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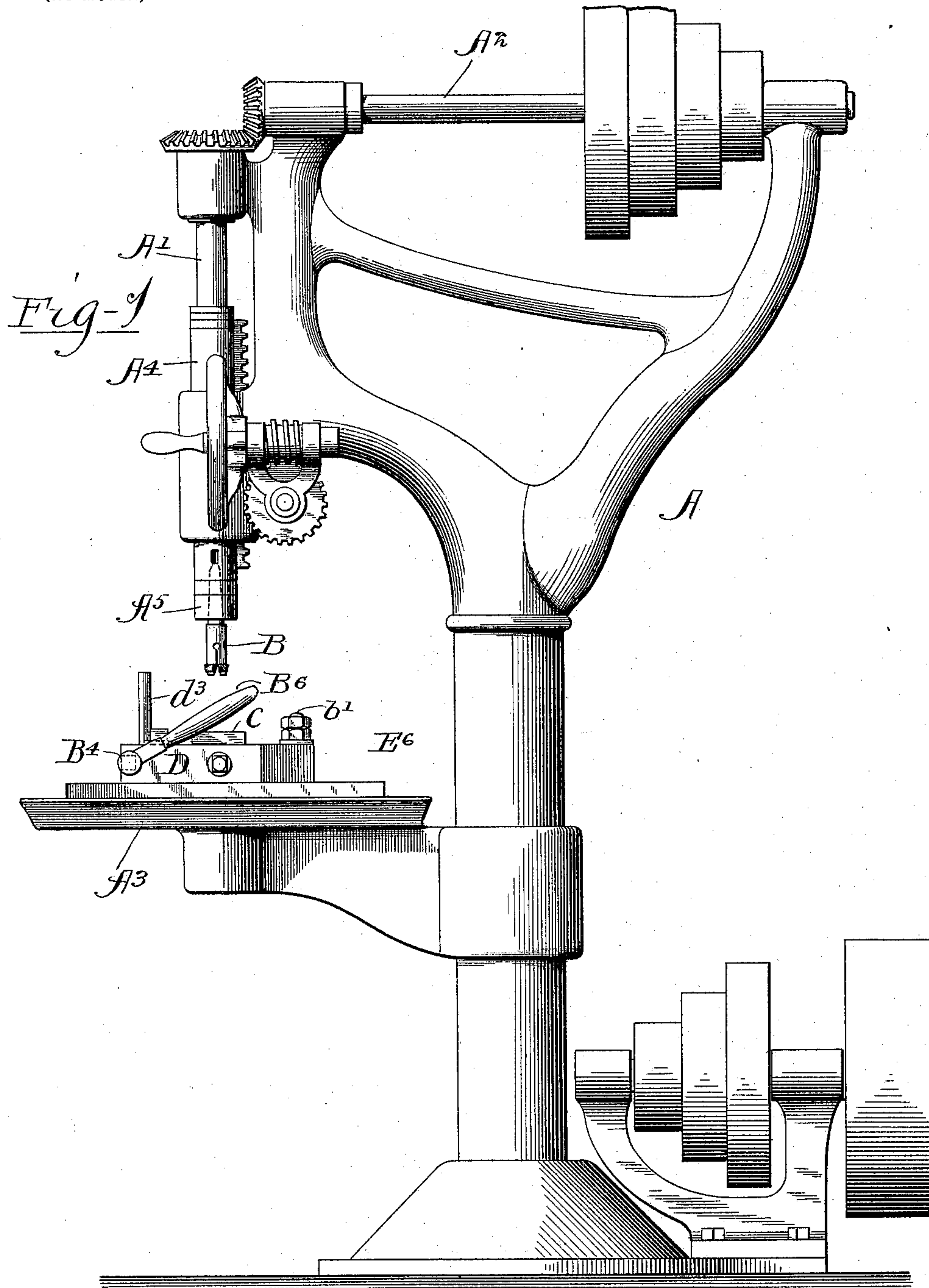
Patented May 23, 1899.

J. N. HALIFAX.
NURLING MACHINE.

(Application filed Mar. 4, 1898.)

(No Model.)

5 Sheets—Sheet 1.



Witnesses

Harold E. Bennett,
Edmund H. Krause.

Inventor

Joseph Nathaniel Halifax

by Poole & Brown
his Attys.

No. 625,726.

