No. 844,046. PATENTED FEB. 12, 1907.

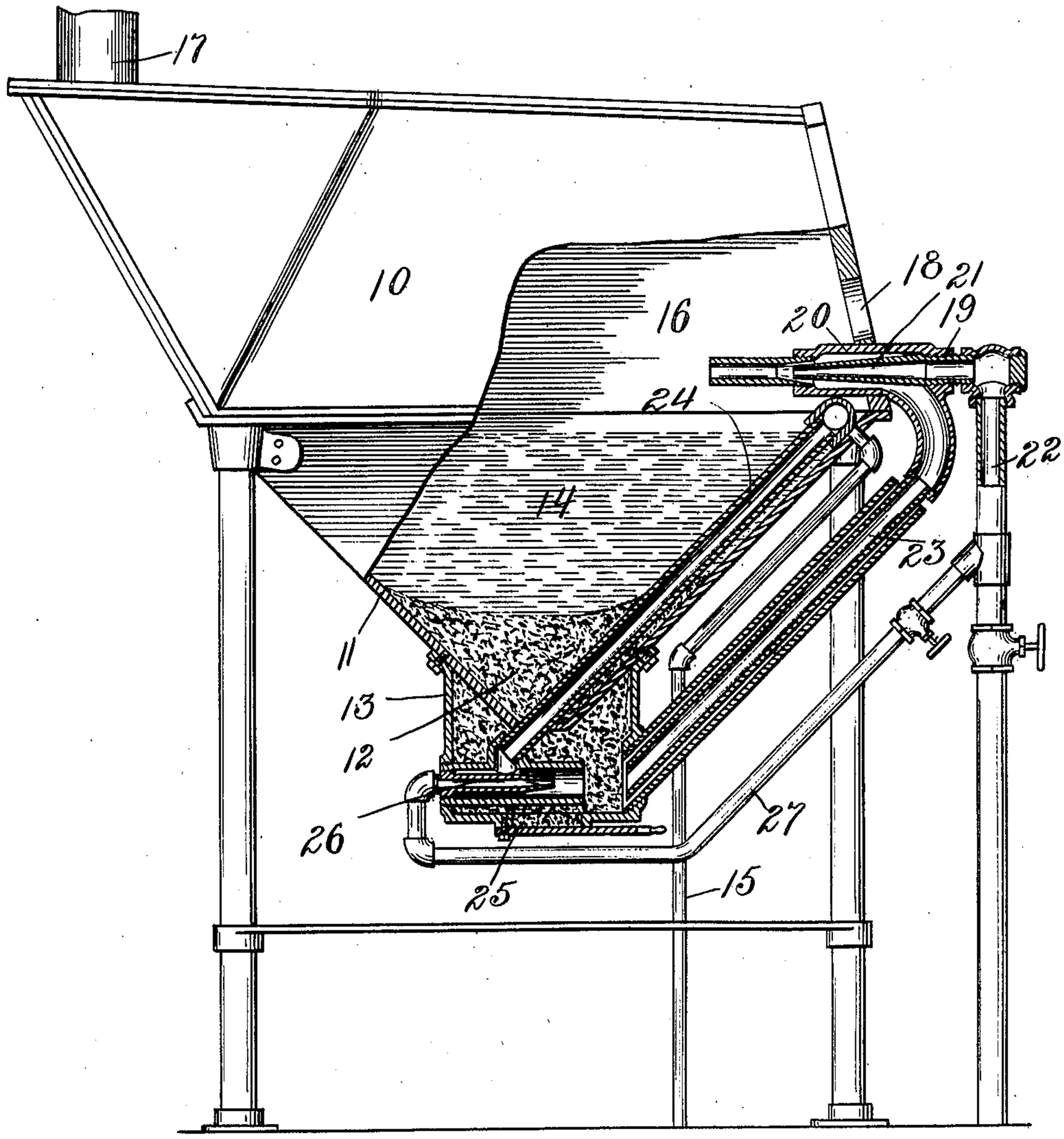
A. H. RADELL.

ART OF ABRADING.

APPLICATION FILED SEPT. 12, 1904.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses:
Ray White
Harry R. L. White

Inventor:
Anthony H. Radell,
By Foree & Bein Attys.

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3 SHEETS—SHEET 2.

Fig. 2.

