

No. 687,716.

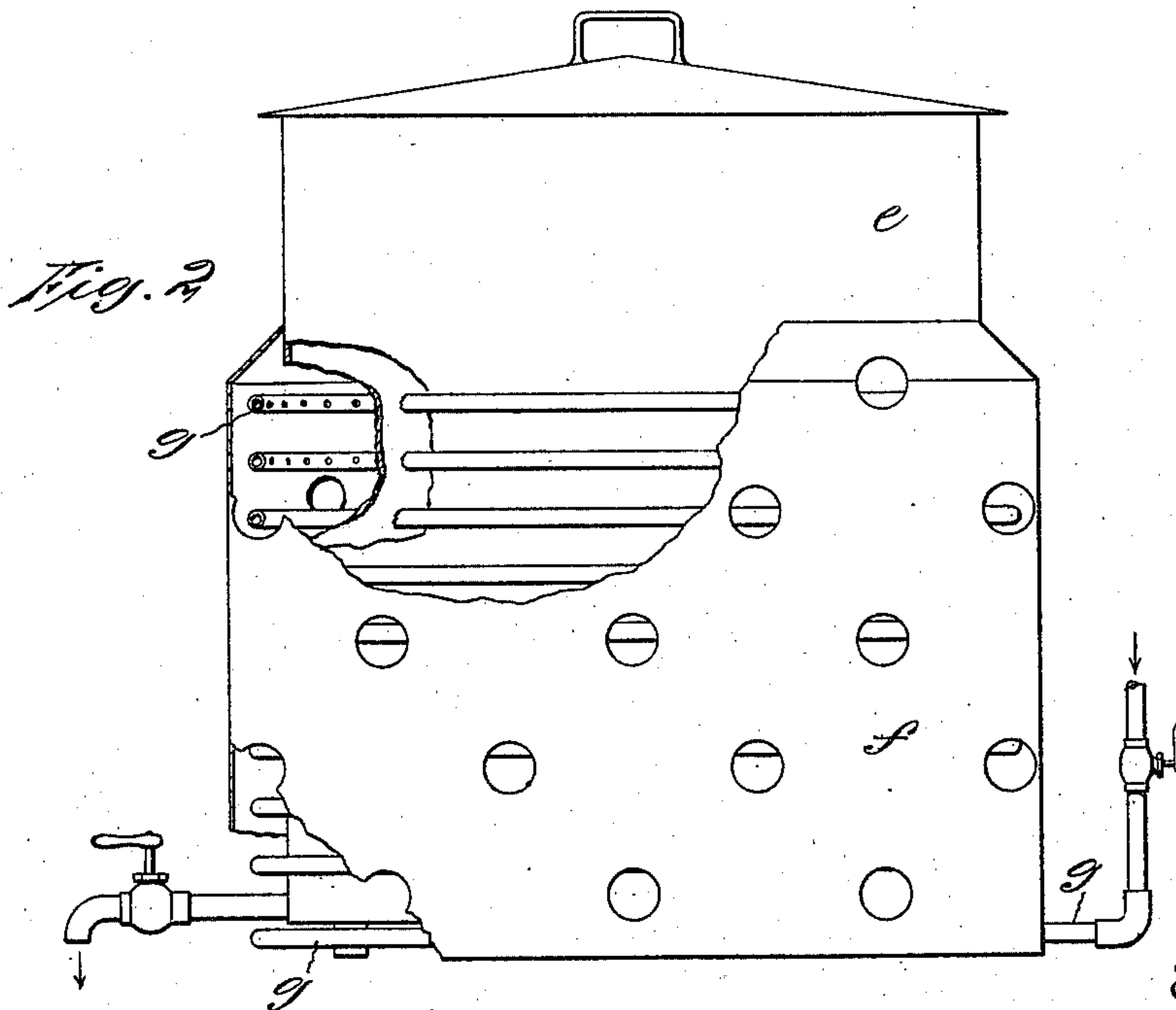
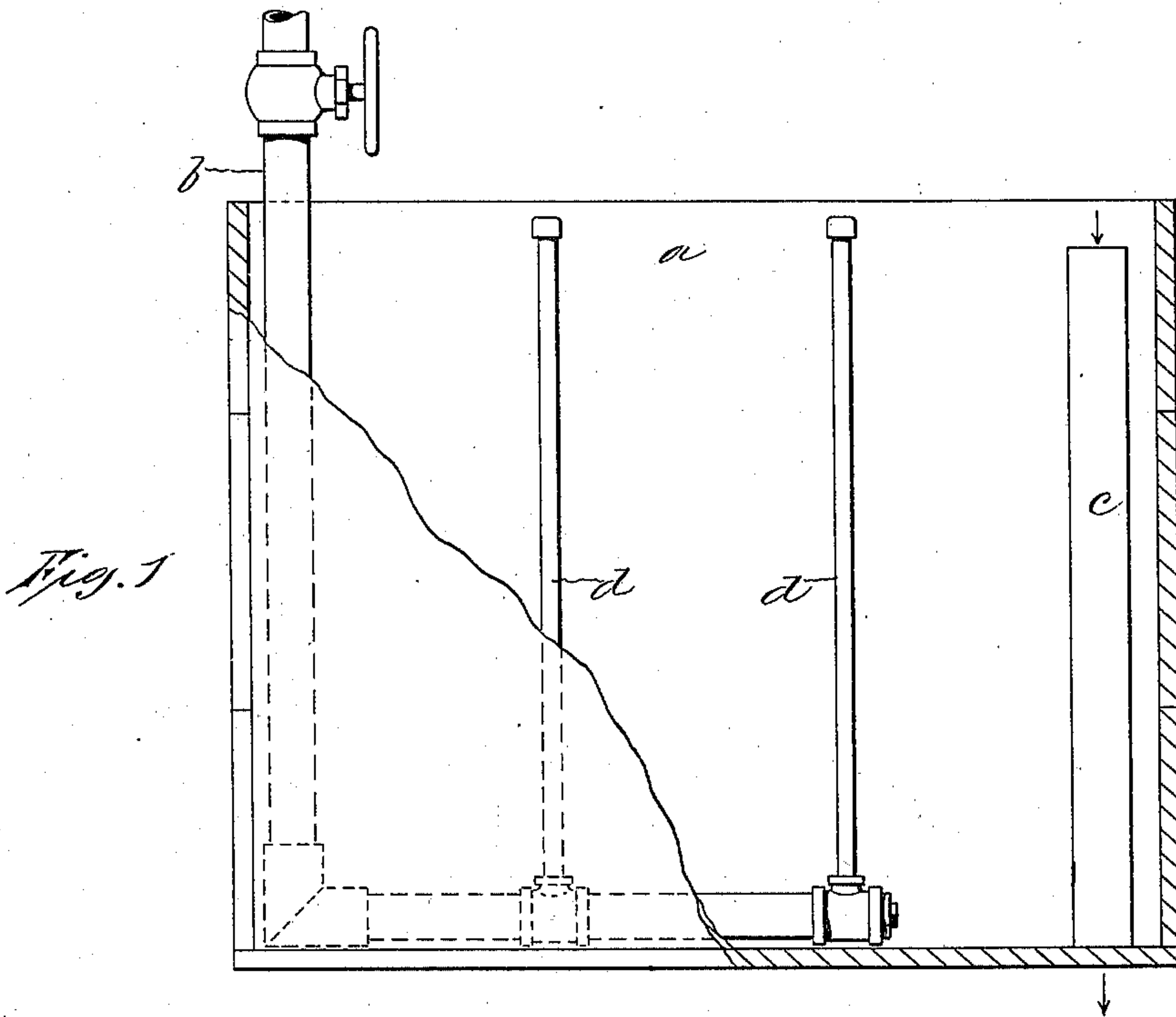
Patented Dec. 3, 1901.

