

April 10, 1956

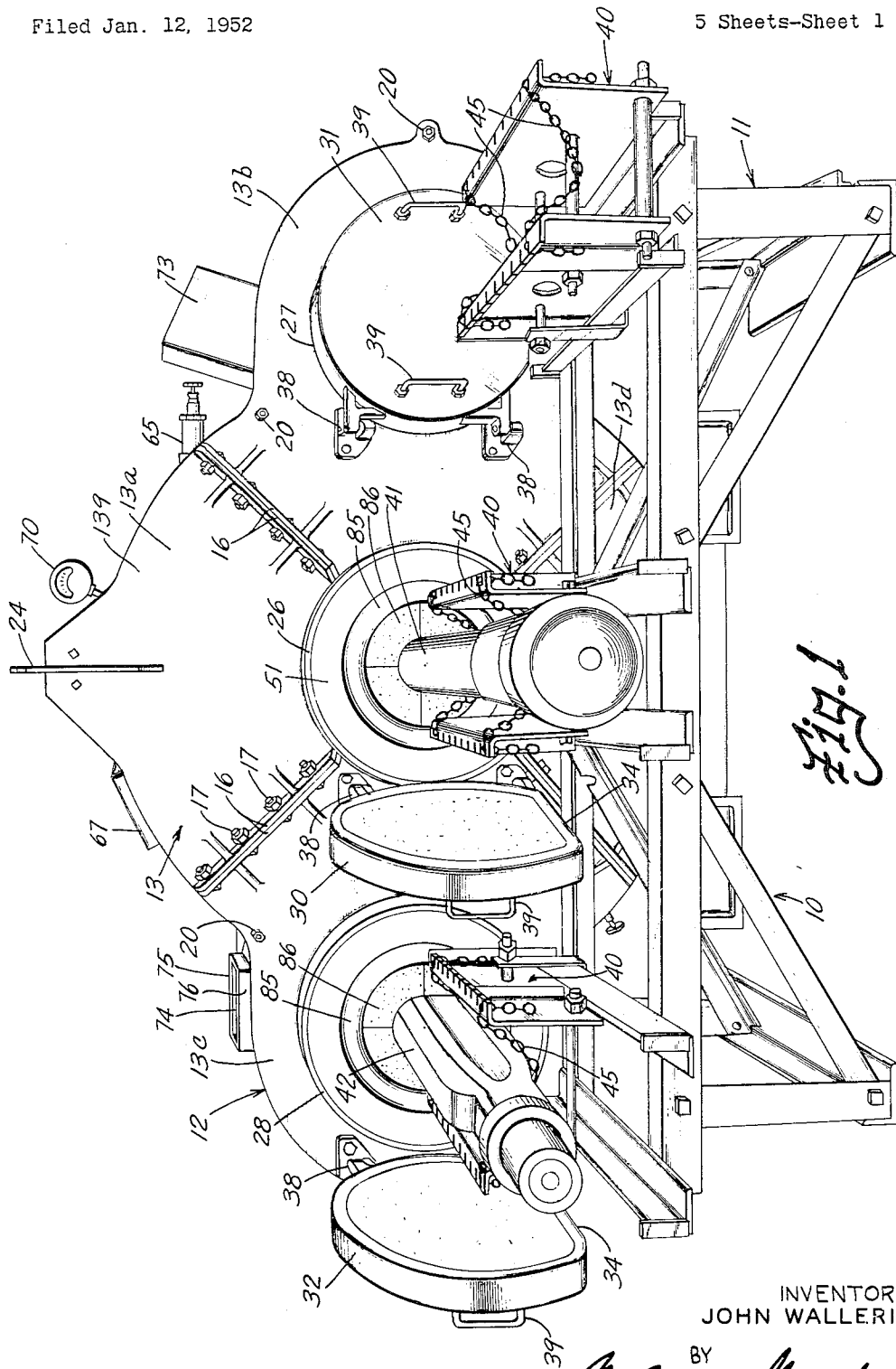
J. WALLERIUS

2,741,469

BIT HEATING FURNACE

Filed Jan. 12, 1952

5 Sheets-Sheet 1



INVENTOR
JOHN WALLERIUS

BY
McCanna & Morbach

ATT'YS

April 10, 1956

J. WALLERIUS
BIT HEATING FURNACE

2,741,469

Filed Jan. 12, 1952

5 Sheets-Sheet 2

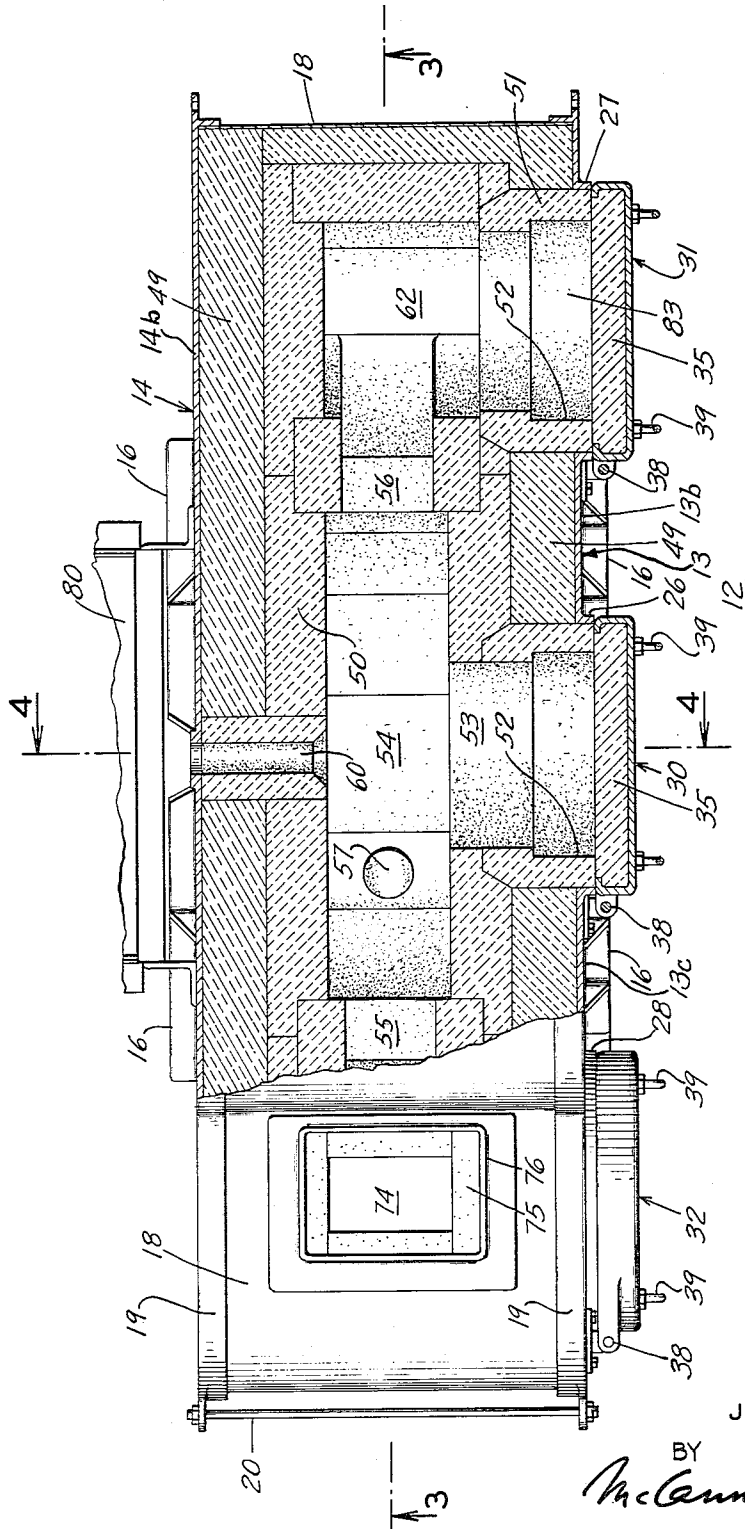


Fig. 2

INVENTOR
JOHN WALLERIUS

BY
McGinnis & Morbach

ATT'YS

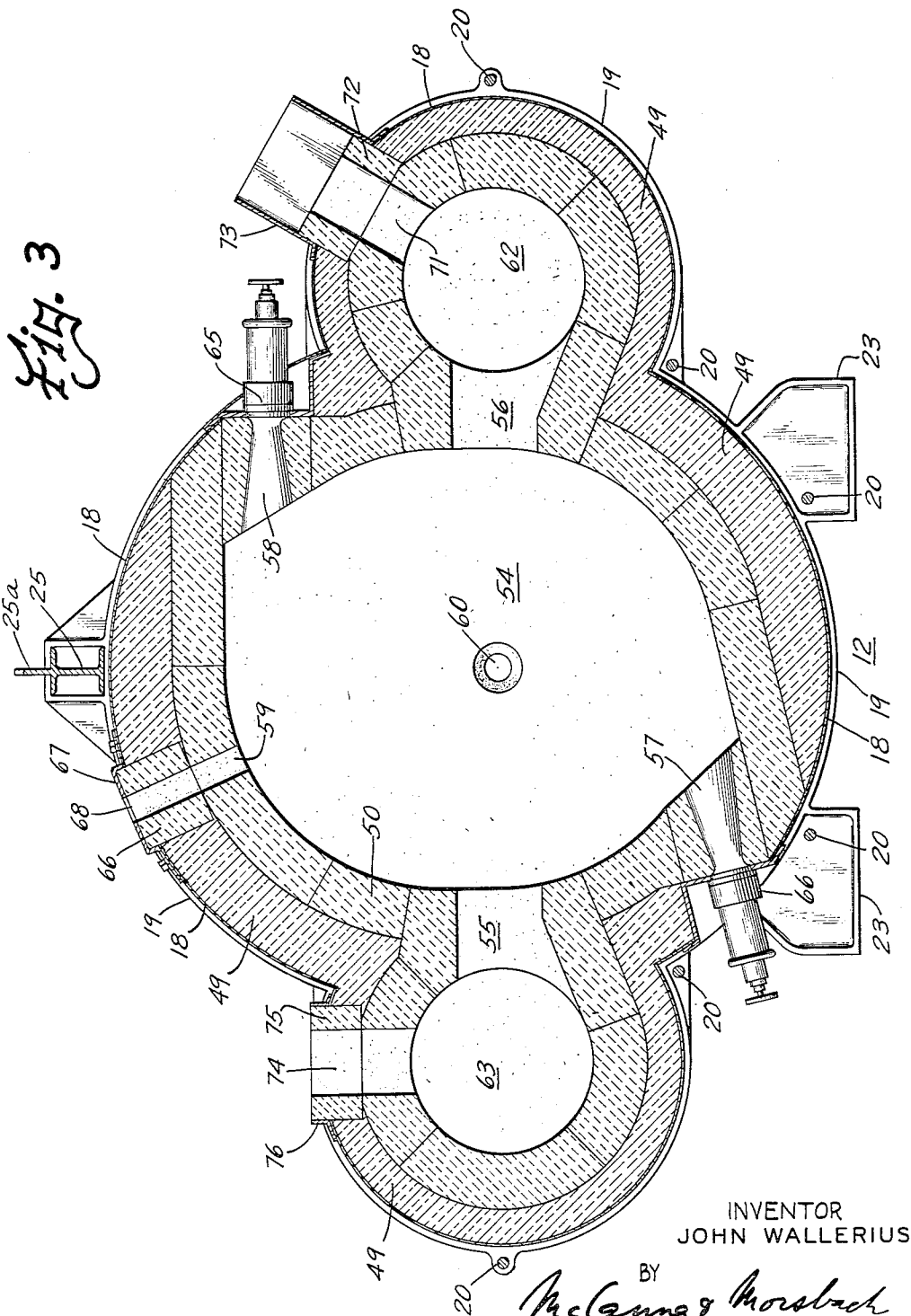
April 10, 1956

J. WALLERIUS
BIT HEATING FURNACE

2,741,469

Filed Jan. 12, 1952

5 Sheets-Sheet 3



April 10, 1956

J. WALLERIUS
BIT HEATING FURNACE