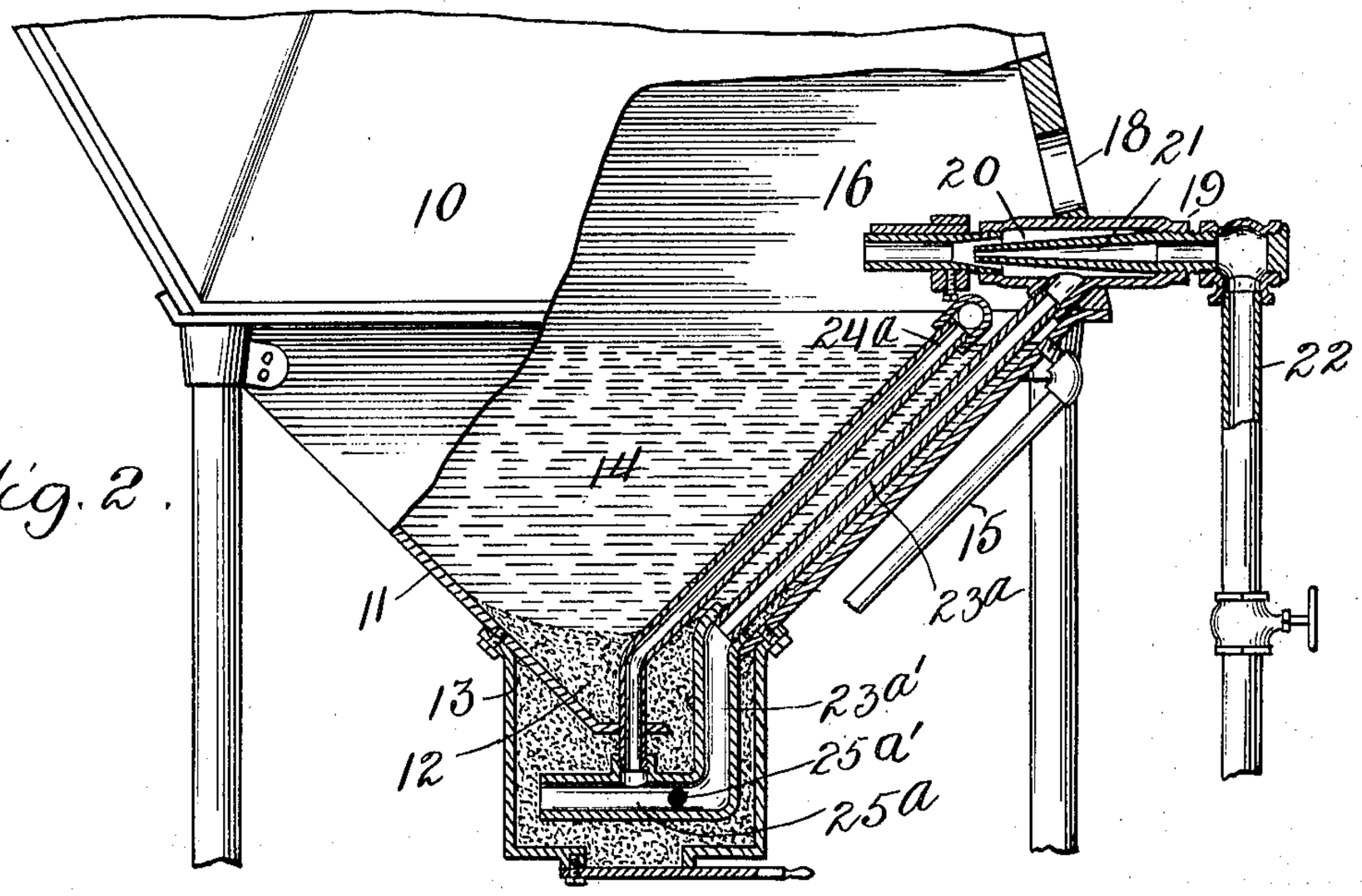

Fig. 3

Witnesses:
Ray White
Harry R. L. White

Inventor:
Anthony H. Radell,
By Foree Bain Atty.

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3 SHEETS—SHEET 3.

