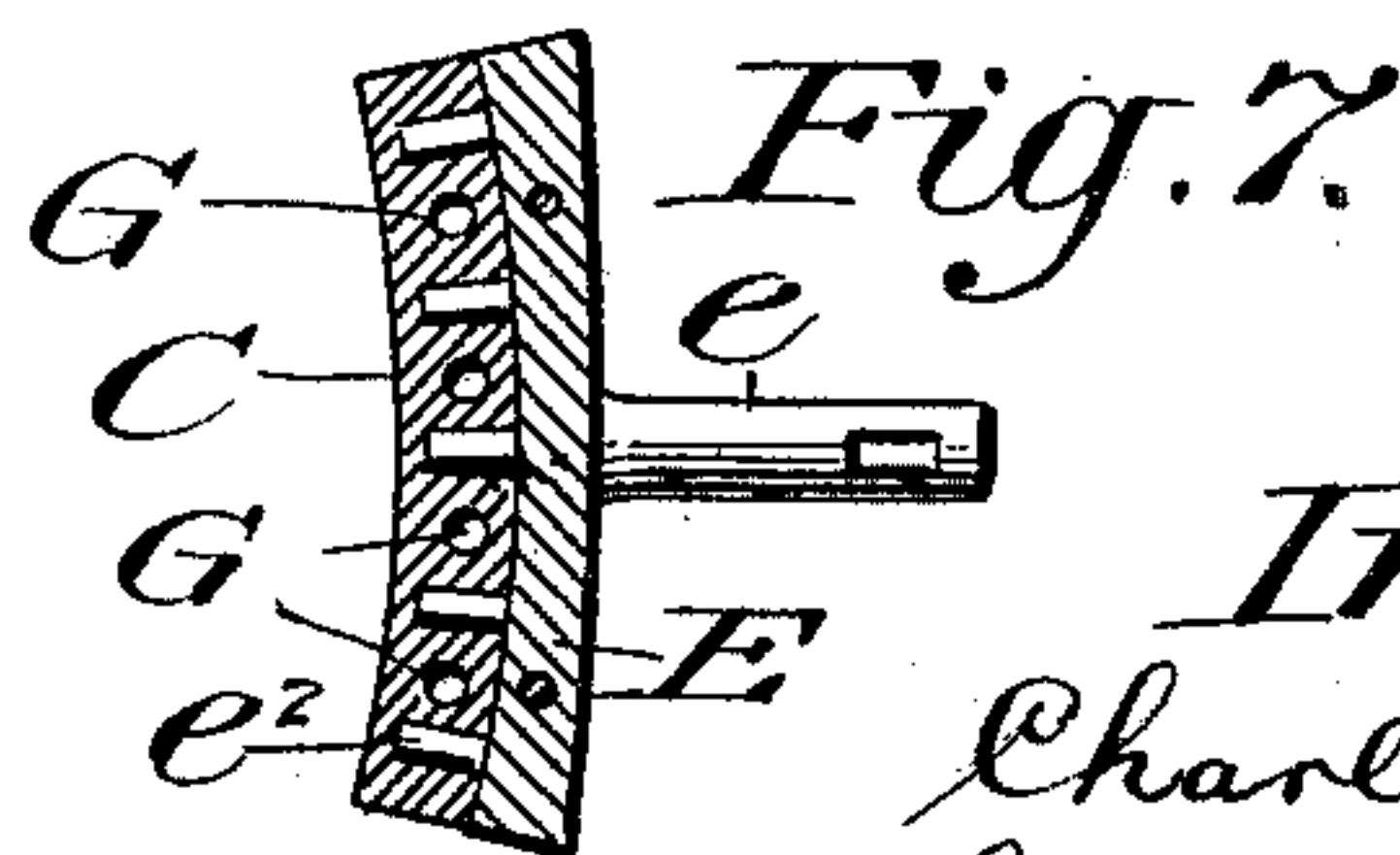
