No. 741,618. PATENTED OCT. 20, 1903.

W. A. BOLE.

ART OF MAKING METAL CASTINGS.

APPLICATION FILED APR. 18, 1902.

NO MODEL.

Fig. 1.

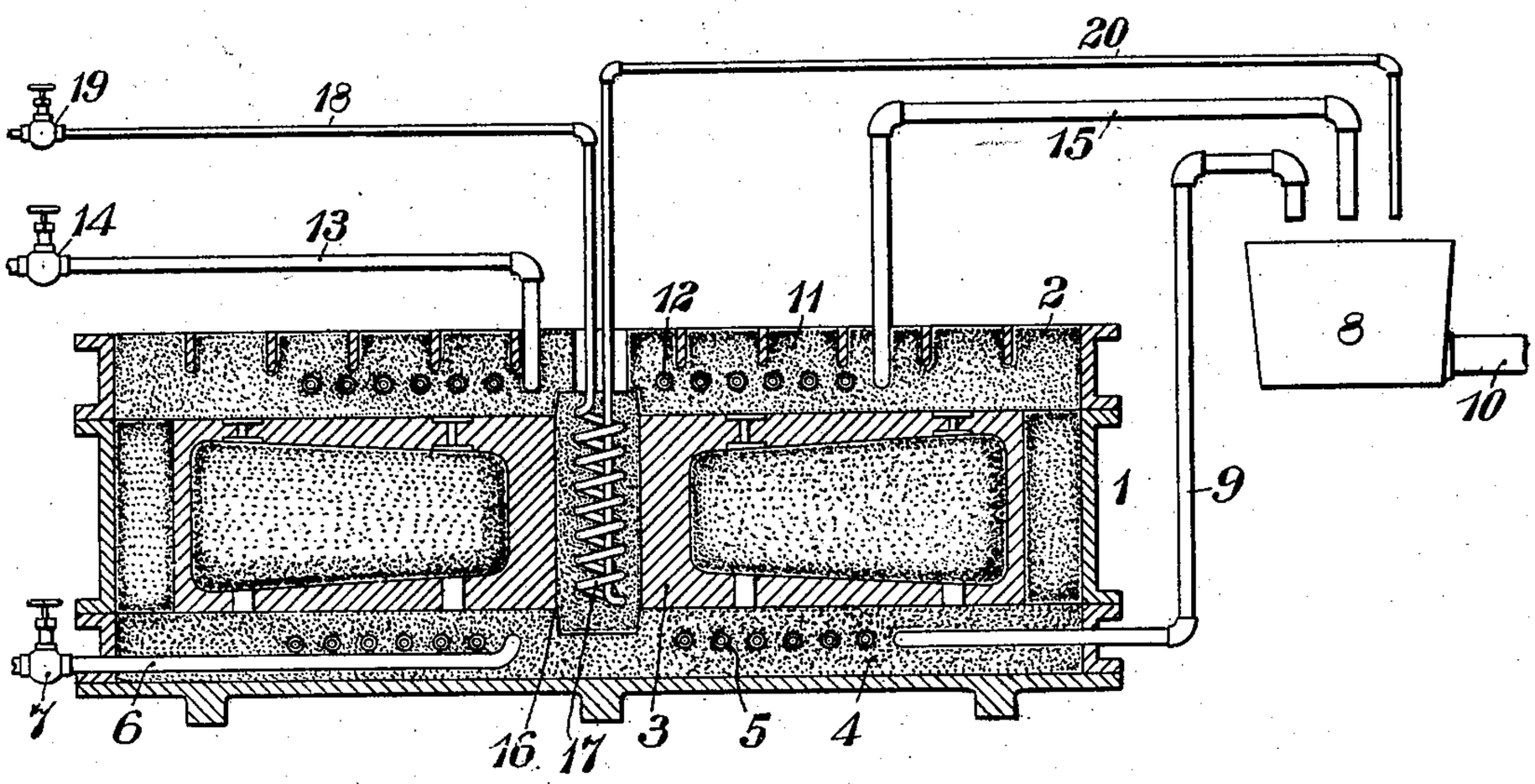


Fig. 2.

