B. STOUGHTON.

SMELTING OR FUSING METALLIC SUBSTANCES.

APPLICATION FILED APR. 14, 1919.

1,376,479. **Patented May 3, 1921.**

Fig. 1.

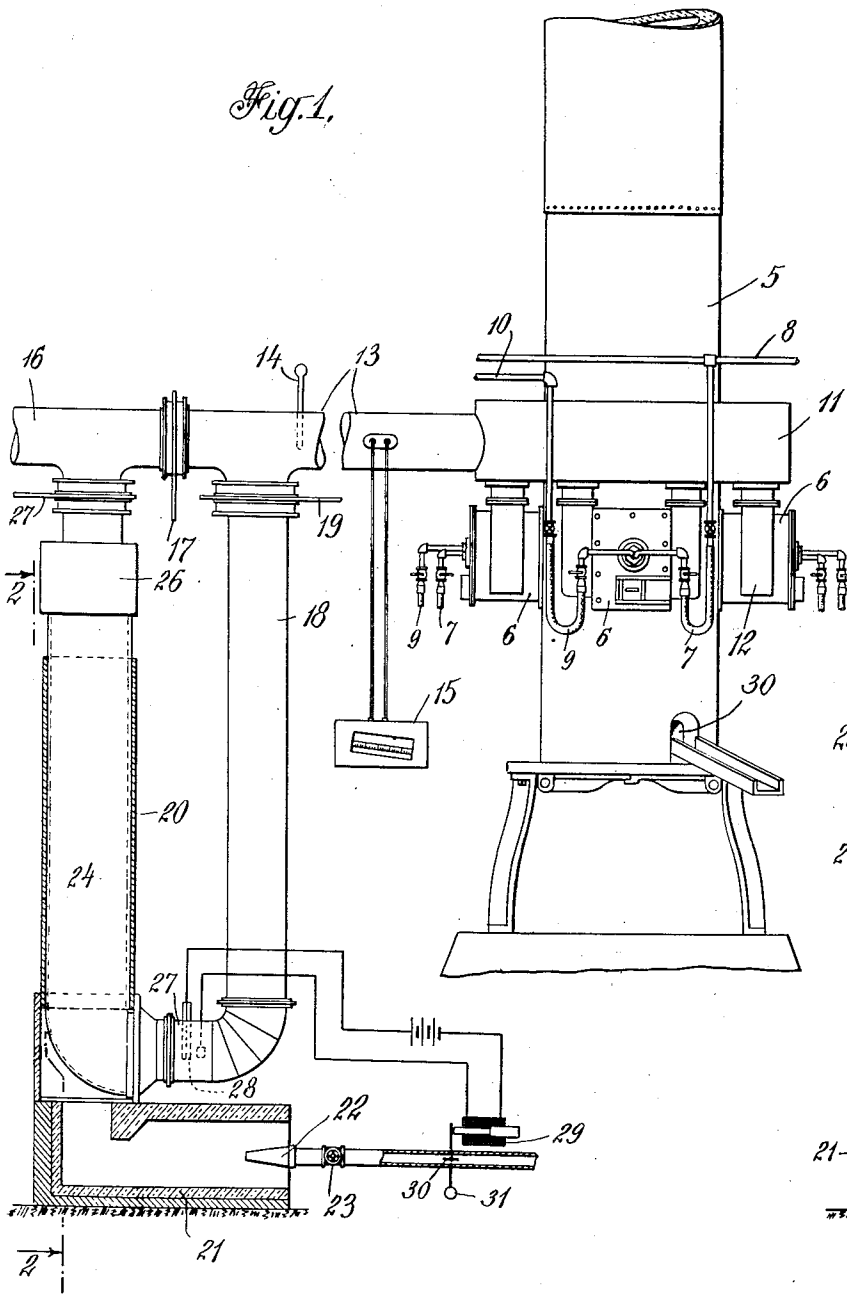
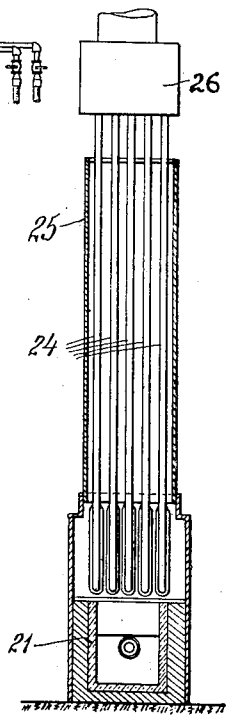


Fig. 2.



