(No Model.)

R. H. LIBBY.

METHOD OF MAKING COMPOSITE BARS.

No. 332,406. Patented Dec. 15, 1885.

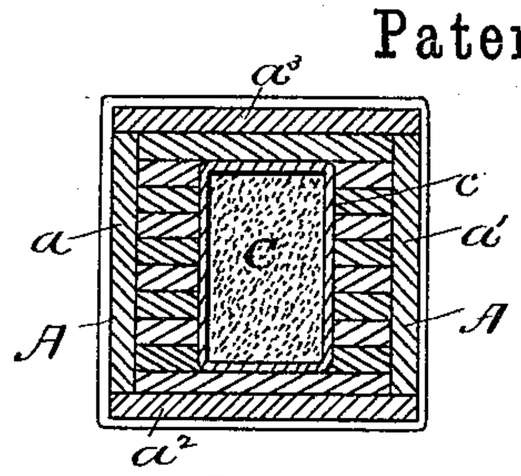

Fig. 1.

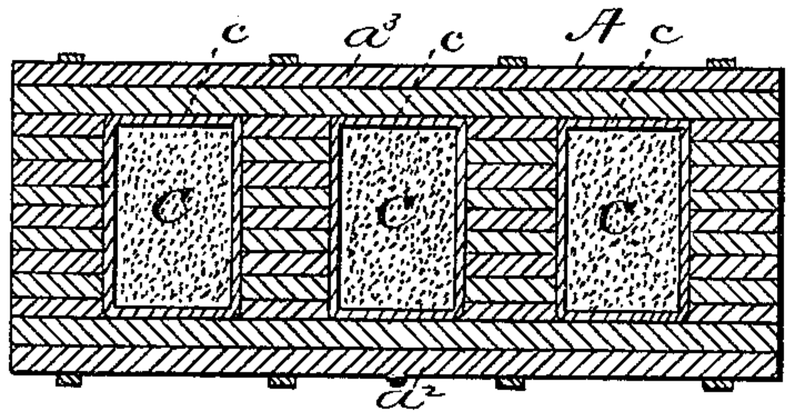

Fig. 2.

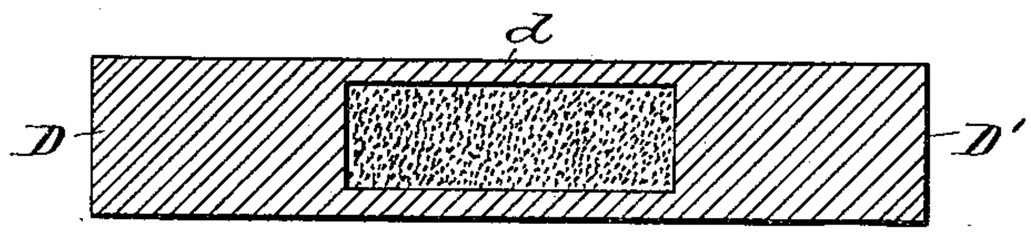

Fig. 3.

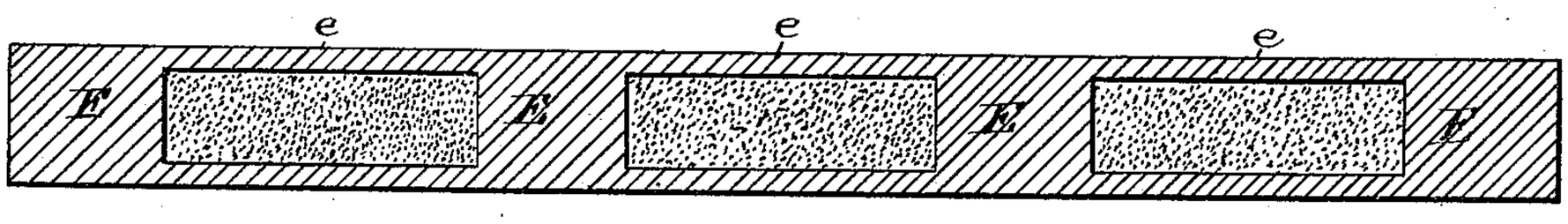

Fig. 4.

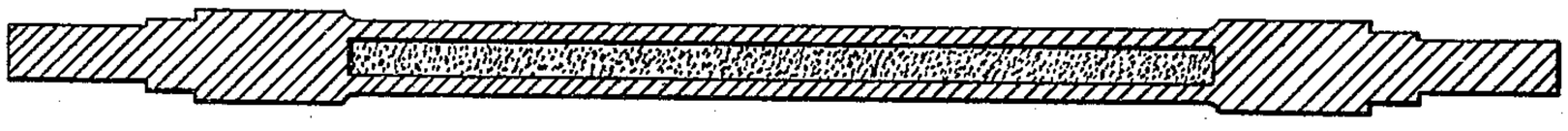

Fig. 5.

