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APPLICATION FILED MAY 17, 1909.

Patented Sept. 20, 1910.

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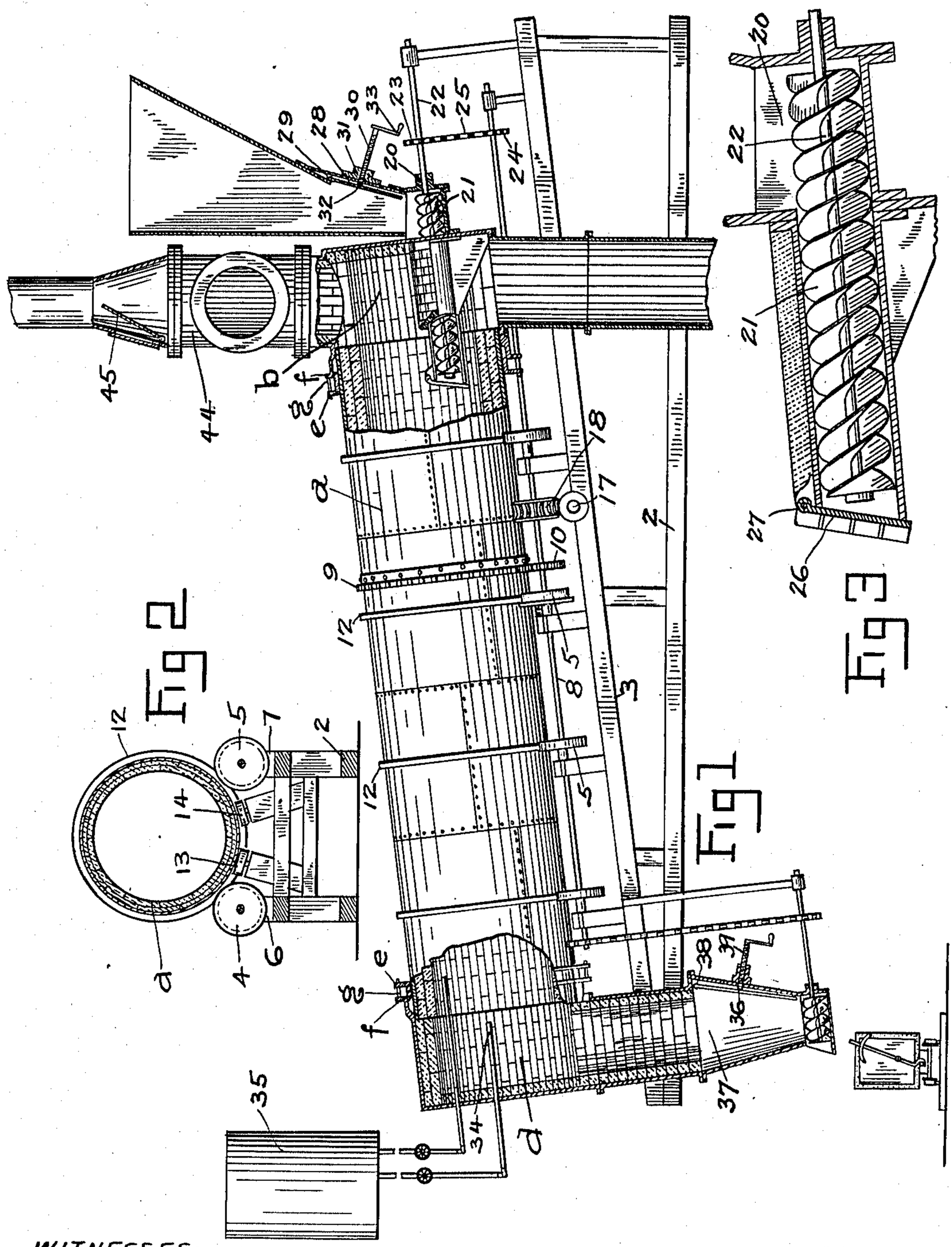