2,741,469

Filed Jan. 12, 1952

5 Sheets-Sheet 4

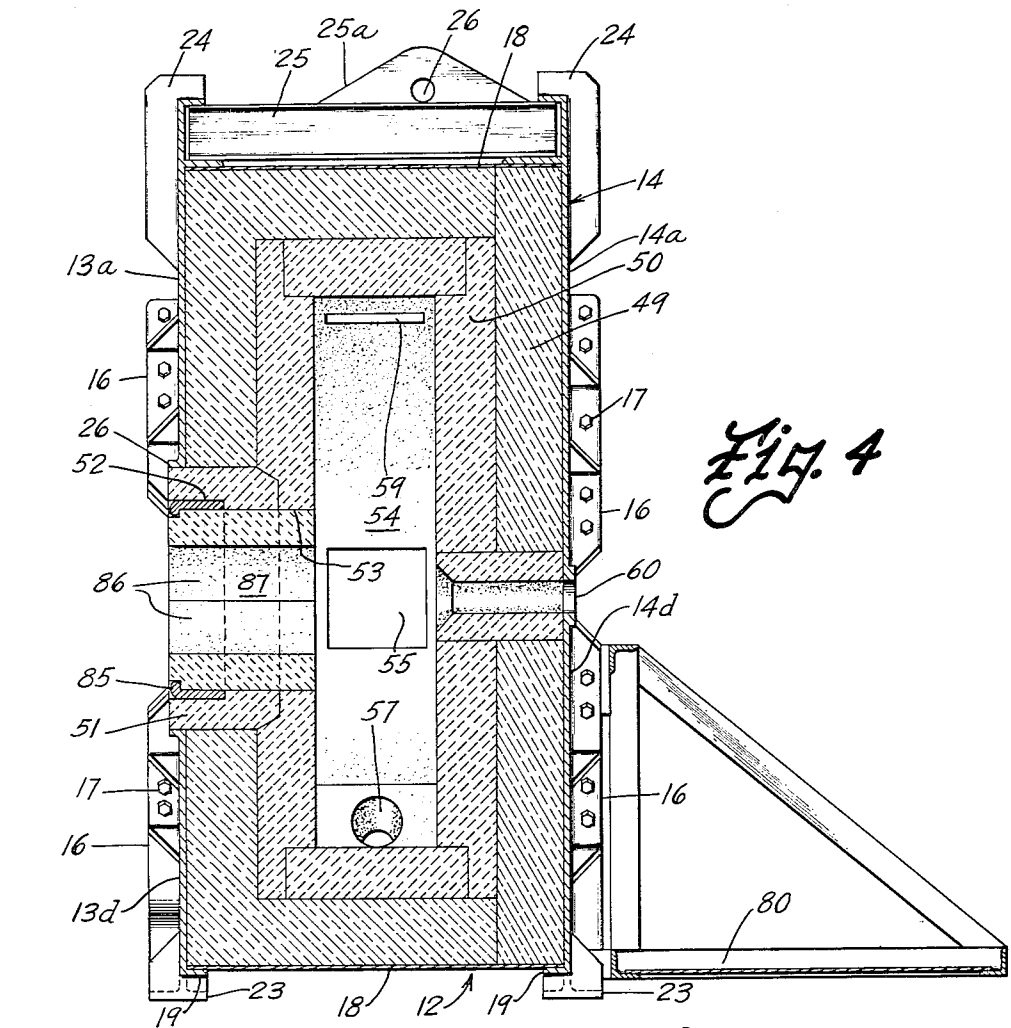


Fig. 4

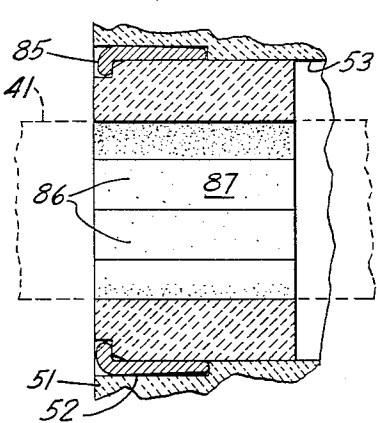


Fig. 6

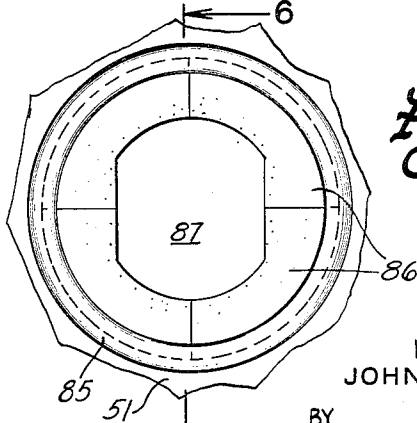


Fig. 5

INVENTOR
JOHN WALLERIUS
BY
McLennan & Morsbach
ATT'YS

April 10, 1956

J. WALLERIUS
BIT HEATING FURNACE

2,741,469

Filed Jan. 12, 1952

5 Sheets-Sheet 5

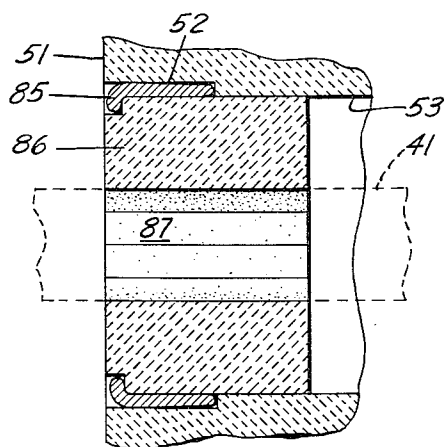
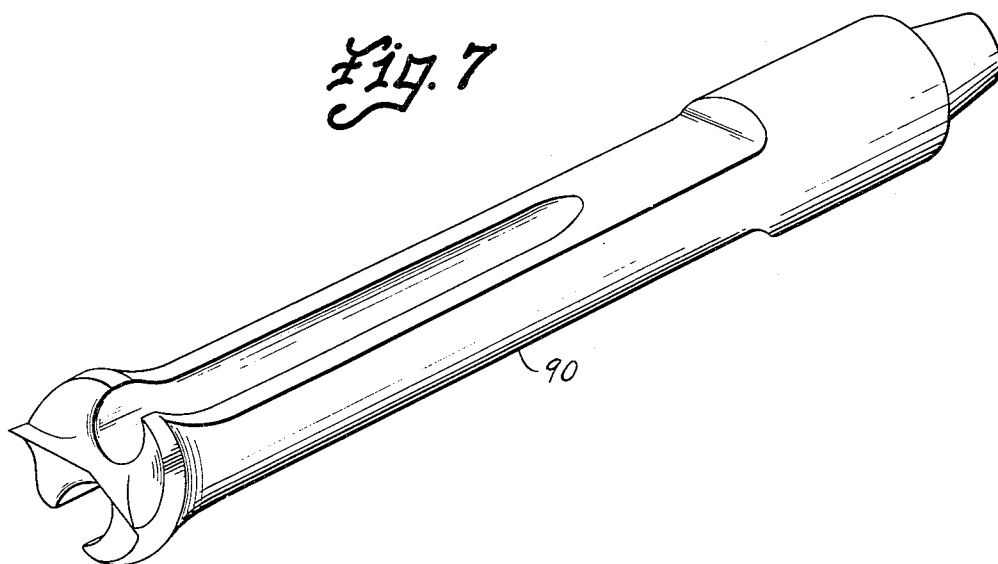


Fig. 8

INVENTOR
JOHN WALLERIUS

BY
McCanna & Morlock

ATT'YS

1

2,741,469

BIT HEATING FURNACE

John Wallerius, Glen Ellyn, Ill., assignor to Sunbeam Corporation, Chicago, Ill., a corporation of Illinois

Application January 12, 1952, Serial No. 266,125

4 Claims. (Cl. 263—2)

The present invention relates to heat treating apparatus and more particularly to a bit heating furnace for heating drilling bits extensively used in drilling blast holes for various mining operations and the like.

In numerous mining and other operations it is necessary to drill blast holes into which the necessary explosive is placed for subsequent detonation to break away the stone, ore, or other material being drilled. For this purpose, extensive use is made of bits which are designed to perform four important functions; namely, (1) penetrating (2) crushing (3) reaming and (4) mixing. The penetrating action or function is accomplished by the cutting edge or point of the drill while the crushing function is accomplished by the face of the drill. The reaming function is obtained by the circumference or outer edge of the bit while the mixing function is accomplished by longitudinally extending slots on either side of the drill bit through which water and cuttings must pass when the bit is moved up and down the drill hole.