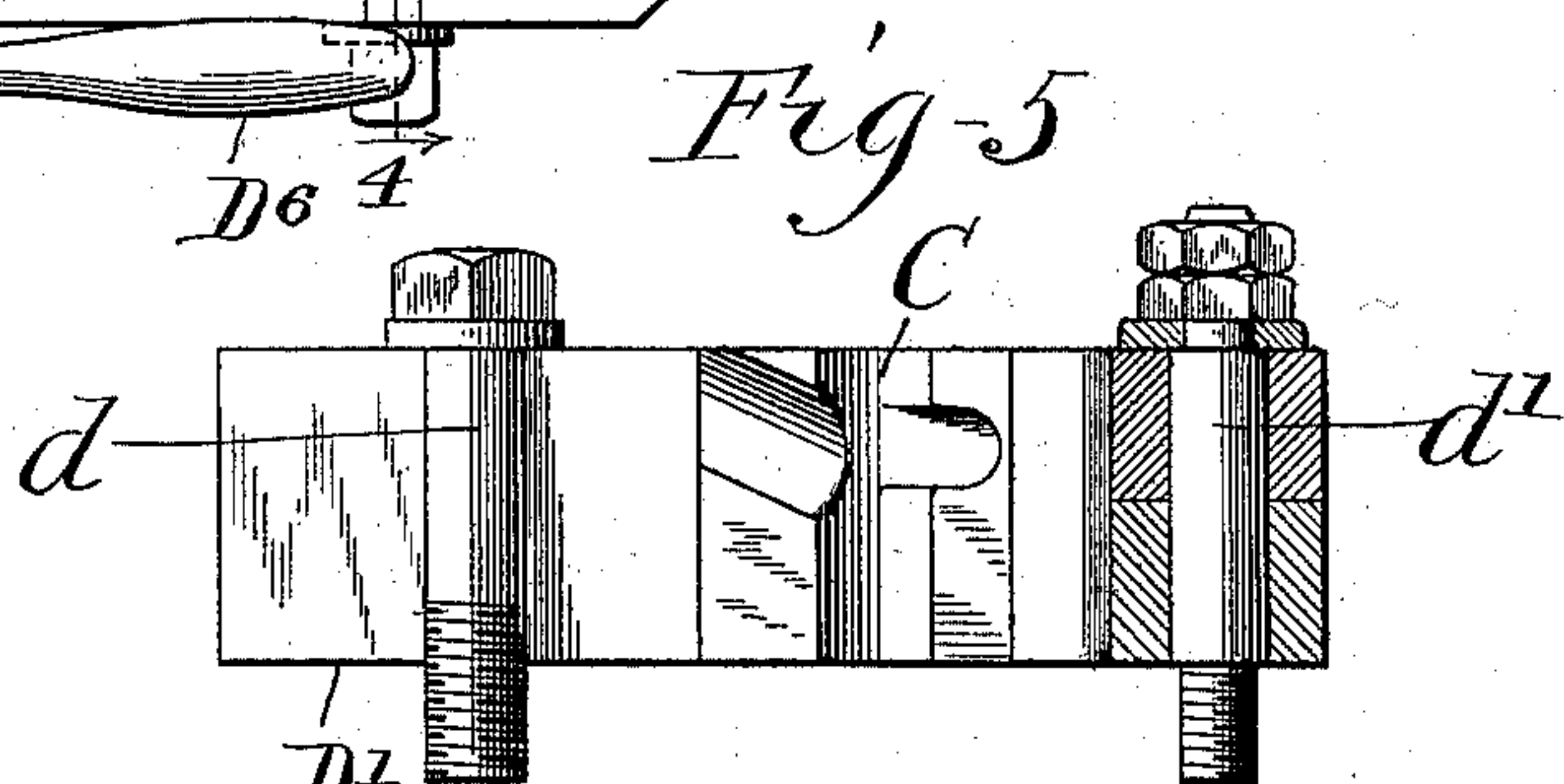
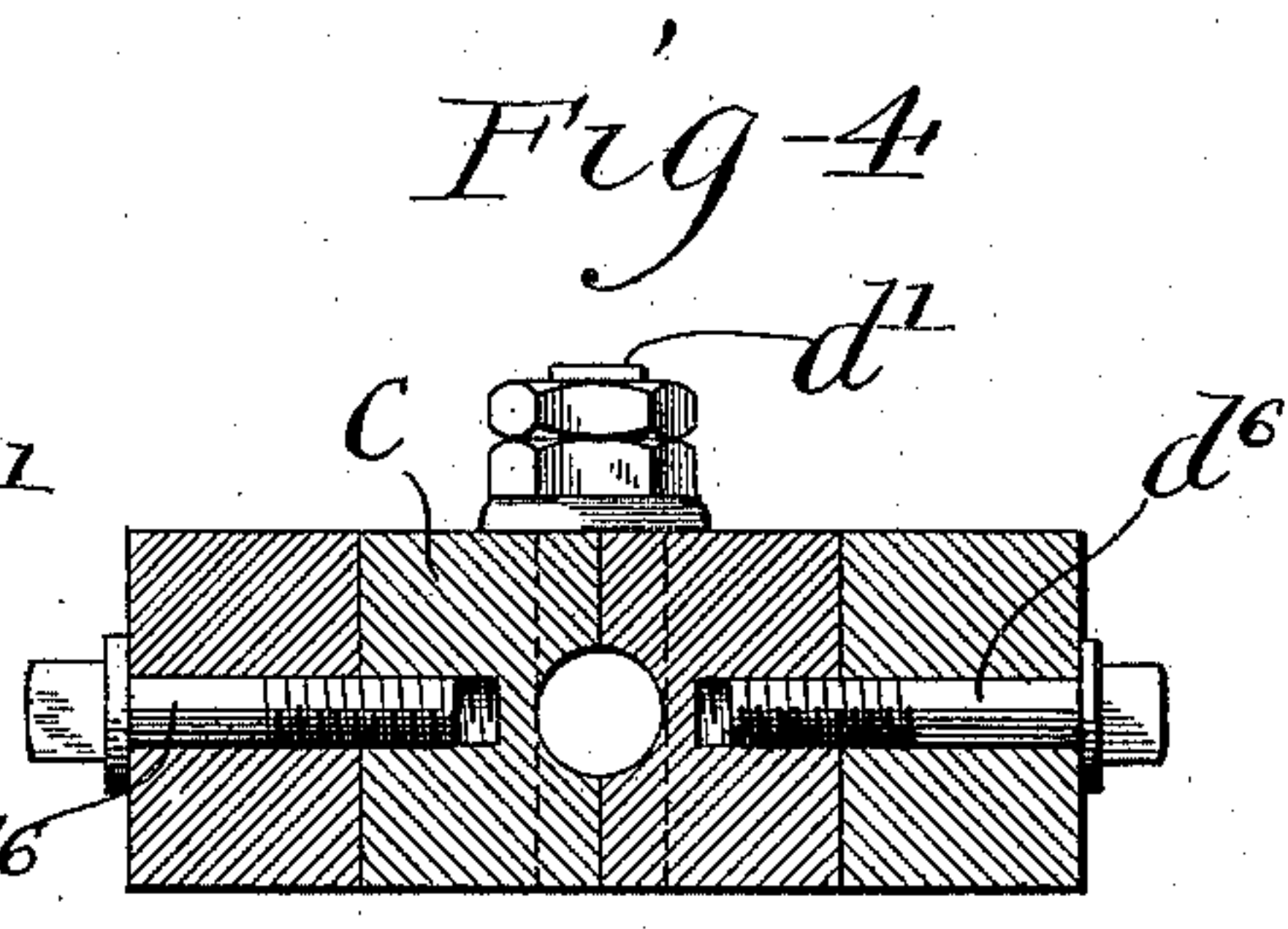
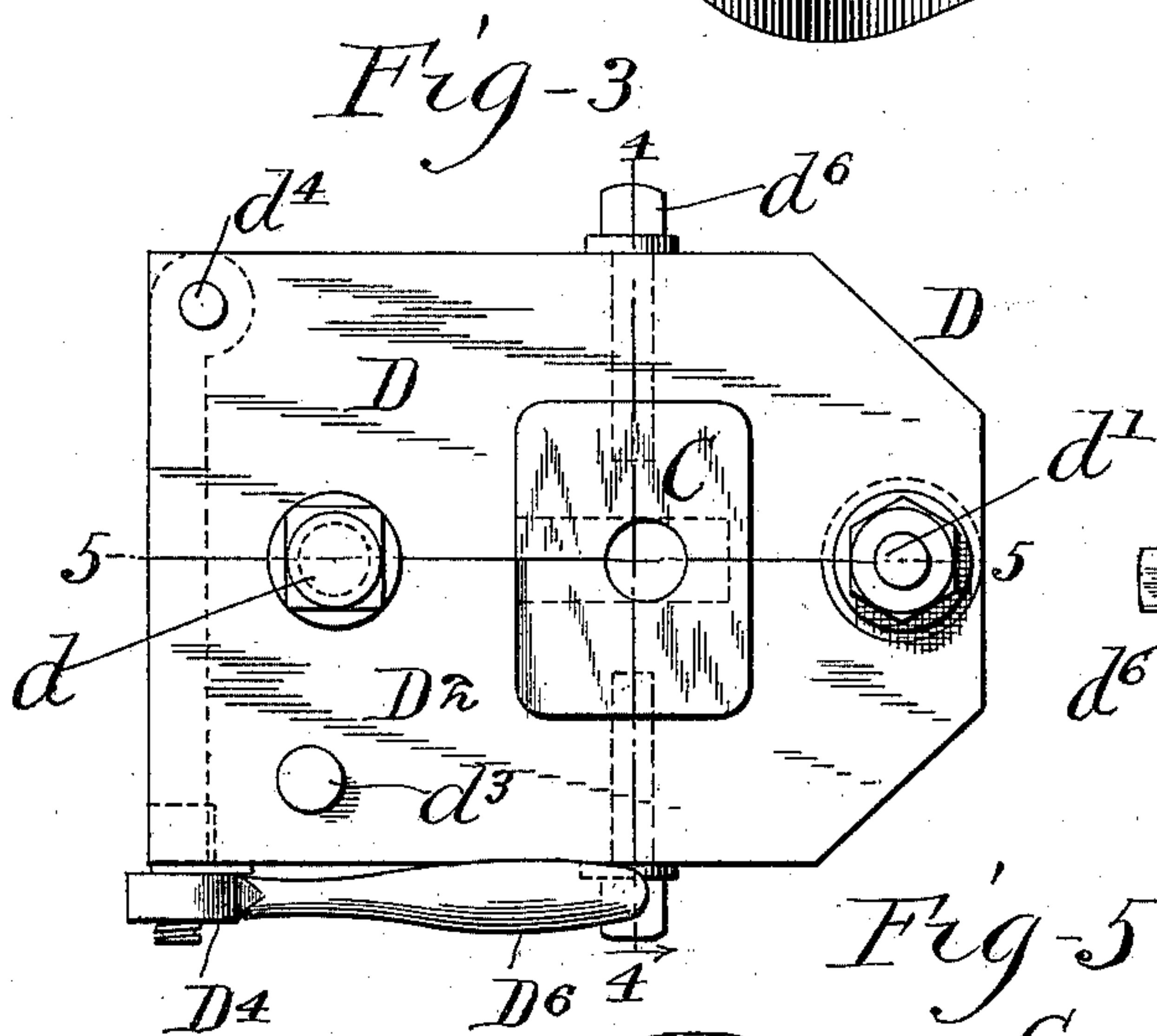
