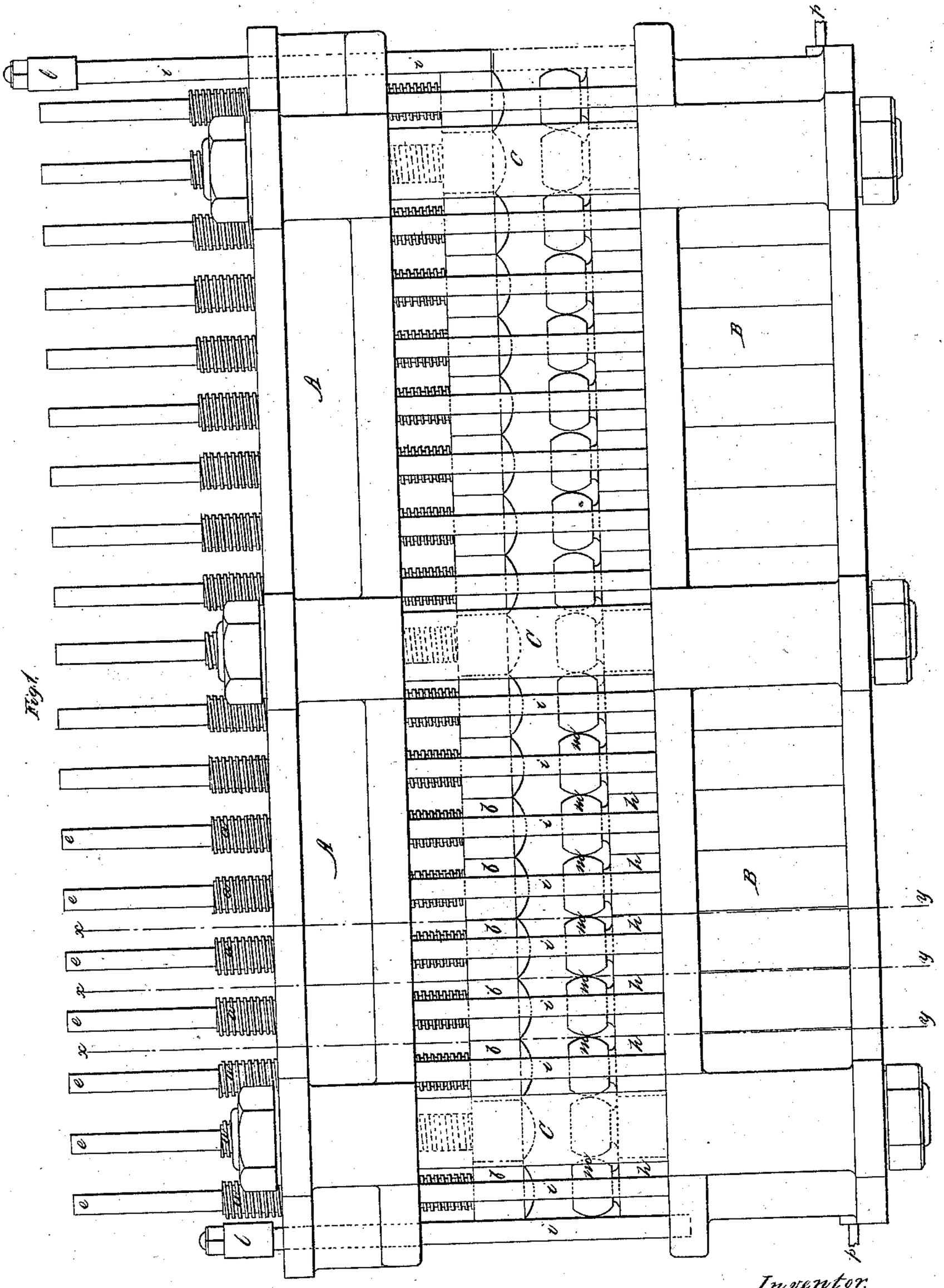
Sheet 1 - 3 Sheets.

J. Cochrane,

Bending Metal Plates,

No. 39,886. Patented Sept. 15, 1863.



Witnesses.
James Cochrane
Andrew S. Todd

Inventor.
John Cochrane.