In difficult drilling operations these bits wear very rapidly particularly in hard material, and in many applications a bit is only run about an hour before it is changed. For the purpose of reconditioning these bits for further use generally termed "bit dressing" or "bit sharpening," elaborate machinery has been developed which is much more effective and accurate than dressing the bits by hand. Machine dressed bits are of uniform shape with every bit being dressed in exactly the same manner. Hand dressed bits are, of course, less uniform and often result, if not properly dressed, in sticking of the tools during the drilling operation. A conventional bit dresser may comprise a horizontal arm and a radial hammer both adapted to strike the bit alternately at as high as 500 blows a minute. This dressing operation occurs when the bit has been heated to a desired temperature generally over 2000° F. Prior to the present invention, it was necessary to heat the bits before dressing in a suitable forge and numerous difficulties were encountered in such prior arrangements. The bits are elongated elements of various diameters depending upon the size of hole to be drilled thereby which holes might vary in diameter from 5 to 12 inches. In prior art arrangements the end of the bit to be dressed was inserted into a forge heated from the bottom. Because of the slow heating the shape of the bit was sometimes lost during such heating. Moreover, a tremendous amount of heat was lost from the furnace and additionally the shank of the bits were heated up sufficiently so that during the subsequent bit dressing operation an undesirable upsetting of these shanks occurred. Actually, only about one-sixth of the length of the bit should be heated, but with a slow forging operation a great deal of heat would travel to the parts of the bit which should not be heated. Moreover, in prior art arrangements, the forges required were such as to mitigate against portability. It would be desirable to provide a bit heating furnace which was portable so that it could be readily moved to any locality

2

where its use is desired since obviously such mining operations in which bit heating furnaces are employed often are moved from time to time and a large fixed installation for machining and heating purposes is unsatisfactory.

- 5 It is furthermore desirable to provide a bit heating furnace which provides uniform heating at high speed. It would furthermore be desirable to provide a bit heating furnace in which the bits may be preheated at lower temperature and then brought up to the final temperature at high speed.

Accordingly, it is an object of the present invention to provide a new and improved heat treating furnace.

It is another object of the present invention to provide an improved bit heating furnace for heating drill bits prior to a bit dressing operation in a manner to heat them at high speed, to heat substantially only the portion thereof to be dressed and to accomplish this with a simple, compact and portable unit.

- 20 It is a further object of the present invention to provide an improved bit heating furnace having a single high heat chamber in which the heating gases whirl around the bit to heat the same at high speed and a plurality of preheat chambers which utilize waste gases from the high heat chamber.

- 25 It is another object of the present invention to provide a portable heat treating furnace for heating the ends of rather elongated objects without effectively heating the other portions of these objects and without substantial loss of heat around the objects being heated.

- 30 Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention reference may be had to the accompanying drawings in which,

- 40 Fig. 1 is a somewhat perspective front view of a bit heating furnace embodying the present invention in which bits are being heated in the high heat chamber and in one of the preheating chambers with the other preheating chamber shown in the closed positions and with adapters associated with each heating chamber;

- 45 Fig. 2 is a top view of the bit heating furnace of Fig. 1 with portions of the top cut away to show the interior construction without any adapters being employed, and with the covers for the heating chambers all in the closed positions;

- 50 Fig. 3 is a sectional view on line 3—3 of Fig. 2 assuming that Fig. 2 shows the complete structure;

- Fig. 4 is a sectional view taken on line 4—4 of Fig. 2 again assuming that Fig. 2 shows the complete structure but with the covers removed and with the adapters in position as shown in Fig. 1;

- 55 Fig. 5 is a front view adjacent one of the chambers of the furnace of Fig. 1 to show the adapter arrangement for adapting the furnace to heat different size bits;

- 60 Fig. 6 is a sectional view taken on line 6—6 of Fig. 5 with a bit to be heated disposed in position and indicated by dotted lines;

Fig. 7 is a perspective view of a representative bit to be heated by the furnace of the present invention; and

- 65 Fig. 8 is a view similar to Fig. 6 illustrating another size of adapter for use with the furnace of the present invention.

Briefly the bit heating furnace of the present invention comprises a central heating chamber for heating about a 9 inch length of a bit which may be up to 12 inches in diameter and two side heating chambers which are heated by waste gases from the central heating chamber for preheating bits prior to their being inserted in the

central chamber for heating them to temperatures in excess of 2000° F. prior to dressing the same. By means of a plurality of oil burners tangentially disposed with respect to a cylindrical heating chamber, a flame is produced within the central heating chamber whirling around the bit, and in effect comprising a rotating flame. With this arrangement, obviously there is no necessity of turning the bits while in the furnace. Means are provided to control the temperature in the main heating chamber and also in the preheating chambers by controlling the amount of gases escaping to the preheating chambers.

Referring now to the drawings there is illustrated a bit heating furnace unit generally designated by the reference numeral 10 which is indicated as a completely portable unit including a suitable stand or frame 11 which may be formed of angle members or the like for supporting the bits to be heated by the furnace. The furnace proper generally designated by the reference numeral 12 comprises a front wall 13 and a back wall 14, which front and back walls may be formed of suitable castings of substantially identical configuration. As best shown in Fig. 3 of the drawings, these front and back walls essentially define a large circular central portion with a pair of smaller circular diametrically opposed end portions joined to the central portion. Preferably for manufacturing purposes, the front and back walls 13 and 14 each comprise a plurality of separate casting sections. As specifically illustrated, the front wall 13 comprises a top front section 13a, side front sections 13b and 13c respectively, and a bottom front section 13d. Similarly the back wall 14 comprises sections 14a, 14b, 14c and 14d. The adjacent edges of these sections are preferably provided with suitable flanges 16, through which fastening means such as bolts 17 may extend whereby the sections are united into an effectively integral front wall 13 and rear furnace wall 14. Preferably these front and rear walls are formed of castiron which provides good rigidity and resistance to warping when subject to the high temperatures encountered in furnaces of this type.

