(No Model.) 4 Sheets—Sheet 1.

G. A. DICK.

APPARATUS FOR MANUFACTURING WIRE, &c., FROM COPPER.

No. 572,872. Patented Dec. 8, 1896.

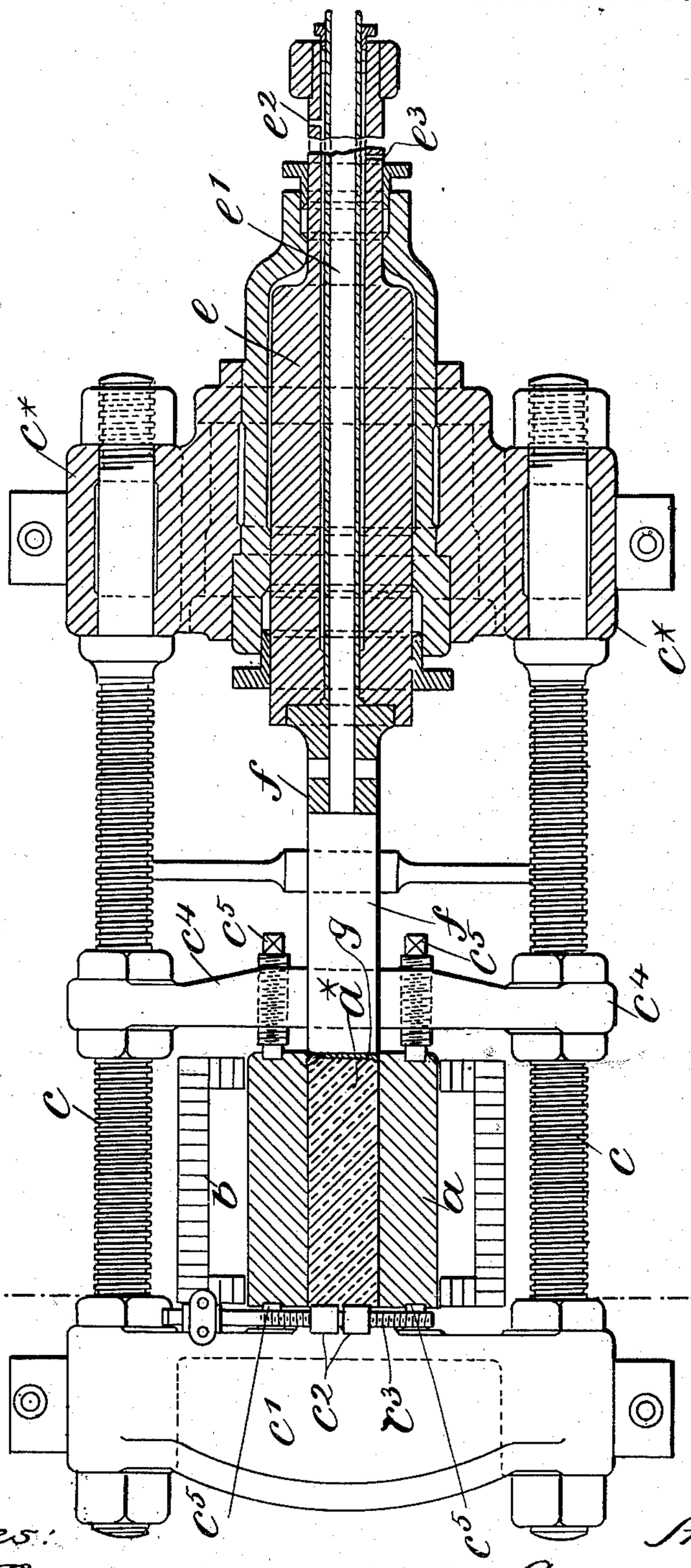

Fig. 1.

