 1 are omitted, and whirling movement is imparted to the powdery fuel by means of jets of compressed air thrown into the pipe b in tangential direction through tangential passages t , as is best shown in Fig. 5. These passages are also inclined so as to direct the jets toward the delivery end of the pipe b , as shown in Figure 4. By thus whirling the powdery fuel around within the pipe b the fuel delivered from the pipe b is thrown outwardly and whirled around within the combustion chamber F , so that it

is thoroughly admixed with the gas and air.

While in describing the invention reference has been made to two particular examples embodying the same I wish it to be understood that my invention is not limited to the constructions shown in the drawings, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing from the invention.

I claim:

1. A burner, comprising an outer casing, a central tubular passage, and three sets of passages therebetween, the passages of said sets being mutually interposed and located radially of said tube, the passages of two sets communicating respectively with inlets for gas and air, and the passages of the third set communicating with the outer air.

2. A burner, comprising an outer casing, a central tubular passage, and three sets of helical passages therebetween, the passages of said sets being mutually interposed and located radially of said tube, the passages of two sets communicating respectively with inlets for gas and air, and the passages of the third set communicating with the outer air.

3. A burner, comprising an outer casing, a central tubular passage, an annular chamber therebetween at one end and three sets of passages therebetween adjoining said chamber, the passages of said sets being mutually interposed and arranged radially of said tube, one set communicating with said chamber, the second set communicating with a gas inlet, and the third set extending through said chamber and communicating with the outer air.

4. A burner, comprising an outer casing, a central tubular passage, an annular chamber therebetween at one end and three sets of helical passages therebetween adjoining said chamber, the passages of said sets being mutually interposed and arranged radially of said tube, one set communicating with said chamber, the second set communicating with a gas inlet, and the third set extending through said chamber and communicating with the outer air.

5. A burner, comprising an outer casing, a central tubular passage, an annular chamber therebetween at one end and three sets of passages therebetween adjoining said chamber, the passages of said sets being mutually interposed and arranged radially of said tube, one set communicating with said chamber, the second set communicating with a gas inlet, and the third set extending through said chamber and communicating with the outer air, said chamber also having communication with said central tubular passage through tangential nozzles inclined toward the delivery end of the burner.

6. A burner, comprising a hollow member having an axial passage for the delivery of

solid fuel, the delivery end of said passage having an outwardly flaring wall, means to conduct air under pressure into said passage in a direction tangential of the passage and towards the delivery end thereof, and helical passages around said axial passage for the delivery of gaseous fuel and air for supporting combustion.

7. A burner comprising an outer casing and an axial passage therein for the delivery of solid fuel, the delivery end of said passage having an outwardly flaring wall, means to conduct air under pressure into said passage in a direction tangential of the passage and toward the delivery end thereof, and helical passages around said axial passage formed by radial division of the space inside said outer casing, each third passage being in communication with said air conducting means, each passage adjacent there- to on one side supplying gaseous fuel, and each passage therebetween being in communication with the outside air.

8. A device for burning powderous solid fuel, comprising in combination, a hollow casing, an axial tube therein and a plurality of radial vanes extending outward from said axial tube, forming three sets of passages, an annular chamber within said casing at one end having a compressed air inlet and being in communication with one set of passages, pairs of said vanes extending through said chamber and forming passages in communication with the outside air, a second annular chamber adjacent said first chamber and having a gas inlet and being in communication with the third set of passages.

9. A device for burning powderous solid fuel, comprising in combination, a hollow casing, an axial tube therein and a plurality of radial vanes extending outward from said axial tube, forming three sets of passages, an annular chamber within said casing at one end having a compressed air inlet, and being in communication with one set of passages, pairs of said vanes extending through said chamber and forming passages in communication with the outside air, a second annular chamber adjacent said first chamber and having a gas inlet and being in communication with the third set of passages, said axial tube being formed with inclined tangential nozzles communicating with said first chamber whereby jets of air act on the powderous fuel in said tube to give it a whirling motion.

10. A device for burning powderous solid fuel, comprising in combination, a hollow casing, an axial tube therein and a plurality of radial vanes extending outward from said axial tube, forming three sets of passages, an annular chamber within said casing at one end having a compressed air inlet, and being in communication with one set of passages, pairs of said vanes extending through

- said chamber and forming passages in communication with the outside air, a second annular chamber adjacent said first chamber and having a gas inlet and being in communication with the third set of passages, and means mounted on said axial tube to conduct air under pressure for giving a whirling motion to material supplied by said axial tube.
- 10 11. A burner for causing complete combustion of powdorous solid fuel, comprising in combination, a substantially fusto-conical casing, an axial tube within said casing for supplying the powdorous solid fuel, a transverse wall forming an annular chamber surrounding said fuel passage and having an inlet for receiving compressed air, a plurality of radial helical vanes extending outward from said axial tube and through said wall, forming three sets of passages one set in communication with the outside air, one set in communication with the annular chamber, and a third set; a cylindrical wall outside said casing forming therewith a chamber having an inlet for receiving combustible gas, said chamber being in communication with said third set of passages.
- 15 In testimony whereof I hereunto affix my signature.

WILHELM VEDDER.