WITNESSES.

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METHOD OF MAKING COMPOSITE BARS.

SPECIFICATION forming part of Letters Patent No. 332,406, dated December 15, 1885.

Application filed November 9, 1885. Serial No. 182,218. (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 Car-Axles, Shafting, and other Articles of Metal, 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 of producing car axles, shafting, and other metal articles having sections thereof solid throughout and sections of tubular or cylindrical form, or in the form of a shell connecting the solid sections, and integral therewith.

In the manufacture of car-axles the solid sections occur at the ends of the shafts, and the tubular or cylindrical sections form the portion of the structure between. In shafts the portions of the shaft supporting the pulley, gear-wheel, or other device should be solid and the remaining sections of tubular or cylindrical form. The disposition of metal in structures of this character in alternating solid and tubular or shell form is very desirable for a great many other purposes, and especially where it is essential to obtain strength with comparative lightness in certain parts of the structure and solidity in certain other parts.

In practicing the invention I construct what is known as a "box-pile"—that is, I form a box of slabs or plates of metal so disposed as to assume or form the solid portions of the structure which is to be made, and this necessarily provides the box with one or more compartments or spaces, which are filled with sand or other suitable refractory material in the form of small atoms. This sand or refractory material may be inclosed in a sheet-metal case before it is placed in the pile; but this is not essential, and the sand or refractory material must bear such position in relation to the metal parts of the pile as will produce upon the subsequent treatment the tubular or cylindrical sections desired. The pile having been thus formed of metal and sand or other similar material, is then covered with a plate of metal of suitable thickness, if necessary, and it is 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, by which it is reduced to the form of a rod or bar, being treated in the same manner that an ordinary ingot would be treated in the manufacture of shafting. In drawing the pile or ingot to shape, the solid metal 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 or cylindrical shape, the sand or refractory material maintaining the position in relation to the surface of the bar and to the solid sections thereof which had been provided it in the pile, and acting as a former in producing the tubular or cylindrical section or sections, and it is of course elongated with the metal as the pile or ingot is drawn out.

In 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 represents a bar or rod made from the heated box-pile shown in Fig. 1 after it has been heated and submitted to the action of the drawing-rolls. Fig. 4 shows a rod or bar made from the box-pile shown in Fig. 2 after it has been heated and submitted to the action of suitable rolls, and Fig. 5 is a view of a car-axle made from the bar or rod shown in Fig. 3.

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. The ends of the box are formed by the slabs B, and the other solid metal sections of the pile are represented by B'.

C represents the body or mass of sand or other formative material of a similar nature, and c the sheet-metal casing.

In Fig. 1 the sand or refractory material is represented as centrally located in the box-pile, and when thus arranged the bar or rod rolled therefrom will have solid metal ends D D', of the same length as represented in Fig. 3, connected by an intermediate tubular or cylindrical section or casing, d, which may be of any desired thickness. This form of bar is especially adapted for the manufacture of car-axles.

In Fig. 2 the sand or other refractory mate-

rial, 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 in the form of slabs. This construction of box-pile will produce a bar or rod having the tubular or cylindrical metal sections disposed in relation to the solid sections substantially as shown in Fig. 4, where E represents the solid parts, and *e* the tubular or cylindrical sections.

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.

The thickness of the tubular, cylindrical, or other shape of the casing or shell depends upon the thickness of the metal about the body of sand or other refractory material in the pile, and also upon the extent of the reduction of the pile by rolling.

I have mentioned herein especially the application of my invention to the manufacture of car-axles and shafting, but I do so simply to show the use to which the invention may be put; but I would not be considered as limiting it thereto, as there are many other articles which can be more cheaply made by this process. I would mention also that the process is especially valuable in making hollow beams, girders, posts, and columns, and that the sand or refractory material with which the tubular or cylindrical shell is filled takes the place of the filling ordinarily placed in hollow columns and posts.

The ends of the pile I have represented as made of slabs of metal, and also the intervening sections between the bodies or masses of sand or other refractory material. A pile built in this way can be more cheaply constructed than in any other manner that I know of.

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

The art of manufacturing rolled metal structures for shafting, axles, &c., having solid metal sections united by integral metal sections in the form of a tube, cylinder, or shell, comprising, first, the forming of a box-pile of alternating sections of metal and sand, or other equivalent refractory material, inclosed in the pile and disposed in relation to the metal as may be desired; second, in heating the box-pile to a welding heat, and, third, in reducing the heated pile thus made by rolling to the required form, all substantially as and for the purposes described.

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Witnesses:
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