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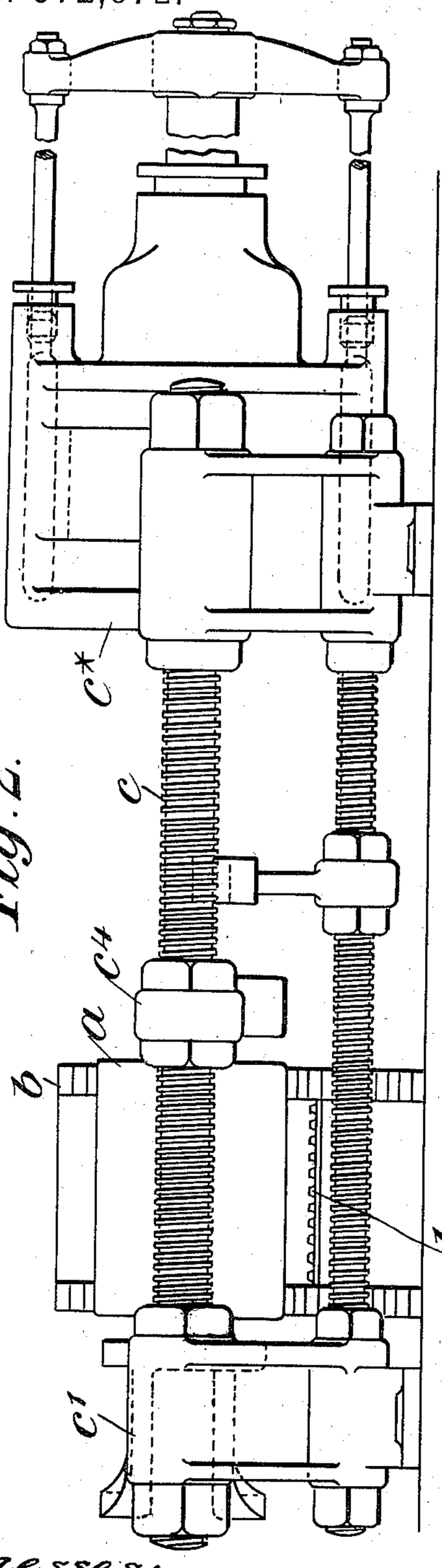

Fig. 2.

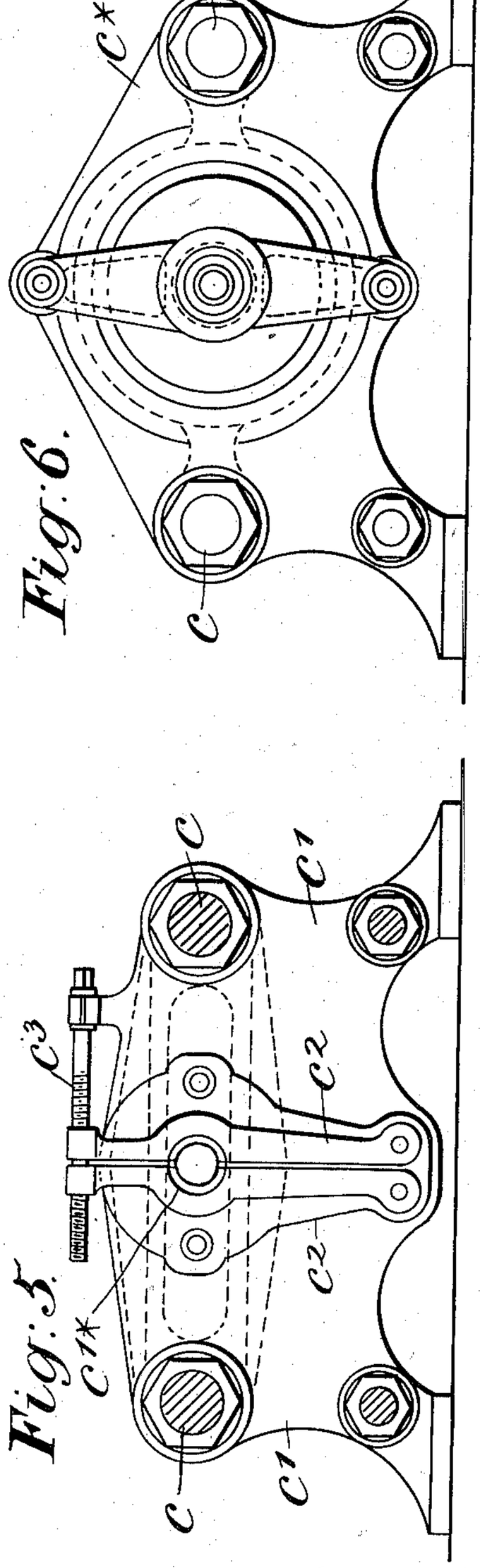

Fig. 6.

Fig. 5.

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APPARATUS FOR MANUFACTURING WIRE, &c., FROM COPPER.