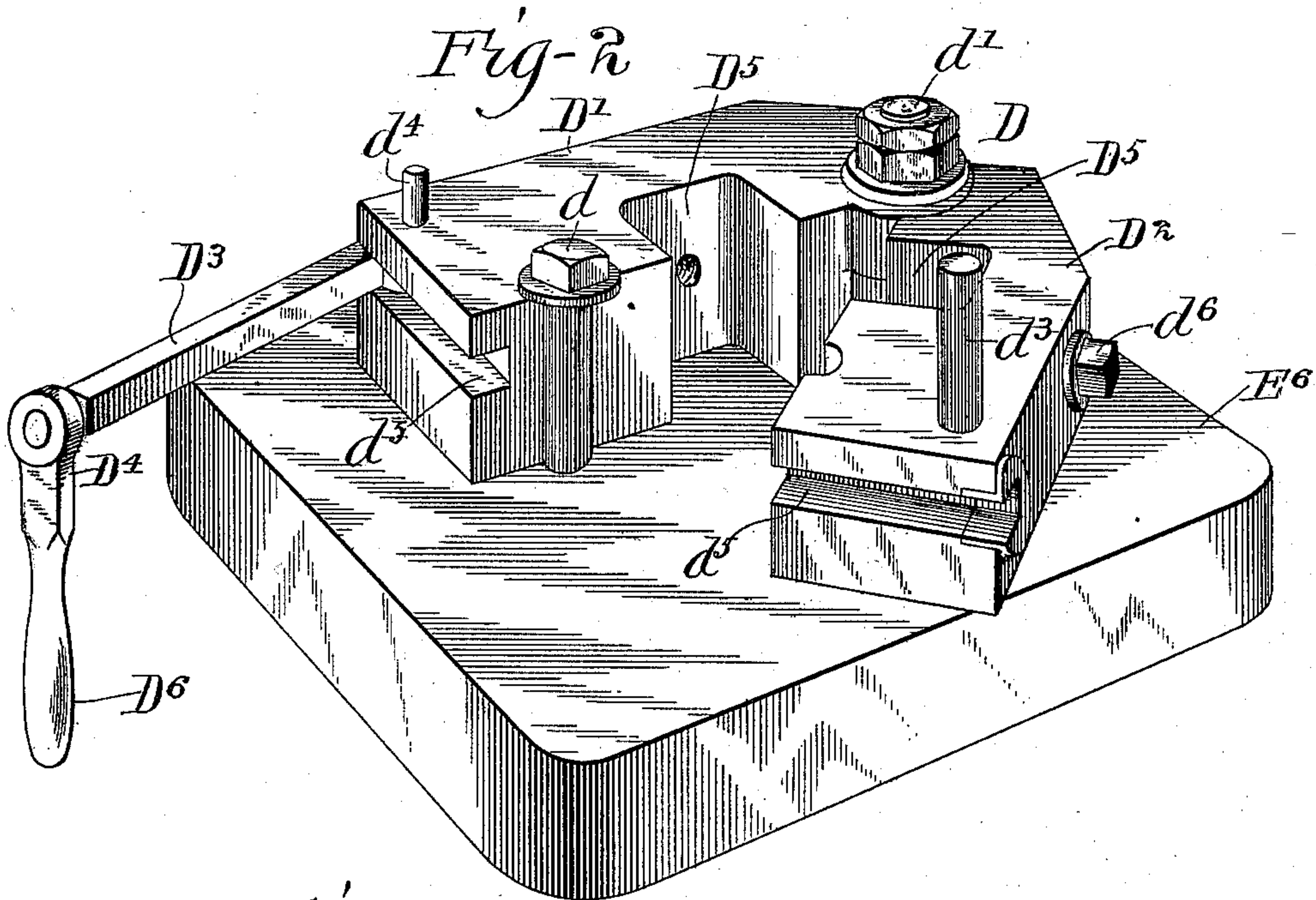
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5 Sheets—Sheet 2.



