

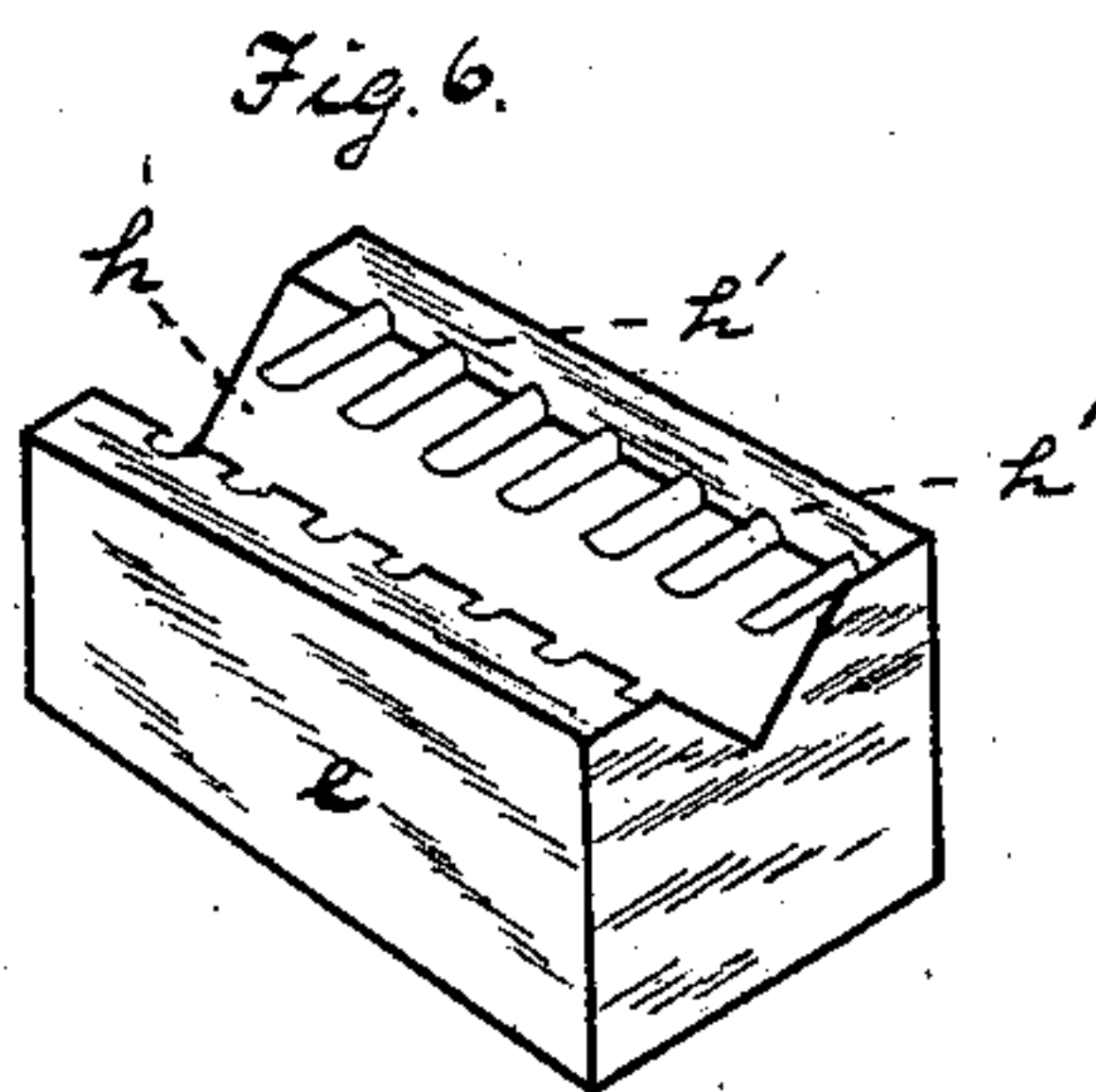