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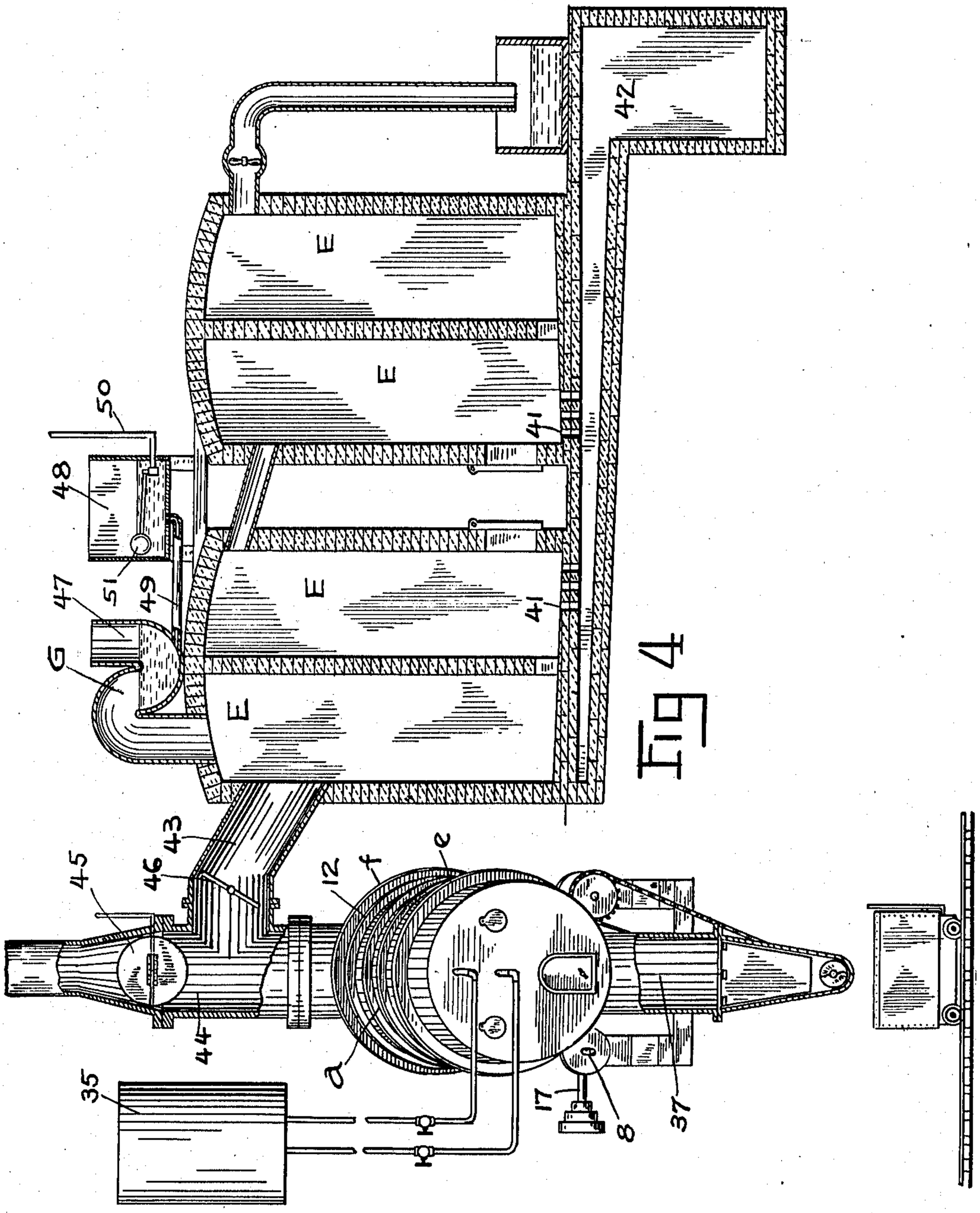

Fig 4.

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QUICKSILVER APPARATUS.

970,705. Specification of Letters Patent. Patented Sept. 20, 1910.

Application filed May 17, 1909. Serial No. 496,443.

To all whom it may concern:

Be it known that I, IRA HAGEMAN, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented new and useful Improvements in Quicksilver Apparatus, of which the following is a specification.

This invention relates to improvements in apparatus for producing quicksilver from the ore by the well known operations of heating the ore and collecting and condensing the vapors in closed chambers.

The object of the invention is the production of an apparatus for treating the ore and producing the metal by what I have termed a continuous process, in which the ore is fed in and passed through the furnace or vaporizing chamber in a continuous stream, instead of being introduced and treated in separate charges, and the fumes are removed and converted into the metal in a like continuous manner.

A further object of the invention is the production of an improved quicksilver apparatus for carrying on by a continuous process the steps or operations whereby the metal is extracted from the ore, and especially for using crude oil, or its distillates, for fuel.

