

(Specimens.)

H. H. EAMES.

PROCESS OF DESULPHURIZING METALLIC ORES.

No. 502,431.

Patented Aug. 1, 1893.

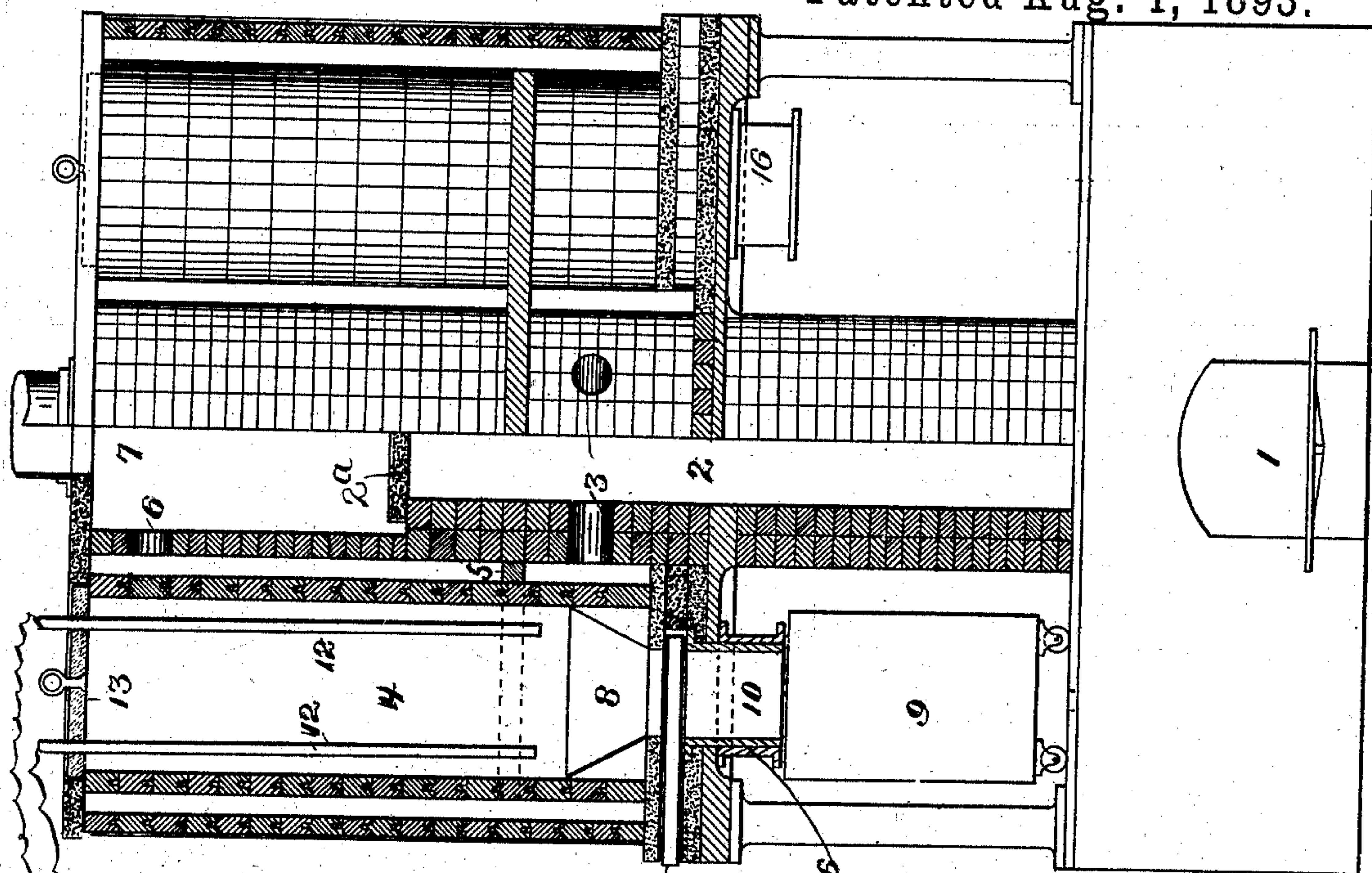


Fig. 1.