To complete the enclosure there is provided in addition to the front and rear walls 13 and 14, a steel shell 18 which with the front and rear walls completes the furnace housing. Preferably, the front and rear walls 13 and 14 are provided with peripheral flanges 19 which overlap the shell 18. Also, the front and rear walls are provided with means for receiving suitable tension bolts such as 20 to hold the walls 13 and 14 and the shell 18 in assembled relationship. The lower casting sections 13d and 14d are provided with integral leg portions 23 for supporting the furnace proper 12 on any suitable surface. Similarly, the upper casting section 13a of the front wall and the upper casting section 14a of the rear wall are provided with suitable integral extensions 24 for receiving a suitable beam 25 having an integral extension 25a with a suitable opening 26 therein to permit engagement by suitable crane or the like, thus assuring complete portability of the unit.

The casting sections defining the front wall 13 are provided with suitable openings defined by flanges 26, 27 and 28 respectively, the flange 26 defining the opening to the main or center heating chamber and the flanges 27 and 28 defining the openings to the preheating chambers. In order that these openings may be closed to conserve the heat within the furnace when the furnace is brought up to temperature or when no bit is being heated, suitable closure members 30, 31 and 32 are provided respectively for the openings at least in part defined by the flanges 26, 27 and 28. As illustrated, these closure members are generally circular configuration with a flattened bottom as indicated at 34. Preferably, the covers 30, 31 and 32 comprise a castiron member having a cross section as best shown in Fig. 2 of the drawings which castiron cover members also support a suitable insulating brick generally designated at 35. Preferably, the covers are hinged by suitable hinges 38, fastened

to the front wall 13. Each door is preferably also provided with a pair of handles 39 for ready manipulation thereof.

Any suitable means for supporting the bits to be heated by the furnace 10 of the present invention may be employed. Since a large portion of the bit will extend outside the furnace during the heating operation, there preferably is provided suitable bit charging equipment which, as illustrated in Fig. 1, may comprise a plurality of bit carriages generally designated at 40, one disposed adjacent each of the openings closed by covers 30, 31 and 32. These bit carriages 40 are mounted on suitable anti-friction bearings forming no part of the present invention which ride on rails whose longitudinal axis is parallel with the axis of the openings into the furnace 10 controlled by the covers 30, 31 and 32. In order to illustrate the operation of the carriages 40, there is shown in Fig. 1 a bit 41 disposed in heating position in the main heating chamber of the furnace 10 and a bit 42 disposed in heating position in the preheat chamber with which is associated cover 32. These bits are supported on the carriages 40 which are provided with suitable adjustable chain slings 45 to properly position the bits on the carriages in dependence upon the particular size bit involved. As illustrated, the bit carriages are disposed on the frame or support 11 and by using the adjustable chain slings 45, any size bits up to 12 inches may be accommodated. It will be understood that by means of suitable lifting mechanism such as crane or the like, the bits may be transferred to the bit carriages 40 and from one bit carriage to another where they may be readily moved into and out of the furnace as desired.

It will be understood that a very high heat is developed within the furnace 10, approximately 1500° F. in the preheating chambers and 2250° F. in the high or main heating chamber. Obviously, to prevent heat loss and to protect operators against the high heat, the furnace chambers are provided with suitable insulating and fire resistant linings. As illustrated, the furnace is lined throughout with a layer of insulating brick generally designated by the reference numeral 49. This insulating brick is provided all around the furnace chamber and is disposed in direct contact with the front and rear walls 13 and 14 respectively and the shell 18. In a commercial embodiment built in accordance with the present invention, the insulating brick provided a wall thickness of 5¼ inches around the high heat chamber. Additionally, in accordance with the present invention, a molded fire clay tile lining generally designated at 50 is provided for the interior of the furnace for direct engagement with the hot flames and gases of the heating equipment described hereinafter. This fire clay lining is inside the insulating brick 49 and in the commercial embodiment built in accordance with the present invention, this lining comprised a thickness of 4½ inches. These thicknesses of linings of fire clay 50 and insulating brick 49 provide adequate insulation for temperatures encountered in the furnace as set forth above and assure minimum heat losses and economical furnace operation. The fire clay lining is also provided around each of the openings into the furnace which lining is designated by the reference numeral 51 around each opening into which material to be heated is inserted. These openings defined by linings 51 are designed so as to accommodate the maximum size bit generally 12 inches in diameter. As illustrated the fire clay lining 51 around each of the openings is provided with a portion of enlarged diameter generally designated at 52, the purpose of which will become apparent as the following description proceeds.