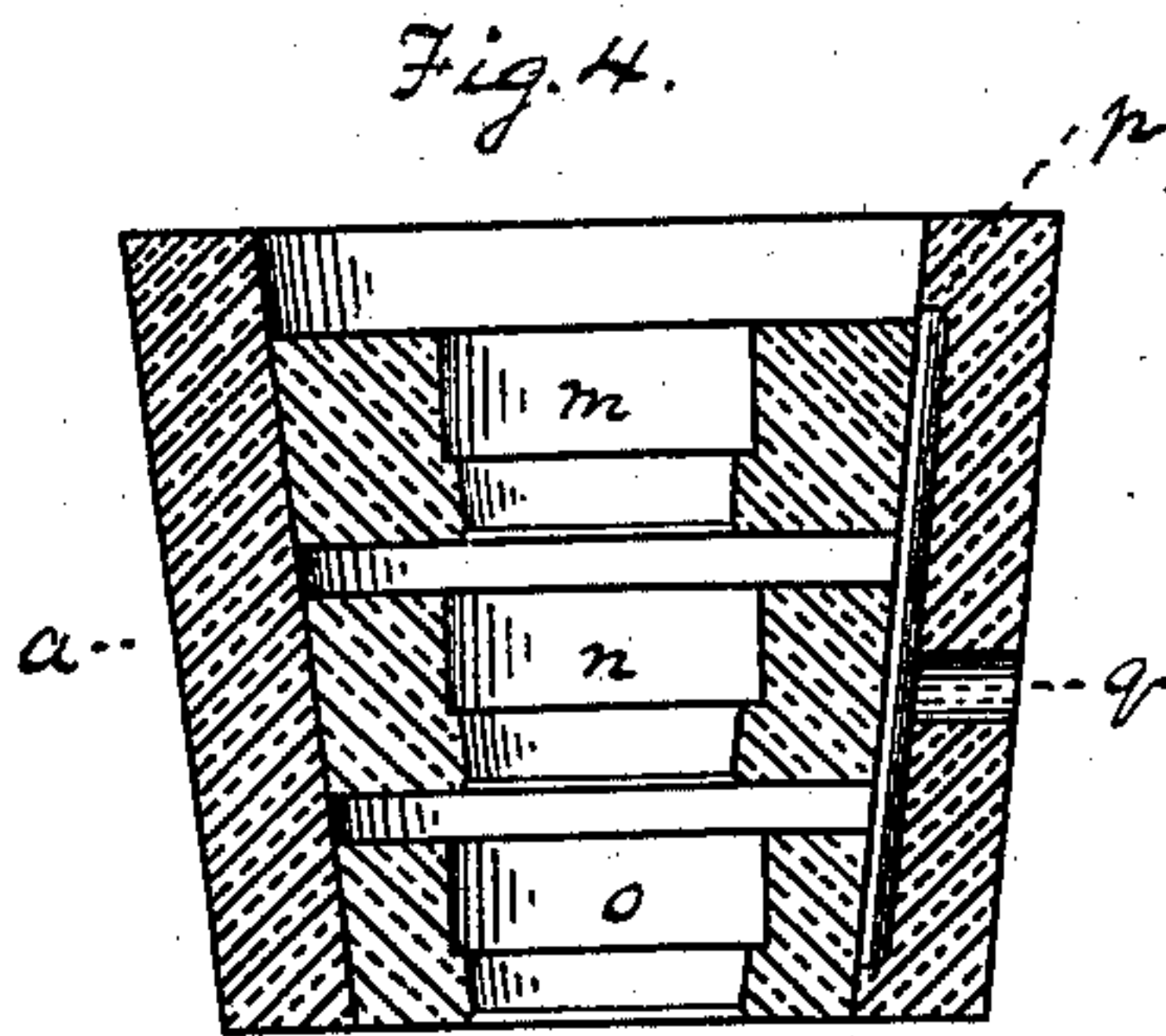