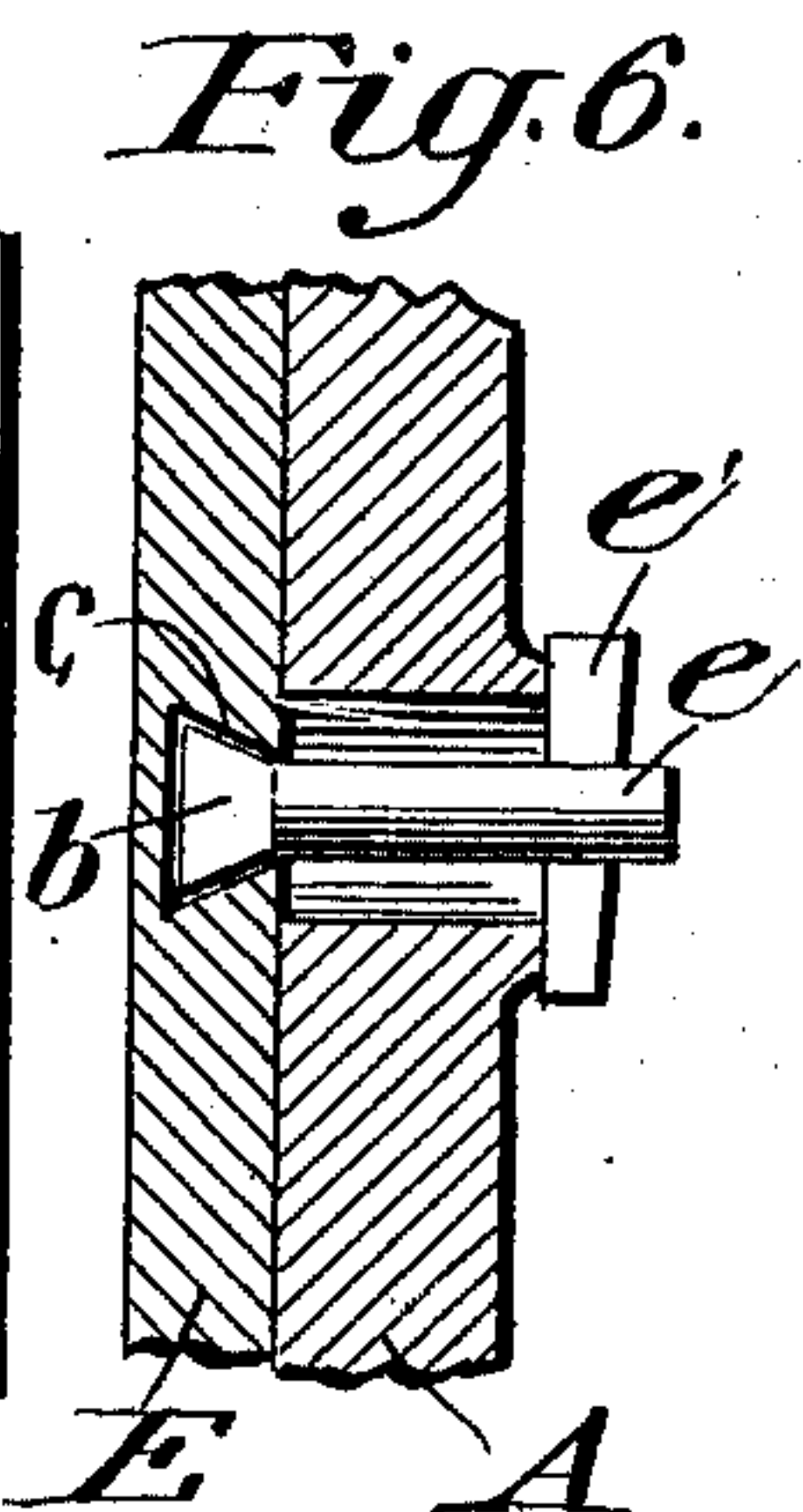
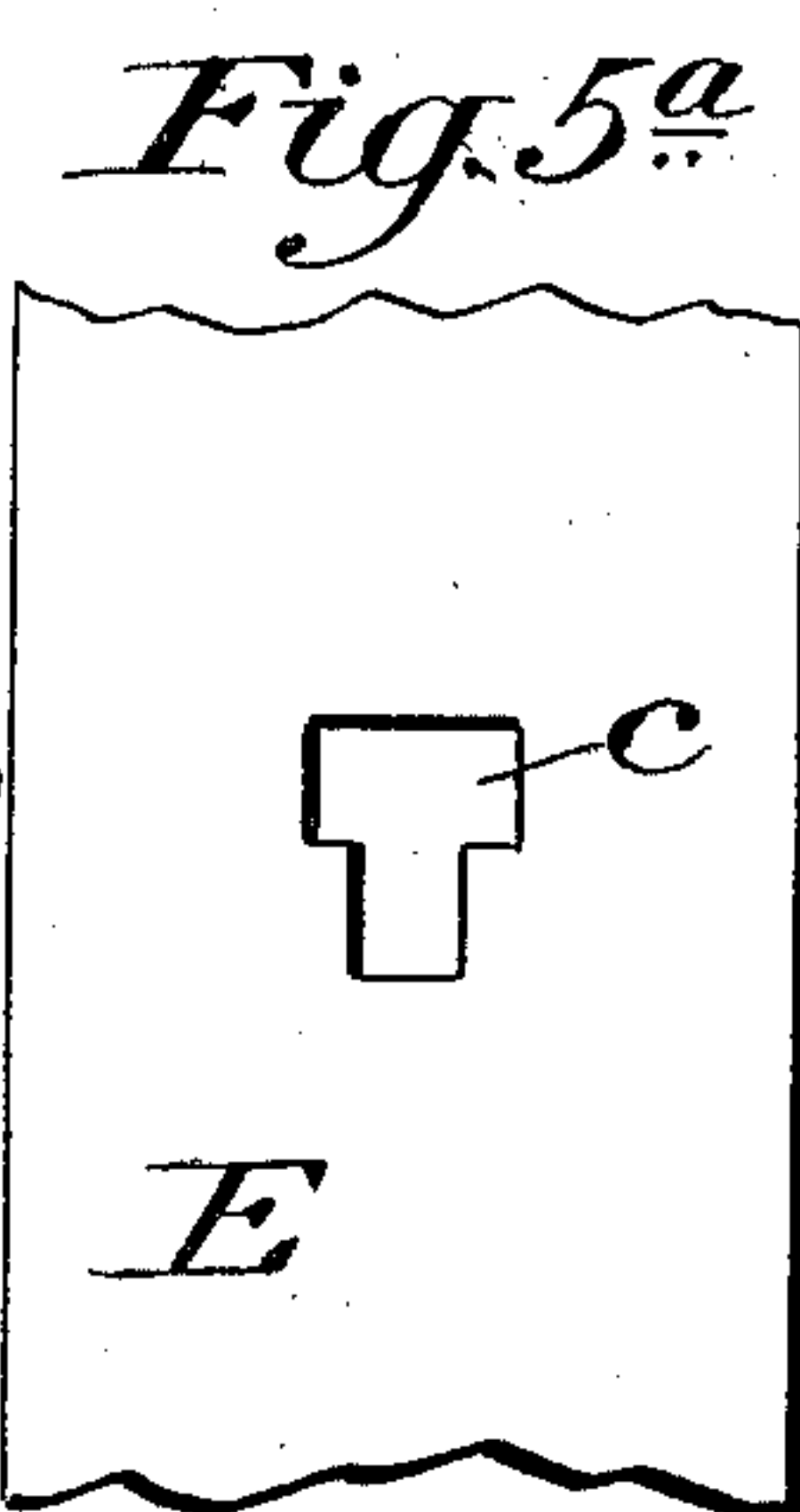