Sheet 2 - 3 Sheets.

J. Cochrane,

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Fig. 3.

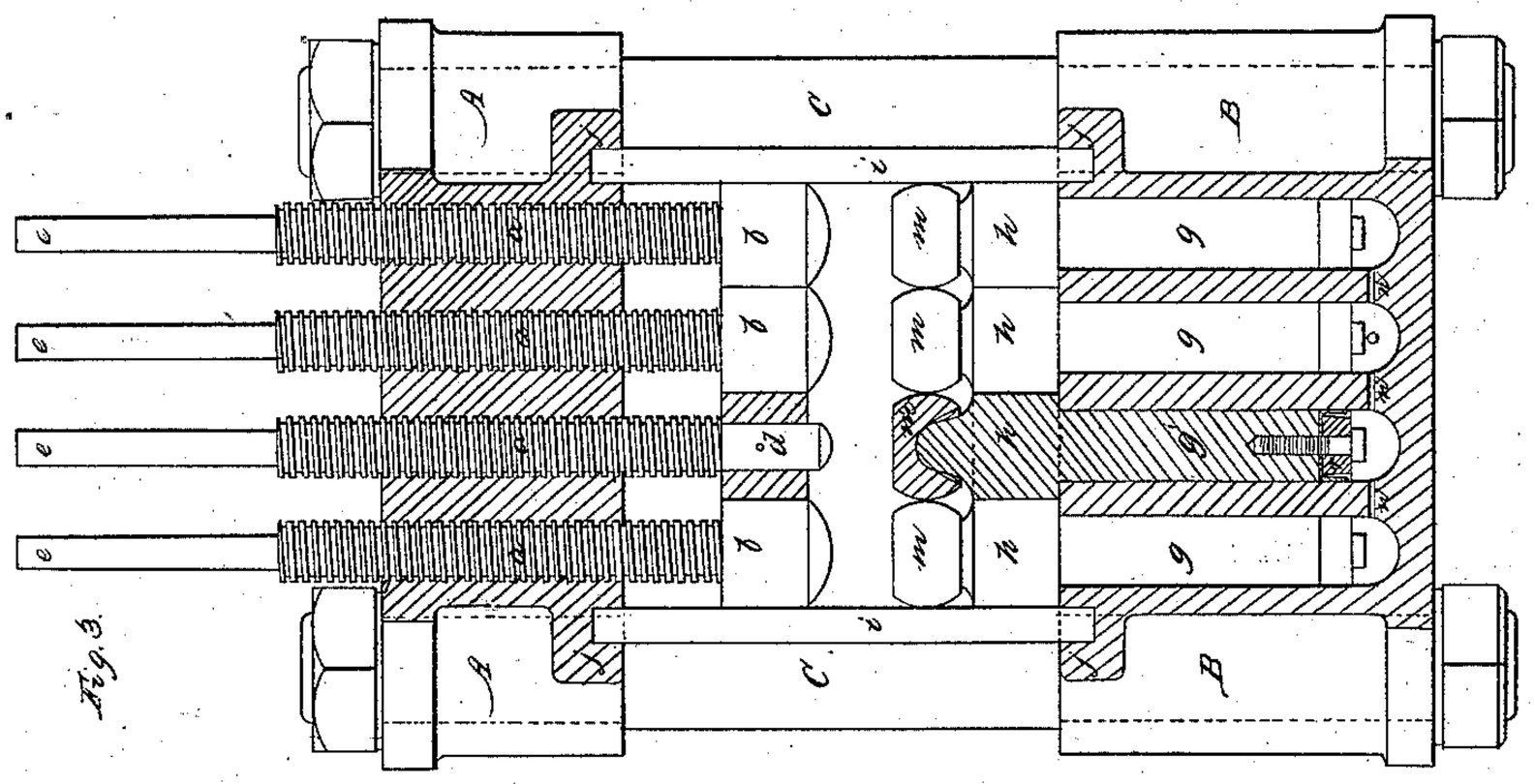
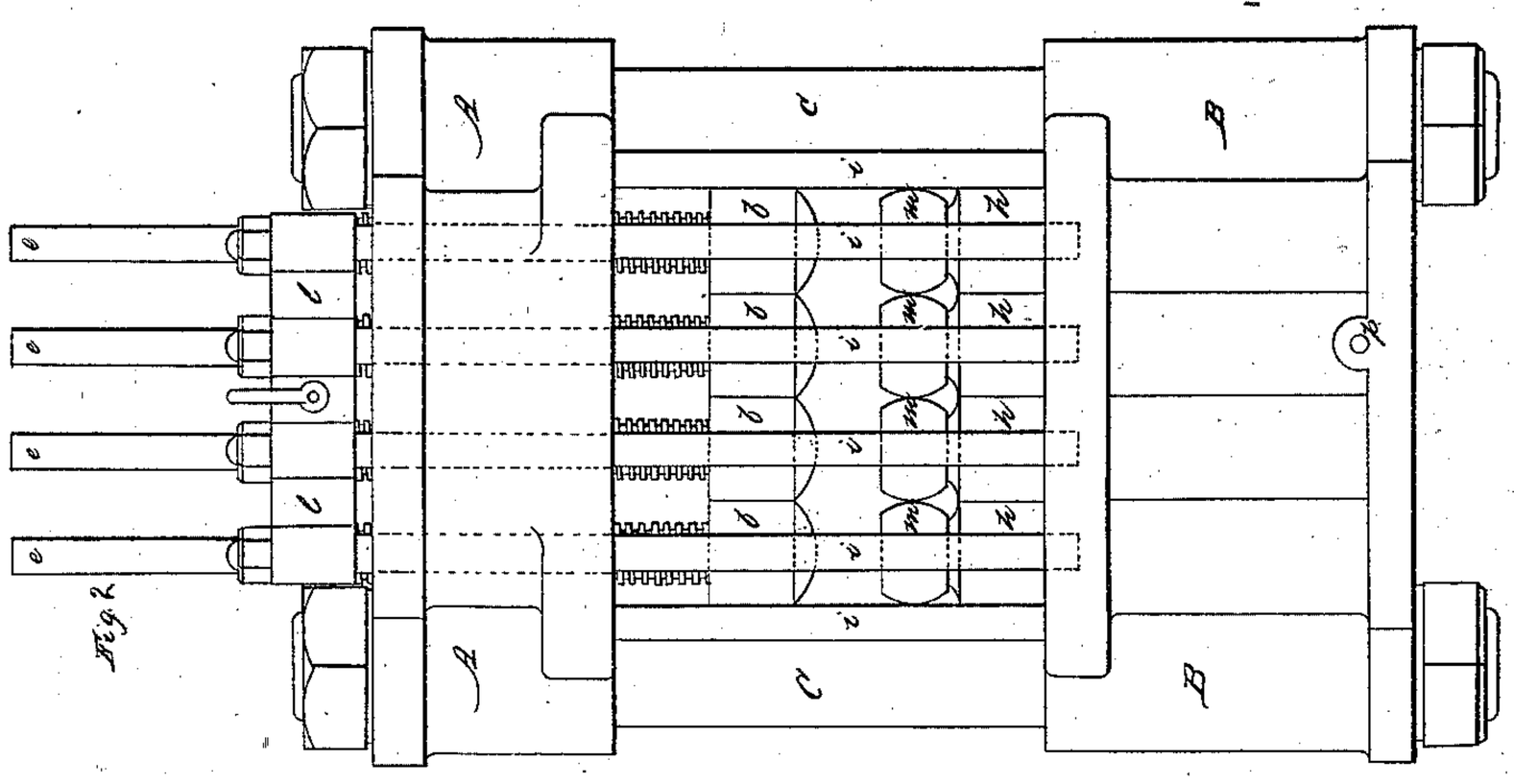