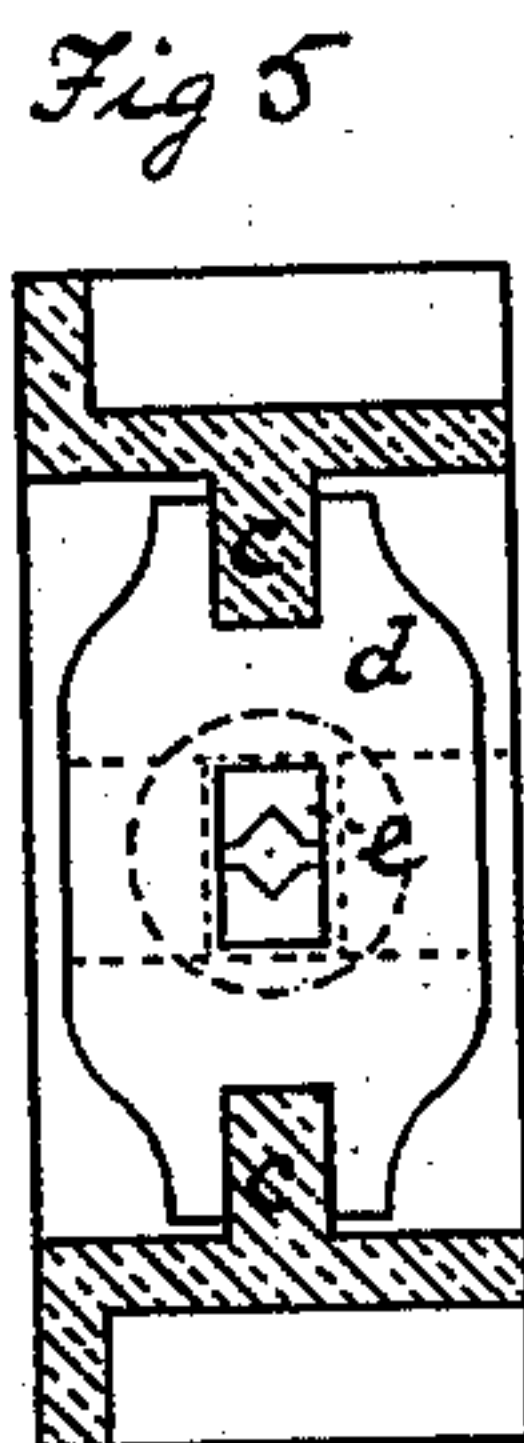
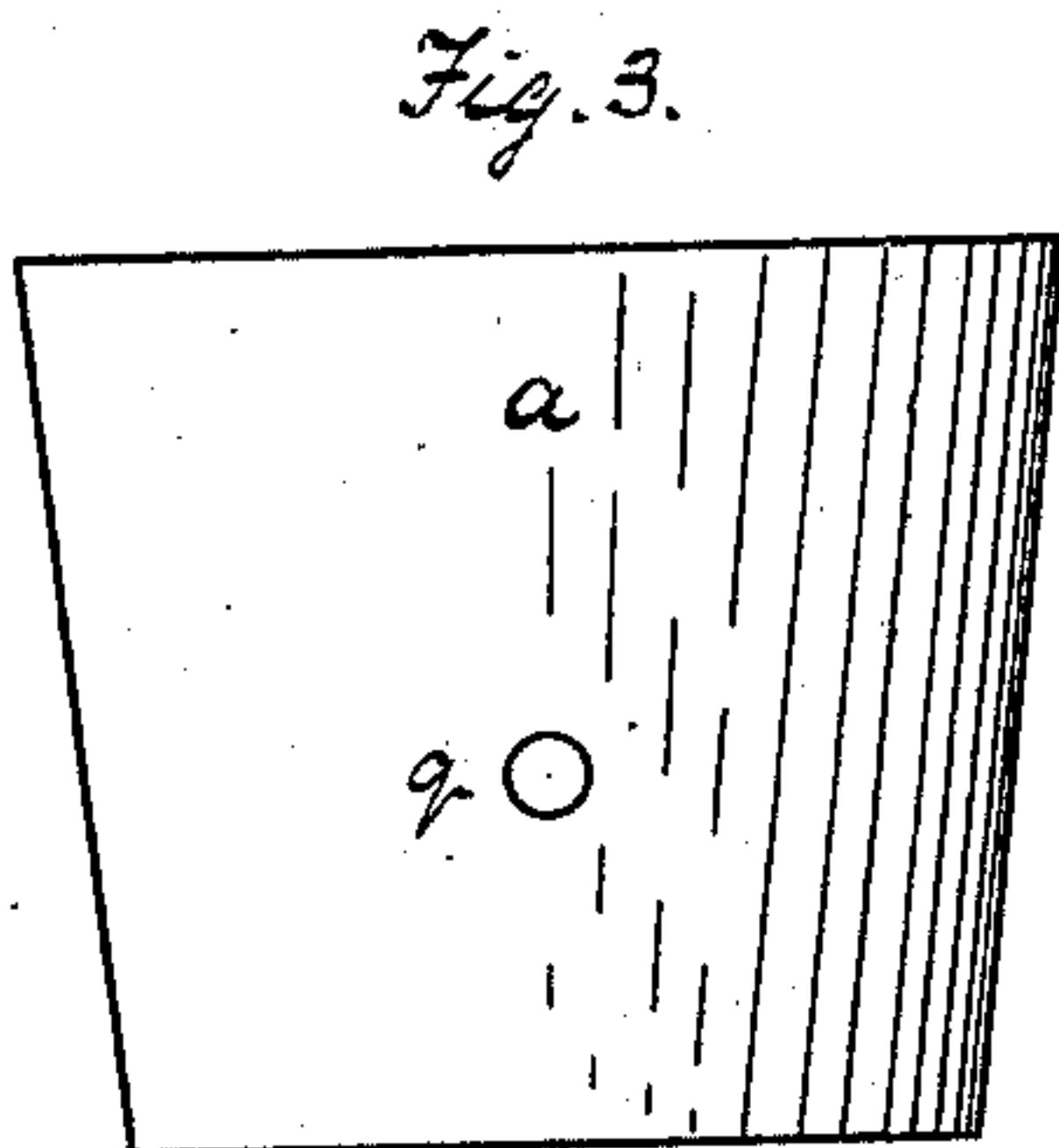