As may best be observed by an examination of Figs. 2 and 4, the opening 53 defined by the lining 51 leads directly into the high heat chamber 54 of generally circular configuration defined by the layer of fire clay 50. In accordance with the present invention, in addition to the opening 53 leading into the chamber 54, there are a plu-

5

ality of additional openings 55, 56, 57, 58, 59 and 60 leading to the high heat chamber 54. The openings 55 and 56 disposed in diametrically opposed positions lead to the preheat chambers 62 and 63 respectively and are effectively, throats or passageways for the gases from the high heat chamber 54 to the low heat chambers 62 and 63. The openings 57 and 58 are provided to accommodate suitable oil burner units to be described hereinafter and designated by the reference numeral 65 and 66 respectively. The oil burner unit 66 disposed adjacent the lower portion of the high heat chamber 54 is arranged tangentially with the periphery of the high heat chamber 54 so that the burning oil flame produced by the oil burner causes tangential flow of gases around the heating chamber 54 and effectively around the bit such as 41 disposed therein. The oil burning unit 65 on the other hand is tangentially disposed with respect to the upper portion of the more or less circular periphery of the high heat chamber 54. As illustrated, the upper burner 65 is disposed on a horizontal axis so as to reduce to a minimum or entirely eliminate any carbonizing of the upper burner which could occur if the upper burner were disposed with its axis in a vertical direction or some component of its axis in a vertical direction.

The opening 59 on the other hand connects the high heat chamber 54 directly to atmosphere and comprises a control vent which is preferably defined throughout by a fire clay wall including the fire clay wall portion 66. A suitable casting 67 having the opening 68 defined therein is provided at the outside of the casting adjacent the opening 59. The vent 59 therefore provides an adjustable control for the gases escaping to atmosphere, and, hence, a control of the temperature in the preheat chambers 62 and 63, since the more gas that is permitted to escape to atmosphere directly from the high heat chamber 54 through the vent 59, the lower will be the temperatures of the preheat chambers 62 and 63 which depend entirely for heating thereof upon the gases passing through the passageways 55 and 56. The upper end of the opening 68 may be controlled by a suitable closure member such as a piece of firebrick which may completely close the opening or partially close it as desired.

The other opening 60 into the combustion chamber 54 is to accommodate a suitable thermocouple, not shown, connected to a suitable indicating pyrometer 70 so that the operator may have an indication of the temperature existing within the high heat chamber at all times.

The preheat chambers 62 and 63 are of circular cross section defined by the inner fire clay lining 50 between which and the shell 18 is the insulating brick layer 49. The preheat chamber 62 is provided with a vent to atmosphere 71 through which the hot gases may escape to atmosphere. This opening 71 is also completely defined by firebrick including a firebrick lining 72. A suitable shield 73 in the form of a casting or the like is attached to the shell 18 where the opening 71 comes out of the furnace to shield the oil burner 65 from the hot gases escaping. Similarly, the preheat chamber 63 is provided with a vent to atmosphere 74 completely defined by firebrick including the firebrick lining 75. A short casting 76 is attached to the shell 18 adjacent the point where the opening 74 comes outside the furnace wall to define the vent opening.

For the purpose of supporting a suitable compressor unit and oil burning equipment connected to the burners 65 and 66, there preferably is provided at the rear of the furnace a suitable angle iron support 80 as shown in Figs. 2 and 4 of the drawings. It will be understood that suitable piping, oil and air proportioning valves and the like will be provided to supply the burners 65 and 66 with a uniform supply of fuel at constant pressure with manual means for proportioning the air and oil ratio at any desired selected value. Since the details of the oil burner control form no part of the present invention, no disclosure thereof is made herein.

6

For the purpose of causing the furnace 10 to be capable of heating bits of all sizes up to 12 inches, and particularly bits of small diameter where there would be an annular space around each opening into the furnace and the bit, there are provided in accordance with the present invention suitable adapters as shown in Figs. 4, 5, 6 and 8 of the drawings insertable into the openings such as 53 for the main heating chamber 54, or the openings 83 into the preheat chambers 62, etc. As illustrated, the adapter comprises a ring formed of a suitable alloy generally designated at 85 and a number of pieces of refractory material 86 arranged to define a somewhat rectangular central opening 87. The pieces of refractory material 86 are cemented together and to the ring 85 to provide an adapter unit providing a somewhat rectangular opening for closely conforming to the exterior shape of bits such as 41 or 42. In Fig. 7 of the drawings there is illustrated a bit 90 representative of the type of bits for which the present furnace is adapted. It will be understood that the adapter unit shown in Figs. 5 and 6 will accommodate one size of bit and depending upon a particular size of adapter units employed, other bit sizes may be used.

In Fig. 8 of the drawings there is illustrated another adapter unit of different size for accommodating a still smaller bit than that for which Figs. 5 and 6 are designed. These adapter units will be inserted into the opening 53 as is clearly shown in Fig. 6, or the openings 83 to the preheating chambers all of which openings are identical so that the adapters are interchangeable. It will be understood that in operating the furnace of the present invention, the openings 53 and 83 will all be provided with identical adapters since for most efficient heat treatment a single size bit should be heated in all three units at the same time.