INVENTOR

Bradley Stoughton

BY

Pennie, Davis, Marvin & Edmonds

ATTORNEYS

UNITED STATES PATENT OFFICE.

BRADLEY STOUGHTON, OF NEW YORK, N. Y.

SMELTING OR FUSING METALLIC SUBSTANCES.

1,376,479. Specification of Letters Patent. Patented May 3, 1921.

Application filed April 14, 1919. Serial No. 289,927.

To all whom it may concern:

Be it known that I, BRADLEY STOUGHTON, a citizen of the United States, residing at New York city, in the county of New York, State of New York, have invented certain new and useful Improvements in Smelting or Fusing Metallic Substances; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the smelting or fusing of metallic substances, and has for its object the provision of certain improvements in processes of this character.

In the smelting or fusing of metallic substances in blast and cupola furnaces, the charge containing such substances is subjected to the action of heat resulting from the combustion of fuel. The fuel may be solid, liquid, or gaseous, or a mixture thereof, and in my United States Letters Patent No. 1,117,274, dated November 17, 1914, there is described an advantageous process for generating heat in a furnace which involves the use of a mixture of solid and liquid fuels. My present invention, while of general application in various processes employing fuel in any of the three physical states aforementioned, is of particular advantage in conjunction with the heat generating process of my patent.

The improvements constituting the present invention contemplate more particularly the control of the temperature of the furnace product. In ordinary foundry practices, where cupola furnaces are used for melting or fusing iron, the temperatures of the molten foundry irons, as usually employed, vary from about 2450° F. to about 2750° F. It is generally desirable to maintain the temperature of the furnace product fairly constant, and, in any event, between certain maximum and minimum temperature limits. In the case of foundry irons, the temperature of the furnace product should not ordinarily fall below about 2400° F. nor rise above about 3300° F. An effective and convenient method for readily controlling the temperature of the furnace product, and for maintaining such product at an approximately constant operating temperature under the usual varying conditions of foundry practice is, accordingly, most desirable, and, in fact, absolutely necessary if entirely satisfactory results are to be attained. The process of the invention accomplishes this purpose and provides a simple and satisfactory method for controlling the temperature of the furnace product.

I have discovered that the temperature of the molten iron tapped from a cupola furnace can be regulated and controlled at will, by regulating and controlling the temperature of a heated blast of air introduced into the furnace through suitable twyers. I have further found that the temperature of the air blast should be relatively low, for example, less than 500° F., and in conjunction with the heat generating process of my aforementioned patent, I have found that when the air blast is heated to a temperature of around 240° F., under normal operating conditions, the temperature of the molten foundry iron may be held approximately constant and within the limits of from 2450° F. to 3300° F.

In carrying out the invention, the metallic substance to be fused or smelted is charged into the furnace in the usual manner. Ordinarily, the charge is composed of a mixture of the matallic substance with solid fuel, such as coke, charcoal, coal, or the like. Where the process of my aforementioned patent is employed, the quantity of solid fuel in the charge will be materially smaller than in those cases in which solid fuel is relied upon exclusively to effect the heating action. A heated blast of air is introduced into the combustion zone of the furnace, and its temperature is adjusted to effect the desired control of the temperature of the furnace product. Preferably, the temperature of the air blast is capable of regulation from ordinary atmospheric temperatures to about 500° F. With such a range of adjustment of the temperature of the air blast, I am able to control the temperature of the furnace product at will, and within a few minutes to effect and maintain any desired operating temperature within the usual limits.