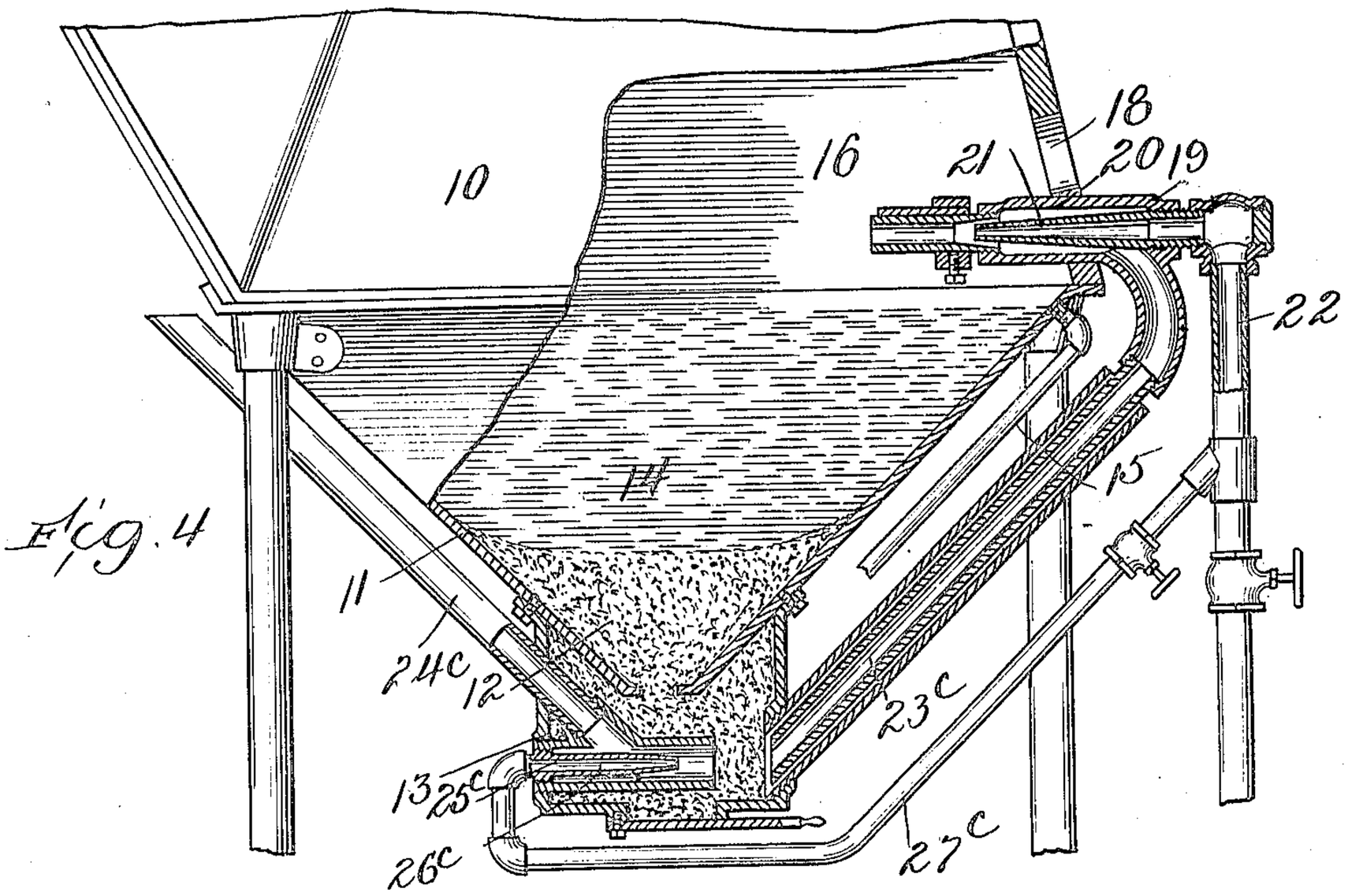

Fig. 4

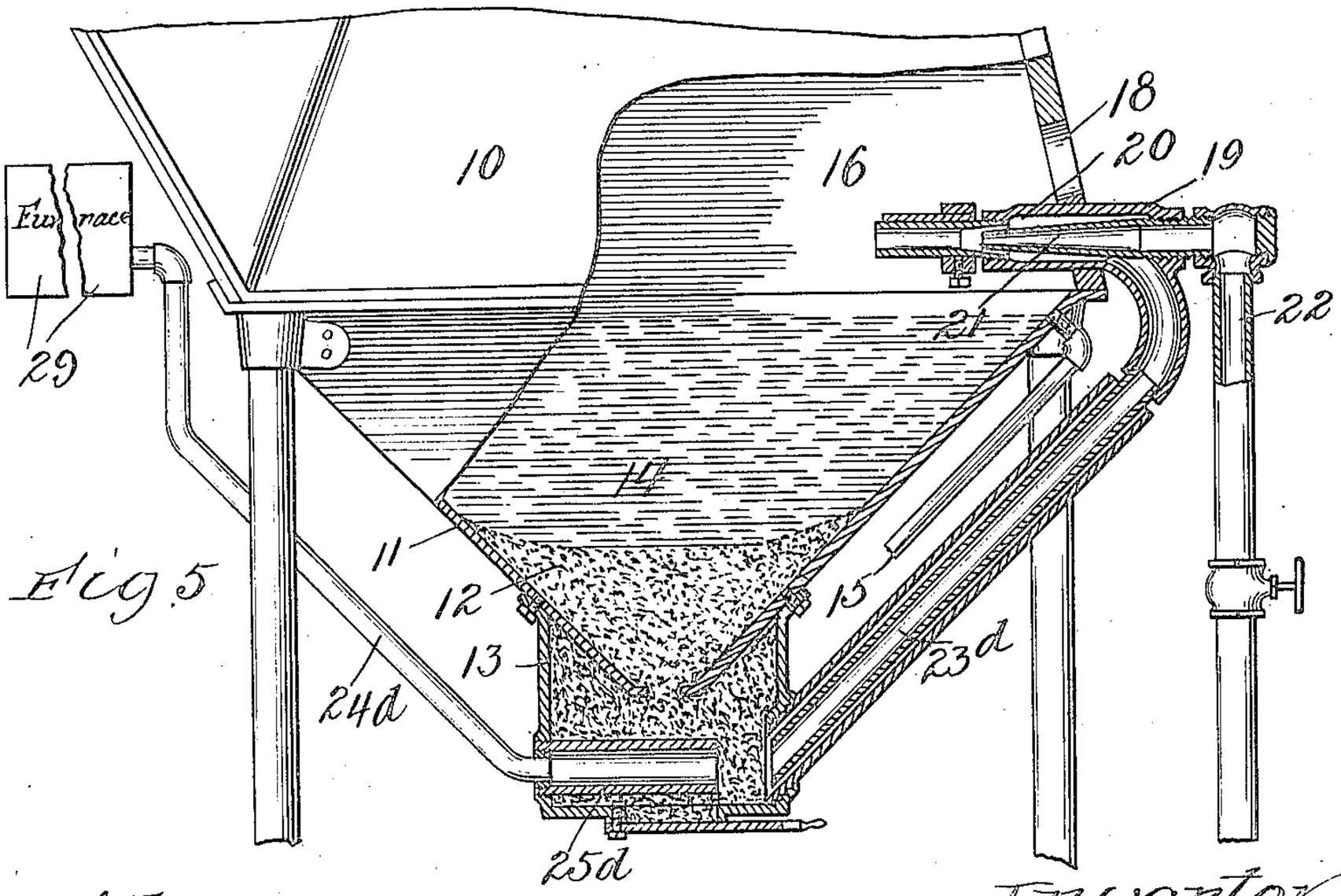

Fig. 5

Witnesses:
Ray White.
Hamer B. Lovelace

Inventor:
Anthony H. Radell,
By Foree Bain Atty.

UNITED STATES PATENT OFFICE.

ANTHONY H. RADELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO BENJAMIN M. FREES, OF CHICAGO, ILLINOIS.

ART OF ABRADING.

No. 844,046. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed September 12, 1904. Serial No. 224,207.

To all whom it may concern:

Be it known that I, ANTHONY H. RADELL, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Art of Abrading; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to the art of abrading, and has particular reference to the art of abrading by the projection of abrasive material by a steam-injector.

In the practice of some branches of this art—for instance, in the sharpening of files or other tools by abrasion—it is important to keep the tool from becoming deleteriously heated, to insure the projection of the abrasive substance at a high velocity, to secure proper action of the abrasive material on the tool, and to provide a satisfactory abrasive composition.

In the practice of the art it has been customary to provide against the heating of the tool by deriving the abrasive material in a moist condition from the bottom of a water-containing casing, the moist abrasive material having less heating effect than dry material. Further, in accordance with the teachings of my prior patent, No. 673,576, dated September 10, 1901, air is mixed with the abrasive material for supply to the injector for the purpose, among others, of maintaining a high velocity of projection of the abrasive material, as it is found in practice that when the injector acts to draw up the unadulterated abrasive material the weight of the material acted upon by the injector is so great as to render the action of the machine sluggish and the velocity of projection of the concentrated stream of material unduly slow. Under the teachings of my prior patent aforesaid, however, the air is taken directly from the general atmosphere and passes in relatively cool condition, with the relatively cool abrasive material, into the vacuum-chamber of the injector to mix with the injected steam in the tip of the injector.

