W. KEMP.

FURNACE FOR SMELTING ORES.

APPLICATION FILED OCT. 3, 1903.

936,781.

Patented Oct. 12, 1909.

2 SHEETS—SHEET 1.

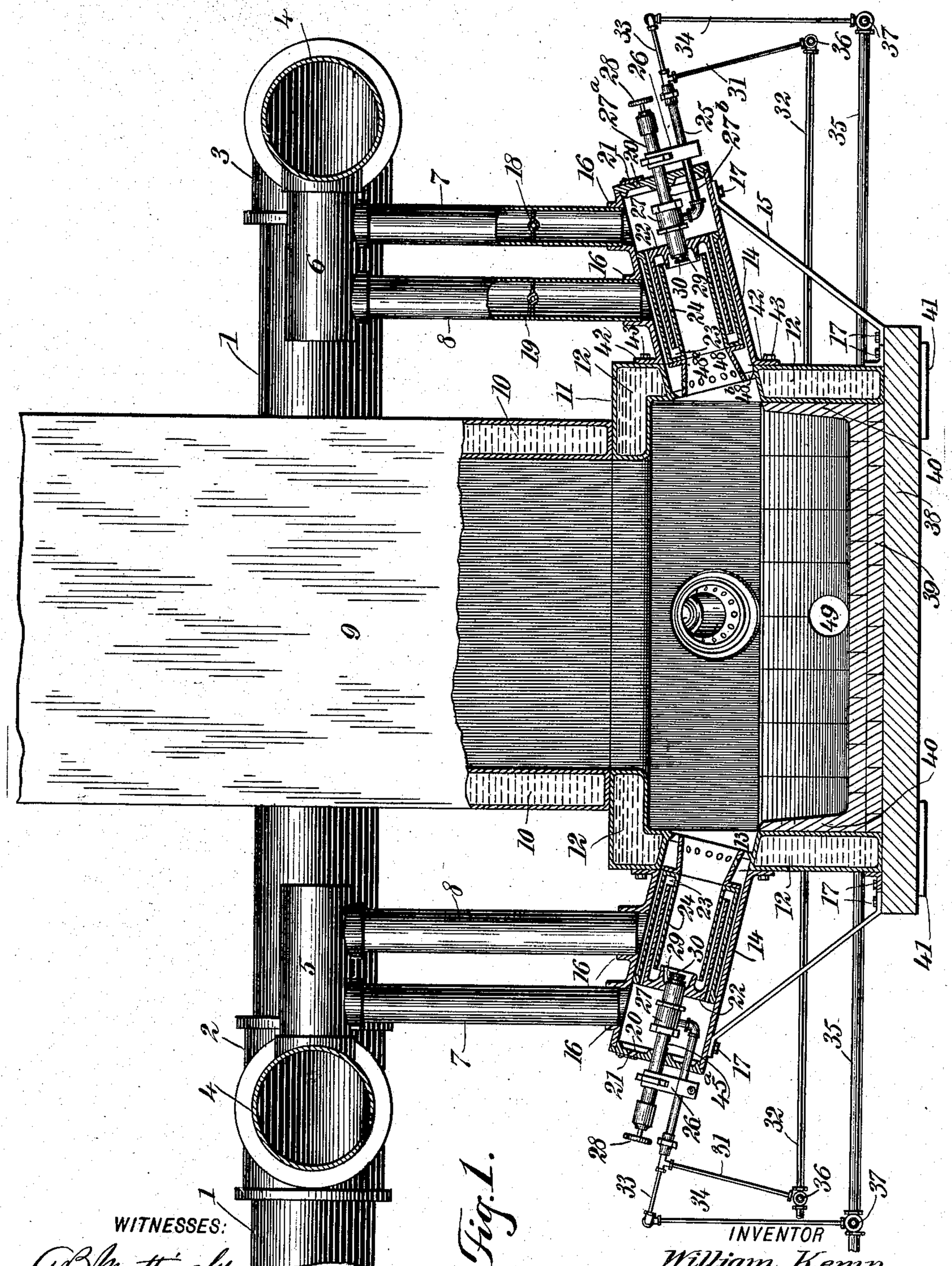

Fig. 1.

WITNESSES:

A. B. Mattingly

Walton Harrison.

