P. WRIGHT.

ELECTRIC INDUCTION FURNACE.

APPLICATION FILED MAY 11, 1914.

1,218,151.

Patented Mar. 6, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

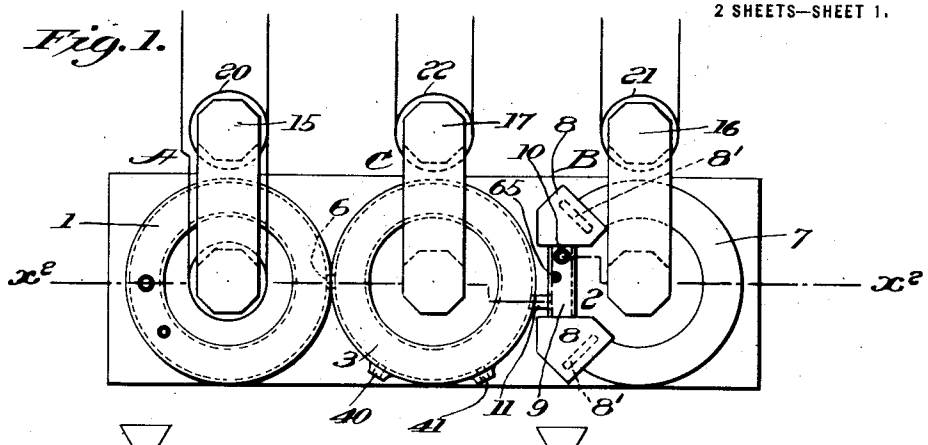


Fig. 2.

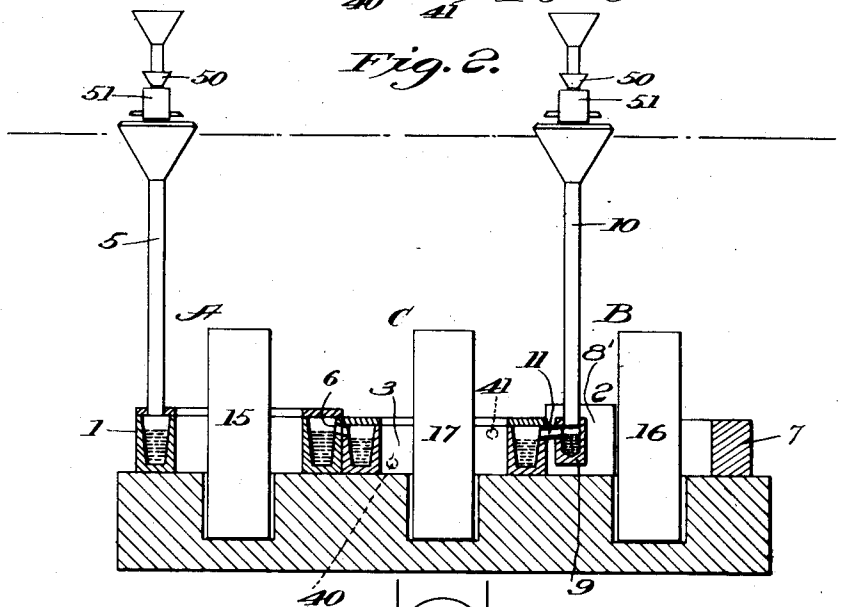
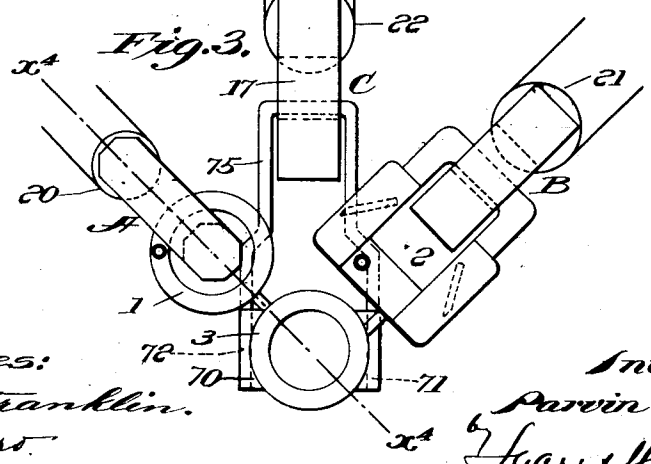


Fig. 3.