I am aware that it is not new to heat the air blast in blast furnace or in cupola furnace practice. But so far as I am aware, the object of all such prior proposals to preheat the air blast has been to secure fuel economy, and, generally, this result has been accomplished by using the waste heat of the furnace to produce the heating of the blast. My present invention does not aim to secure fuel

economy but rather to provide an immediate and ready control of the temperature of the furnace product, by controlling at will the temperature of the preheated air. Furthermore, in accordance with the principles of the present invention, the preheating of the air blast is carried only to temperatures less than about 500° F., whereas, with fuel economy in view, preheating of the air blast to temperatures of from 900° F. to 1400° F. is generally recommended.

The preheating of the air blast, for the purposes of my present invention, is effected in such a manner that the temperature of the blast introduced into the furnace can be readily adjusted. To this end, I provide an independent preheater for heating the air blast. The preheater is preferably provided with a gas or oil burner, and the desired regulation of the temperature of the air blast may be then readily effected by adjusting the quantity of liquid or gaseous fuel supplied to the burner or burners of the preheater. Where solid fuel is used in conjunction with the preheater, the desired temperature regulation may be effected by adjusting the draft through the bed of ignited fuel. This independent and adjustable source of heat for heating the air blast supplied to the furnace is an important and characteristic feature of my present invention, since it insures the immediate and ready control of the temperature of the air blast, and hence of the furnace product, in accordance with the principles of the invention.

An apparatus adapted for carrying out the method of the present invention is illustrated in the accompanying drawings, in which

Figure 1 diagrammatically represents, in elevation, the furnace and the preheater; and

Fig. 2 is a sectional elevation of the preheater on the section line 2—2 of Fig. 1.

The cupola furnace 5 illustrated in the accompanying drawings is designed to be operated in accordance with the heat generating process of my aforementioned patent. The furnace has four ignition chambers 6 into which liquid fuel is introduced in an atomized condition. The liquid fuel, such, for example, as crude oil, fuel oil, pulverized fuel, tar, or the like, is supplied to each ignition chamber by a pipe 7 communicating with a main supply pipe 8. The air for atomizing the liquid fuel is supplied to each ignition chamber through a pipe 9 communicating with a main air supply pipe 10. Above the ignition chambers 6 is arranged the bustle pipe 11, from which the air blast is conducted to each ignition chamber 6 through flues 12. A twyer opening into the interior of the furnace 5 is associated with each ignition chamber, as will be well understood by those skilled in the art.

The air blast is supplied to the bustle pipe 11 by means of a main blast pipe 13. A temperature indicating device is inserted in the pipe 13 in order to indicate the temperature of the air blast passing therethrough. This temperature indicating device may take the form of a thermometer 14. A blast volume meter 15 is also operatively connected with the main blast pipe 13 for the purpose of measuring the volume of the blast entering the cupola.

Air at ordinary atmospheric temperature may be supplied to the main blast pipe 13 from the main air supply pipe 16, and the quantity of air so admitted to the pipe 13 is controlled by a gate or valve 17. Preheated air is supplied to the pipe 13 by a pipe 18, provided with a gate or valve 19, and communicating with the outlet 27 of the preheater 20.

The preheater comprises a furnace 21 provided with a liquid or gaseous fuel burner 22, associated with which is a valve 23 for controlling the amount of fuel burned per minute. The preheater proper comprises a plurality of flues 24 arranged within a housing or outside covering 25. The flues 24 open into a manifold 26 at their upper ends, and the manifold communicates through a gate or valve 27 with the main air supply pipe 16. At their lower ends, the flues 24 open into the pipe 18.

Each of the flues 24 is designed to provide a relatively large heating surface for the air passing therethrough and to this end each flue is relatively wide in one dimension, and relatively shallow or narrow in the other dimension. The flues 24 are spaced apart within the housing 25, so that the hot products of combustion from the furnace 21 will come in contact with the large heating surface of each flue during the passage of such gaseous products through the housing. The lower end of each flue 24 has a curved elbow portion, as illustrated in Fig. 1 of the drawings. I have found that as a result of this configuration, the burning out of the flues by the action of the hot gases is materially reduced. The products of combustion from the furnace 21 give up most of their heat in rising through the housing 25 and escape into the open air at the top of the housing.

