

No. 744,036.

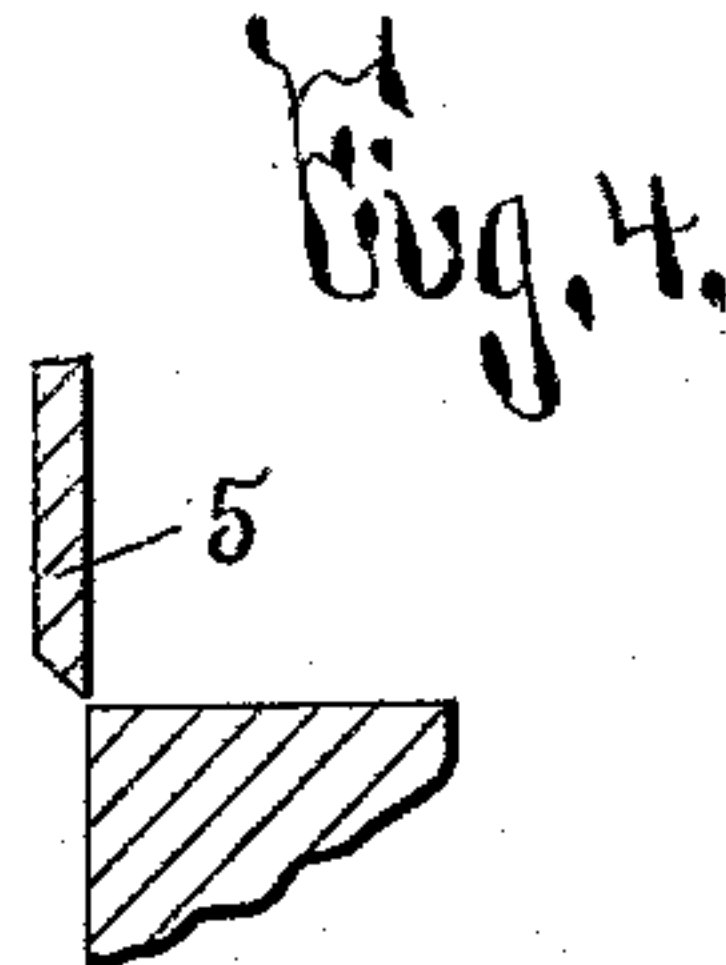
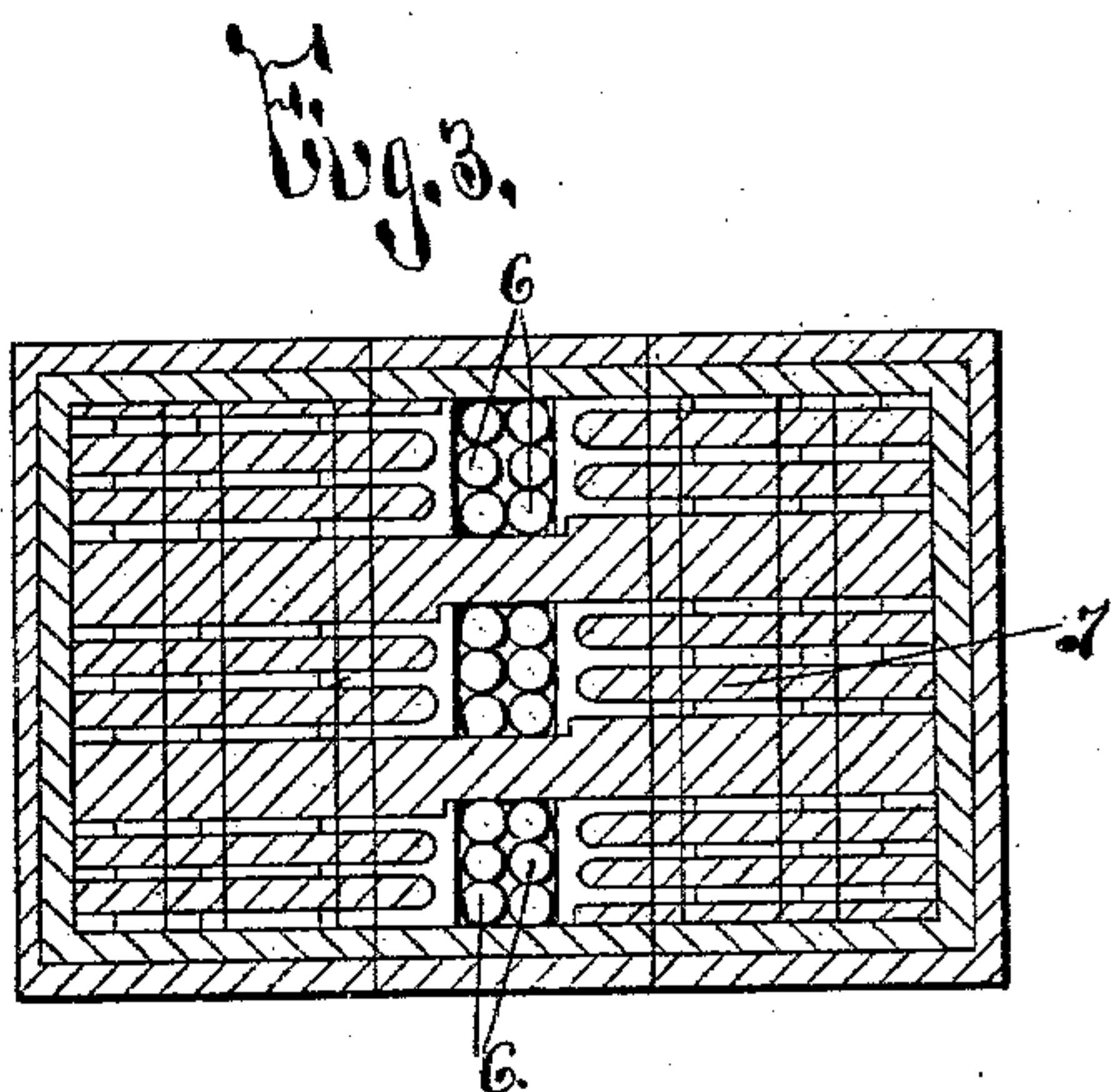