INVENTOR

William Kemp

BY

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ATTORNEYS

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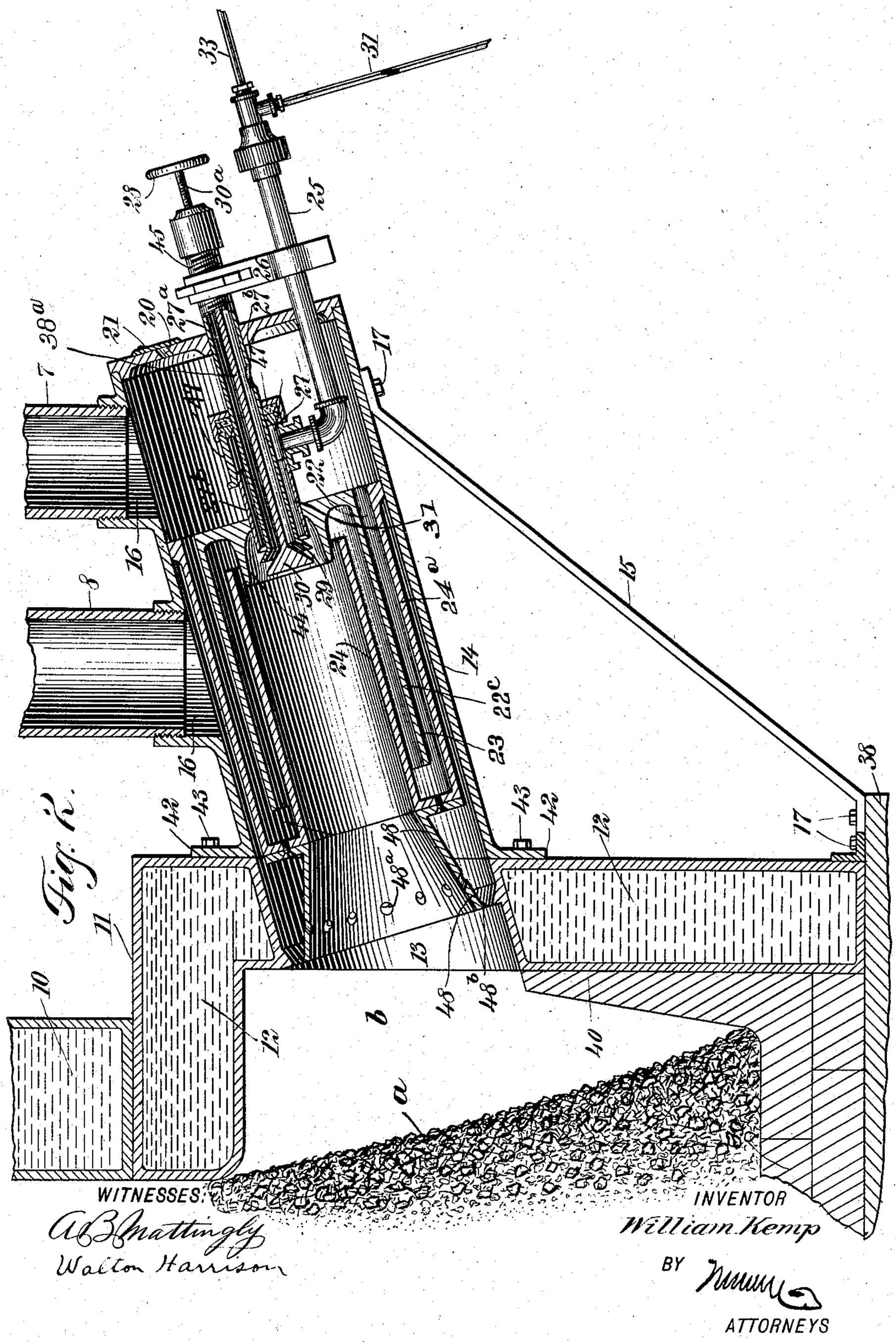

Fig. 2.

WITNESSES:

A B Mattingly

Walton Harrison

INVENTOR

William Kemp

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UNITED STATES PATENT OFFICE.

WILLIAM KEMP, OF TUCSON, ARIZONA TERRITORY, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE KEMP HYDRO-CARBON FURNACE COMPANY, A CORPORATION OF NEW YORK.

FURNACE FOR SMELTING ORES.

936,781. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed October 3, 1903. Serial No. 175,583.

To all whom it may concern:

Be it known that I, WILLIAM KEMP, a citizen of the United States, and a resident of Tucson, in the county of Pima and Territory of Arizona, have invented new and useful Improvements in Furnaces for Smelting Ores, of which the following is a full, clear, and exact description.