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Fig: 3.

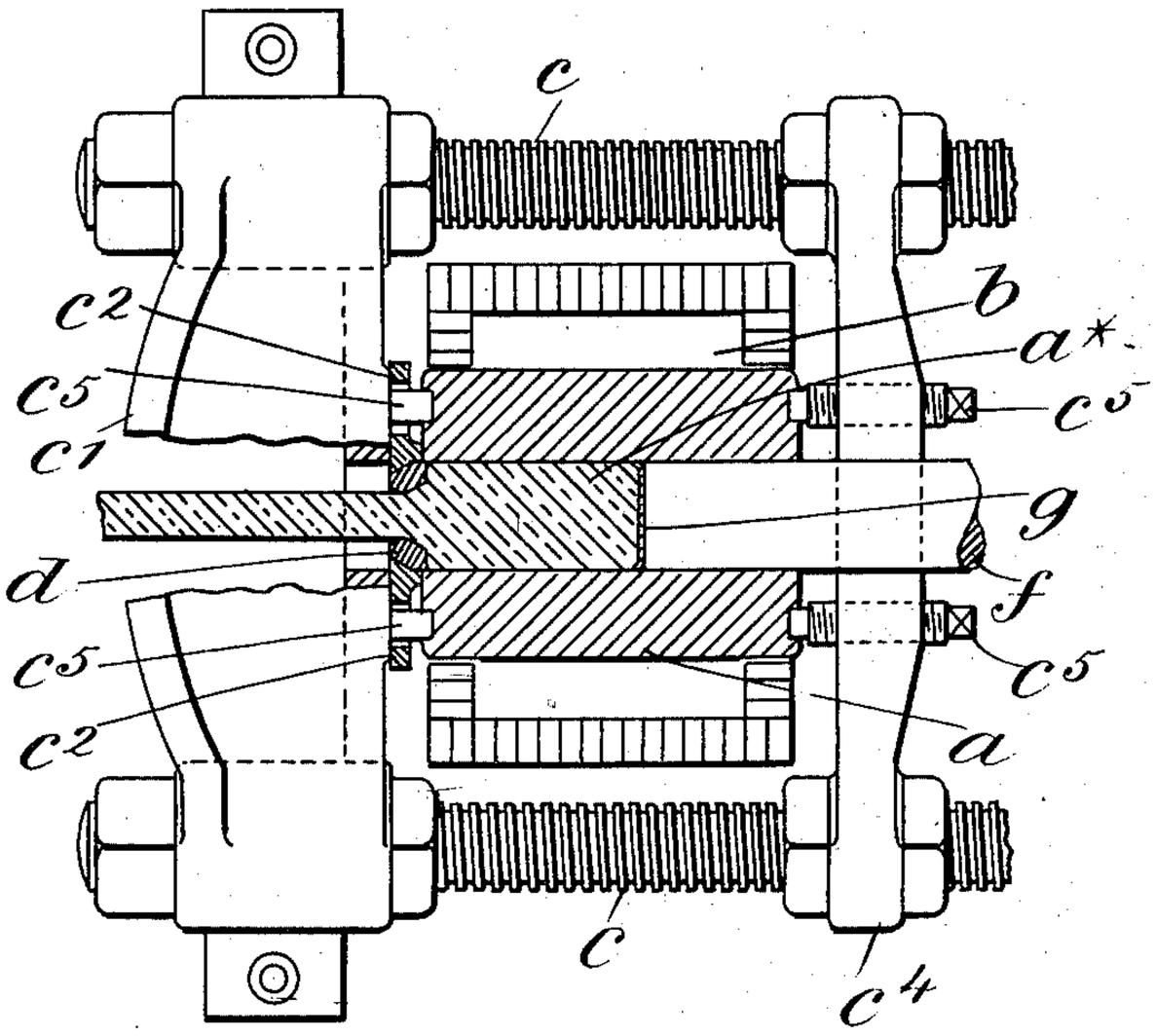


Fig: 4.

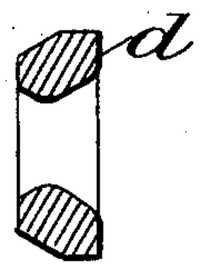


Fig: 12.