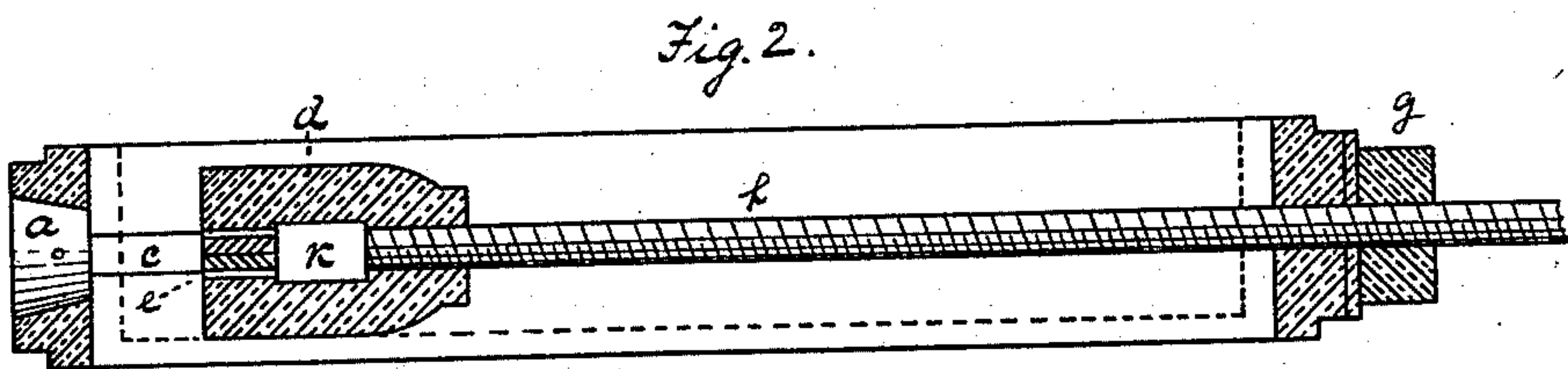
