(No Model.)

R. H. LIBBY.

COMPOSITE BAR.

No. 332,405. Patented Dec. 15, 1885.

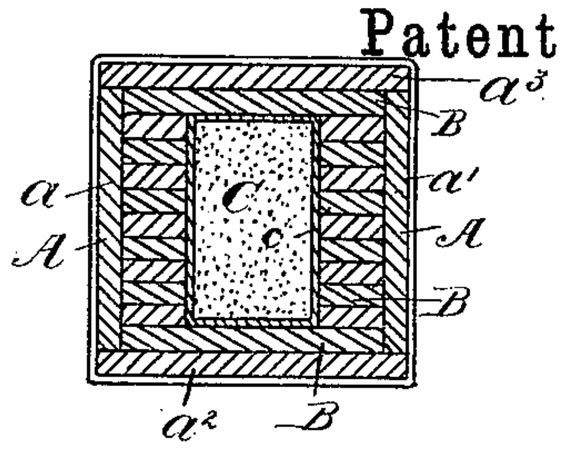

Fig. 1.

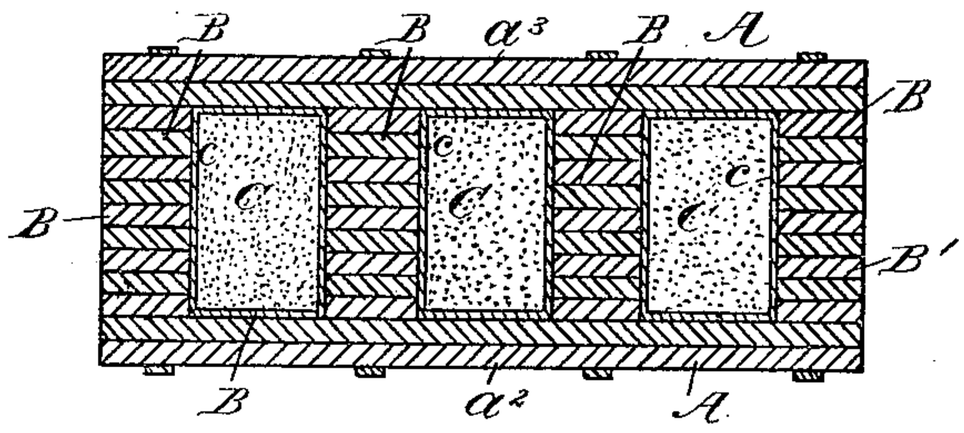

Fig. 2.

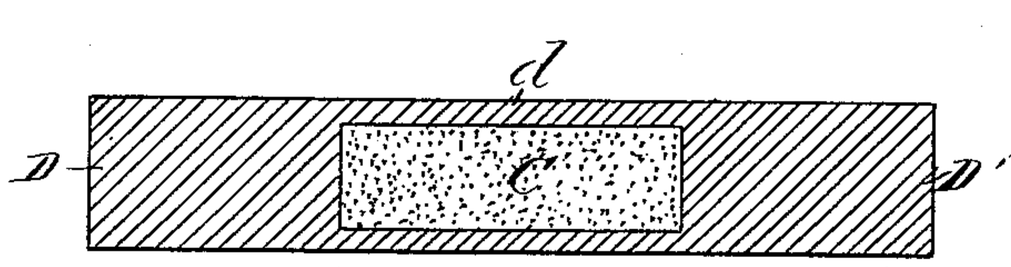

Fig. 3.

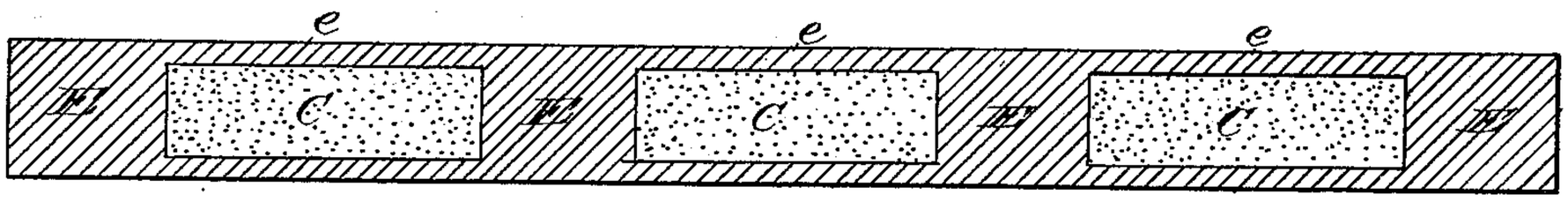

Fig. 4.

WITNESSES

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COMPOSITE BAR.

SPECIFICATION forming part of Letters Patent No. 332,405, dated December 15, 1885.