The steam employed in machines of this type being usually under high pressure and having a high degree of superheat condenses readily upon meeting the relatively cool body of abrasive material and air. Such condensation of the steam, as will be well understood, materially reduces the velocity of projection of the abrasive material and mixes with the abrasive material, before it reaches the surface to be abraded, an undue quantity of water. This excess of free water seems to act as a cushion for the abrasive granules and prevents proper action of the abrasive material upon the surface to be abraded, thereby decreasing the efficiency of the machine. I have found that these disadvantages may be overcome by mixing with the abrasive material supplied to the injector a body of highly-heated gaseous material—such as air, steam, or steam and air—heated to or in excess of the boiling-point of water. The admixture of the volume of highly-heated gaseous material with the abrasive material to be fed to the injector insures all the advantages derived by the use of air at atmospheric temperature in the machine of my former patent, and in addition by heating to a relatively high degree the entire body of matter supplied to the vacuum-chamber of the injector prevents undue condensation of steam at the nozzle of the injector and obviates or minimizes the disadvantages of reduced velocity of projection and efficiency of action of the abrasive material inherent in machines of the old type.

The aim of my invention may be accomplished by the use of apparatus of diversified form and differing widely in construction, and I have therefore in the drawings suggestively illustrated various styles of machines such as might be employed in the practice of the art of abrading in accordance with my invention.

In said drawings, Figure 1 is a side view, partly in elevation and partly in section, of an advantageous form of apparatus for the practice of my invention. Figs. 2, 3, 4, and 5 are similar views of fragments of various modified forms of apparatus likewise adapted for the practice of my invention.

Referring now to said apparatus, it will be seen that there is provided in general a casing 10 of any suitable form having a bottom structure 11, suitably shaped to cause a body 12 of granular material deposited therein to seek a relatively small area which constitutes the source of supply of such material. In

each construction shown the source of supply is a well communicating with the bottom 11.

The bottom 11 is of such construction as to afford a suitable receptacle for a body of liquid 14, maintained at a predetermined level by the provision of a suitable overflow-pipe 15.

Above the water-body 14 is left a space 16, which I will term an "air-space," substantially inclosed save at a steam-outlet 17 at the rear end of the casing 10, and an aperture 18 at the front end for the insertion of a tool.

Projecting into the chamber 16 below the aperture 18 is a steam-injector 19, having a vacuum-chamber 20, through which extends a steam-nozzle 21, communicating with a steam-supply pipe 22, constituting what I will term the "source of steam-supply." With the vacuum-chamber 20 of the injector, preferably adjacent the rear end thereof, communicates a material-conduit 23 of suitable construction, the opposite end of which communicates with the well 13 or other source of material-supply.

While for convenience I have shown the parts thus far described as practically identical in all of the views, I do not desire to be understood as limiting myself to the specific construction shown, as the parts thus far described are old in the art and any other suitable structure providing a steam-injector and a source of material-supply operatively associated with the vacuum-chamber thereof might be employed.

For the practice of my present invention, however, means should be provided for heating to a high degree the material acted on by the injector, as by admitting a supply of a highly-heated gaseous matter to the vacuum-chamber of the injector with the abrasive material.

In practice I prefer that the gaseous matter supplied to the injector with the abrasive material be highly-heated air or a mixture of air and steam heated to or in excess of the boiling-point of water, (though steam alone might be used,) and I prefer that the highly-heated gaseous matter be mixed with the abrasive material to be supplied to the injector at substantially the point where it leaves the source of material-supply.

In the specific construction shown in Fig. 1, 24 indicates a conduit for supplying gaseous material, which for brevity I will term the "air-conduit," leading from the chamber 16 to a head 25 in the well 13, arranged to confront the open end of the material-conduit 23.

26 indicates a steam-nozzle arranged within the head 25 to act as an injector and connected, as by a suitable valved pipe 27, with the source of steam-supply 22.

During the operation of the machine constant ejection of superheated steam into the chamber 16 heats the air-body therein to a high degree, so that air and steam derived from said chamber through the air-conduit 24 is heated to or in excess of the boiling-point of water. The action of the injector 19 serves, as will be well understood, to create a vacuum tendency in the vacuum-chamber 20, and so acts to draw a mixture of abrasive material and the heated gaseous matter supplied by conduit 24 from the lower portion of well 13 into the vacuum-chamber of the injector. The steam-jet 26 assists in this operation by acting as an injector to draw heated gaseous matter through the conduit 24 and project it, together with the abrasive material, into the material-conduit 23 to relieve the drag upon the injector 19. The steam-jet 26 also serves to impart heat to the material in transit to the injector 19 and further insures that the material fed to the injector 19 shall be in a highly-heated condition, tending to minimize the condensation of the injected steam at the nozzle of the injector.