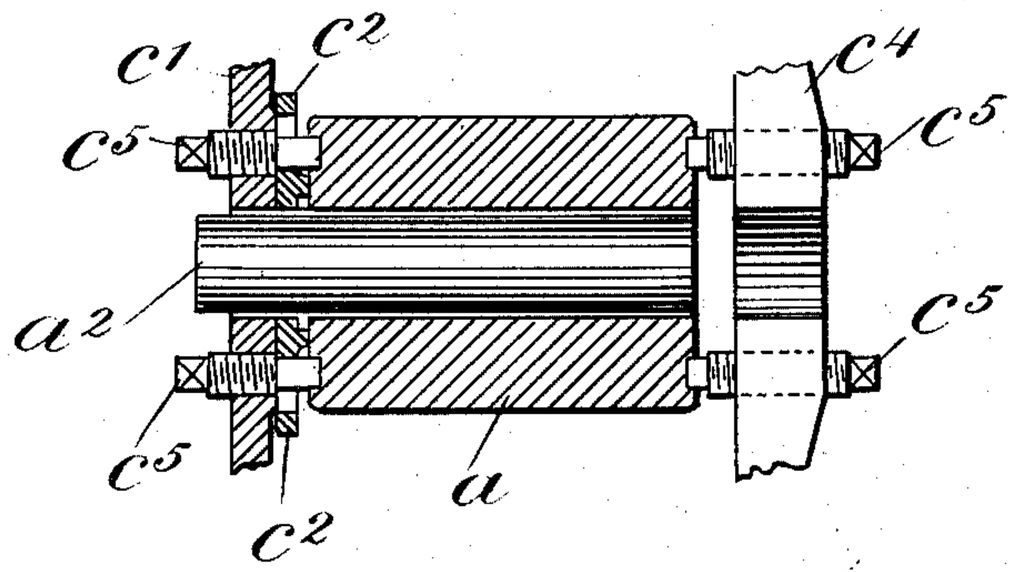
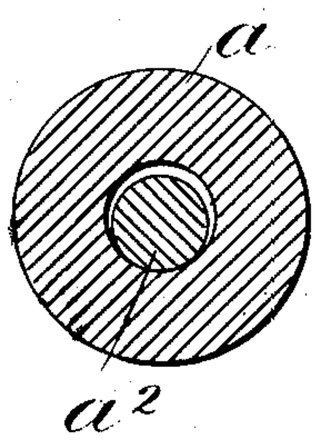


Fig: 13.



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G. A. DICK.

APPARATUS FOR MANUFACTURING WIRE, &c., FROM COPPER.

No. 572,872. Patented Dec. 8, 1896.

Fig: 7.

Fig: 8.

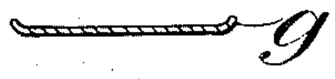


Fig: 9.

Fig: 10.

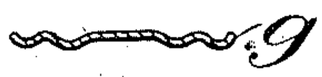


Fig: 11.

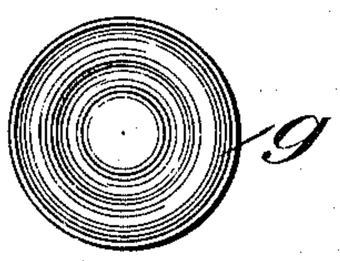


Fig: 14.