My invention relates to furnaces, and admits of general use, but is of peculiar value in furnaces provided with water jackets and adapted to be used in connection with burners for smelting ores.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in both the figures.

Figure 1 is a front elevation, partly in section, of a furnace embodying my invention; and Fig. 2 is a fragmentary vertical section through one of the burners and a portion of the water jacket and its immediate connections.

The air pipe is shown at 1, and is provided with the usual connections 2, 3, for supplying branch pipes 4, provided with distributing heads 5, 6, and each of these heads is provided with downwardly extending pipes 7, 8, for supplying the air to the furnace. The furnace consists of a shaft having a double walled water jacket 9 containing water 10, and this water jacket rests upon another water jacket 11, containing water 12. The said water jacket 11 forms the walls of the smelting chamber, and is set outwardly from the water jacket 9; as shown, thus to enlarge the lower part of the furnace, relatively to the shaft, and thereby furnish an increased internal capacity to said smelting chamber, as will hereinafter be more fully explained. This water jacket is provided with twyer apertures 13 each having the sides thereof extending obliquely upward as indicated more particularly in Fig. 1. The casings of the burners are shown at 14 and are provided with braces 15, secured in position by means of bolts 17, whereby these burners are greatly strengthened. Each burner 14 is provided with inlets 16 communicating with the pipes 7, 8. Gates 18, 19, are provided for the purpose of governing the flow of air through the pipes 7, 8. The aperture 20 in the burner 14 is a peep-hole, and is closed by a drop door 21, which may be turned to the right or left in order to enable the operator to look into the burner. The head or part 22 in the burner is provided with a sinuous channel 23, formed in part by an inner cylinder 24 and an outer cylinder 24ª, both concentric and integral therewith. The mixing pipe is shown at 25 and is provided with a clamp 26 extending upwardly therefrom. Mounted centrally within the burner 14 is a cylinder 27 to which the mixing pipe 25 is connected. A hand wheel 28 is provided for the purpose of controlling the burner.

A pipe 27ª mounted concentrically with cylinder 27 is provided at its inner end with a flaring portion 29 serving as a valve seat, and also as a distributing nozzle. Mounted centrally within this flaring portion 29 is a conical valve 30, mounted upon a revoluble stem 30ª and controllable by the hand wheel 28. The oil inlet tube is shown at 31 and is connected with the oil pipe 32. The steam inlet tube 33 is connected by another tube 34 with a steam pipe 35. The oil pipe 32 is connected with another pipe 36 which feeds the same, and somewhat similarly the steam pipe 35 is connected with a pipe 37 whereby it is fed with steam.

The bed of the furnace is shown at 38 and upon it rests the brickwork 39. A wall or lining 40 of fireproof material is built upon the brickwork 39 and extends upwardly therefrom. It will be noticed in Fig. 1 that this wall is of gradually decreasing thickness upwardly, the upper edge thereof being comparatively thin and beveled or inclined downwardly and inwardly corresponding to and flush with the lower portions of the sides of the said openings 13 so that the wall presents an inclined inner surface. The purpose of this inclination is to produce a space *b* between the upper portion of the wall and the matte *a* within the furnace, said space being gradually widened upwardly, due to the fact that as the ore falls to the bottom of the smelting chamber from the shaft of the furnace, the same spreads outwardly on the bottom and assumes a conical form upwardly, as shown. The bed 38 rests upon supports 41.

Each burner casing 14 is provided with a flange 42 so disposed as to form an oblique surface, and bolts 43 secure the flange 42 to the water jacket 11, as indicated in Fig. 1, the arrangement being such that the axes of

the several burners are in alinement with the centers of the several apertures 13. By this arrangement the inclination of the burner, the oblique conformity of the apertures 13 and the inclination of the wall 40, produce a coacting relation, the blaze from each burner being driven downward and into or through the ore at the lower part thereof, while the said space *b* also becomes filled with the burning mixture from the burners, thereby forming a belting of the mixture around or about the ore, which greatly facilitates the reducing or smelting operation.