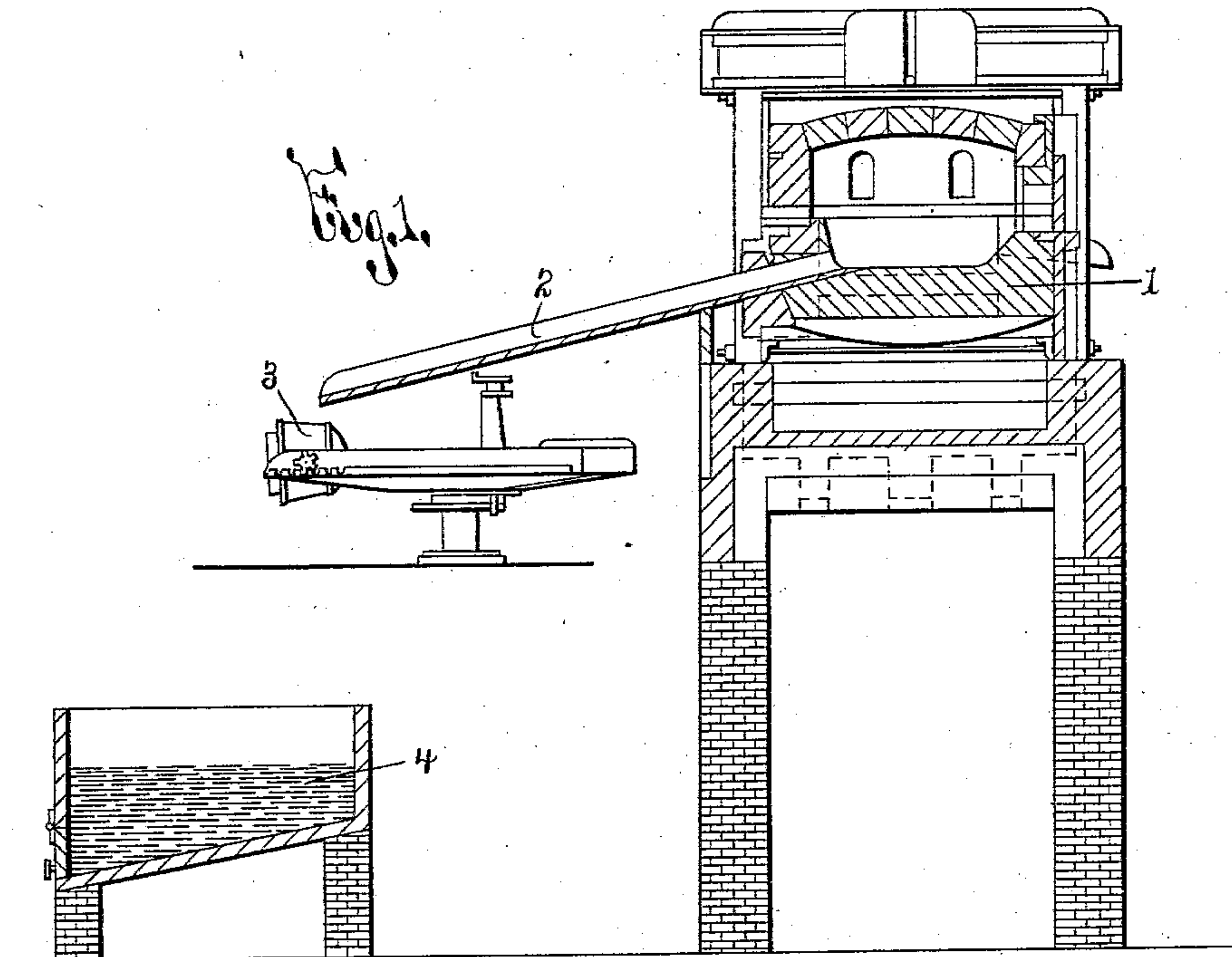
PATENTED NOV. 17, 1903.