Fig. 2.



Witnesses.
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Sheet 3-3 Sheets.

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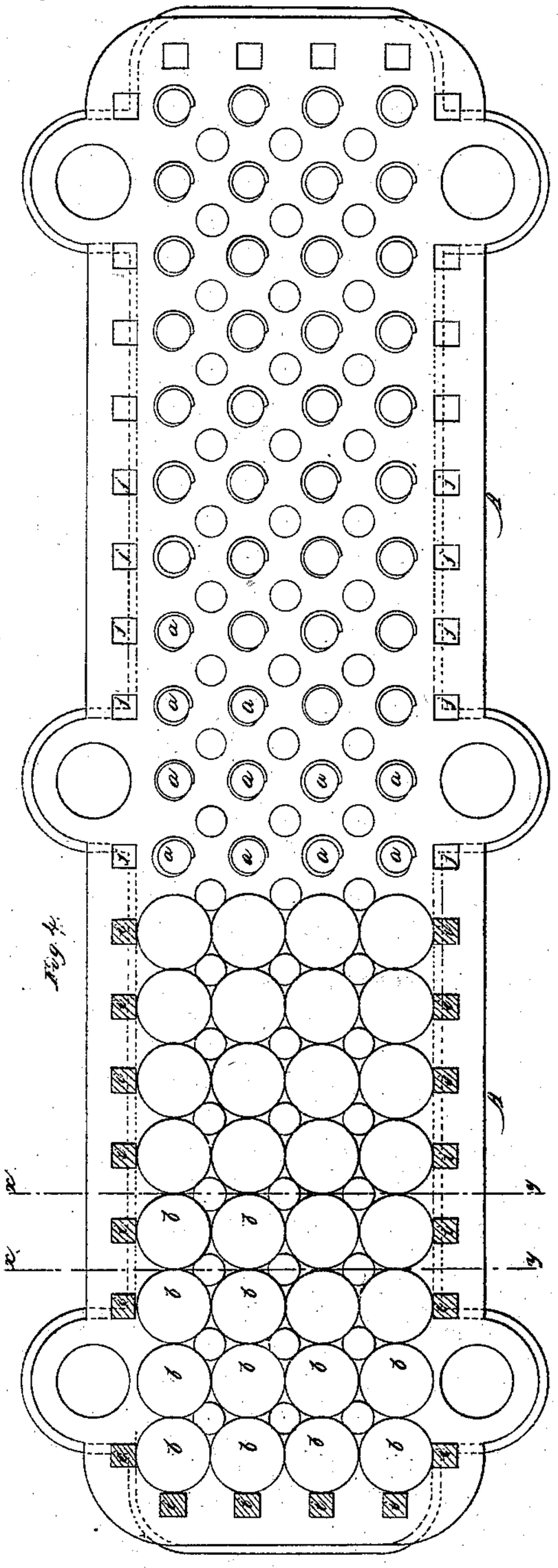

Fig. 4.