The head or part 22 of the burner is provided with an inwardly extending annular bead 44, as shown more particularly in Fig. 2, and also with an inwardly extending cylinder 22^c located between the inner and outer cylinders 24 and 24^a and coöperating with the cylinders in the formation of the sinuous channel 23 hereinbefore referred to, said head fitting in the interior of the burner casing 14, as shown. The pipe 27^a is threaded at 45 where it passes through the clamp 26, and the pipe 25 is connected with the pipe 27^a the latter passing through the cylinder 27, and packed by means of a stuffing box 47. An air jacket 48, having holes 48^a is provided for the purpose of increasing the heat of air supplied to the furnace and also for the purpose of protecting the metal work from excessive heat, the outer end of the jacket having an air deflector 48^b. Air passes freely through a hole 27^b in the pipe 27^a, to mingle with the vapor mixture issuing from the burners through the apertures 13 thereby tending to prevent excessive heating in the burner, the same step serving to raise the air to a higher temperature.

The general operation of the burners is described in my other application filed concurrently herewith Serial No. 175,582, and need not be dwelt upon in detail in the present application, which relates more particularly to the furnace proper as above described. It may be stated, however, that by means of the pipes 36, 32, 31, liquid hydrocarbon is supplied, and that steam is supplied through the pipes 35, 37 and tubes 34, 33 to the mixing pipe 25, in which the vaporizing of the oil or hydrocarbon starts to take place. The admixture is thence conducted to the cylinder 27, thence through vapor pipe 27^a to the interior of the cylinder 24 and the air is supplied through the pipes 7 and 8 which are controlled by the gates 18, 19. Air from the pipe 7 passes through the sinuous channel 23, becoming thereby heated to a great extent and is discharged at a point immediately near the bead 44, being thus carried through the central cylinder 24. Air from the pipe 8 passes exteriorly around the cylinder 24^a and goes directly to the flame within the furnace.

Referring to Fig. 2, it will be seen that the copper matte *a* is separated from the inclined wall 40 by the space *b*, and through this space the flame from the burner flows directly against and into the inclined body of the ore. It will be noted that the space between the matte *a* and the upper surface of the inclined wall is used for several purposes. It gives more room for the flame and prevents the slag from getting into the burner by allowing for the downward and outward flow thereof. It will thus be seen that the angle at which the burner is directed, the angle made by the inclined surface of the ore *a*, and the angle made by the surface of the wall 40, coöperate with each other. Upon actual test this furnace has proven more efficient than the old style furnaces heretofore used.

By means of the space *b* above described the ore is kept or held a sufficient distance from the burners to prevent immediate contact, so that the slag has more room in which to get away from the burners. That part of the furnace immediately adjacent to the burners and including the lower end of the matte *a*, I call the smelting chamber; that is to say, the burners direct their flames directly into the smelting chamber.

Having thus described my invention, I claim as new and desire to secure by Letters Patent,—

1. In a furnace for smelting ores, a charging shaft having water-jacketed walls, and a smelting chamber provided with vertically straight water jacketed walls, a portion of the water jacket projecting inwardly at the upper part of the smelting chamber and on which the water jacket of the shaft rests, the said projecting portion causing the ore to present an inclined surface, a wall of tapering thickness disposed within said smelting chamber and so arranged as to form a surface inclined relatively to said inclined surface of said ore, and a burner connected with said smelting chamber and free to heat the space between said inclined surface of said ore and the inclined surface of said wall.

2. In a furnace for smelting ores, the combination of a charging shaft having its walls water-jacketed, a smelting chamber larger in diameter than the shaft and having a water jacket extending vertically upward and provided at its top with a portion extending laterally inward and on which the water jacket of the shaft rests, the walls of said smelting chamber being provided with openings having inwardly and downwardly inclined sides, said smelting chamber having an inner wall gradually decreasing in thickness upwardly and with the upper edge thereof inwardly and downwardly inclined corresponding to and substantially in alinement with the lower sides of said openings.

3. In a furnace for smelting ores, the com-

bination with a shaft having a double walled water jacket, a smelting chamber larger in diameter than the shaft and having a water jacket extending vertically upward and provided at its top with a portion extending laterally inward so as to leave a space underneath said portion, the water jacket of the shaft resting at its lower end on said inwardly projecting portion of the water jacket of the smelting chamber, the said projecting portion causing the ore fed into the smelting chamber to present an inclined surface, the water jacket of the smelting chamber being provided with openings extending obliquely downward and inward, and burners extending into said openings in the water jacket for directing the flames inwardly and downwardly within the smelting chamber, the said smelting chamber having a flat bottom surface and an inner wall gradually decreasing in thickness upwardly and terminating at the lower edges of the said openings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM KEMP.

Witnesses:
L. W. WAKEFIELD,
HARRY L. HEFFNER.