Witnesses

Harold B. Bennett
Edmund A. H. H. H.

Inventor

Joseph Nathaniel Halifax

by

Pool & Brown

his Attys.

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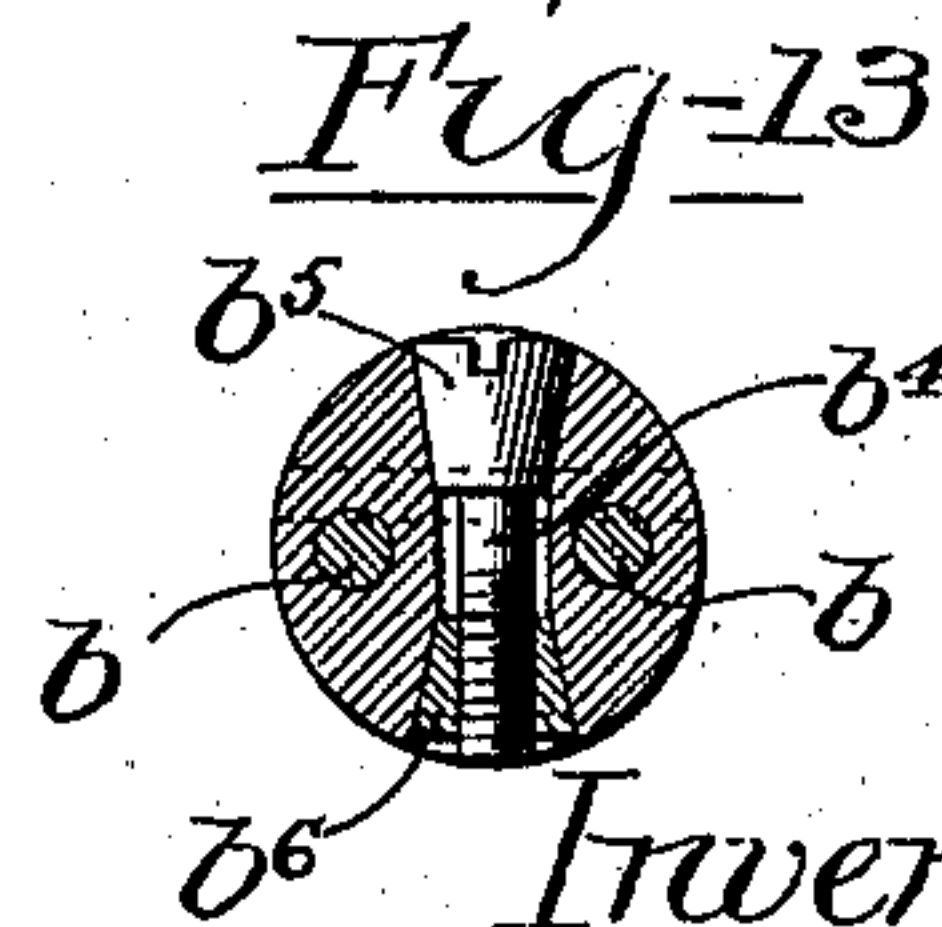
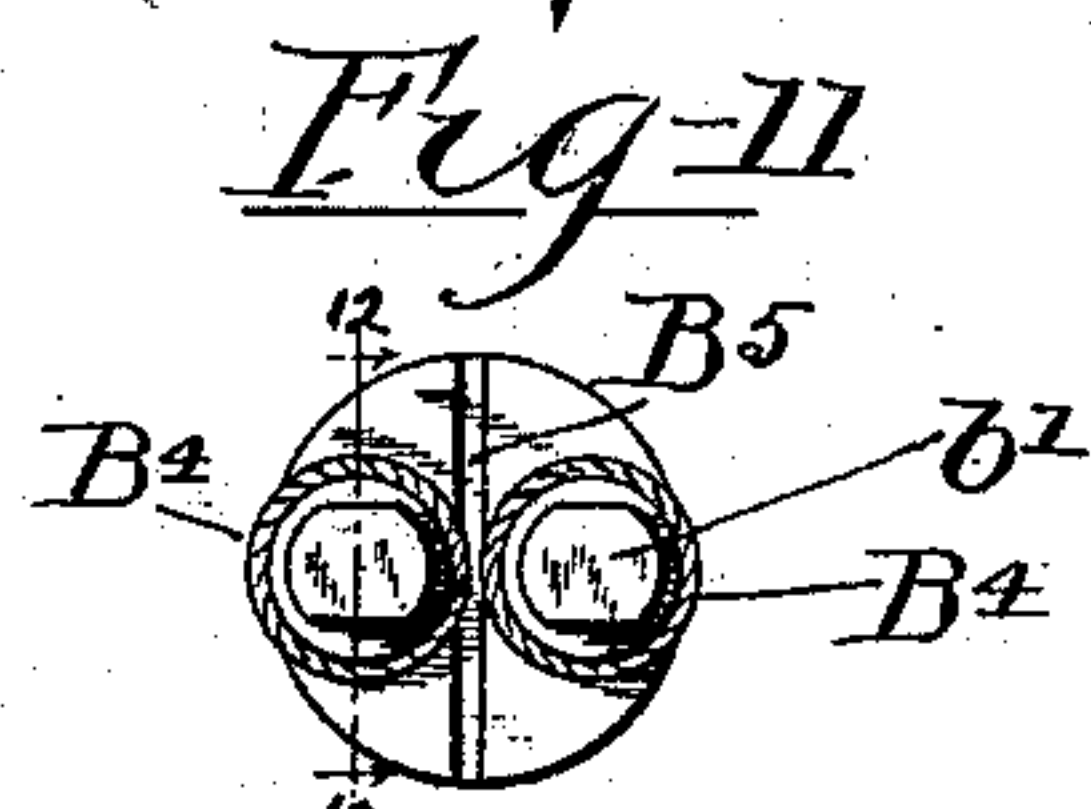
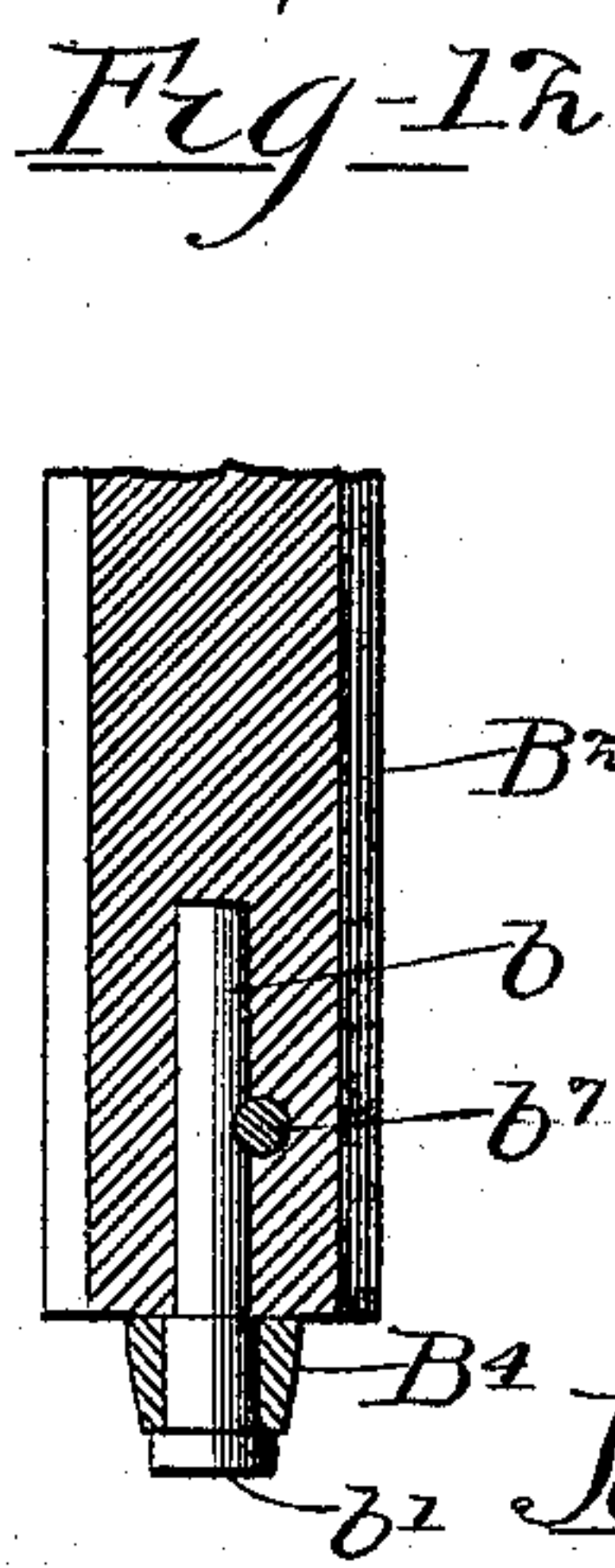