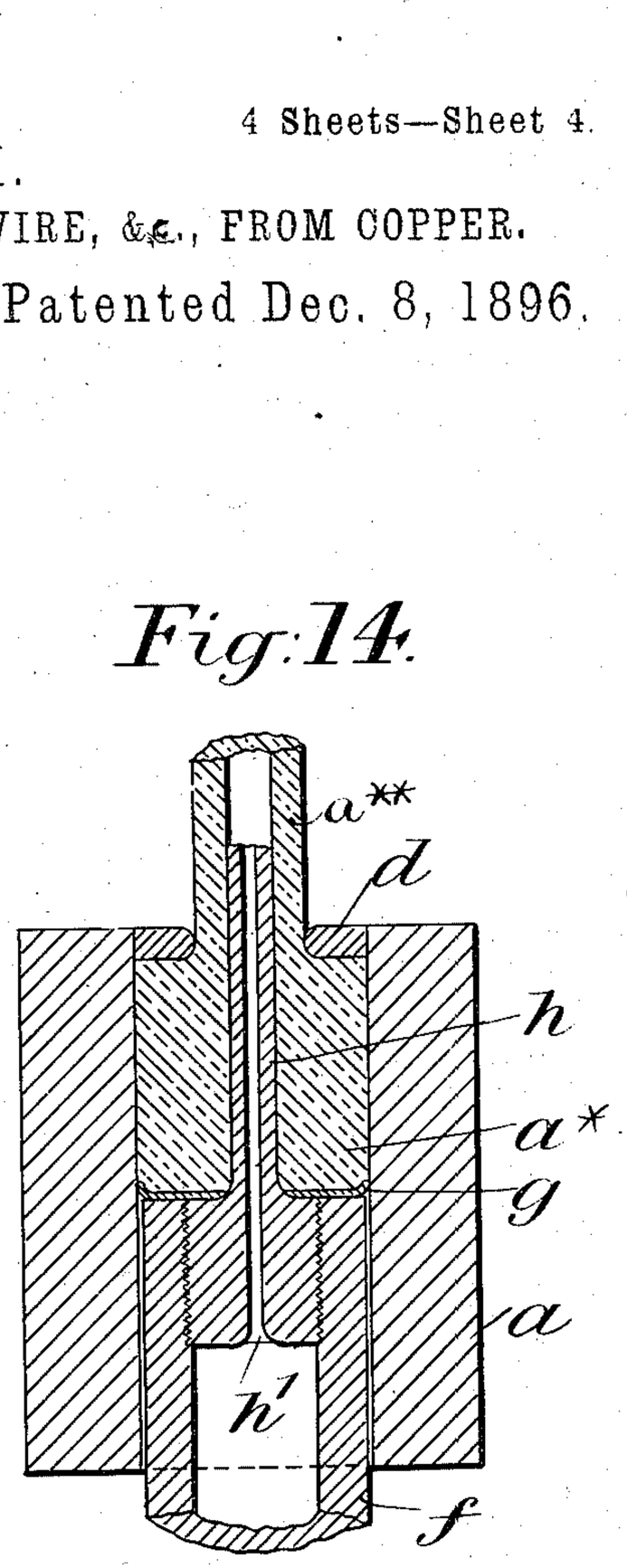
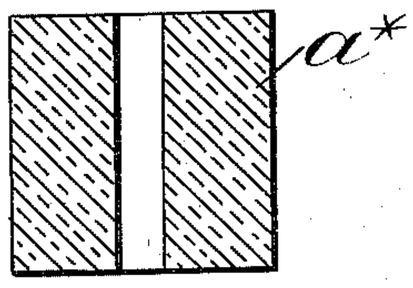


Fig: 15.



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UNITED STATES PATENT OFFICE.

GEORGE ALEXANDER DICK, OF LONDON, ENGLAND.

APPARATUS FOR MANUFACTURING WIRE, &c., FROM COPPER.

SPECIFICATION forming part of Letters Patent No. 572,872, dated December 8, 1896.

Application filed April 13, 1894. Serial No. 507,428. (No model.)

To all whom it may concern:

Be it known that I, GEORGE ALEXANDER DICK, engineer, a subject of the Queen of Great Britain, residing at No. 110 Cannon Street, in the city of London, England, have invented certain new and useful Improvements in the Manufacture of Wire, Rods, or Bars from Various Copper Alloys and in Apparatus Therefor, which apparatus can be used for making wires, rods, or bars from other alloys or metals, of which the following is a specification.

This invention relates to improvements in the manufacture of wire, rods, or bars (hollow or solid) from such copper alloys as require a temperature of at least 800° or 900° Fahrenheit to heat them to redness, and which, when so heated, become plastic and malleable, and, upon cooling, possess the necessary degree of hardness for the article to be produced therefrom.

For example, alloys of copper and zinc, copper and aluminium, or of copper and zinc combined with small quantities of other metals, such as iron, aluminium, nickel, or manganese, in or in about the proportions given in the following formula, will answer the purposes of this invention:

Copper.....	58	85	90	60
Spelter.....	40	10	..	40
Iron.....	2	..	..	..
Aluminium.....	..	5	10	..
Total.....	100	100	100	100

This invention further relates to improvements in apparatus to be employed primarily in the manufacture above referred to; and in order that the said invention may be clearly understood and readily carried into effect I will proceed, aided by the accompanying drawings, fully to describe the same.