W. B. BROOKFIELD.

PROCESS OF MANUFACTURING STEEL.

APPLICATION FILED DEC. 30, 1902. RENEWED SEPT. 2, 1903.

NO MODEL.



WITNESSES:

Chas. J. Jones.
Chas. Young.

INVENTOR

William Bertin Brookfield.

BY

Henry Parsons
ATTORNEYS

UNITED STATES PATENT OFFICE.

WILLIAM BERTIN BROOKFIELD, OF SYRACUSE, NEW YORK.

PROCESS OF MANUFACTURING STEEL.

SPECIFICATION forming part of Letters Patent No. 744,036, dated November 17, 1903.

Application filed December 30, 1902. Renewed September 2, 1903. Serial No. 171,697. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM BERTIN BROOKFIELD, of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Process of Manufacturing Steel, of which the following is a specification.

This invention has for its object a process of producing steel known commercially as "crucible-steel" which is particularly practical and causes the product to be especially uniform in hardness and character; and to this end the invention consists in the manner of treatment hereinafter specifically pointed out and claimed.

In describing this invention reference is had to the accompanying drawings, in which like characters refer to corresponding parts in all the views.

Figure 1 is a sectional view, partly in elevation, of the greater portion of one form of apparatus for carrying out my process. Figs. 2 and 3 are sectional views, respectively, of one of the crucibles and a crucible-furnace forming part of said apparatus. Fig. 4 is a detail view of means for cutting bars or plates of the product formed by my process before the final fusing of the ingredients composing the steel.

In the commercial manufacture of crucible-steel the component ingredients, including material, as iron, forming a base, and the metallic alloying substances are inserted into the respective crucibles and are subsequently fused, and the fused mixtures are cast into ingots which are rolled or otherwise manipulated for forming finished bars or plates. Owing to the insertion of the ingredients composing the steel into a number of different crucibles of relatively small capacity there is obviously more or less variation in the character of the steel produced from the mixtures fused in the respective crucibles. One of the metallic alloying ingredients inserted into the crucibles for forming steel in this manner is chromium, and, as is obvious to those skilled in the art, the chromium raises the fusing-point of the mixtures, does not readily and uniformly unite with the iron, and unites to a greater or less extent with the carbon of the crucibles or melting-pots, thus causing the steel product to be more or less seamy and

ununiform in carbon and materially lessening the lifetime of the crucibles.