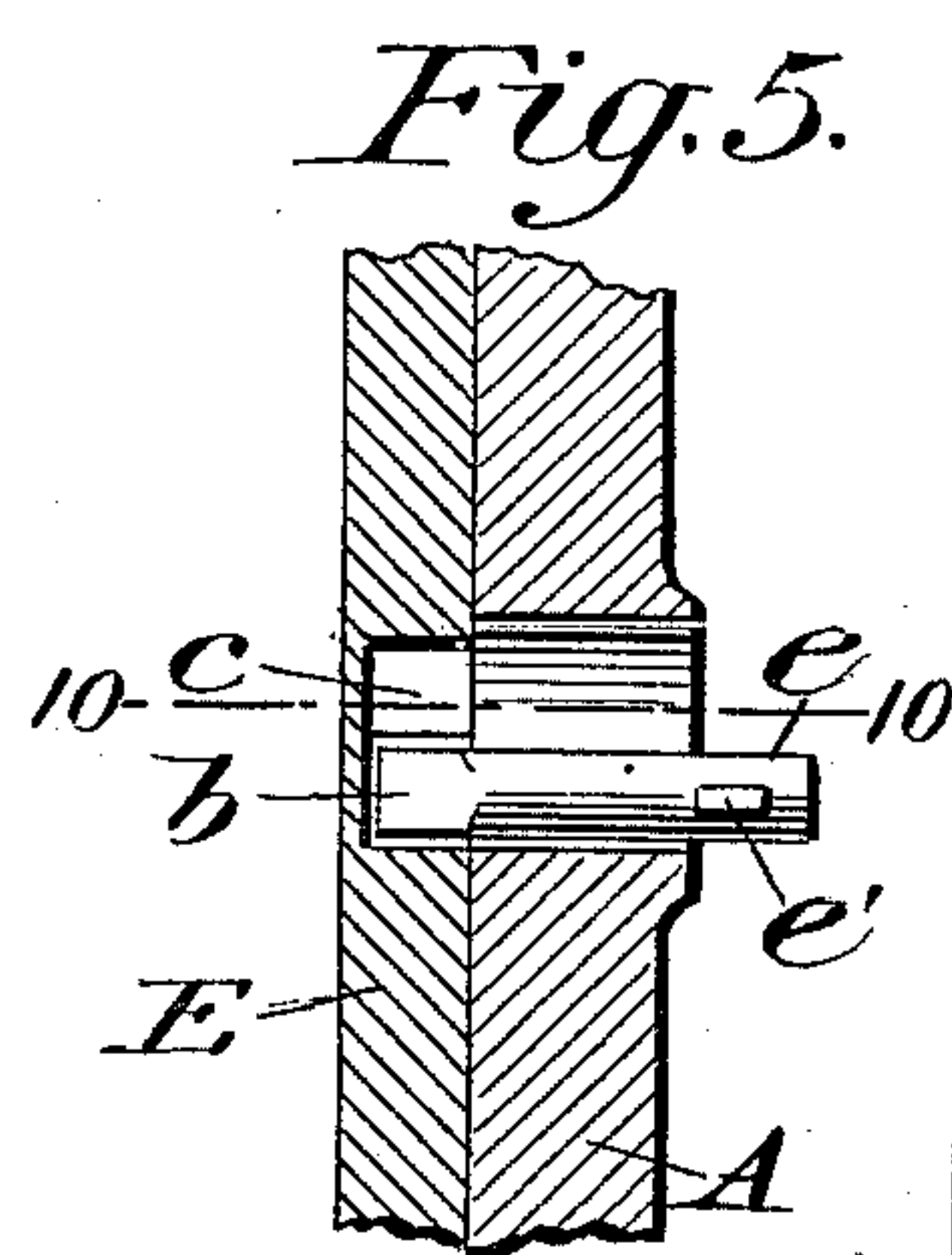