A quicksilver apparatus of my invention consists of the various parts and combination of parts and details of construction hereinafter described and claimed.

The accompanying drawings illustrate a quicksilver apparatus embodying the various parts and features of the invention.

Figure 1 of the said drawings is a side-elevation of the furnace and the chambers at the ends through which the ore is fed to and the refuse rock is withdrawn from the vaporizing cylinder the chambers and the means for regulating and controlling the feed and the discharge of the material being shown in section. Fig. 2 is a vertical transverse section of the cylinder, showing its supporting and carrying means. Fig. 3 is a longitudinal sectional-view, on an enlarged scale, of the ore feeding means. Fig. 4 represents in end elevation the furnace on that part of the apparatus in which the ore is heated to volatilize the metal, and in longitudinal section the condensing chambers and connected parts.

Referring to the drawings *a* designates the cylinder in which the ore is subjected to the required degrees of heat to volatilize the metal; *b* and *d* are two chambers at opposite ends of the cylinder and between which it is arranged for continuous rotary motion when in operation.

The cylinder and the chambers are lined with fire-brick in the usual manner, and air-tight joints secured between the ends of the cylinder and the chambers by packing rings *e*—*f* similar in construction to the glands of a stuffing-box on a cylinder head; the inner one *e*, being drawn into the outer one *f* by screws *g*.

Like the cylinders in apparatus of similar character employed for roasting ores, the cylinder *a* is inclined from the end connected to the feeding-in chamber *b* to the chamber *d* at the opposite end; the chamber *b*—*d* being placed on an inclined bed or framework of timbers 2—3. For revolving the cylinder between these stationary chambers it is mounted on wheels 4—5 carried by bearing blocks 6—7 on the frame, and is connected with a rotatable shaft 8 by a toothed ring 9 on the body of the cylinder and a pinion 10 on the shaft. Bearing rings 12 are provided on the cylinder to take the wear of the carrying wheels. The thrust of the cylinder due to its inclination is taken from the lower chamber *d* by rollers 13—14 placed in front of one of the flanges or rings 12 against the face of which they are arranged to bear. For the same purpose one set of the carrying-wheels 4—5 has flanges in contact with the ring. These flanged wheels and rollers are placed preferably under the middle of the cylinder, and additional ones at intermediate points between the middle and the ends when needed.

In the present construction of my improved apparatus the cylinder obtains its motion from a power driven shaft 17 with which the shaft 8 carrying the wheels 5 is connected by a worm-wheel 18 on one shaft and a worm on the other, the cylinder being connected with the shaft 8 by a pinion 18 in mesh with a toothed-ring 9 on the cylinder body.

No novel features are involved in the manner of mounting and revolving the cylinder as above described, other construction or arrangement of means for the same purpose may be employed as may be found better adapted for cylinders of increased length or diameter.

A novel feature in a quicksilver apparatus

of my invention consists in the means for feeding the ore continuously and for regulating the quantity passing into the cylinder according as the conditions in the cylinder or other parts of the apparatus may be found to require from time to time. In this part, also, provision is made for preventing the escape of fumes through the outlet and hopper to the atmosphere whenever it becomes necessary to interrupt or suspend the flow or movement of the ore into the cylinder. As embodied in the present apparatus this means consists of a feeding tube 20 forming a horizontal extension or continuation of the bottom of a hopper into the chamber *b*, and having a feeding screw composed of a helical blade 21 fast on a shaft 22 to which rotary motion in the tube is given by connecting the shaft with the shaft 8, or with some other moving shaft or part on the frame. In the present construction the connection is made by sprocket-wheels 23—24 on the shaft and a chain-belt 25. This feeding-tube intersects the contracted opening or mouth at the bottom of the hopper and extending therefrom into the chamber, it terminates in an open end to which is fitted a lid or flap 26 so attached to the tube by a hinge-joint 27 as to seat on the end of the tube and close the outlet by gravity when it is not held away from its seat by the pressure of the stream of ore passing out of the tube. The face of the rim around the outlet slopes at an angle and the lid is fitted to seat tightly on it, and close the outlet against the escape of the fumes from the cylinder when the outlet is not filled with ore, or when from any reason the flow of the ore from the tube into the cylinder is interrupted or the stream is not moving under sufficient pressure to keep the mouth of the tube well filled. Under normal conditions of working the lid is held away from its seat by the pressure of the moving stream of ore, and as the weight of the lid is always acting in opposition to the force exerted by the feeding-screw, the stream of ore becomes somewhat compressed or compacted in the tube so that the particles of ore filling up the outlet will keep back the fumes while the outflow of the ore continues.