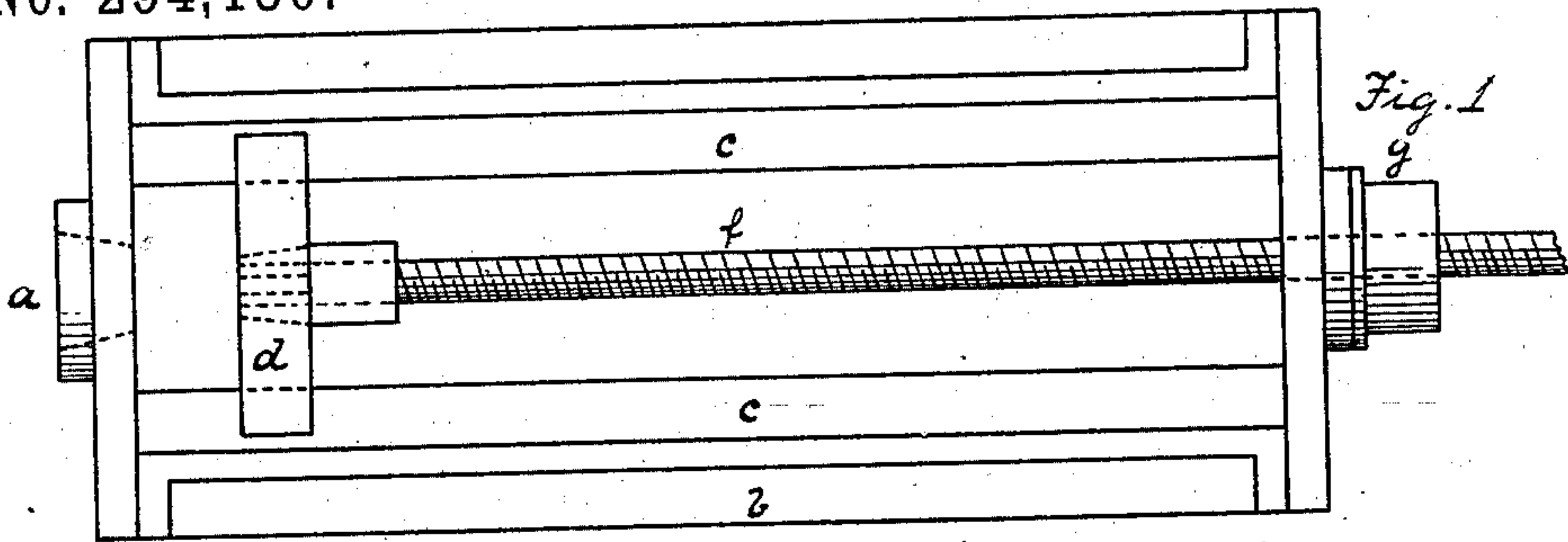
(No Model.)

