UNITED STATES PATENT OFFICE.

W. M. ARNOLD, OF NEW YORK, N. Y.

IMPROVED METHOD OF COMBINING WROUGHT-IRON WITH CAST-IRON.

Specification forming part of Letters Patent No. **54,838**, dated May 22, 1866; antedated May 18, 1866.

To all whom it may concern:

Be it known that I, WILLIAM M. ARNOLD, of the city, county, and State of New York, have invented a new and Improved Mode for Combining and Uniting Wrought with Cast Iron, and thus forming solid compound castings to be used in the arts; and I do hereby declare the following to be a full and exact description thereof.

The nature of my invention consists in forming a skeleton of wrought-iron rods or wire or cables of the same general shape as the article to be constructed, after so preparing this wrought-iron as to protect it against the action of molten cast-iron so far as to prevent any injurious effect from the same. I then place it in a suitable mold and cast the melted iron around it, thus securing the rigidity and hardness of cast-iron and the tensile strength of wrought-iron.

In order to protect the wrought-iron from the deleterious effect of the contact of the cast-iron, I cover the former with a coating of tin or some other suitable metal. Copper and various other fusible metals may be used for this purpose. I prefer the use of tin or its compounds, and pure tin is better than any of its alloys, so far as my experience enables me to judge.

In order to prepare the wrought-iron for being coated as aforesaid it should be first cleansed by the use of a solution of sal-ammoniac or other proper substance. It is then tinned by being dipped into a bath of melted metal. One coating is found generally sufficient for the purpose intended.

I prefer forming the skeleton of wrought-iron before subjecting it to the tinning process. When thus prepared it is placed in the mold and the molten metal is poured around it and is allowed to cool in the usual way.

For some purposes it may be advisable to use steel instead of wrought-iron for constructing the skeleton of the casting, and instead of pure cast-iron a composition or an alloy may be used. In fact, I much prefer to use for this purpose a composition patented by myself in August, 1864. The wrought-iron skeleton thus treated and enveloped with cast-iron in a casting will retain its original form and character without being affected or weakened by the contact of the molten metal. The two kinds of iron will thus be solidly united, producing a compound of much greater strength and usefulness than could have been obtained in any other manner.

The principal uses contemplated by me for this compound are its application to the construction of shafts, axles, car-wheels, beams, girders, railroad-bars, and cannon; but it may be applied to many other uses.

In the casting of large shafts I propose to make them hollow, which my mode of construction, above described, renders entirely feasible. By this means I secure much greater strength by the same weight of metal than though the shaft were made solid.

By this union of wrought and cast iron I secure an extraordinary degree of strength. Every one is aware of the great tensile strength of wood. Were the fiber of the wood once separated from the cellular substance in which it is embedded its strength would be trifling in comparison with what it is with all its natural surroundings. The cellular substance, which forms so large a portion of the woody mass, while it exerts directly but a very small portion of actual strength, still, by bracing the fiber and holding it in such a position that the entire strength of all the fibers is exerted at the same time, and before the breach of any one of them commences, the strength of the whole is prodigious. Accordingly, we find that the tensile strength of wood, which is made up in so small a degree of actual fiber, is much greater than than that of a hempen rope of equal area of section and which is made up entirely of fiber.

By my invention I imitate the arrangement by which nature secures such extraordinary results in woody fiber. The skeleton of wire is the fiber; the cast metal performs the functions of the cellular substance in which that fiber is embedded. It is thus effectually braced and firmly held in such positions that the entire strength of all these wrought-iron fibers, lying in the same, or nearly the same, direction, will be called into requisition before there can be any fracture. In addition to all this, the cast metal possesses very great direct and positive strength.

In cases of large castings I prefer forming the wire, in the first place, into ropes or cables the size of which shall be somewhat proportioned

to the magnitude of the article to be cast. These cables I then braid or weave together, sometimes placing one set longitudinally and winding another spirally. Additional courses may be woven or wound around those portions where the greatest strength is requisite, which may in this manner be fortified to any desired extent. The clear spaces between the cables in either of these courses need not be greater than the diameters of the cables themselves, and as the cables increase in magnitude they may relatively be placed in greater proximity to each other. Experiment must determine how close they may be placed without the danger of preventing the metal from penetrating and filling all the interstices between the different cables. Instead of cables, single wires may be used, but in such cases they should be of a pretty large size and placed so far apart as to permit the melted metal to penetrate and fill all the vacant spaces between the wires. Rods or bars of wrought-iron may be used instead of wires or cables.

I do not intend to limit myself to the precise method of construction hereinbefore described, as this can be greatly varied without a departure from the principle of my invention; nor do I propose to confine myself to the use of any particular metal to be melted and used in carrying out my invention; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The mode hereinbefore described for combining and uniting wrought with cast iron—that is to say, forming a skeleton of wire which has been coated or tinned and so arranged and placed at such intervals that the melted metal can penetrate all portions of such skeleton, and then filling those interstices with cast metal, substantially in the manner and for the purpose above set forth.

2. The tinning or coating of iron wire in such a way as to prevent the molten metal which shall afterward be combined with it from producing any injury to such wire, substantially as above set forth.

3. Forming a skeleton of metallic wire, and then filling up the interstices with molten metal, for the purpose and substantially in the manner above set forth.

W. M. ARNOLD.

Witnesses:

R. T. CAMPBELL,

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