By my invention crucible-steel is produced in a novel manner, as follows: The material, as iron, forming a base, and a metallic alloying substance, as chromium, are melted together in bulk in suitable means, as an "open-hearth" furnace 1, Fig. 1, and are thus refined, mingled, and united to a maximum degree. I usually first fuse the iron in the furnace 1 and then add the chromium and subject the entire mass to heat in said furnace until the two metals are thoroughly mixed together. The iron and chromium compound is cooled and mechanically broken up or subdivided into small parts or fragments in any desired manner. In the illustrated apparatus for carrying out my process said compound is conducted from the furnace 1 through a trough 2 into a ladle 3 and while molten is dropped from said ladle into a body of water or other liquid in a receptacle 4, whereupon the compound readily separates into substantially spherical bodies of relatively small size, which are quickly cooled in the water, are uniform in hardness and character, and are easily handled and fused. It will be understood that the furnace 1 or the trough 2 is provided with suitable means for controlling or preventing the flow of the molten metal from the furnace through the trough. If desired, the iron and chromium compound or mixture may be discharged from the ladle 3 into molds and cast into ingots which may be rolled into bars or plates, and said bars or plates while hot may be cut by a knife 5, Fig. 4, or other tool. Said broken-up or subdivided iron and chromium compound is then filled into crucibles 6 with the desired amount of other metallic alloying substance, as molybdenum, and the same are fused in a crucible-furnace 7, whereupon the molybdenum readily unites with the iron and chromium.

In following out this process I preferably use the iron, chromium, and molybdenum in the following proportions, by weight: iron, 95.50 to 77.50 parts; chromium, 1.50 to 7.50 parts, and molybdenum three to fifteen parts.

The length of time during which the iron and chromium are heated in the furnace may

be from one to twelve hours, and the length of time during which the iron and chromium compound is heated in the crucibles with the molybdenum may be from one to six hours.

5 To those skilled in the art it will be understood that the proportions of the material, as iron, forming a base, and the metallic alloying substances, as chromium and molybdenum, and the length of time during which the same
10 are subjected to heat are dependent more or less upon the grade of the materials and that a small amount of silicon, usually less than two per cent, is present in the finished product. It will also be understood that instead
15 of iron a good grade of soft steel may be used.

It will be particularly noted that by producing steel as described the materials are refined by the fusing and heating in the furnace and are thoroughly mixed, even though
20 the steel is low in carbon, that the uniting of the material, as iron, forming a base, and the metallic alloying substance, as chromium, in the furnace reduces to a minimum the liability of the combination of said alloying substance with the carbon of the crucibles and the resultant disintegration and destruction
25 of the crucibles, and that the entire process greatly facilitates the production of a finished product of maximum uniformity in hardness and character and the manufacture of finished bars or plates which are free from defects, as seams, &c., to a maximum degree.

30 Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

35 1. The herein-described process of producing steel, the same consisting in fusing together part of the ingredients for forming the steel, said ingredients fused together including material forming a base and a metallic
40 alloying substance, subdividing the mass of said ingredients, and then fusing said subdivided product with the balance of the ingredients for forming the steel, substantially
45 as and for the purpose described.

2. The herein-described process of producing steel, the same consisting in fusing together part of the ingredients for forming the steel, said ingredients fused together including material forming a base and a metallic
50 alloying substance, dropping the fused mixture into a body of liquid and thereby reducing said mixture to a subdivided or fragmentary condition, and then fusing said subdivided product with the balance of the ingredients for forming the steel, substantially as
55 and for the purpose specified.

3. The herein-described process of producing steel, the same consisting in fusing in bulk together material forming a base and a
60 metallic alloying substance, reducing the resultant product to a subdivided or fragmentary condition, and then fusing said subdivided product with other metallic alloying substance substantially as and for the purpose
65 described.

4. The herein-described process of producing steel, the same consisting in fusing iron and chromium together, subdividing the mass of said fused iron and chromium, and fusing
70 said subdivided iron and chromium mixture with molybdenum, substantially as and for the purpose described.

5. The herein-described process of producing steel, the same consisting in fusing iron
75 and chromium together, dropping the fused mixture into a body of liquid and thereby reducing said mixture to a subdivided or fragmentary condition, and then fusing said subdivided product with molybdenum, substantially as and for the purpose set forth.
80

In testimony whereof I have hereunto signed my name in the presence of two attesting witnesses, at Syracuse, in the county of Onondaga, in the State of New York, this 27th
85 day of December, 1902.

WILLIAM BERTIN BROOKFIELD.

Witnesses:

D. LAVINE,
S. DAVIS.