In view of the detailed description above, the operation of the present invention will be readily understood by those skilled in the art. In heating bits for the dressing operation, the furnace is set in operation with the covers 30, 31 and 32 in a closed position so that the chambers may be brought up to temperature. If desired, only the cover 30 need be closed and a bit may be placed in each of the preheat chambers 62 and 63 for preheating. After the bit in one of the preheat chambers is heated to at least 1000° F. (a dull red heat), it is placed in the high heat chamber 54 and another bit is placed into the preheat chamber from which the bit has just been removed. Thus one bit is in the high heat chamber and two other bits are disposed in the preheat chambers. The temperature to which the bits are heated in the preheat chamber may be controlled by controlling the size of the vent 59. When the bit in the high heat chamber is heated to a forging heat somewhere between 2000 and 2100 F., it is removed for dressing and one of the bits from the preheat chambers is moved into the high heat chamber. Bits are maintained in the preheat chambers for a period twice as long as they are in the high heat chamber. Depending upon the particular size of the bits to be heated, the appropriate adapter units will be employed whereupon only the portion of the bits desired to be heated will be heated. Moreover, the hot gases whirling around the bit in the high heat chamber by virtue of the tangential position of the burners 65 and 66 will cause the bit in the high heat chamber to be uniformly heated throughout without any movement thereof. The same is also true of the bits in the preheat chambers since the disposition of the openings 55 and 56 and the vents 71 and 74 insure such circular motion of the hot gases in the preheat chambers 62 and 63 as well as in the high heat chamber 54.

From the above description, it will be apparent that there has been described a bit heating furnace which is designed for many years of service with a minimum of maintenance. It will, moreover, provide heating at high production rates. Moreover, this heating will be even heating throughout with close temperature control.

In a particular furnace built in accordance with the present invention bits up to 12 inches in diameter could be heated with heat distribution along 9 inches of the bits.

While there has been illustrated and described one embodiment of the present invention, it will be understood that numerous changes and modifications will occur to those skilled in the art and it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A furnace for uniformly heating to a temperature of the order of 2000° F. the end portion only of an elongated work piece, comprising a generally cylindrical high heat chamber, a preheat chamber disposed adjacent said high heat chamber, means for introducing hot gases along a tangent with respect to the circumference of said high heat chamber to produce a rotation of hot gases around the longitudinal axis of said high heat chamber, means defining a first opening for introducing the end of a work piece to be heated along said axis of said high heat chamber, passageway means for said hot gases from said high heat chamber to said preheat chamber whereby said hot gases from said high heat chamber provide the source of heat for said preheat chamber for preheating a work piece in said preheat chamber to the order of 1500° F., means for controlling the temperature of said preheat chamber comprising vent means from the upper part of said high heat chamber to atmosphere, and a closure for said first opening to prevent loss of heat from said high heat chamber when no work piece is disposed therein.

2. A furnace for uniformly heating the ends of drilling bits prior to a bit dressing operation comprising a housing having three spaced circular openings disposed along a horizontal line across the front thereof, a centrally disposed cylindrical high heat chamber having its longitudinal axis disposed in a horizontal position, said central opening leading to said high heat chamber, a pair of cylindrical preheat chambers one disposed on either side of said high heat chamber with their longitudinal axes parallel with said longitudinal axis of said high heat chamber, said other two openings each leading to a different one of said preheat chambers, means for supporting an elongated work piece along the axis of each of said chambers in a manner to permit insertion of the end of said work piece into one of said chambers for heating, a source of hot gases, means for introducing said hot gases into said high heat chamber to produce a constant whirl of hot gases around the end of a work piece disposed in said high heat chamber, means for causing hot gases from said high heat chamber to enter each of said preheat chambers and swirl around the ends of any work pieces disposed therein, and means comprising a vent in said high heat chamber for controlling the temperature in said preheat chambers.

3. A furnace for heating the ends of drilling bits prior

to a bit dressing operation comprising a housing having three spaced circular openings disposed along a horizontal line across the front thereof, a centrally disposed cylindrical high heat chamber having its longitudinal axis disposed in a horizontal position, said central opening leading to said high heat chamber, a pair of cylindrical preheat chambers one disposed on either side of said high heat chamber with their longitudinal axes parallel with said longitudinal axis of said high heat chamber, said other two openings each leading to a different one of said preheat chambers, means for supporting an elongated work piece along said axis of each of said chambers in a manner to permit insertion of the end of said work piece into one of said chambers for heating, a source of hot gases, means for introducing said hot gases into said high heat chamber for producing rotating hot gases around the end of a work piece disposed in said high heat chamber, means for causing hot gases from said high heat chamber to enter each of said preheat chambers and swirl around the end of any work pieces disposed therein, vent means at the top of each of said preheat chambers, and means comprising a vent in said high heat chamber for controlling the temperature in said preheat chamber.

4. A furnace for uniformly heating the end portion only of a drilling bit prior to a bit dressing operation, comprising, a generally cylindrical heating chamber having an opening therein, means for introducing hot gases along a tangent with respect to the circumference of said heating chamber to produce a constant swirl of hot gases around the longitudinal axis of said chamber and hence around the end of a drilling bit disposed therein, said opening to said chamber having a diameter sufficiently large to conform closely to the cross section of the largest bit to be heated in said chamber, and an adapter insertable in said opening for effectively reducing the dimension of said opening to conform closely to the cross section of a drilling bit of a size smaller than that of said largest bit, said adapter comprising a ring and a plurality of pieces of refractory material cemented together and to said ring to form a unit, said pieces of refractory material being shaped to define a somewhat rectangular opening.

References Cited in the file of this patent

UNITED STATES PATENTS

310,402	Fox	Jan. 6, 1885
515,261	Sperry	Feb. 20, 1894
932,508	Smith	Aug. 31, 1909
1,582,036	Grunewald	Apr. 27, 1926
1,716,695	Hinderliter	June 11, 1929

OTHER REFERENCES

Pages 8 and 9, Industrial Furnaces, by W. Trinks, John Wiley and Sons, Inc., New York, third edition, 1934, volume I.