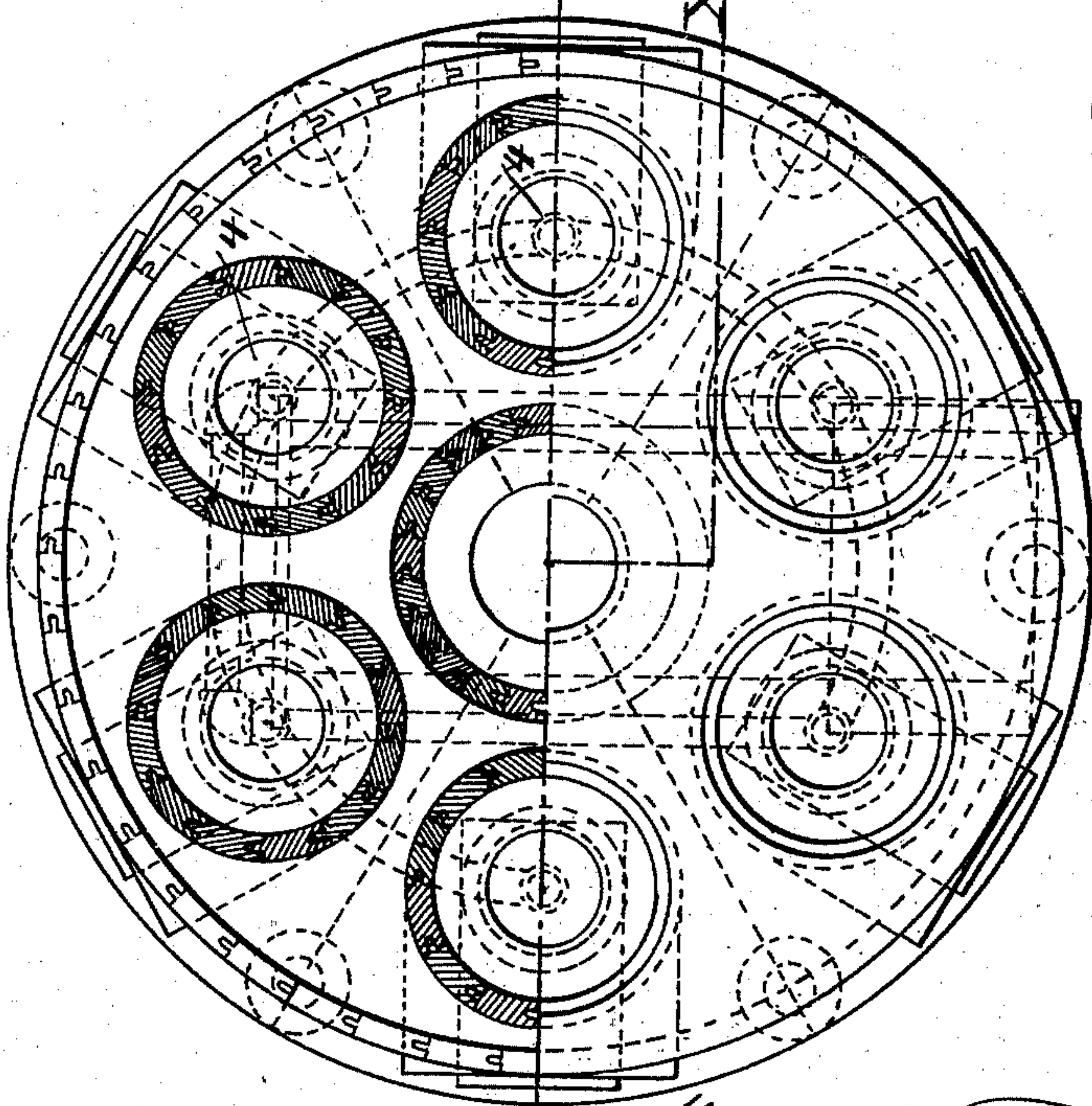


Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

HENRY H. EAMES, OF BALTIMORE, MARYLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE EAMES PURIFYING AND SEPARATING COMPANY, OF WEST VIRGINIA.

PROCESS OF DESULPHURIZING METALLIC ORES.

SPECIFICATION forming part of Letters Patent No. 502,431, dated August 1, 1893.

Application filed April 30, 1888. Serial No. 272,308. (Specimens.) Patented in England October 16, 1888, No. 14,837.

To all whom it may concern:

Be it known that I, HENRY H. EAMES, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in the Process of Desulphurizing Metallic Ores; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to processes for refining, purifying or discharging impurities from minerals and metallic ores and also to the extraction from those ores or other substances containing it, sulphur, in a liquid or semi-liquid form and by means of which the metals in the ores will be left in a state approximately pure.