J. H. HELM.

HARDENING AND STRAIGHTENING IRON AND STEEL RODS.

No. 294,130.

Patented Feb. 26, 1884.



Witnesses

R. W. Townsend  
J. K. Smith

Inventor

J. Henry Helm

by his attorneys

Rekewell & Herr



# UNITED STATES PATENT OFFICE.

J. HENRY HELM, OF ALLEGHENY, PENNSYLVANIA.

## HARDENING AND STRAIGHTENING IRON AND STEEL RODS.

SPECIFICATION forming part of Letters Patent No. 294,130, dated February 26, 1884.

Application filed May 28, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, J. HENRY HELM, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Hardening and Straightening Iron and Steel Rods and Shafting; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a new and improved process whereby iron and steel rods and shafting, as produced by the ordinary mode of rolling, are converted into finished rods or shafting, the fibers of which extend in straight lines parallel with the axis of the rod or shaft, the surface of which is polished and hardened, and the metal composing the bar or shaft is rendered dense and compact throughout, by which process a new and improved article of manufacture is produced, consisting of iron or steel bars or rods having a high degree of polish and hardness, which are straight, and retain all the strength, stiffness, and rigidity with which they emerge from the finishing-die, such rigidity and stiffness not having been impaired by any subsequent straightening.

It is well known that heretofore in all of the methods of either cold rolling or drawing rods or shafting the bars are not rolled or drawn straight, but have to be straightened by a subsequent and separate process. These bars, which have been crooked and then straightened, may be bent again with much less strain or force than would be required to bend a rod originally drawn straight.

I am aware that metal rods, bars, and wire have been elongated, polished, and hardened by drawing them through tapering dies. It has, however, been impossible to draw the bar or rod in such a manner as to produce a straight fiber parallel with the axis of the rod, and the bar or rod as it comes from the die is bent or twisted. In order to render these rods or bars straight, they are passed through rolls, or are bent to the required shape by other devices. The stiffness and rigidity of the bar, however, is thereby impaired, and they are liable to resume the crooked shape imparted by the drawing operation. The utility of shafting and rods which have been hardened and polished by drawing them through dies has therefore been greatly lessened by this serious imperfection.

The object of my invention is to draw the bar or shaft so as to harden and polish the sur-

face thereof, to render the fibers compact in lines parallel with each other, and at the same time keep the fibers in a straight line parallel with the axis of the shaft or bar.

I will now describe my invention, so that others skilled in the art may use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation of the apparatus employed by me in my improved process. Fig. 2 is a top view, partly in section. Fig. 3 is a side elevation of the die box or case. Fig. 4 is a sectional view of the same, showing the dies. Fig. 5 is an end view, partially in section, of the apparatus, showing the grippers. Fig. 6 is a perspective view of one of the grippers.

Like letters of reference indicate like parts wherever they occur.

The iron or steel bars or rods, having been formed of the desired shape by rolling or otherwise, are first cut or swaged at one end, so as to form a portion about six inches in length, of a smaller diameter than the remaining part of the rod or bar, the purpose of which is to form an entering end on the bar, which is readily held and retained by the grippers. The scale is then removed from the bar by means of an acid bath, after which it is cleaned by being immersed in a soda bath in the usual manner. The rod or bar so prepared is then ready to be subjected to my improved process.

In order to prevent friction and injury to the surface of the bar as it is drawn through the dies, it is first, after having been cleaned, as described, boiled for about ten minutes in a strong or saturated solution of chloride of sodium or common salt in water. This forms a perfect and even coating on the rod. It is then drawn successively through one or more sets of dies, arranged so that their centers shall be in a line one with the other, which dies have but slightly and gradually tapering openings or holes, the second die being of a slightly less diameter than the first, and so on, each die reducing the bar about one-hundredth of an inch. These dies are held in a suitable box or boxes, (having an oil-conduit therein, so that the surfaces of the dies may be kept coated with oil,) combined or in connection with apparatus for drawing the bar or rod through the dies.

Owing to the gradual taper of the dies and



slight decrease in their diameters, the greatest possible amount of compression with the least possible amount of elongation is obtained, so that the density and also the stiffness of the rod or bar are increased instead of weakened. In this a radical difference exists between my improved process and the common method of drawing wire, the purpose of the operation in the latter case being merely to elongate the wire, whereby the stiffness is decreased without a material increase in density. The rod or bar is then drawn through another set of two or more dies having a somewhat greater taper than those already mentioned, in order to smooth and polish the surface. These dies, which are preferably three in number, are arranged in the die-box, so that their centers are in a line one with the other, the effect of which is to render the fibers of the bar perfectly straight in a line parallel with its axis, and to give it a smooth and polished surface.