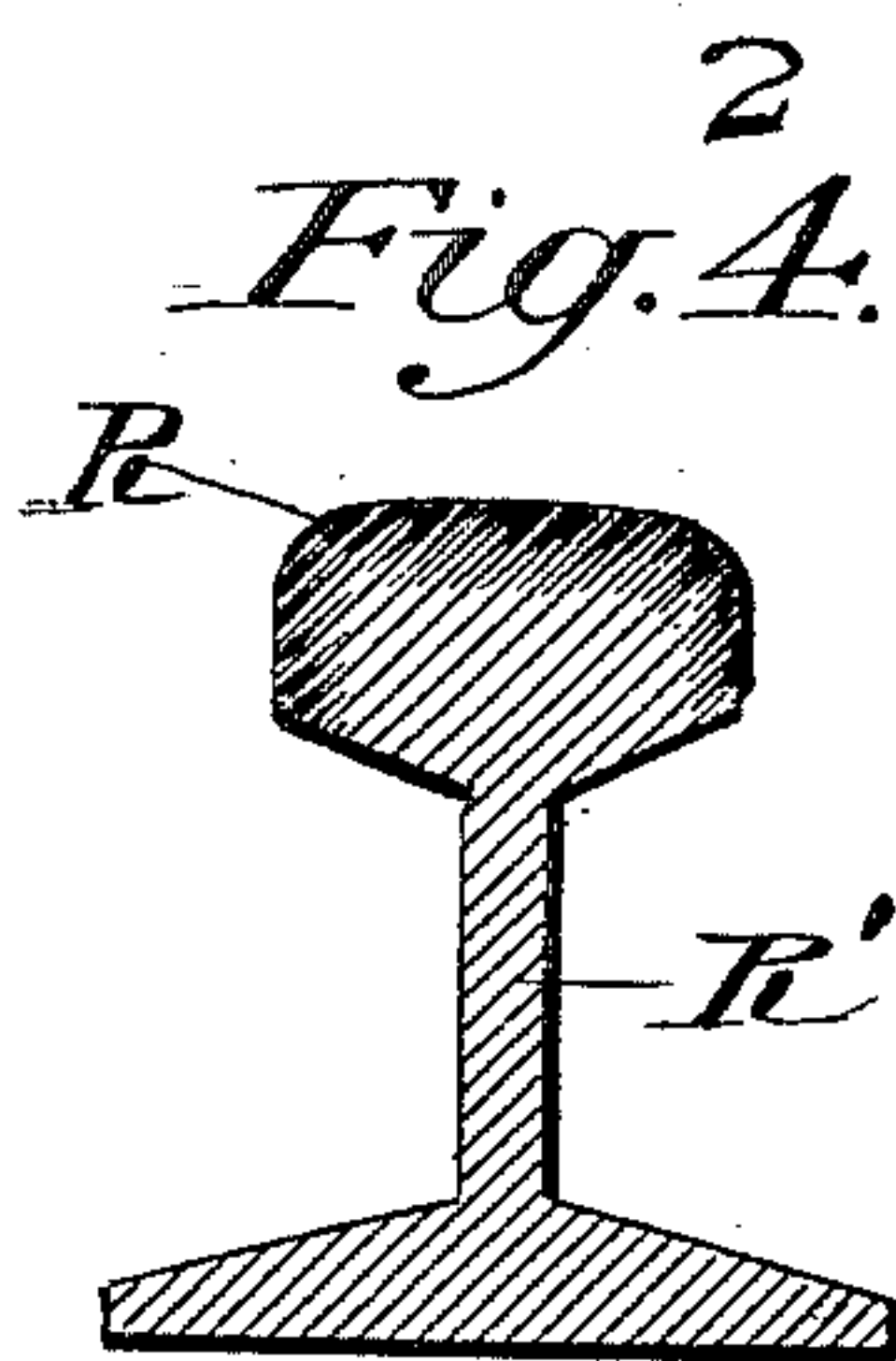