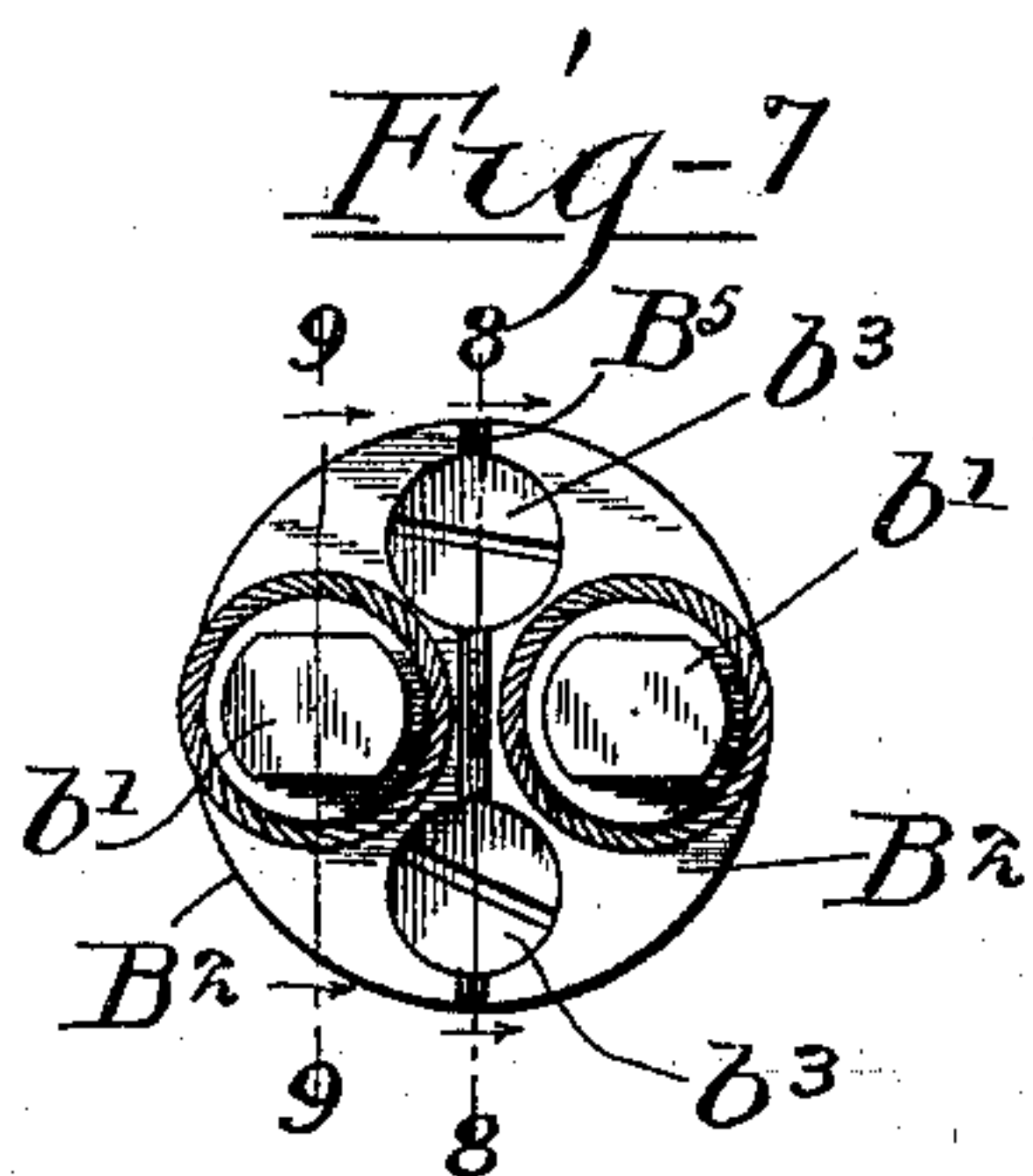
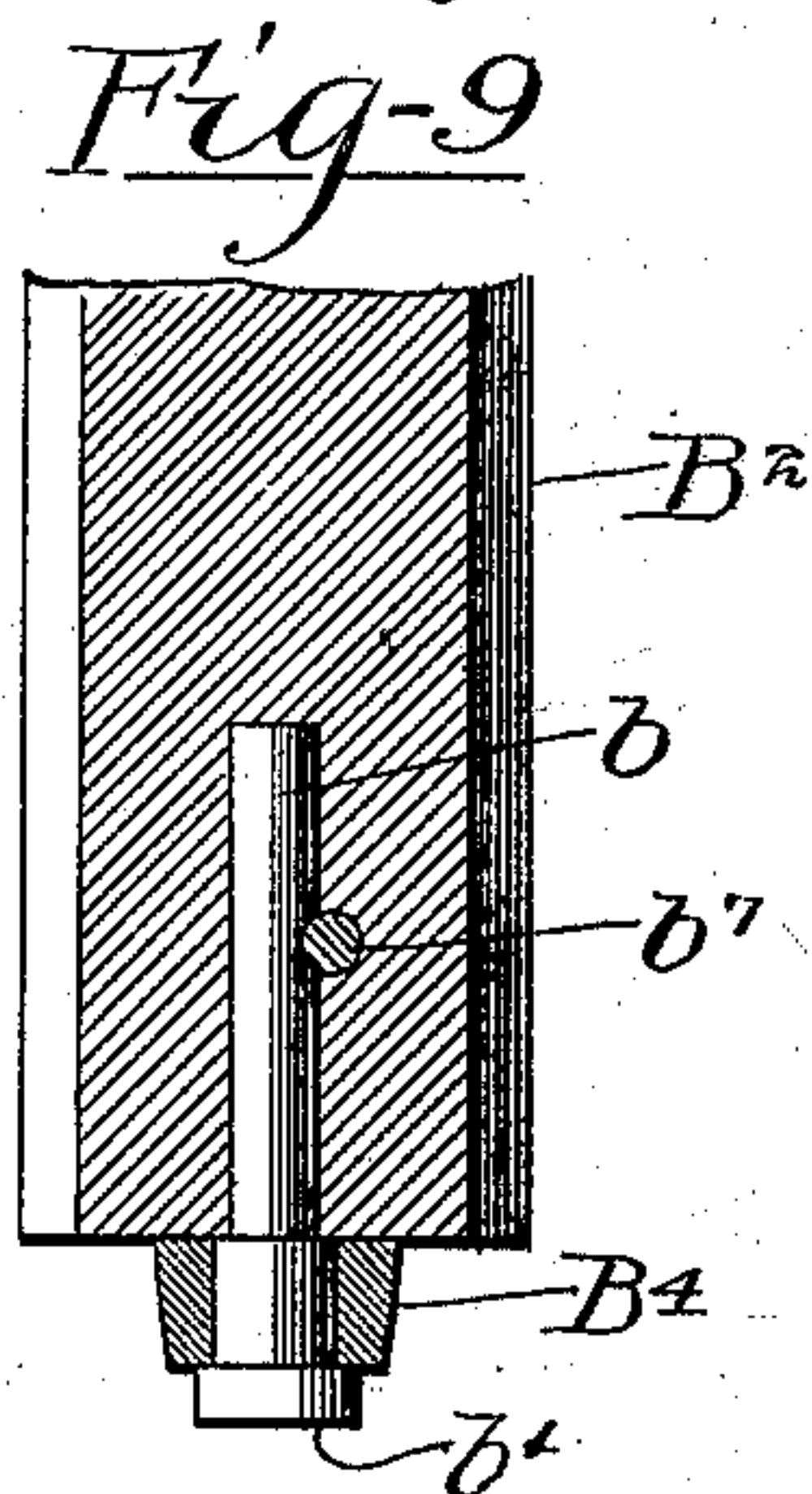
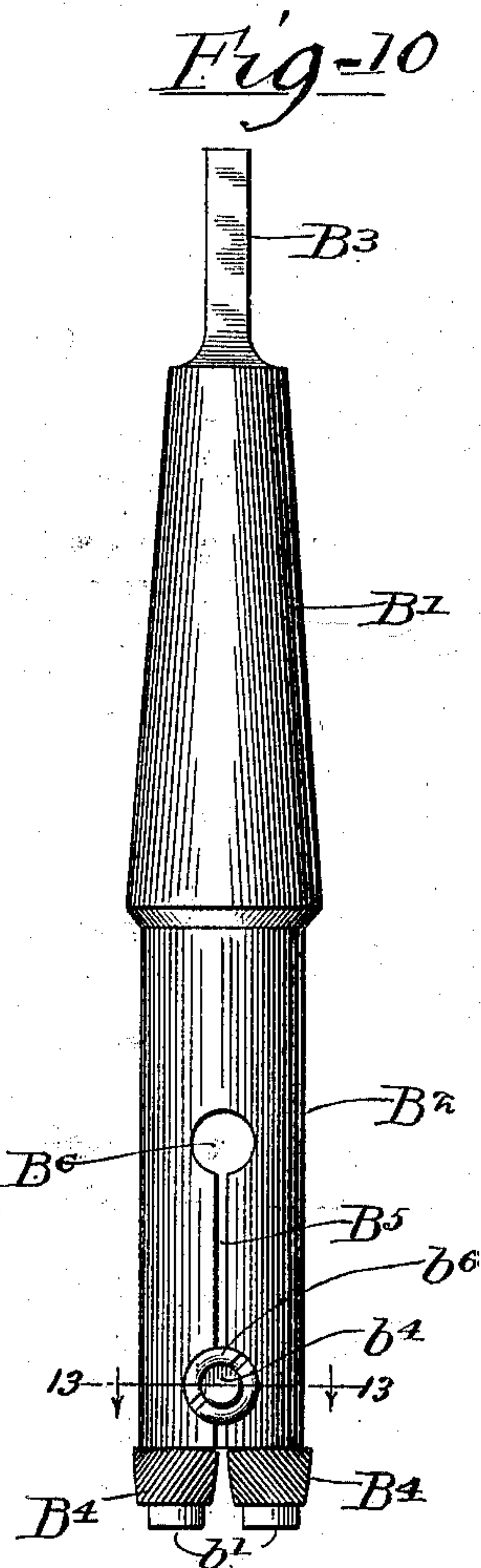
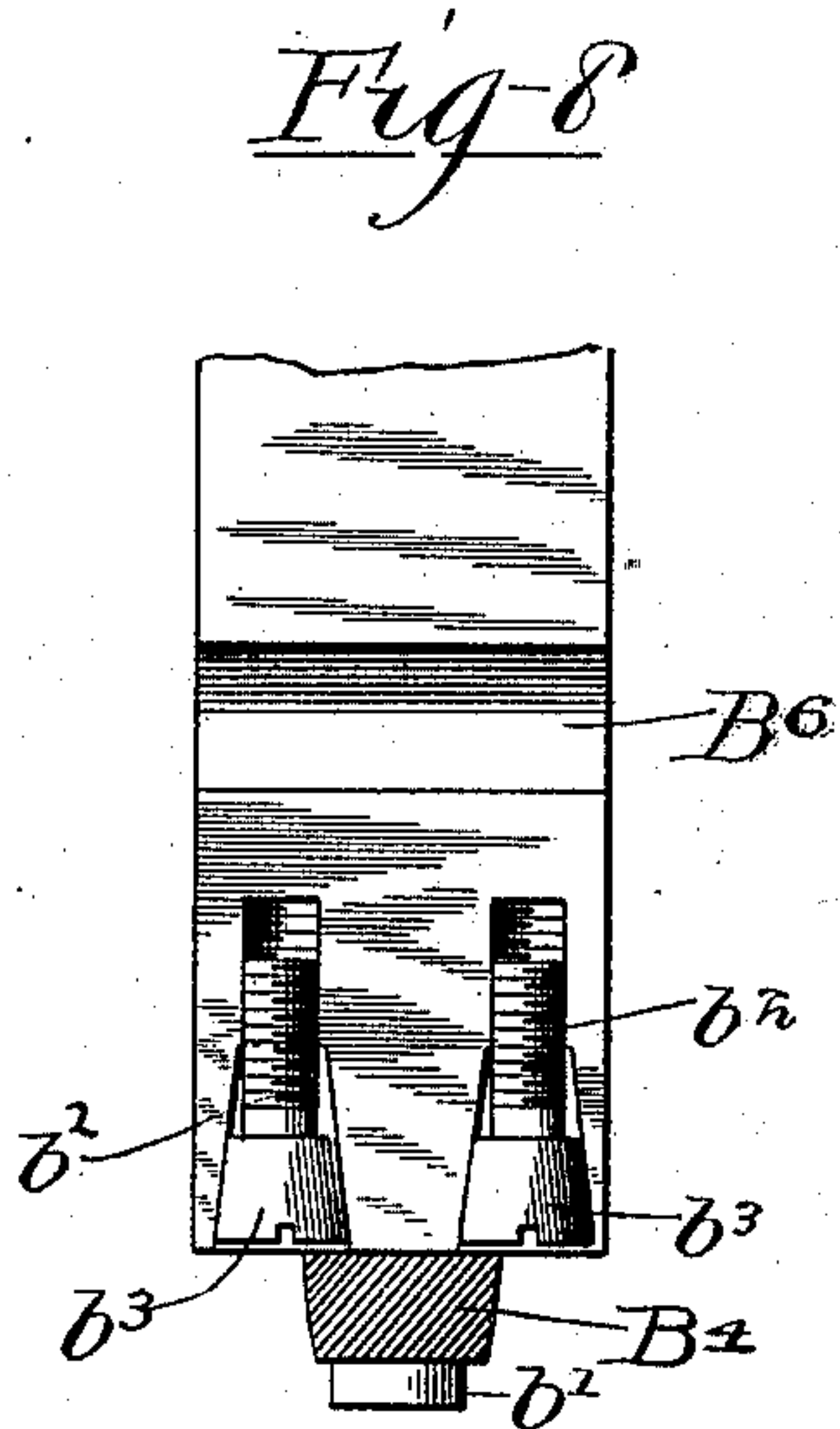