Witnesses:
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Sully Fuss.

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2 SHEETS—SHEET 2.

Fig. 4.

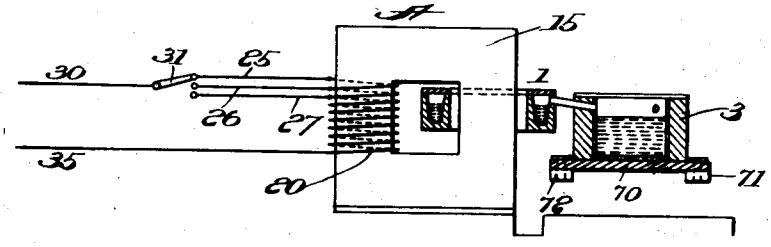


Fig. 5

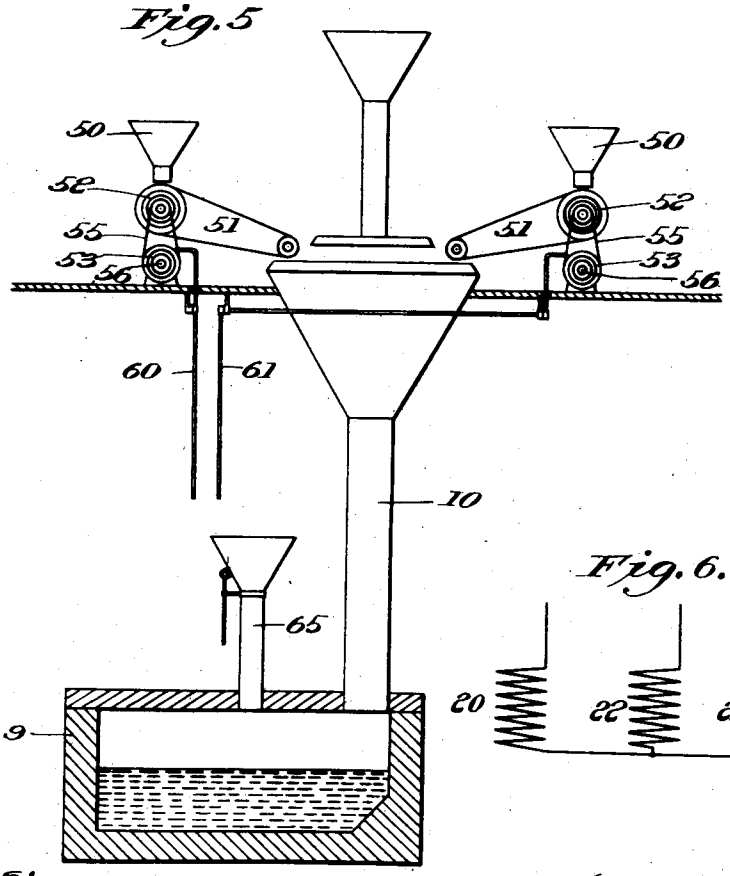


Fig. 6.

Witnesses:
Alan Franklin.
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UNITED STATES PATENT OFFICE.

PARVIN WRIGHT, OF VANCOUVER, BRITISH COLUMBIA, CANADA.

ELECTRIC INDUCTION-FURNACE.

1,218,151. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed May 11, 1914. Serial No. 837,773.

To all whom it may concern:

Be it known that I, PARVIN WRIGHT, a citizen of the United States, residing at Vancouver, in the county of New Westminster, Province of British Columbia, and Dominion of Canada, have invented a new and useful Electric Induction-Furnace, of which the following is a specification.

This invention relates to electrical induction furnaces. The object in general of the invention is to provide an electrical induction furnace for melting metals and for smelting iron and other ores, which will be highly efficient in operation.

A more particular object is to provide a furnace of this type, which will be continuous in its operation and constant in its current consumption.

A further object is to provide a furnace of this type which may be charged and discharged continuously and without being uncovered.