W. R. BENNETT.

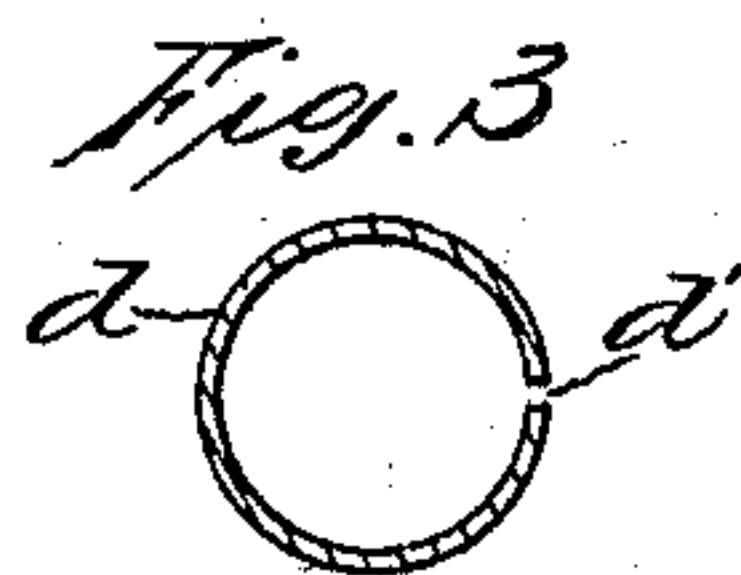
PROCESS OF HARDENING AND TEMPERING STEEL.