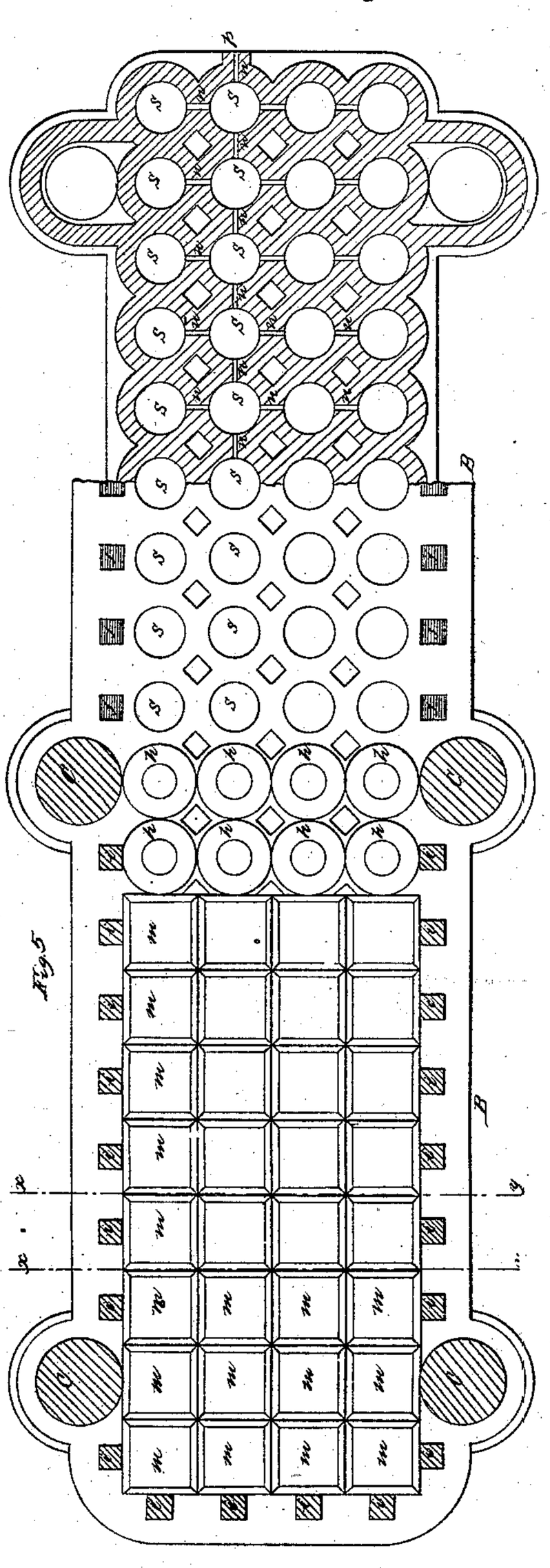

Fig. 5.

Witnesses.
James Cochrane
Andrew J. Todd

Inventor
John Cochrane

UNITED STATES PATENT OFFICE.

JOHN COCHRANE, OF NEW YORK, N. Y.

IMPROVEMENT IN PRESSES FOR BENDING METALLIC PLATES.

Specification forming part of Letters Patent No. **39,886**, dated September 15, 1863; antedated October 28, 1862.

To all whom it may concern:

Be it known that I, JOHN COCHRANE, of the city, county, and State of New York, have invented a new and useful machine or press for bending metallic plates into the various forms of mold required in naval construction and for other purposes; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, to wit:

Figure 1, which is a side elevation of the machine; Fig. 2, which is an end elevation; Fig. 3, which is a transverse section; Fig. 4, which is an inverted plan of the entablature and cope; and Fig. 5, which is a top view of the bottom piece or base, together with a portion of the moving platen.

The nature of my invention consists, first, in so constructing a press for bending metallic plates that its cope shall be capable of being altered and adapted to any form required for such plates within the range of its mechanical deflection by having a number of resisting-points therein, that can be individually elevated or depressed at pleasure, and thereby be made to conform to the curves, twists, swells, and hollows of those portions of the vessel or other purpose for which such plates are respectively intended; secondly, in forming and opposing to said adjustable cope a multipartite platen, containing as many parts, and in the same order of arrangement, as the resisting-points of the cope, so that they shall be centrally opposite to each other, the several parts of the said platen being operated simultaneously by hydrostatic pressure in such wise that each of them shall be impacted or forced against its corresponding point in the cope, thus coaptating the whole platen to and against the whole cope, and thereby forcing a plate of flexible metal when placed between them into the required conformation, as previously given to the cope by the manual adjustment of its several resisting-points.

To enable others skilled in the art to make and use my said press, I will proceed to describe its construction and mode of operation, and in referring for this purpose to the several drawings the same letters will be used to indicate the same parts in all the figures.

The entablature A A, Figs. 1, 2, 3, and 4, and the base B B, Figs. 1, 2, 3, and 5, are of cast-iron, and should be of the best quality with reference to toughness. These are the principal parts of the machine or press, and they are substantially combined and united together by means of the wrought-iron columns C C C, Figs. 1, 2, and 3. (Shown in section, also, at C C C C, Fig. 5.) These columns are represented in the drawings as screwed by nuts at their tops and lower ends, but they may be secured by any other of the known methods that are employed for such purposes.

In the entablature A A are a number of strong iron or steel screws, *a a a a*, Figs. 1, 2, and 3, passing through vertical holes, in which the internal thread is cut in the substance of the entablature, for its whole thickness, as shown in A A, Fig. 3, or separate nuts may be introduced into the entablature for this purpose. These screws should be made to fit accurately but not tightly, because they have to be run up and down by hand to adjust them to the form required for the proposed plate, and they must all be made of exactly the same length. On the lower end of each of the said screws I make a cylindrical enlargement or head, as shown at *b b b*, Figs. 1, 2, 3, and 4, the diameter of which enlargement must be equal, or nearly so, to the central distances of the screws. The heads of the screws being thus in contact or partial contact with each other, they will mutually support and sustain each other against bending by lateral slip while acting on an inclined surface of hot iron, as the heat apparently reduces the natural friction between the surface of the plate and the resisting-point. These enlarged heads may be forged or cast in the same piece with the screws, or they may be made to slip on, as shown in section at *d*, Fig. 3, and the bearing-points should be of a rounding form, so as to suit any direction of slope in the plate, or, if it be preferred, they may be furnished with button-shaped bearing-points, attached in such a manner that they may freely adapt their position to the surface of the plate.