Other objects will appear from the following description.

Referring to the drawings:

Figure 1 is a plan view of the furnace.

Fig. 2 is a vertical section thereof taken on line x^2—x^2, Fig. 1.

Fig. 3 is a plan view of a modified form of the invention.

Fig. 4 is a vertical section taken on line x^4—x^4, Fig. 3.

Fig. 5 is a view of the ore and flux feeding means of the furnace.

Fig. 6 is a diagrammatic view showing one way in which the primary coils of the furnace transformers are connected.

In the present embodiment of my invention, two melting or smelting furnace receptacles 1 and 2 are arranged adjacent a crucible 3. If desirable only one receptacle or a greater number than two may be associated with the crucible. A shaft 5 communicates with the receptacle 1 through which shaft the ore is introduced into said receptacle. The receptacle 1 has an outlet 6 through which the smelted ore overflows from the receptacle into the crucible 3. The furnace 2 comprises a U shaped heating element 7, electrodes 8 formed on the ends of element 7, and a resistor 9 which connects said electrodes. The receptacle element 7 is formed of good electrical conducting material such as copper, while the electrodes 8 and resistor are preferably formed of cast iron. An ore shaft 10 communicates with resistor 9, and supplies the ore to the resistor 9. The electrodes 8 are provided with cooling chambers 8′ into which air or water may be introduced for preventing the electrodes from becoming too hot. The resistor 9 is provided with an outlet 11 through which the smelted ore overflows from the resistor 9 into the crucible 3. The furnaces 1 and 2 and crucible 3 respectively surround the cores 15, 16, and 17 of three parallel transformers A, B and C and constitute the respective secondaries of said transformers. Said cores are respectively wound with primary coils 20, 21 and 22 which are connected to any suitable electric generator (not shown) so that they may be operated independently or in conjunction with each other. The primary coils may be connected at different points to a plurality of wires 25, 26 and 27, as shown in Fig. 4, which wires may respectively be brought into connection with the circuit main 30 by means of switch 31. In connecting up the primary coils, I prefer to use what is known to electricians as the star connections, that is,—one phase of the circuit is connected to one end of each coil, and the other ends of the coils are connected together, as shown in Fig. 6 of the drawing. When the switch is in connection with wire 25 the current flows through the entire coil. When the switch is in connection with wire 26, the current flows through all the turns of the coil except the last turn thereof, and when the switch is in connection with wire 27, the current flows through all of the turns of the coil except the last two. By varying the number of turns of the coils through which the current flows, by means of switch 31, the turns of the coil are varied and consequently the voltage and heat induced by the primary coils in the furnace secondaries 1 and 2 and crucible secondary 3 are varied. The crucible 3′ is provided with an outlet 40 through which the molten metal is drawn from the crucible and an outlet 41 through which the slag is withdrawn. Flux feeding means are associated with the shafts 5 and 10, which means comprise flux hoppers 50 into which the flux is placed, flux conveyers 51, which receive the flux from the hoppers and deliver it into said shafts and cone pulleys 52 and 53 and belts 55 passing around said pulleys, which belts and pulleys transmit power from shafts 56 to the conveyers

51 to drive said conveyers. The belts 55 may be shifted on the cone pulleys 52 and 53 to vary the speed of the conveyers and the amount of flux delivered into the shafts 5 and 10, by means of belt shifting levers 60 and 61 which are located within easy reach of the operator. Auxiliary flux feeding shafts 65 communicate with the receptacles 1 and 2 for feeding additional fluxes to said receptacles in case the slag stiffens up and becomes too thick.

In the modification of my invention, illustrated in Figs. 3 and 4 of the drawing, the transformers A, B and C are arranged at an angle to each other and the crucible 3, instead of surrounding the transformer core 17 and forming the transformer secondary, is mounted upon resistor 70, connected to electrodes 71 and 72 on a frame 75, which surrounds the core 17 of the transformer C and forms the secondary coil of the transformer. The crucible is heated when the resistor between the electrodes of secondary 75 is heated. The ore is smelted in the furnace secondaries 1 and 2 by the heat of the secondary current of the transformers A and B, while the molten metal in the crucible 3 is kept at the desired temperature by the heat of the current in the crucible secondary resistor between 71 and 72 of transformer C. The crucible is lined with a thick coating of high grade magnesite or dolomite so that the metal may be kept at any desired temperature indefinitely.