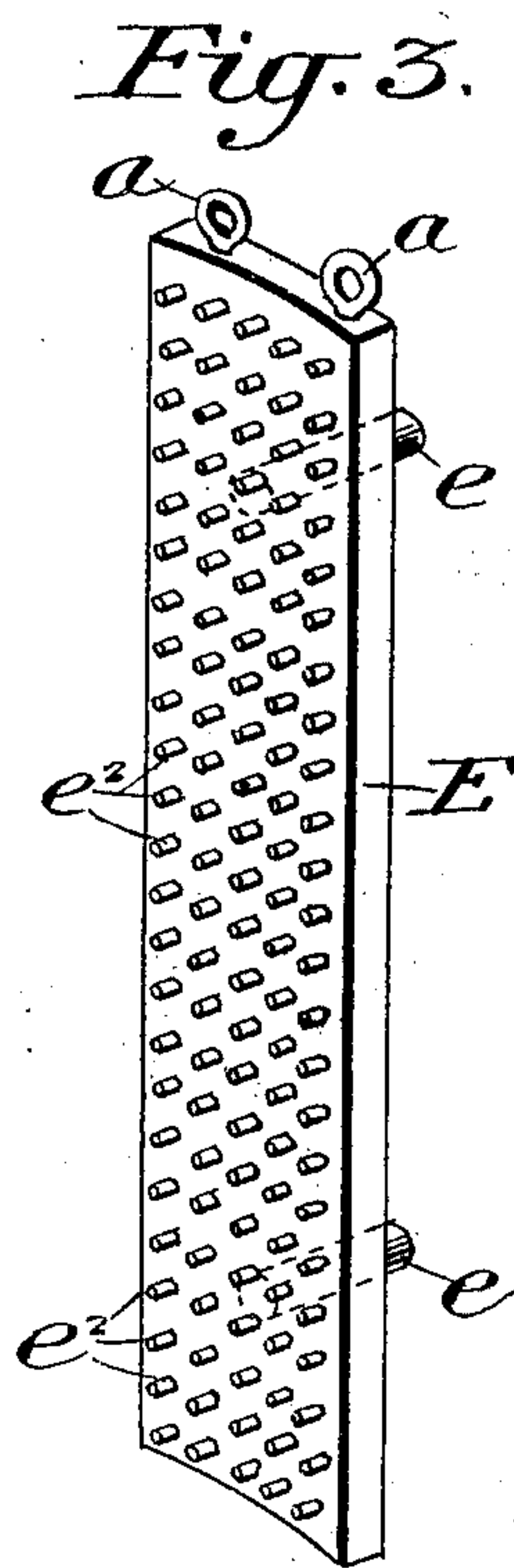
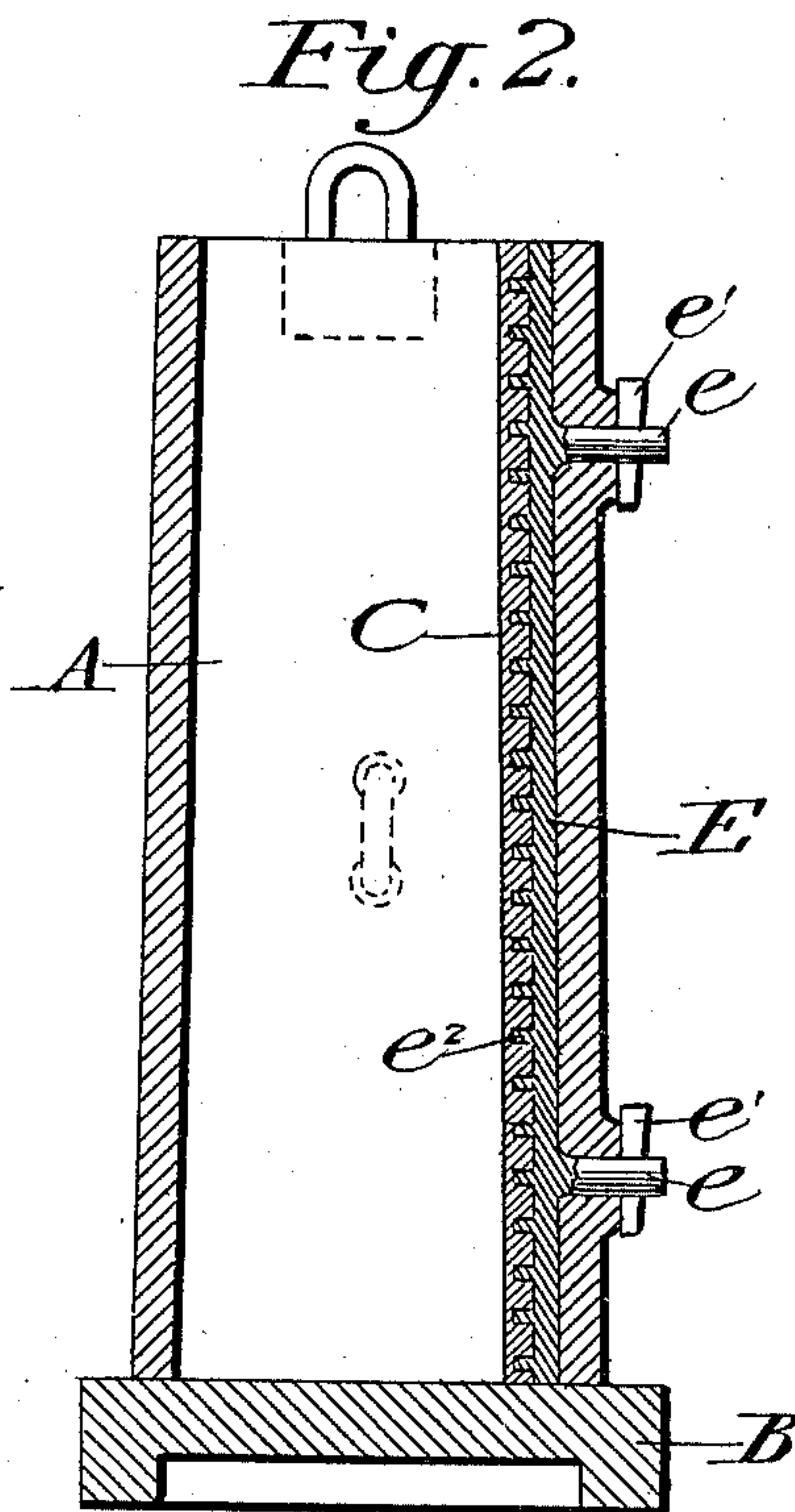