In practice I have found that the best results are attained by the use of an abrasive material consisting of mixed ground quartz and carborundum in the proportion of about three (3) parts of quartz to one part of carborundum; but I do not desire to be understood as limiting myself to the use of such abrasive material.

In Fig. 2 the material-conduit 23^a communicates with the conduit portion $23^{a'}$ of a head 25^a, with which also communicates the air-conduit 24^a, leading from the chamber 16 above the water-line within the casing. Apertures $25^{a'}$ are provided in the head 25^a intermediate the point of connection of the conduit 24 thereto and the end of conduit-section 23^a. This form of device depends entirely upon the action of the injector 19, and the gaseous material supplied is solely derived from the chamber 16, said gaseous material comprising highly-heated air and steam. I have found in practice, however, that this form of device is very practical and quite efficient.

In Fig. 3 I have shown a form of apparatus in which the air-conduit 24^b and material-conduit 23^b communicate with a head 25^b, substantially like that last described, but wherein the air-conduit 24^b leads to the general atmosphere, heat and steam being supplied to the air in said conduit by a steam-jet 26^b, arranged in the conduit 24^b and connected by a suitable pipe 27^b with the source of steam-supply 22.

In the form of apparatus shown in Fig. 4 a somewhat similar arrangement is provided, the air-pipe 24^c extending to the general atmosphere, but communicating at its lower end with a head 25^c, confronting the end of the material-conduit 23^c, and into which extends the injector-jet 26^c, connected by a suitable pipe 27^c with the source of steam-supply 22. In this instance the injector 26^c

is depended upon to supply heat, and it will be apparent to those skilled in the art that the conduit 24ᶜ might be entirely omitted and the steam-jet 26ᶜ employed alone to supply the heated gaseous material in the form of steam alone with some of the advantages attendant upon the use of my invention.

In Fig. 5, 29 indicates a furnace or other air-heater of suitable construction connected by an air-conduit 24ᵈ with a head 25ᵈ, arranged in suitable proximity to the material-conduit 23ᵈ to supply heated air derived from the furnace to said material-conduit with the abrasive material drawn therethrough by the action of the injector 19.

Throughout these views parts common to all are indicated by the same numerals as in Fig. 1.

While I have shown various arrangements of heating apparatus and sources of heat-supply as falling within the spirit and scope of my invention, I do not desire to be understood as intimating that these are the only arrangements which might be advantageously employed, and I desire it to be understood that I consider any form or arrangement of heating apparatus which will produce the effect of heating to a high degree the material supplied to the vacuum-chamber of the injector as being suited to the practice of my invention.

What I claim, therefore, and desire to secure by Letters Patent of the United States, is—

1. Improvements in the art of abrading by the projection of moist abrasive material by a steam-injector, which consist in heating the moist abrasive material to a high degree and supplying the same to the injector in a highly-heated condition.

2. In the art of abrading by the projection of moist abrasive material by a steam-injector, the step of supplying moist abrasive material and highly-heated gaseous matter to the vacuum-chamber of the ejector.

3. In the art of abrading by the projection of moist abrasive material by a steam-injector, the steps of highly-heating air, and supplying the highly-heated air to the injector with the moist abrasive material.

4. In the art of abrading by the projection of moist abrasive material by a steam-injector, the improvement which consists in highly heating air, supplying the same to the abrasive material before it reaches the injector to heat said abrasive material, and supplying said mixture of highly-heated air and abrasive material to the injector while in a heated condition.

5. In the art of abrading by the projection of abrasive material and air by a steam-injector, the step of heating the air before it reaches the injector.

6. A process of sharpening files which consists in subjecting the files to a blast of abrasive material, steam and heated air.

7. In the art of abrading by the projection of abrasive material, the step of supplying a moist mixture of carborundum and quartz to the injector with a volume of highly-heated gaseous matter.

8. In the art of sharpening files by the projection of moist abrasive material against them by a steam-injector, the step of supplying a mixture of the moist abrasive material and gaseous matter to the vacuum-chamber of the injector at a temperature above the point of condensation of the injector-steam.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ANTHONY H. RADELL.

In presence of—
GEO. T. MAY, JR.,
MARY F. ALLEN.