In order to accomplish the purpose of my invention it is absolutely necessary that the centers of the dies should be in a line one with the other; and to this end I fit the dies in the die-box by grinding the inner circumference of the die-box and the outer circumference of the dies until the dies fit in the box, their centers being in a true straight line with each other. The slightest variation from this straight line would be apparent and magnified in the bars drawn through the dies. These dies before mentioned are placed and secured in a tapering die-box, *a*, which die-box is situated at the end of a frame, *b*. Mounted in the frame *b* and extending from the die-box *a* in a straight line are ways *c*, on which slides the carriage or head *d*, which holds the grippers *e*. From the rear end of the head *d* a rod, *f*, on which is formed a screw-thread, extends to and passes through the other end of the frame *b*. At this point on the screw-rod *f* is a nut, *g*, screw-threaded, by turning which the head *d* is either drawn from or advanced toward the die-box *a*. The grippers *e* are formed in two parts, having a V-shaped groove or cavity, *h*, in their meeting surfaces, on which are corrugations or teeth *h'*. The outer surfaces of these grippers are tapered, so as to fit in the tapered opening in the head *d*, the purpose of the taper being to bring the grippers together when they are drawn into the cavity in the head and cause them to bite firmly on the end of the bar or rod. These grippers are inserted in their cavity in the head *d*, at the rear end thereof, through the opening *k*.

In order to draw the bar through the dies, the smaller or swaged end of the bar or rod to be operated on is passed through the die or dies in the die-box into and between the grippers in the head *d*. By turning the nut *g* the head or carriage is caused to move along the ways *c* away from the die-box *a*, and the rod is drawn through the die or dies. The dies

*m n o* are situated in the die-box at a slight distance apart, and in the inner surface of the die-box is a groove or space, *p*, communicating with an oil-hole, *q*, through which oil may be introduced, so as to cover the surface of the dies.

I am aware that iron and steel rods have, while heated, been drawn through tapering dies for welding purposes; that in the manufacture of wire the metal, while cold, is drawn through dies of a decreasing diameter, in order to elongate the metal, and that rods and bars have been drawn, while cold, through single tapering dies, to harden and polish the rod.

I am also aware that metal rods have been drawn through a series of two divided converging dies; but iron and steel bars have not heretofore been drawn through a series of two or more solid tapering dies fixed so that their centers shall be on a straight line one with the other, so as to render the fibers of the bar straight and parallel with the axis of the bar.

Rods, bars, and shafting produced by my improved process can be easily distinguished from artificially-straightened shafting by placing the ends of the shafting on two supports and suspending a weight sufficiently heavy to cause the rod or shafting to deflect from a straight line between the supported ends. When this rod or shaft is turned on its axis, if it has been crooked and afterward straightened, the weight will cause a greater deflection in the direction of the former curve or bend, while with bars produced by my improved process the deflection will be the same on all sides of the bar.

The advantages obtained by drawing the rod through a series of tapered dies, the centers of which are on a line with each other, are the strength, rigidity, and straightness of the bar produced in addition to the density, hardness, and polish produced by the drawing operation.

I do not desire to claim, broadly, the process of hardening, stiffening, or elongating iron or steel rods or shafting by drawing them through single fixed dies, or through one or more divided converging dies; but,

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The herein-described process of hardening, stiffening, and straightening iron or steel bars or shafts, which consists in drawing them through two or more solid tapering dies, the centers of which are fixed in a line one with the other, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 25th day of May, A. D. 1883.

J. HENRY HELM.

Witnesses:

JOHN S. KENNEDY,  
JNO. K. SMITH.