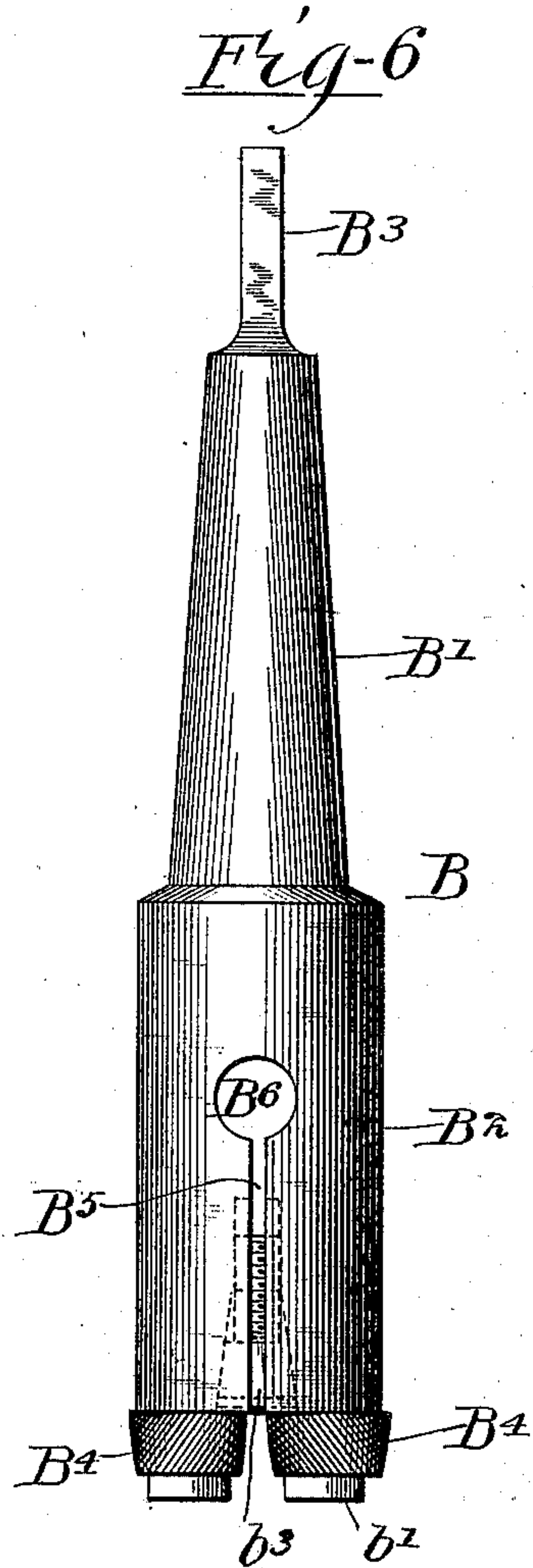
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(Application filed Mar. 4, 1898.)