In the drawings, Figure 1 is a sectional plan of an apparatus having my invention applied thereto. Fig. 2 is a side elevation thereof. Fig. 3 is a similar view to Fig. 1 of part of the apparatus, but showing more clearly the arrangement of the die and also the issuing rod. Fig. 4 is a sectional view of the die separately. Fig. 5 is a transverse section taken on the line 1 1 of Fig. 1, but showing the die removed. Fig. 6 is an opposite end elevation thereof. Fig. 7 represents a plan of the check-disk. Fig. 8 is a transverse section thereof, and Figs. 9 and 10 are similar views representing slight modifications in the form thereof, and Fig. 11 is a plan of Fig. 10. Fig. 12 is a portion of Fig. 1, but showing the application of the heated bar; and Fig. 13 is a transverse section thereof. Fig. 14 is a vertical section of a modified form of apparatus adapted to produce hollow bars, and Fig. 15 is a longitudinal section of a mass of metal apertured to produce a hollow bar.

In the several views, in which like parts are indicated by similar letters of reference, Figs. 4, 7 to 11, and 14 and 15 are drawn to an increased scale with respect to Figs. 1, 2, 3, 5, 6, 12, and 13.

Referring to Figs. 1 to 11, *a* represents a cylindrical pressure-chamber or container, which is open at both ends and is reversible, that is to say, capable of being turned end for end, if required. This pressure-chamber or container is formed of steel or other suitable metal, which will withstand the high temperature required to maintain in a plastic state the metal or alloy which is introduced therein and which will, when so heated, resist the pressure exercised by a hydraulic ram *e*, which forces, squeezes, or squirts the metal through the die or dies, as hereinafter described.

The pressure-chamber or container *a* is placed within or surrounded by a suitable coke or gas furnace *b*, (preferably arranged from end to end thereof,) the office of which is to maintain the contents of the pressure-chamber or container *a* in the necessary plastic condition during the squeezing operation.

The pressure-chamber is removably mounted in an adjustable frame composed of the screw-threaded side pieces *c* and the end pieces *c'* and *c**, the end piece *c'* carrying the removable die *d* and accessory parts and the end piece *c** carrying the ram which operates the piston or plunger *f*. Carried by the cross-head *c'*, which is centrally formed with an opening *c'** therein, are two jaws c^2, which are pivotally, or they might be otherwise, mounted upon the cross-head *c'*, and adapted to be brought together or separated by a

screw c^3 or other suitable means, the office of these jaws c^2 being to facilitate the holding in position and removal of the die d.

The die-plate d is formed of steel or other suitable metal and an opening, which opening has the form of the section to be given to the wire, rod, or bar to be produced, and the die d, around the said aperture, is beveled on both faces, so as to give free access to the metal or alloy a^* during the squeezing process, hereinafter referred to, to more perfectly condense the metal and to avoid unnecessary friction after the wire, rod, or bar is formed.

In connection with the pressure-chamber or container a is employed a hydraulic ram e, which acts upon an iron or steel block f, which latter enters the pressure-chamber or container a at the end opposite to the die d, and this block or piston f is made separate or detachable from the ram, so that it may be heated when required, and for this purpose it loosely fits into the end of the ram e.

In order to produce a wire, rod, or bar, the pressure-chamber or container a is heated to near the temperature of the plastic alloy, and the metal which is to be squeezed is then introduced into the pressure-chamber or container a, the heat of the furnace b maintaining the metal in the container a at the proper heat during the squeezing operation. The metal may be introduced into the pressure-chamber or container a in a molten state, and the furnace b may in some cases be dispensed with, the molten metal bringing the pressure-chamber or container a to the required temperature, while the metal is allowed to cool to some extent and until the required plastic condition is reached before being operated upon.

When introducing molten metal into the chamber a, the set-screws c^5 are slackened back, the latter is removed from the frame by any suitable foundry appliances, and the charge is inserted while the chamber a is in a vertical position, the lower end being previously closed by a plug or cap, and the chamber is replaced.

In some cases, and more especially when the metal is not in a fluid condition, the pressure-chamber a may, as represented at Figs. 12 and 13, be previously heated by the introduction of a heated block or cylinder of iron or steel a^2, which is removed before the pressure-chamber a is charged.

In order to center and hold the pressure-chamber or container a in position, and also to prevent any movement thereof on the return stroke of the ram e, set-screws c^6, passing through the cross-head c' and through an adjustable transverse bar c^4 on the opposite side of the frame, are employed to impinge upon the ends of the pressure-chamber or container a and thus to center and hold it securely in position.