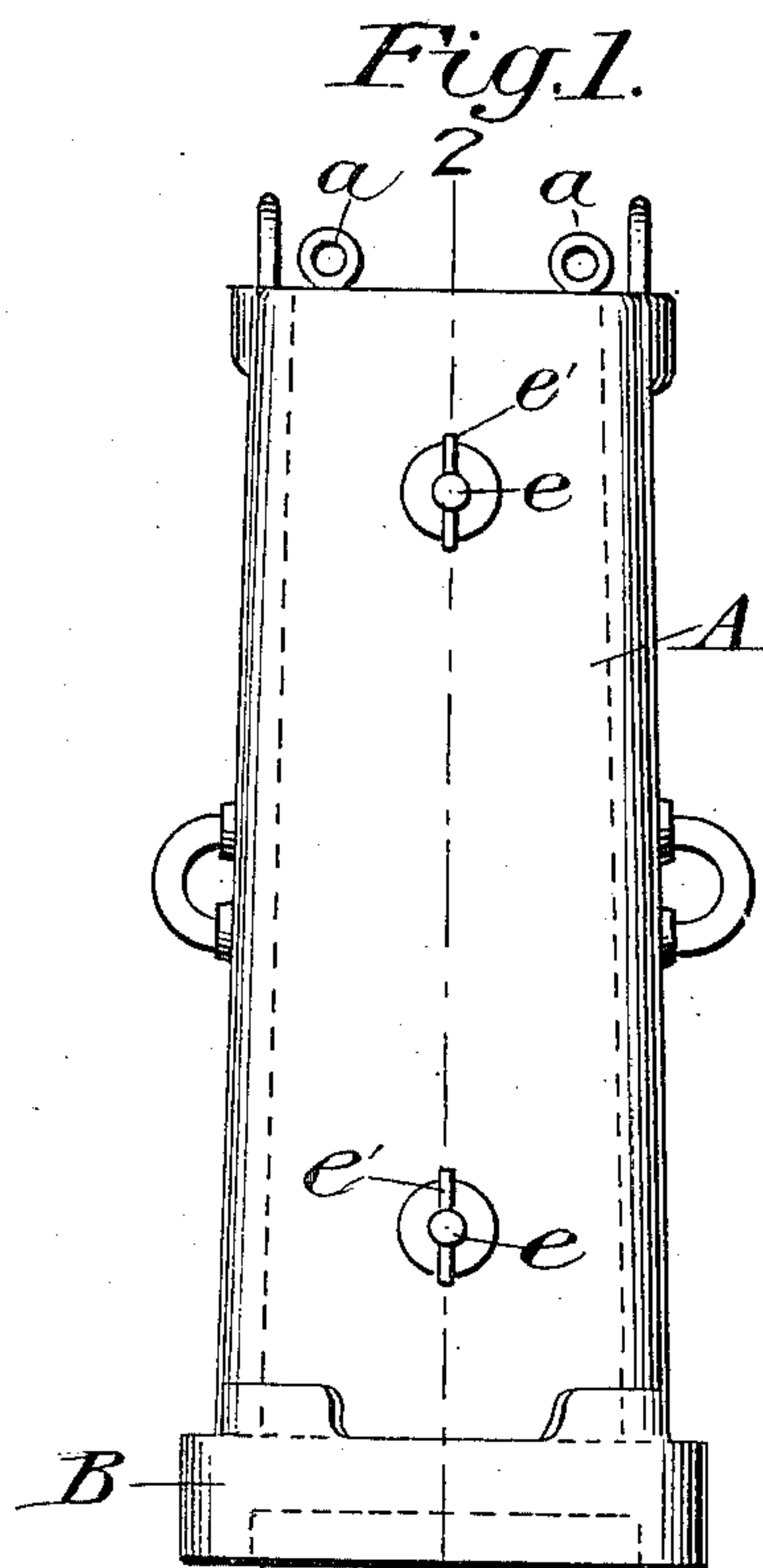