For controlling and regulating the quantity of ore passing into the feeding-tube from the hopper a plate 28 in the throat of the hopper is adjustable with relation to one wall or side of the hopper to contract the area of the throat to a greater or less extent, or close it altogether; for which purpose it is attached by a hinge 29 to the back wall of the hopper on the inside and is adjustable from the outside by a screw-rod 30 working in a threaded socket 31 in the back of the hopper, the end of the rod being set against the back of the plate 28 on which is a bearing-block 32 to take the end of the screw. A hand-crank 33 in the opposite end of the rod furnishes a convenient means for turning the rod 30 from the outside of the hopper.

The quantity of ore passing into the cylinder from the feeding hopper is always under control and is readily increased or reduced by varying the area of the throat of the hopper, while the screw in the feeding-tube may be turning at the same speed. The progress of the ore through the cylinder and its even distribution over the bottom of the cylinder from end to end, on the other hand, is controlled by the rapidity of its discharge from the lower end of the cylinder; and a further novel feature of the invention consists in a provision of means for controlling the discharge of the spent rock from that end of the apparatus and thereby varying and regulating from time to time the depth of the moving body of ore being acted on by the heat, as well as the rate at which the ore is being moved while being subjected to the heat.

By checking or restricting the outflow of the spent material from that end while the feeding-in of the ore at the opposite end is going on the body of ore is maintained at any desired depth in the cylinder and it can be kept to any desired period of longer or shorter duration within the region of the greatest heat as it approaches and is moved through that part of the cylinder. This end is attained also by the novel application and arrangement of means for introducing and buring liquid fuel in the cylinder, in which oil-burners 34 of well known construction set in the chamber *d* and connected with a supply tank 35 outside are arranged to set up and maintain by the combustion of the fuel within the cylinder the degrees of heat required. The chamber *d* from which the spent rock passes out of the apparatus being also the fuel chamber, the ore is under the influence of the greatest heat at the point of its discharge from the cylinder, so that by choking or reducing the outlet the body of ore will back up in the cylinder and its flow or travel can be retarded to a greater or less extent according to the conditions found to exist in the cylinder.

The means provided for that purpose consists of an adjustable gate 36 placed in the trunk or discharge tube 37 leading from the bottom of the chamber *d* to the outside, and arranged like the gate 28 in the feed-hopper so as to vary by its angular position the area of the outlet; its upper end being attached by a hinge 38 to one wall of the tube on the inside, and its lower end resting against the end of a screw-rod 39 working through a threaded socket in the opposite side of the tube 37 and provided with a handle.

In adapting this apparatus to use oil for fuel, provision is made for connecting the combustion-chamber with a stack or chimney until the condition of effective combustion and the required degrees of heat are produced in the cylinder, and for shutting off the communication with the chimney and connecting the cylinder with the condensing chambers. This part of the apparatus in which the fumes generated in the cylinder are collected and condensed consists of a series of brick-work chambers communicating after the manner of condensing chambers employed in quicksilver apparatus; the outlet from one chamber to the next in the series being located at the farthest point from the inlet, so as to cause the fumes to travel through the whole series in a circuitous manner to the final outlet.

Each chamber has apertures 41 in the floor through which the metal finds outlet and collects in a pit or chamber 42 beneath. The first chamber of the series is connected by a pipe 43 with the stack 44 on the chamber *b*, and above the point of connection the stack is provided with a damper 45 for closing the outlet to the chimney after the burners have been started and the temperature raised to the required degrees to act on the ore. These conditions are accelerated by closing the outlet to the condensing chambers E when communication with the chimney is open; and the pipe or conducting passage for the fumes is fitted with a damper 46 for that purpose. This feature of providing direct connection with a chimney in starting the oil-burners, and producing a condition of effective combustion in the fire-chamber, and of shutting off the outlet to the chimney and connecting the cylinder space with the condensing chambers when the temperature begins to act on the ore, is an important feature in the practical and successful employment of oil fuel in operating quicksilver ores.