In my improved furnace the ore and flux may be fed continuously to the melting or smelting receptacles 1 and 2 through the shafts 5 and 10, and the molten metal may be drawn off continuously from the crucible 3 through the outlet 40 as long as the ore is fed to the smelting furnaces and smelted therein and delivered to the crucible, thus providing for continuous operation of the furnace.

The continuous operation of the furnace with the continuous feeding of the ore and flux to the smelting receptacles provides for constant consumption of current in the furnace and maintains a constant load on the generator.

The construction of the furnace 2 is such that a greater agitation of the molten metal is caused than in other similar furnaces. Such agitation takes place in the resistor 9 and is due to the magnetic effect of the electrodes 8 on the metal, said electrodes affecting the magnetic induction due to the primary winding of the transformer in such manner that magnetic variations are produced in the melted metal resulting in agitation thereof.

The close combination of the melting or smelting receptacles and the crucible forms a unitary structure which is easy to control and which eliminates considerable heat loss.

The construction of the furnace is conducive of the highest efficiency in the operation thereof.

What I claim is:

1. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of copper and having electrodes and having a chambered element formed of cast iron closed at its ends by said electrodes.

2. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of relatively good electrical conducting material and having means to hold a body of melted metal between the ends of said good conducting element and in circuit with said element, said means being interposed between the ends of said good conducting element.

3. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of relatively good electrical conducting material and having enlarged terminal electrodes at the ends of said good conducting element and having means to hold a body of melted metal between said electrodes and in contact with said electrodes.

4. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of relatively good electrical conducting material and having enlarged terminal electrodes at the ends of said good conducting element and having a chambered resistor in circuit with said electrodes, said resistor being interposed between said electrodes.

5. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of relatively good electrical conducting material and having a cast iron chambered resistor in circuit with said good conducting element interposed between the ends thereof.

6. In an electrical furnace, a transformer having a U-shaped secondary provided with iron terminal electrodes, a resistor connected with said electrodes, said resistor being provided with an overflow outlet for discharging the surplus ore therefrom, a crucible for receiving said ore discharge from the resistor, and resistance means for heating said crucible.

7. An electric furnace comprising a core, primary winding for said core, and a secondary coil surrounding the core, said secondary coil having an element formed of relatively good electrical conducting material and having enlarged cast iron electrodes at the ends of the good conducting

element and having a chambered cast iron resistor in circuit with said electrodes.

8. An electric furnace comprising a core, winding for said core, and a secondary coil surrounding the primary core, said secondary coil having a relatively large copper element and having enlarged cast iron electrodes at the ends of the copper element and having a chambered cast iron resistor in circuit with said electrodes.

9. In an electrical furnace, a transformer having a U-shaped secondary of good conducting material, enlarged metal electrodes on the ends of said U-shaped secondary, a metal resistor inclosed in and connecting said electrodes to one another, a crucible for receiving the melted metal from said resistor, and means for heating said crucible.

10. In an electrical furnace a transformer having a secondary provided with enlarged terminal electrodes, a resistor connecting said electrodes to one another and having a chamber, said chamber being provided with means for supplying ore, overflow outlet means for the chamber for discharging the surplus smelted ore therefrom, a crucible for receiving said ore discharge from the resistor chamber, and means for heating said crucible.

11. An electric furnace comprising cores, windings for said cores respectively, and secondary coils surrounding the respective cores and forming the receptacles of the furnace, there being an outlet opening from one of said receptacles to the other.

12. An electric furnace comprising a core, a primary winding for said core, a secondary coil arranged to have an electric circuit induced therein by an electric current in the primary winding, said secondary coil having a resistor in its circuit, and a crucible mounted on said resistor.

In testimony whereof, I have hereunto set my hand at Vancouver, B. C. this 30th day of April 1914.

PARVIN WRIGHT.

In presence of—
SAM A. MOORE,
C. W. STEWART.