C. S. PRICE & G. E. THACKRAY.

MOLD FOR METAL CASTING.

(Application filed July 20, 1900.)

(No Model.)



Witnesses:
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UNITED STATES PATENT OFFICE.

CHARLES S. PRICE AND GEORGE E. THACKRAY, OF WESTMONT,
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MOLD FOR METAL-CASTING.

SPECIFICATION forming part of Letters Patent No. 686,952, dated November 19, 1901.

Application filed July 20, 1900. Serial No. 24,271. (No model.)

To all whom it may concern:

Be it known that we, CHARLES S. PRICE and GEORGE E. THACKRAY, citizens of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Molds for Metal-Casting; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The increase in concentrated wheel-loads in railway service has been very considerable during the past few years, and owing to this traffic the destructive action on road-beds and rolling-stock has become more and more marked and of greater extent in a given time than that which has been usual heretofore.

It is the object of our invention to provide an apparatus for the manufacture of steel rails in which those portions of the head that are subject to wear are formed of hard steel, which gradually merges into a steel of softer quality, which forms the lower portion of the head, the web, and the flanges. A rail so constructed is well adapted to resist the wear and abrasion due to the passage of heavily-loaded wheels, and at the same time it is tough, reliable, and well suited to withstand the loads which it has to carry by reason of the softer quality of its lower portions.

In carrying out our improvement we use a mold one portion of which is lined with a special carbonaceous material, so held in position that when steel is poured into the mold part of the ingot is in contact with said carbonaceous lining and by reason thereof absorbs a certain amount of carbon, which has the effect of making that portion so treated harder than other portions of the ingot. This carbonaceous lining may be applied to any or all sides of the ingot-molds or any portion thereof in order to properly locate the harder portions of the ingot, as may be readily understood. It may be applied to the surfaces of ordinary cast-iron molds by means of a removable plate fitted to one of its sides, secured thereto by means of bolts passed through holes in the sides of the molds, said bolts being provided with keys, nuts, or

other means for securing a bearing against the outer surfaces of the mold in such a way as to hold the plate securely therein. This removable plate may be provided with projecting studs, pricklers, scores, indentations, or other irregularities so designed as to provide a suitable base upon which to hold the carbonaceous lining, one of the advantages of said plate being its portability, so that it can be readily handled, made up, dried, and placed in position in the mold.

We do not limit ourselves to the exact arrangement of lining shown in the drawings, as it may also be extended over one side and portions of the two adjoining sides, or it may cover all sides in case an ingot is desired the central portion of which shall be softer than the exterior. Our lining may also be used in connection with a mold of any kind and on all or any portions of the inner surfaces thereof, dependent upon the desired position of the highly-carbonized steel, as hereinbefore noted.

We have found by practice that charcoal is more readily soluble in heated steel than is coke-dust; but in order to make a lining with it that shall be sufficiently porous to allow the escape of the gases evolved during and after the pouring of the steel we use a small portion of coke-dust in connection with the charcoal lining, so that it shall have the needed porosity. In order to provide the necessary porosity for the escape of gases from the lining in certain other cases, we may provide it with longitudinal vents G, formed by the withdrawal of wires previously placed in proper position, after the manner of usual foundry practice in this respect. By varying the proportions of coke-dust and charcoal we are able to form a lining which will give the required degree of carbonization dependent upon the ease of solubility of said mixture.

It is essential to the proper action of our carbonaceous lining that it shall be as free as possible from gases that would be evolved by the application of heat, and to further insure a proper result the lining should preferably be sufficiently porous or so vented as to allow any gases formed during and after the pouring to escape without damage to the ingot or lining.

Although our invention is shown in the drawings in connection with the manufacture of rails having the head harder than the web or flanges, we do not limit ourselves to its use in this connection solely, but it may be applied to the manufacture of any articles of steel in which it is desirable to have hard portions to resist wear and softer ones to insure certain toughness and resistance to impact, as may be readily understood by one skilled in the art.

While the manner of preparation of our carbonaceous lining is to a certain extent immaterial, we prefer to thoroughly incorporate the materials in a dry state, and in case water is needed for proper action of the binding material this is supplied after the dry mixing has been thoroughly effected. The mixture is spread on the plate covering those surfaces of the mold corresponding to the portions of the ingot or other shape which are desired to be hardened, after which the lining is properly dried or baked in an oven, the heat being raised toward the last in order to thoroughly drive off all the moisture and as much of the volatile matter of the compound as is consistent with retaining its strength after the baking operation. In preparing the mixture in which coal-tar pitch is used as a binder in connection with coke or charcoal we prefer to first mix the binder and carbonaceous matter together in a dry condition in a finely-granular form, and after being thus thoroughly mixed together they may be heated and further mixed in a suitable pan, the effect of this heating being to soften the pitch, so as to make the whole mass coherent, after which it may be spread on the plate-surfaces as desired and then baked, as heretofore described.