In connection with the condensing chambers E of this apparatus I provide a safety blow off G consisting of a trapped outlet 47 in the top of one of the chambers closed by a water-seal, and a means for automatically restoring the seal whenever it may be destroyed by the pressure set up in the chamber by accumulating fumes, as well as for maintaining the seal in working condition by replacing any waste or reduction in the body of water in the trap. This means consists in a water tank 48 connected with the trap-chamber 47 by a pipe 49 and a supply-pipe 50 leading into the tank with a float operated valve 51 of any well known construction arranged in the tank to control the supply of water.

The supply-tank is arranged and its valve is adjusted to operate in such manner that the working level of the tank-water is maintained at the required height to keep the water seal in the trap always at its proper level to seal the outlet.

I claim:—

1. In a quicksilver furnace the combination of a revolving volatilizing cylinder, a condensing chamber, a conductor for the fumes between the cylinder and the condensing chamber, a separate outlet for the products of combustion from the cylinder, means for separately controlling the fumes conductor and the said outlet, means for introducing liquid fuel into one end of the cylinder, means for feeding into the opposite end the material to be treated and an outlet for the waste material from the end of the cylinder opposite to the feeding in end.

2. In a quicksilver furnace, the combination of a revolving volatilizing cylinder, a feeding-in chamber for the material in one end of the cylinder, a feeding-in device adapted to advance the material continuously in said conductor, means for preventing the escape of the volatilized products from the cylinder through said conductor, an outlet for the waste products from the cylinder, and means for controlling said outlet to prevent the escape of the volatilized matter from said waste product outlet, and means for burning liquid in the end of the cylinder farthest from the feeding-in end.

3. In a quicksilver furnace, the combination of a revolving volatilizing cylinder, a feeding-in device in one end of the cylinder adapted to be continuously operated, a liquid fuel burner situated in the end of the cylinder farthest from the feeding-in end, a condensing chamber, means for carrying off the volatilized matter from the cylinder and discharging it into the condensing chamber, an outlet from the cylinder for carrying off the waste products of combustion, means for separately controlling said outlets, and means for preventing the escape of fumes from the waste products outlet.

4. In a quicksilver furnace, a revolving volatilizing cylinder, a stationary chamber, a feeding-in device in said chamber having a conductor extending into the cylinder, a stationary chamber at the opposite end having an outlet for the waste products discharged from the end of the said cylinder, means for separately controlling the said inlet and outlet to prevent the escape of the volatilized products at the feeding in and discharge end of the said cylinder, and means independent of the feeding-in and discharging devices for regulating the feed of the material at one end, and the discharge of the waste products at the opposite end.

5. In a quicksilver furnace, the combination of a revolving volatilizing cylinder, an ore-hopper, a conductor leading from the outlet of the hopper into the cylinder, an ore feeding device in said conductor, means

for varying the area of the hopper outlet, and means operating to close the outlet end of the conductor when the discharge of the ore therefrom into the cylinder is interrupted.

6. In a quicksilver furnace the combination of a revolving volatilizing cylinder, having an oil burner in one end and an outlet for the products of combustion from the opposite end to the atmosphere, means in said outlet for controlling the communication with the atmosphere, a condensing chamber, and means for controlling communication of the cylinder with said chamber, an ore feeding device adapted to introduce the ore into the cylinder at the end farthest from the fuel burner, and an outlet for the waste product at the fuel burning end.

7. The combination with a revolving volatilizing cylinder of a feeding hopper, a tubular conductor leading from the outlet of the hopper into the cylinder, an adjustable gate in said hopper adapted to control the outlet, an ore feeding device in said conductor and means adapted to close communication between said ore conductor and the cylinder when the discharge of the ore from said conductor is suspended.

8. A furnace for extracting volatilizable metal from their ores and converting the same to a metallic form, comprising a revolving volatilizing cylinder, an ore supply hopper, means for continuously feeding the ore from said hopper including a conductor leading from the outlet of the hopper into the cylinder, an adjustable gate in the said outlet for varying the area thereof, means controlling the outlet end of said conductor adapted to be opened when the ore is being discharged from the conductor and to close the outlet end of said conductor when the discharge of the ore ceases, an outlet for the waste product from the end of the cylinder opposite the feeding in end, means for introducing liquid fuel into the cylinder, a conductor connecting the cylinder with an outlet to the atmosphere and means for controlling the same.

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Witnesses:
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M. REGNER.