H. A. BARDEEN AND F. W. HARRIS.

APPARATUS FOR ANNEALING PIPE.

APPLICATION FILED APR. 28, 1917.

1,324,001. Patented Dec. 2, 1919.

Fig. 1.

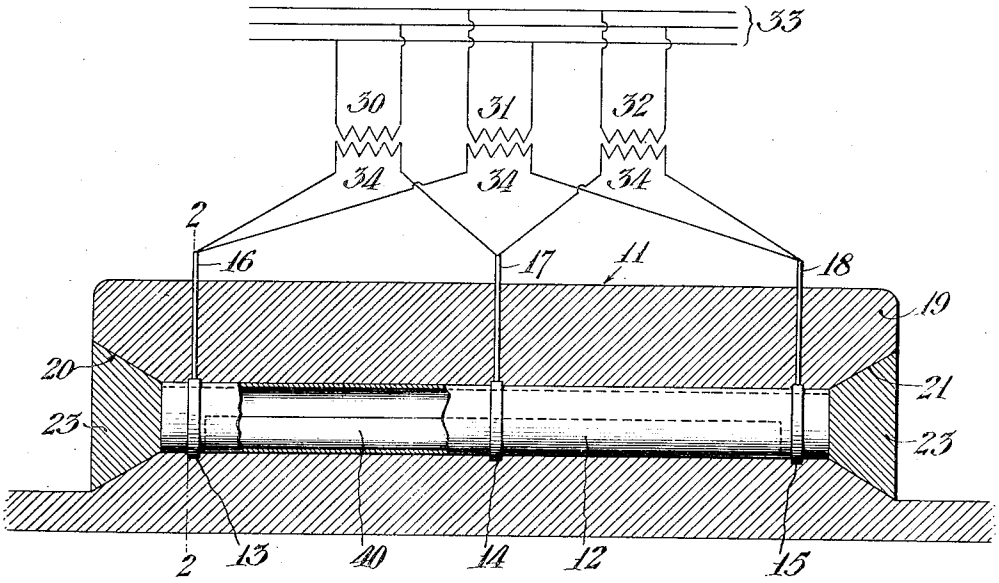
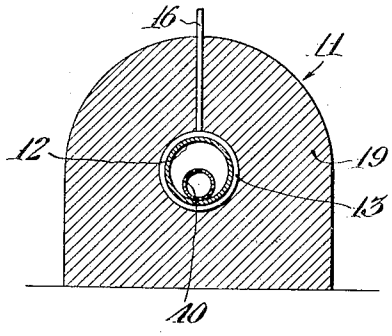


Fig. 2.



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APPARATUS FOR ANNEALING PIPE.

1,324,001. Specification of Letters Patent. Patented Dec. 2, 1919.

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To all whom it may concern:

Be it known that we, HUGH A. BARDEEN and FORD W. HARRIS, both citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Apparatus for Annealing Pipe, of which the following is a specification.

In the production of oil wells it is common to use rotary drill pipe, which is rotated in the well, carrying a bit at its lower end. This pipe becomes defective in time due to the excessive strains imposed upon it. The principal object of the invention is to provide means for treating such pipe for the purpose of increasing its toughness and durability.

In the manufacture of pipe it is not ordinarily found to be commercially feasible to give the pipe perfect heat treatment, and a great deal of the drill pipe shipped from the mill is defective in spots due to unequal heating, or to other causes which are apparently beyond the control of the mill. A further object of the invention is to provide means for heat treating such pipe for the purpose of rendering it homogeneous in its structure and characteristics and for giving it a maximum of toughness and durability.

While the process and apparatus illustrated herein has a special utility as applied to drill pipe, it has a further utility in the treatment of casing, tubing, pump rods, drill stems, etc., such as are used in the oil industry, and a further object of our invention is to provide a process and apparatus whereby such articles can be readily heat treated.

Referring to the drawings, which are for illustrative purposes only; and which are extremely diagrammatic in character:

Figure 1 is a sectional elevation through one form of furnace in which the process may be carried on.

Fig. 2 is a section on a plane represented by the line 2—2 Fig. 1.

In this drawing, a three phase furnace is illustrated. The furnace 11 consists of an iron or steel shell 12, preferably made up in the form of a pipe and having three bands 13, 14 and 15 welded or otherwise secured thereon. Conductors 16, 17 and 18 are secured to the bands 13, 14 and 15 respectively, the shell 12 being surrounded by a mass of heat insulating material 19 which is cut away at 20 and 21 to give access to the interior of the shell 12. Heat insulating plugs 23 are used to fill the openings 20 and 21 when the furnace is in operation. There are three transformers 30, 31 and 32, these transformers having their primaries each connected to a different one of the three phases of a three phase transmission line 33. The secondaries 34 of the transformers 30, 31 and 32 are connected as shown in Fig. 1, one of the secondaries being connected between the conductors 16 and 17, another between the conductors 16 and 18, while the third is connected between the conductors 17 and 18. A three phase voltage being applied to the transmission line 33, a current having a very high amperage and low voltage is generated in the secondaries 34 and heavy currents flow longitudinally in the pipe 12.

The method of operation is as follows:

The joint of tubing 40, which is to be heat treated, or the other material to be treated, is placed inside the shell 12, through one of the openings 20 or 21, and these openings are plugged by means of the members 23. The heavy currents flowing into the shell 12 rapidly heat it, bringing it up to the desired temperature, which may be observed or registered by any well known pyrometric means not shown. This temperature may be regulated by regulating the voltage on the supply line 33. The tubing 40 is heated by radiation from the shell 12 and is also heated by current flowing longitudinally therethrough. It is further heated by induction from the shell 12.

Our object in making the shell 12 of iron is to provide of the large secondary induction effects produced in such a shell by alternating currents passing longitudinally through said shell. Such currents tend to set up magnetic fluxes which circulate about the circumference of the shell. As the magnetic path is a closed circle these fluxes are quite intense and tend to induce eddy currents and hysteresis losses that greatly mag-

nify the heating effect. This results in a higher voltage and a lower current than would be the case were the resistance of the iron alone depended on for the heating.

We claim as our invention:—

A polyphase electric furnace comprising a metal cylinder; heat insulation for the exterior of the cylinder; and means for impressing voltages having different phases on successive sections of said cylinder.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 21st day of April, 1917.

HUGH A. BARDEEN.
FORD W. HARRIS.