I have obtained British Letters Patent of October 16, 1888, No. 14,837, for improvements in the process of and apparatus for extracting iron from its ores and in obtaining by-products.

Figure 1 represents an elevation partially in section of the furnace used for carrying my process into effect. Fig. 2 is a plan view of the same partially in section.

The view shown in Fig. 1 represents a section of Fig. 2 taken on the line $x-x$.

In the drawings 1 represents a furnace; 2 the fire chamber or stack which is closed at the top by a slab 2^a which separates the portion of the stack 2 from the portion of the stack 7 above it and causes the fire to be deflected through the fire-passages 3 into the fire-passage around the crucible and out through the fire passages 6 into the portion 7 of the stack.

3—3 are flue holes communicating from the stack 2 into a fire space surrounding each crucible 4—4—4. 5 is a fire-wall in the fire space around said crucible which will deflect the fire and cause it to surround the crucible.

6—6 are fire outlet holes by which the fire and products of combustion escape again into the stack 7 which is a continuation of stack 2.

8 is a hopper in the bottom of the crucible 4. 9 is a receptacle or car located below the crucible.

10 is a collar or fitting funnel connecting the hopper 8 with the receptacle or car 9. 55

16 is a sleeve surrounding the collar 10 secured to the under side of the frame-work of the crucible and employed for the purpose of securing the car 9 to the lower end of the collar 10. 60

11 is a closing slide which enters a slot below the crucible 4 and separates crucible 4 from receptacle or car 9.

12—12 are electrodes generally made of carbon rods, extending into the crucible 4 through the cover 13 and connected by wires 14—14 to a dynamo or battery 15. The cover 13 is hermetically sealed so as to prevent the admission of air. The slide 11 is fitted so as to make a hermetical seal at the bottom of the crucible and the receptacle or car 9 is fitted hermetically to the throat or funnel 10. The whole is so arranged that when a charge of ore is placed in the crucible 4 it will be entirely out of contact with the atmosphere and it may be heated and treated by the action of the heat and current at a comparatively low temperature and in the presence only of its own self-generated gases. 70

It is well known that sulphur exists in many earths and ores throughout the country. By my method I place the ores or other substances containing the sulphur into a closed receptacle so as to exclude the air and then apply heat thereto while the air is excluded, and a current of electricity, by means of which the sulphur is separated or eliminated, and the metal is left in a gangue or matrix. 80

The impurities which exist in these ores or earths are numerous and may be classed under the general head of substances other than metals. Many of them contain sulphur, some of them phosphorous, and some of them both sulphur and phosphorous. 85

A description of my method of treatment as applied to what are known as the sulphide and oxide ores will be sufficient to illustrate the entire process which consists in placing the ores in a closed vessel to exclude the air and subjecting them while so inclosed to the 90 100

action of heat and electricity, by means of which the foreign substances are eliminated either in gaseous form combining with other elements or are driven out as in the case of the sulphide ores, where the sulphur is discharged in a semiliquid form.

I will first describe the operation of my process with the sulphide ores and afterward with the oxides. I take the sulphides and break up the large lumps into convenient shapes and sizes and place them in a closed retort. This retort may or may not be provided with means for discharging the air within it; in general practice the air in the retort will not injure the process, but it is important to have it sealed so that air cannot enter during the operation of the process. I then heat the ores while thus inclosed and subject the mass to the action of an electric current while heated and excluded from the air. The result is that the impurities are discharged from the ores; the sulphur falling by gravity to the bottom in a liquid or semiliquid form to be utilized as required and leaving the ore in the shape of a friable sponge in which the gold and some other metals remain in a pure or nearly pure state mixed in the gangue or matrix to be separated from each other by another and different process. The process also applies to what are known as arsenical ores. This sulphur may be obtained from ores or earths which have no value except for the sulphur they contain, or it may be obtained from ores containing valuable metals, such as are known as the sulphide ores containing gold, silver, copper, iron, &c., separately or in combination, in which latter they are sometimes called complex ores.