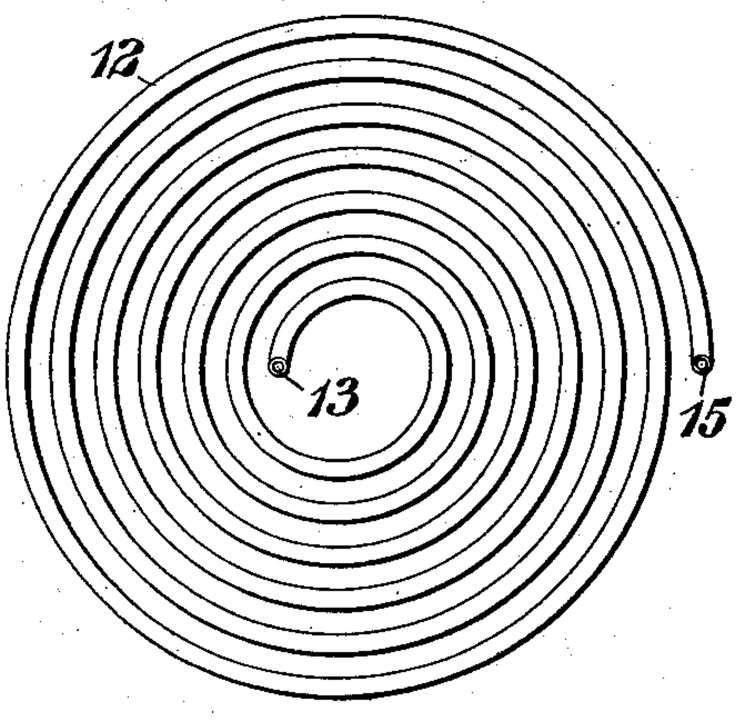
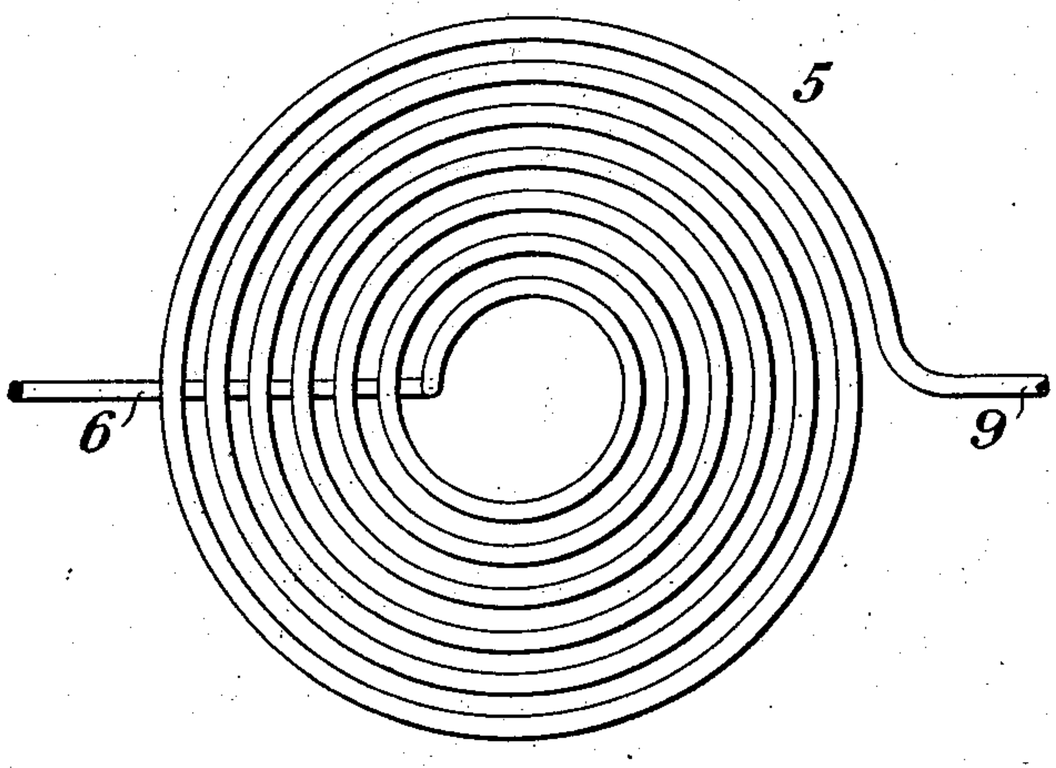


Fig. 3.



WITNESSES:

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No. 741,618. Patented October 20, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM A. BOLE, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

ART OF MAKING METAL CASTINGS.

SPECIFICATION forming part of Letters Patent No. 741,618, dated October 20, 1903.

Application filed April 18, 1902. Serial No. 103,619. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. BOLE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Art of Making Metal Castings, (Case No. 1,049,) of which the following is a specification.

My invention relates to the art of casting metal; and it has for its object to provide a method which shall insure substantially synchronous cooling, and consequently synchronous shrinkage of all portions of the metal constituting a casting or such other regulated cooling and shrinkage as shall tend to so control internal strains as to obviate danger of rupture of the casting by reason of such strains.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section through a sand mold provided with means for practicing my method, and Figs. 2 and 3 are respectively plan views of two of the coils shown in Fig. 1 through which cooling liquid is circulated.