(Application filed Mar. 14, 1901.)

(No Model.)



Witnesses
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UNITED STATES PATENT OFFICE.

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PROCESS OF HARDENING AND TEMPERING STEEL.

SPECIFICATION forming part of Letters Patent No. 687,716, dated December 3, 1901.

Application filed March 14, 1901. Serial No. 51,086. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM R. BENNETT, a citizen of the United States of America, residing at New Britain, in the county of Hartford and State of Connecticut, have invented a certain new and useful Process of Hardening and Tempering Steel, of which the following is a description, reference being had to the accompanying drawings, wherein—

Figure 1 is a view, partly in section, of a hardening-tank. Fig. 2 is a view, partly in elevation, partly broken away, and partly in central vertical section, of an oil-tank. Fig. 3 is a view in cross-section, enlarged scale, of one of the upright pipes hereinafter mentioned.

The object of the improvement is the hardening and tempering of steel in large masses—for instance, cutters, dies, and projectiles—and preventing the stock from cracking and undue shrinking, checking, and from having unequal internal strains.

The stock to be hardened and tempered is first heated to a desired degree in any proper way. It is then plunged into a bath of water, which is kept in motion where it comes in contact with the stock by freshly-inflowing streams. Any suitable fluid can be used as a cooling-bath. A tank for this work is shown in Fig. 1, wherein the letter *a* denotes a tank, *b* inlet-pipe, and *c* overflow-pipe. From the inlet-pipe rise the upright pipes *d*, as many in number as may be desired. These upright pipes are mortised along one side, as at *d'*, and the incoming water finds access to the tank through these mortises. The heated stock is plunged into the bath between these upright pipes *d*, with the effect that the inflowing streams of water or the like keep the water and the bath in motion where it contacts with the surface of the stock. This movement of the water on the surface of the stock causes the stock to be uniformly hardened. The stock is left in the water until the vibration incident to the cooling is about stopping, (something easily felt by an operator, who holds the stock by a pair of tongs or by a pulley-block.) It is then suddenly drawn from the water-tank and immersed in a tank of oil, preferably animal oil. A tank for that purpose is shown in Fig. 2. The oil contained therein would naturally be at about the temperature of the room—say 80° Fahrenheit. The stock is kept in the oil-

bath until it has heated the oil to a desired degree, preferably until the oil and stock are practically of one temperature. There is a thermometer inside of the oil-tank for observing temperature. After the oil has thus been heated by the stock the gas-flames (shortly hereinafter described) are lighted about the vessel which contains the oil, and the oil and stock are heated together up to the temperature required—say to 380° or 400° Fahrenheit. The oil when inclosed will not flame until a temperature from 550° to 565° Fahrenheit is attained. After the stock has thus been heated to a desired temperature together with the oil the gas-flames are shut off. The stock is buried in sawdust or other proper material and allowed to cool.

In Fig. 2 the letter *e* denotes the vessel which contains the oil. The letter *f* denotes a jacket outside the same, perforated for the inflow of air. The letter *g* denotes a gas-pipe containing numerous apertures so located and directed that their flames when ignited play upon the oil vessel *e*. By preference this coiled gas-pipe is arranged both below the oil vessel and also around it. It is of course provided with a stop-cock for shutting off the gas when desired. The letter *h* denotes a cock for drawing off the contents of the vessel *e*.

I claim as my improvement—

1. The process of hardening and tempering steel which consists in, first, heating the stock, second, cooling it in a bath, third, immersing it in oil till it heats the oil to the desired degree, and, fourth, heating the oil and stock together to a higher degree, all substantially as described and for the purposes set forth.

2. The process of hardening and tempering steel which consists in, first, heating the stock, second, cooling it in a bath of water keeping said bath in motion at its contact with the stock by freshly-inflowing streams, third, immersing the stock in oil till it heats the oil to a desired degree and, fourth, heating the oil and stock together to a higher degree, all substantially as described and for the purposes set forth.

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