I cannot state the degree of heat required, or the intensity or quantity of the electric current, except approximately. I believe, but do not know the fact, that a heat sufficient to melt the sulphur in the ores will be sufficient; in practice I open the furnace doors and see that the retort containing the ores is about a cherry red in appearance; then I know that the heat is sufficient for practical purposes, and that good results will follow, but I am not prepared to state that good results will not follow from a lower or higher degree of heat, so long as it is not sufficient to volatilize the sulphur or fuse the metal. I have also found that a current of fifteen ampères will answer all practical purposes for each retort, but cannot say that more or less than this will not answer in degree. The degree of heat and volume or intensity of the electric current will in some cases vary according to the ores used. In the case of the oxide ores this same process may be performed, varied rightly to suit the character of the ore. These ores contain oxygen, many of them sulphur and some of them both sulphur and phosphorous. When these ores do not contain sulphur, I mix with them a small quantity of carbon and subject them to the same steps or stages of the process, viz: Put them in a re-

ceptacle, and close it to exclude the air and subject the ores to the action of heat and electricity. The ore in this case is left as in the case of the sulphide ores in the shape of a friable sponge in which the metals remain in a pure or approximately pure state mixed with the gangue or matrix to be separated from each other by another and different process. The quantity of carbon mixed with the ore will depend much upon the character of the ore. I have practically performed the process with about five per cent. of carbon therewith. More than this however would not hurt it, and in some ores the process may be performed with less. When these ores contain sulphur I mix them with lime or limestone, and treat them in the same way, but in this case the sulphur does not run out in a semi-liquid state, but combines with the lime and forms sulphate of lime. The metal however is left in the same condition in the gangue or matrix. Carbon may also be added to the mixture to facilitate the process. It is of no consequence how the heat is applied so that the air is not allowed to come in contact with the ores during the process, nor how the electric current is applied to the mass so long as it is heated to a proper temperature, and excluded from the air. The process is applicable to ores containing iron, gold, silver, copper and other metals. It will be seen that the steps or stages are the same throughout, viz: The inclosing of the ores in a receptacle to exclude them from the air, and subjecting them to the action of heat and electricity while so inclosed. It will also be seen that the product left in the receptacle is the same, viz: the gold and some other metals are left in the gangue or matrix in a pure or approximately pure state, to be separated therefrom by any other process, but in the case of the sulphide ores subjected to this same process there is an additional product, a pure or approximately pure sulphur which in leaving the ore has run out and dropped into its receptacle. The subject matter of my invention may therefore be directed to both the purifying or separating of the metals and also to the obtaining of the sulphur, both of which are accomplished by the same process involving the same series of steps or stages performed upon the ores.

The process involving the treatment of oxide ores above described by the use of carbon has been made the subject-matter of another application filed by me March 15, 1893, Serial No. 466,019.

What I claim, therefore, and desire to secure by Letters Patent, is—

1. The method of eliminating impurities and foreign substances from metallic ores, by placing them in an entirely closed vessel and subjecting them while so inclosed to the action of heat insufficient to fuse the ore and an electric current.

2. The method or process of purifying or refining sulphide ores or minerals containing

5 sulphur, by inclosing said minerals or ores in a receptacle out of contact with the atmosphere and subjecting the same while so inclosed to the action of heat and an electric current, whereby the sulphur is discharged in a liquid or semi-liquid form and the gold and some other metals are left in the gangue or matrix in a pure or approximately pure condition.

10 3. The method or process of obtaining sulphur from minerals or metallic ores which contain it, by first placing the ores in a closed receptacle to exclude the air and subjecting them while so inclosed to the action of an electric current and a heat sufficient to liquidize the sulphur, whereby the sulphur is discharged in a liquid or semi-liquid form.

20 4. The method or process of purifying or refining oxide ores containing sulphur by inclosing said ores with a suitable quantity of lime or limestone in a receptacle out of contact with the atmosphere, and subjecting them

while so inclosed to the action of an electric current and a heat sufficient to eliminate the sulphur without fusing the metals whereby the metals are left in the gangue or matrix in a pure or approximately pure condition. 25

5. The method or process of purifying or refining oxide ores containing sulphur by mixing them with carbon and lime or limestone, then inclosing the ores in a receptacle out of contact with the atmosphere and then subjecting them while so inclosed to the action of an electric current and a heat insufficient to fuse the metals in the ores, whereby the metals are left in a pure or approximately pure condition in the gangue or matrix. 30 35

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. EAMES.

Witnesses:

JNO. T. MADDOX,
WM. L. BAILIE.