In making castings which comprise unequal thicknesses of metal, particularly if the castings are of large size, some portions will cool more rapidly than others, and it follows that the thicker and heavier sections continue to contract after the thinner sections have assumed their final dimensions, strains being thus produced in the castings which are sometimes so serious as to cause the castings to rupture, even while in the mold, and sometimes giving no visible sign of their existence until the skin of the castings is removed by machining, when the internal stresses produce a rupture of the casting. Cases have been known in which the rupture due to internal strains took place months after the castings were made and without any previous visible indication of the existence of such strains.

In the case of castings having different portions of unequal thickness the thicker portions obviously cool and solidify much more slowly than the thinner portions, this being specially pronounced where the outer portions are the thinner ones, since the more rapid cooling incident to the lesser thickness of the metal is further enhanced by the more ready radiation of heat toward the outer surface of the flask or of the mold. By reason of this unequal cooling lack of uniformity of crystalline structure and consequently unbalanced strains are present in the casting. I avoid these difficulties by artificially cooling the thicker portions of the casting, which would naturally cool slowly, and independently regulate the cooling effect at different points, so as to secure an approximately uniform rate of cooling throughout the casting.

In the drawings the flask 1 contains a sand mold 2 for casting an iron piston 3, this being given as an example of a large casting having different thicknesses of metal, which unless specially treated would not cool synchronously. In order to properly cool the thicker portions of the metal, I provide the lower part or drag 4 of the mold with a spiral coil 5, placed as close to the face of the mold as is practicable, to which a cooling liquid, such as water, is supplied from a suitable source through a pipe 6, in which is a cock 7 for regulating the flow. The other end of the coil 5 communicates with a vessel 8 for receiving the waste water through a pipe 9, the vessel 8 being connected by a pipe 10 with a sewer or other suitable place for discharging the waste water. The upper part or cope 11 of the mold is also provided adjacent to the face of the mold with a spiral coil 12, supplied with water from a suitable source through a pipe 13, in which is a valve 14 for regulating the flow. The other end of the coil also discharges through a pipe 15 into the vessel 8. In this particular form of casting the core 16, which provides the piston-rod opening, is also provided with a coil of pipe 17, here shown as having the form of a helix and as connected at one end to a supply-pipe 18, having a regulating-valve 19, and as having its other end connected to a pipe 20, which discharges into the vessel 8.

In practicing my method I first pour the molten metal into the mold, and after the ladle is removed I open the cocks 7, 14, and 19 and thereafter regulate the flow of water

through the several coils in accordance with the cooling effects desired by proper manipulation of the cocks.

The form, number, and location of the cooling-pipes will obviously depend upon the size and shape of the casting, and the apparatus shown is therefore to be understood as merely indicative of separate cooling means for different portions of the casting, the supply of cooling liquid being independently regulated in accordance with the form and size of the casting, so as to insure practically synchronous cooling and hence synchronous and equalized contractions of the metal. It may be sometimes desirable, however—as, for example, in the case of the piston shown or in the case of a pulley—to cool the inner portions more rapidly than the rim in order that the final shrinkage of the rim may serve to bind the structure together in a manner similar to that of a tire which is shrunk upon the felly of a wagon-wheel.

My method enables me to secure either a practically synchronous shrinkage or any artificial deviation therefrom which may be necessary or desirable.

By employing the separate controlling devices 7, 14, and 19 for the several supply-pipes and also providing means whereby the coils may discharge separately it is possible to regulate the quantity of water in each coil as may be necessary in order to produce the desired cooling effect and to determine by feeling the temperature of the water as it discharges from the pipes 9, 15, and 20 or by use of thermometers just what regulation of the supply is necessary in order to keep the cooling of all the parts of the casting uniform, or substantially so.

I claim as my invention—

1. The improvement in the art of making metal castings in sand molds, which consists in promoting approximately synchronous shrinkage of all portions of the metal by subjecting the sand which constitutes the mold, adjacent to different portions of the casting, to the cooling action of independently-regulated quantities of cooling fluid.

2. The improvement in the art of making metal castings in sand molds, which consists in promoting approximately synchronous shrinkage of all portions of the metal by subjecting one or more portions of the sand constituting the mold, adjacent to the casting, to the action of independently-regulated quantities of cooling fluid during the cooling operation.

3. The improvement in the art of making metal castings, which consists in promoting approximately synchronous shrinkage of all portions of the metal by subjecting any one or more of a plurality of different portions of the sand which constitutes the mold, adjacent to the metal, to the action of independently-regulated quantities of cooling fluid during the cooling operation.

In testimony whereof I have hereunto subscribed my name this 11th day of April, 1902.

WILLIAM A. BOLE.

Witnesses:

A. B. GRANGE,

D. C. ARLINGTON.