A suitable quantity of metal having been introduced into the pressure-chamber or container a, and the required consistency having been attained, the ram or plunger e and block or piston f are gradually caused to advance, when the metal a^* will be gradually forced, squirted, or squeezed through the die or dies d in the desired form.

In order to prevent the plastic metal in the advance of the ram or plunger e and block or piston f being forced between the same and the walls of the pressure-chamber or container a, I place between the piston f and the plastic metal a dished, beveled, or annular corrugated metal plate or disk g, such as I have represented at Figs. 7 to 11, which loosely fits the bore of the pressure-chamber or container a, so that under the pressure of the ram or plunger e and block or piston f the disk or plate g will to some extent spread and thereby closely fit the pressure-chamber or container a and constitute an efficient check against the passage of the metal under pressure past the same. This plate, disk, or check g is formed of a metal or alloy, such as copper, iron, steel, nickel, silver, or the like, that is less plastic and more rigid at the temperature at which the squeezing takes place than the metal or alloy to be operated upon in the pressure-chamber or container a.

When the plastic metal has been squeezed out of the pressure-chamber or container a, the clips or jaws c^2 of the cross-head c' are caused to be opened and the die d forced out of position by the continued movement of the ram, after which the latter is retracted, the pressure-chamber or container a is again charged with plastic metal, the die d is replaced in position, and the above-described operation is repeated.

In the example given at Fig. 14 I have shown a means of producing hollow bars according to my invention. For this purpose I arrange within the pressure-chamber or container a a mandrel h, of steel or other suitable material, corresponding with the aperture of the die d, which mandrel is fixed with the block or piston f and passes through the die d, and is of a suitable diameter to enable the metal a^* to pass around it and through the die d in sufficient quantity to produce a hollow bar of the required thickness, as represented in the drawings at a^{**}. In making hollow bars in this manner the metal, if it be introduced into the pressure-chamber or container in a plastic state, must be provided with a hole, as represented at Fig. 15, corresponding with the mandrel h and intended to relieve the same in a similar manner to that represented in Fig. 14.

In some cases, and as represented in the drawings, Fig. 14, the mandrel h is formed hollow or with a passage h' therethrough, and air or steam may, during the squeezing operation, be forced through such passage h' to retain the mandrel h in a comparatively cool state and to cool the hollow bar a^{**} after it is formed.

I sometimes introduce into the bore of the

ram *e* a tube *e'*, smaller than the bore, so as form a casing provided with an inlet e^2 and outlet e^3, through which air, gas, or water may be caused to circulate for cooling evenly the wire, rods, or bars. This arrangement is shown for convenience in connection with Fig. 1.

By the means hereinbefore described I am enabled expeditiously and economically to produce lengths of wire, rods, or bars from copper alloys of the nature above stated in various forms and sections.

It will be readily understood by persons conversant with the manufacture of wire, rods, or bars that the apparatus hereinbefore described for effecting such manufacture from various copper alloys can also be advantageously employed in the manufacture of such articles from other alloys or metals.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a device of substantially the character specified, the combination of a frame composed of the screw-threaded side pieces or bars at the ends carrying cross-heads, a pressure-chamber open at both ends for containing the heated alloy, suitable means for mounting it in the frame consisting of a cross-bar working on the side pieces or bars and carrying set-screws which bear against the said chamber and set-screws carried by the end piece or cross-head, a die also carried by the end piece or cross-head, an aperture in the cross-head for the passage of the squeezed metal and a suitable plunger or piston working in the chamber and actuated by a hydraulic ram carried by the frame, substantially as shown and described.

2. In a device of substantially the character specified, the combination of the frame, a pressure-chamber mounted in said frame, a die located at one end of the chamber and suitable means for removably securing it in place on the end piece consisting of a pair of jaws pivoted to the end piece and adapted to surround the die and a set-screw for holding the jaws around the die, and a piston also carried by the frame and working in the chamber, substantially as shown and described.

3. In a device of substantially the character specified, the combination of the pressure-chamber for containing the heated alloy, a die, a piston working in the chamber and a thin disk of metal formed with annular corrugations placed in front of the piston and of a higher melting-point than the plastic alloy or metal under treatment so that it retains its rigidity in the presence of the heated metal and expands under pressure so as to prevent the squeezing of the plastic metal past the piston, substantially as herein shown and described.

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