Application filed September 18, 1885. Serial No. 177,445. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. LIBBY, of Boston, in the county of Suffolk and State of Massachusetts, a citizen of the United States, have invented a new and useful improvement in the art of manufacturing articles of metal having alternating solid and tubular sections, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification in explaining its nature.

The object of the invention is to provide a simple and easy means for producing metal articles having a certain predetermined section or sections thereof of tubular form, and a certain section or sections of solid metal disposed in relation to the tubular sections, as may be desired. The disposition of metal in this alternating solid and tubular form is very desirable for a great many purposes, and especially where it is desirable to obtain strength with comparative lightness in certain parts of the article and solidity in certain other parts—as, for instance, a shaft for transmitting power, or a car-axle, where it is desirable to have the ends of solid metal and the intermediate section inside the journal or wheel-bearings tubular. This produces not only a cheaper shaft or axle, because less metal is required, without increasing the labor, but it makes a better and stronger article than can be produced in any other way with the same amount of metal. I have mentioned these two articles to show the use to which the invention may be put; but I would not be understood as limiting it thereto, as there are many other articles which can be better and more cheaply made by this process than by the present mode of manufacture. I would mention also that the process is especially applicable in making columns, posts, &c., and that the sand or refractory matter by which the tubular section is formed, and which fills it, takes the place of the filling ordinarily placed in hollow columns or posts.

In practicing the invention I make what is known as a "box-pile"—that is, I form the box of slabs or plates of metals—and there is placed within the box the metal which is to be subsequently formed, as hereinafter described, into the desired article, and there is placed in proper relation to the metal within the pile a body of sand or other equivalent refractory material. This sand or refractory material is incased, preferably, in a thin sheet-metal case, and it is located in the pile and in relation to the metal contained therein with regard to the position which it is desired that the cavity or non-metallic part of the article to be produced shall bear to the solid portions thereof. The pile is then covered with a plate or sheet of metal and properly strapped or fastened together. It is then heated in a furnace to a welding heat, and is then submitted to the shaping and forming action of a train of rolls, and treated in the same manner as an ordinary ingot would be treated in the manufacture of metal rods and bars. In drawing the heated pile or ingot to shape the solid metallic portions thereof will remain solid, and be rolled to a solid form, and the portion covering the sand or refractory material will be caused to take a tubular form, the sand or refractory material remaining at the center and acting as a former in producing the tubular section or sections, and is of course elongated with the metal as the pile or ingot is rolled out.

Referring to the drawings, Figure 1 represents a cross-section of one form of box-pile. Fig. 2 represents in longitudinal section another form thereof. Fig. 3 shows the bar or rod made from the heated box-pile shown in Fig. 1 after it has been submitted to the action of the rolls, and Fig. 4 shows the rod or bar rolled from the heated box-pile shown in Fig. 2.

In Figs. 1 and 2, A represents the box or casing of the pile. It is made up of two side pieces or plates, a a', the bottom plate, a^2, and the top plate, a^3.

B represents the metal contained in the box, the ends of which preferably are closed by the piles B′.

C represents the body or mass of sand or other refractory material, and c the sheet-metal casing inclosing it.

In Fig. 1 the sand or refractory material is represented as centrally located in the box-pile, and when thus located the bar or rod rolled therefrom will have solid metallic ends D D′ of the same length as represented in Fig. 3, connected by an intermediate metallic tube, shell, or casing, d, of greater or less

thickness, according to the extent of the reduction of the ingot or pile and the proportion which the sand or refractory matter bears to the metal surrounding it in the pile.

In Fig. 2 the sand or refractory material, instead of being centrally located in one mass in the pile, is arranged in separate bodies or masses, and the spaces between them are filled with metal, and the construction of the box-pile will produce a bar or rod having the tubular metal sections disposed in relation to the solid sections substantially as shown in Fig. 4, where E represents the solid portions and *e* the shells or tubes. Any kind of metal which may be treated as herein described—namely, by being heated to a welding heat and then rolled or otherwise reduced to shape—may be used.

In Fig. 3 the bar or rod best adapted for the manufacture of car-axles is shown.

It will be obvious that the use of my invention for car-axles and for shafting possesses many advantages. For car-axles it will be seen that the ends furnishing the bearings and supports for the wheels can be made solid and the section of the axle between the bearings in the form of a shell, and that for shafting the portions of the shaft which of necessity must be solid for properly supporting pulleys, wheels, &c., can easily be made so, while the intermediate sections may be made tubular or cylindrical, and that car-axles and shafting made in this way are cheaper than the all-metal articles, as they contain less metal, while their strength is increased, and the danger from crystallization decreased on account of the removal of the metal center.

I reserve the right to make a separate application for the process or manner of manufacturing the structure herein described.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

As an improved article of manufacture, a metal structure for shafting, axles, &c., having solid metal sections united by an integral metal section or sections in the form of a tube, cylinder, or continuous shell, all substantially as and for the purposes described.

ROBERT H. LIBBY.

Witnesses:
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