The flues 24 and outside covering 25 may be made of galvanized iron, or other suitable material. Since, in accordance with the invention, the heating of the air blast is not carried to very high temperatures, the flues 24 may be constructed of thin sheet metal, thus giving greatly improved heat transference, which leads to more rapid control of the temperature and improved efficiency. As a further result of the relatively low temperatures to which the air

blast is heated in accordance with my present invention the iron work of the preheater is not oxidized and burned out, thus enabling the provision of a durable heater having a relatively long life.

The preheater is preferably provided with a thermostatic safety device for preventing the temperature from exceeding the desired or predetermined maximum. This device may, for example, comprise a thermostatic electric contact 28 inserted in the outlet pipe 27 of the preheater, and electrically connected to an electromagnetic mechanism 29. The mechanism 29, when energized, operates to completely or partially close a safety valve 30 in the fuel supply pipe of the burner 22. Normally the valve 30 is held wide open by a weight 31, and always occupies this normal open position when the mechanism 29 is deënergized. The thermostatic safety device, in holding the temperature below a predetermined maximum, prevents overheating of the preheater and thereby increases its durability and its useful life.

The operation of the apparatus illustrated in the accompanying drawings, in practising the present invention, will, it is believed, be understood from the foregoing description. The temperature of the heated air blast is indicated by the temperature indicating means 14—15, and the temperature may be readily controlled and adjusted by manipulating the blast gates 17 and 19, or by diminishing or increasing the amount of fuel burned per minute in the furnace 21. The temperature of the furnace product, which may be withdrawn from the furnace 5 through a tap hole 30, may be indicated in any desired manner, and often will be apparent to the operator from its physical condition and appearance. If the temperature of the furnace product becomes too low, the temperature of the air blast is increased and in this manner the furnace product is brought to the desired temperature, and similarly a decrease in the temperature of the furnace product is effected by decreasing the temperature of the air blast. This procedure gives the operator immediate control of the temperature of the furnace product. The preheating of the air blast may be regarded in the nature of a factor of safety, since under favorable operating conditions preheating of the air blast may be dispensed with for several hours, or even several days, at a time, and then the operating conditions will alter so that it is necessary to preheat the air blast in order to secure the desired temperature of the furnace product. The preheating of the air blast may further be considered in the light of a final adjustment for securing the desired temperature of the furnace product. The fuel combustion within the furnace 5 will impart to the furnace product a certain temperature, and the heated air blast in conjunction with the adjustability of its temperature provides a relatively fine, as well as final, adjustment of the temperature of the furnace product.

I claim:—

1. The improvement in the process of smelting or fusing metallic substances which comprises subjecting the metallic substance in a furnace to the action of the heat resulting from the combustion of fuel, and controlling the temperature of the furnace product by means of a heated air blast whose temperature can be rapidly regulated at will.

2. The improvement in the process of smelting or fusing metallic substances which comprises subjecting the metallic substance in a furnace to the action of the heat resulting from the combustion of fuel, and introducing into the combustion zone of said furnace a heated blast of air whose temperature is less than about 500° F.

3. The improvement in the process of smelting or fusing metallic substances which comprises subjecting the metallic substance in a furnace to the action of the heat resulting from the combustion of fuel, and introducing into the combustion zone of said furnace a heated blast of air at a temperature of approximately 240° F.

4. The improvement in the process of smelting or fusing metallic substances which comprises subjecting the metallic substance in a furnace to the action of the heat resulting from the combustion of fuel, and introducing into the combustion zone of said furnace a blast of air whose temperature can be regulated from about 500° F. down to normal atmospheric temperature.

5. The improvement in the process of heat treating materials which comprises subjecting the material in a furnace to the action of the heat resulting from the combustion of fuel, and introducing into the combustion zone of said furnace a blast of air whose temperature can be regulated from about 500° F. down to normal atmospheric temperature.

6. The improvement in the process of heat treating materials which comprises subjecting the material in a furnace to the action of the heat resulting from the combustion of fuel, introducing a heated blast of air into the combustion zone of said furnace, and automatically preventing the temperature of said air blast from exceeding a predetermined maximum value.

In testimony whereof I affix my signature.

BRADLEY STOUGHTON.