The screws in the entablature being numerous, their points will serve all the purposes in this application of a cope of continuous surface, and they can all be arranged with facility to the proper positions for the curve, twist, or bulge required by manipulation, using for that purpose, if necessary, a small hand-

wheel or a wrench or lever upon the shanks of the screws above the entablature, raising or depressing the screws till their top points, *e e e*, Fig. 1, 2, and 3, conform to the templets, molds, or measurements of the part of the vessel or purpose for which the plate to be operated on is intended, and, all the screws being of the same length, their lower points, which form the cope, will present the same identical conformation, thus making the cope the exact counterpart in form or mold of the plate required, having also while in action all the inflexible solidity of the entablature itself.

The base B B, Figs. 1, 2, 3, and 4, contains the hydrostatic chambers *s s s*, Fig. 5, and their rams or pistons *g g g*, Fig. 3, and which in number and order of arrangement correspond with the screws in the cope. These chambers are bored out true, and are made to communicate with each other or with the forcing-pumps by means of small passages for that purpose, as shown at *n n n*, Figs. 3 and 4, the pump-connection being at *p*, Figs. 1, 2, and 5, or in any other convenient place. The rams or pistons *g g g*, Fig. 3, are turned to a neat fit for the chambers, so as to slide in them without binding or looseness, and they are all packed with cupped leather at their lower ends, as shown in section at *r*, Fig. 3. This method of packing I prefer, because it exposes less of the internal surface of the chambers to the hydrostatic pressure than when the chambers are packed at the top in the usual manner of packing hydrostatic presses. These several rams are also made with cylindrical enlargements at top, as shown at *h h h*, Figs. 1, 2, 3, and 5, which enlargements have a diameter equal, or nearly so, to the central distances of the chambers, thus placing them in contact, or partial contact, with each other, as shown at *h h h*, Fig. 5, thereby securing mutual support when acting upon inclined surfaces, as previously explained in relation to the enlargements on the screws which form the cope; and as a further security in this respect to both the screws and rams, or the cope and platen, I place the guard-bars *i i i*, Figs. 1, 2, and 3, (shown also in section at *i i i*, Figs. 4 and 5,) around the whole cope and platen, one guard-bar being centrally opposite to each pair of screws and rams, and are secured in position by entering into cavities or mortises, *j j j*, Figs. 3, 4, and 5, in both the entablature and base; but the end bars are made so that they can be removed when necessary to put in or take out a plate. This may be done by uniting them to a cross-piece, *l l*, Figs. 1 and 2, by which they may be drawn up or let down to their place, like a portcullis, or they may be hinged, so as to open and close like a gate, in which case they must have a suitable fastening to hold them in position when closed. Upon the top of each ram I place a cap-piece, *m*, Figs. 1, 2, 3, and 5, so arranged as to admit of vibration, as shown in section at *m'*, Fig. 3. These caps may also have the proper size, as shown in Figs. 1, 2, 3, and 5, to act upon the principle of mutual support, but this would not be necessary where the rams have the enlarged heads of proper size for that purpose. The cope having been brought by manual adjustment to the desired form, the plate to be molded is first heated to redness and then put into the press through the open gate, which is then closed and secured. The force pumps are then set on and continued at work till the rams below the platen have forced the plate into contact with the resisting-points that form the cope, thus setting the plate and completing the operation. The water is then let off from the chambers, which permits the platen to fall to its lowest position and level, when one of the gates may be opened and the plate removed. The machine is then ready for readjustment to suit another portion of the vessel.