We have found the following proportions of material give excellent results and are what we prefer to use: coke-dust, eight parts, hard coal-tar pitch, one part; or charcoal, eight parts, hard coal-tar pitch, one part; or charcoal, seven parts, coke-dust, two parts, coal-tar pitch, one part.

In addition to the above mixtures we have found that in certain cases a composite lining is useful, the face of which is composed principally of charcoal, the backing being made of coke-dust, both bound together with coal-tar pitch. In making this compound lining the backing is first applied to the face of the plate, whose surface is roughened in any suitable way, after which the charcoal facing is applied to the required thickness, thus making a lining the outer face of which is formed principally of charcoal, which is spread upon the coke backing. We have found that charcoal is more readily soluble in steel than coke-dust; but after being baked in its ordinary powdered condition it is not sufficiently porous to give vent to the gases evolved during and after the pouring, nor does it bake sufficiently hard to make the best lining. By using the compound lin-

ing, as above described, we obviate some of the difficulties connected with the use of charcoal for the entire body of the lining, as the coke backing is sufficiently porous to give proper vent, besides which it resists heat better than charcoal, and thus produces a casting of better surface. After forming an ingot by pouring molten steel into a mold provided with an entire or partial carbonaceous lining, as above described, said ingot after stripping may be heated, if necessary, hammered, rolled, forged, or otherwise worked to produce rails, wheels, armor-plate, machinery, slides, or guides, or, in fact, any articles for which it is adapted in the arts. After pouring the steel in the mold, as described, we prefer to allow it to remain there for some time in order that it may properly absorb the carbon, which absorption continues during a considerable range of temperature. It is manifest, however, that by stripping the ingot after a long or short exposure to the carbonizing material the hardening effect may be made more or less within a certain range.

Having given this general description of our invention, we will now, to make the matter more clear, refer to the annexed drawings, which form part of this specification, and in which like letters refer to like parts.

Figure 1 is a side elevation of a mold provided with our carbonaceous lining mounted on a removable plate, showing a steel ladle in position for pouring into it. Fig. 2 is a longitudinal section taken on the line 2 2 of Fig. 1. Fig. 3 is a separate perspective view of the pricker-plate shown in connection with the mold in Fig. 2. Fig. 4 is a cross-section of a rail, in which the upper hardened portion of the head is indicated by heavy shading. Fig. 5 is a vertical section of the mold A, showing an arrangement for securing the pricker-plate E thereto; and Fig. 5^a is a side view of the same. Fig. 6 is a horizontal section taken on the line 10 10 of Fig. 5. Fig. 7 is a cross-sectional view of the plate and its lining, showing the longitudinal vents.

In the different figures, A is a metallic mold provided with a carbonaceous lining C.

E is a plate provided with a number of prickers $e^1 e^2$ and bolts $e e$, by means of which it is secured to the mold A with the aid of keys $e' e'$.

a represents eyebolts secured to the upper portion of the pricker-plate E for the purpose of lifting it.

Referring to Figs. 5 and 6, which show one arrangement for securing the pricker-plate E to the mold A, e is a key-bolt formed with an outwardly-tapering head b , which is adapted to drop into the slotted hole c , the upper part of this hole being of sufficient size to allow such introduction. In this arrangement the key e' is normally in a horizontal position, in which respect it differs from the key e' of Figs. 1 and 2.

Instead of the above arrangement the bolt

e may be fixed to the plate E, as shown in Figs. 2, 3, and 7.

Referring to Fig. 4, R represents the upper hardened portion of a rail made by our process, while R' represents the bottom flange, which is softer than the upper portion of the head, as indicated by the shading.

In Figs. 1 and 2, B is a mold-stool.

We are aware that steel has been hardened both locally and throughout by the slow cementation process in contact with carbonaceous material by the aid of heat, and we are also aware that articles of iron and steel have been produced with hard portions or faces by welding harder material thereto, either in the usual way or by pouring molten steel or iron against previously-heated pieces of hard steel properly located in the mold; but both of these processes are quite expensive, while the latter especially requires a long period of time for conducting the operation properly, and we do not claim such process or apparatus for conducting said process; but

What we claim, and desire to secure by Letters Patent, is—

1. A mold provided with a metal plate forming part of its interior surface, said plate having a soluble carbonaceous lining, and the plate and mold being provided with cooperating fastening means, whereby the plate may be detached and resecured in position.

2. A mold provided with a metal plate forming part of its interior surface, said plate having a soluble carbonaceous lining provided with a series of longitudinal vents, and means for detachably securing the plate in the mold.

3. A mold provided with a metal plate forming part of its interior surface, said plate having a carbonaceous lining composed of a mixture of crushed coke and coal-tar pitch, a series of longitudinal vents within said lining, and means for detachably securing the plate in the mold, substantially as shown.

In testimony whereof we affix our signatures in presence of two witnesses.

CHARLES S. PRICE.

GEORGE E. THACKRAY.

Witnesses:

D. J. JONES,

G. H. EVANS.