The accompanying drawings are on a scale of an inch and a half to a foot, and represent a press that is calculated for plates nine feet long and twenty-two inches wide, and is capable of exerting a force by the simultaneous action of the hydrostatic pressure within its chambers upon its pistons of seven million five hundred thousand pounds, or three thousand seven hundred and fifty tons, which is sufficient to bend, bulge, or twist the thickest plates of that size heretofore used in shipbuilding; but the wrought-iron plates now required for the protection of ships of war are of such extraordinary thickness that a press competent to bend or twist them must have a corresponding force. These plates have been specified at fifteen and a half feet long, thirty-three inches wide, and four and a half inches thick. A press to suit these plates, constructed on the plan and principle within described, will have a crushing-force of twenty million pounds, or ten thousand tons, which is supposed to be ample for the purpose.

In the machine, as here figured and described, each resisting-point of the cope is centrally opposed by a hydrostatic ram or piston beneath the platen, thus apparently requiring as many hydrostatic chambers in the base or lower part of the machine as there are screws in the entablature or resisting-points in the cope. This, however, is not absolutely necessary for the practical attainment of the purposes contemplated, as the platen may be so constructed by means of accommodating bearings that two or more of its parts may be mounted upon the top of a single hydrostatic ram of proportionably larger diameter, and so produce the same result as when each of such parts was operated by a single piston. Again, the platen might be composed of transverse pieces or parts extending the full width of the bed, each mounted upon two hydrostatic rams and having accommodating bearings to admit of motion or vibration, and thus measurably secure the advantages of the multipartite platen and principle of action within described. Again, also, the platen might be made in the same manner as the cope within described, with as many

adjustable bearing-points in it as would be in the cope with which it might be used, and it also might be operated as a whole or in parts by the simultaneous action of the hydrostatic rams or pistons within the chambers in the base of the machine, and in that mode of construction obtain the advantages of the multipartite platen in combination with the simultaneous action of the hydrostatic pressure in its several chambers.

In the accompanying drawings the entablature and the base are both represented as composed of single castings, but they can, if desired, be made in several pieces, each of which must be the full width of the machine, and they must all be bolted or secured together longitudinally, the joints running transversely, as shown by the red lines *x y x y*, Figs. 1, 4, and 5, and there might, with propriety, especially in those large and ponderous machines for bending and molding ship-armor, be as many sections in the machine as there are transverse rows of hydrostatic chambers in the base or of screws in the entablature. The guard-bars also are represented as separate pieces of square bar-iron, introduced to secure the platen and cope from side slip while acting on inclined surfaces; but columns for holding the base and entablature together, as well as for retaining them at the proper distance apart, may be placed along the sides of the machine opposite each transverse row of chambers and screws, and thus be made to answer the double purpose of guide-bars and columns—an arrangement that would be particularly convenient for those machines in which the sections would have but a single row of chambers and screws.

Various other alterations might possibly be suggested in relation to the construction of this machine, without, however, materially changing its principle or mode of operation. I therefore do not confine myself to any particular mode of construction or set of details, but claim the right to use such arrangements, combinations, sizes, and proportions of parts as will enable me most perfectly to apply the principle of my invention to the purpose intended.

Having thus described the nature, construction, and principle of operation of my improved machine for bending, bulging, and twisting metallic plates, what I claim therein as my own invention, and desire to secure by Letters Patent, is—

1. The combination of an adjustable cope with a multipartite or adjustable platen operated by hydrostatic pressure, in the manner or substantially in the manner described.

2. The enlargement on the screws of the cope and on the rams below the platen, or of the caps or bearing-points, which form the platen, so that they may mutually support and sustain each other when acting upon an inclined surface, in the manner or substantially in the manner described.

3. The combination of the guide-bars, or of the columns arranged as guide-bars, with the cope-screws and the rams below the platen, or the caps upon the rams, which form the platen, when those several parts are made to be in contact or partial contact with each other and with the guide-bars or columns for the purpose of mutual support when acting upon inclined surfaces, in the manner or substantially in the manner described.

4. The gates at either or both ends of the machine, whether arranged to open and close like a portcullis, or otherwise, substantially as described.

JOHN COCHRANE.

Witnesses:

JAMES COCHRANE,
ANDREW I. TODD.