(No Model.)

5 Sheets—Sheet 3.



Witnesses

Harold Bennett

Edmund A. Franke

Inventor

Joseph Nathaniel Halifax

by *Pooler & Brown* *his Attys*

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J. N. HALIFAX.
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(Application filed Mar. 4, 1898.)

(No Model.)

5 Sheets—Sheet 4.

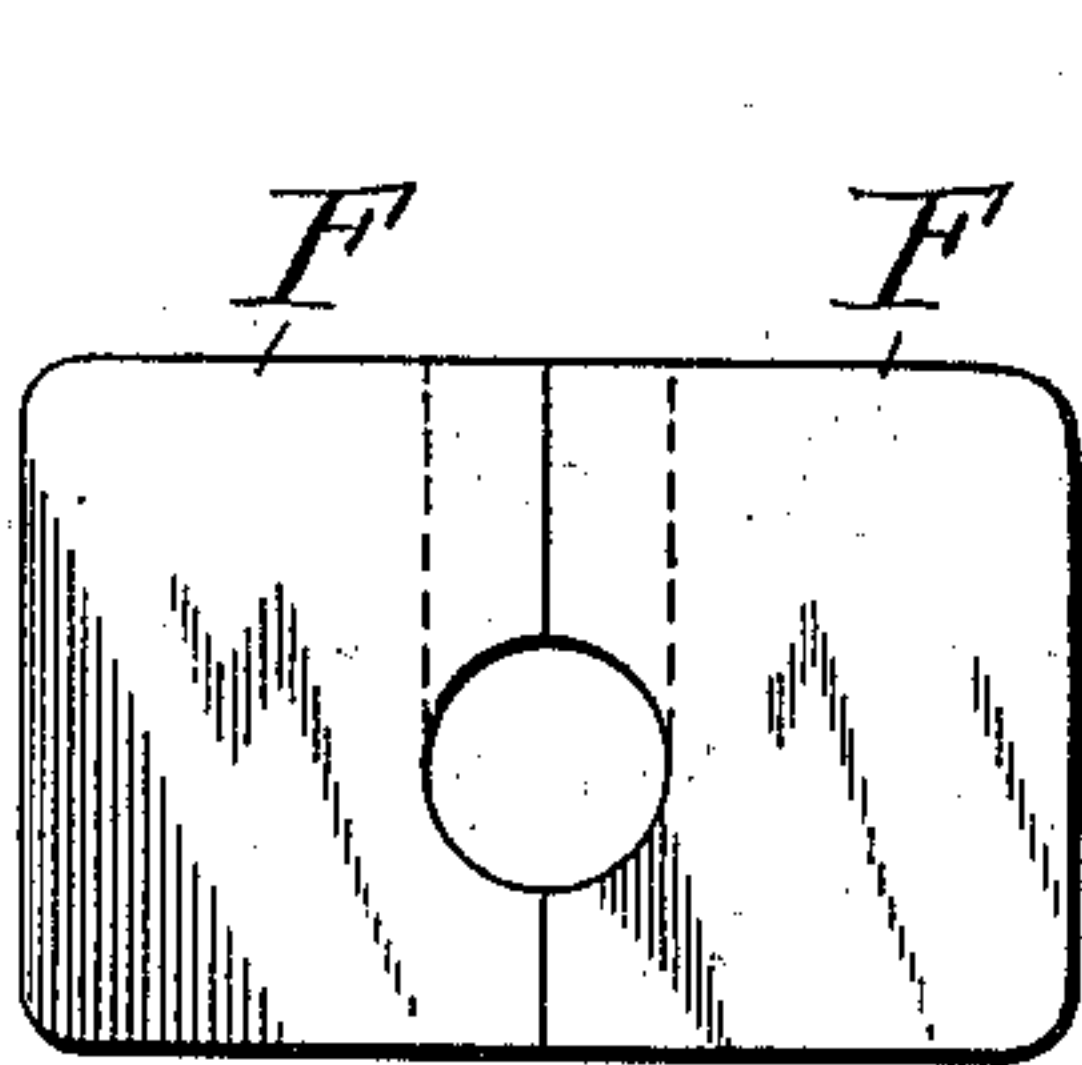


Fig-14

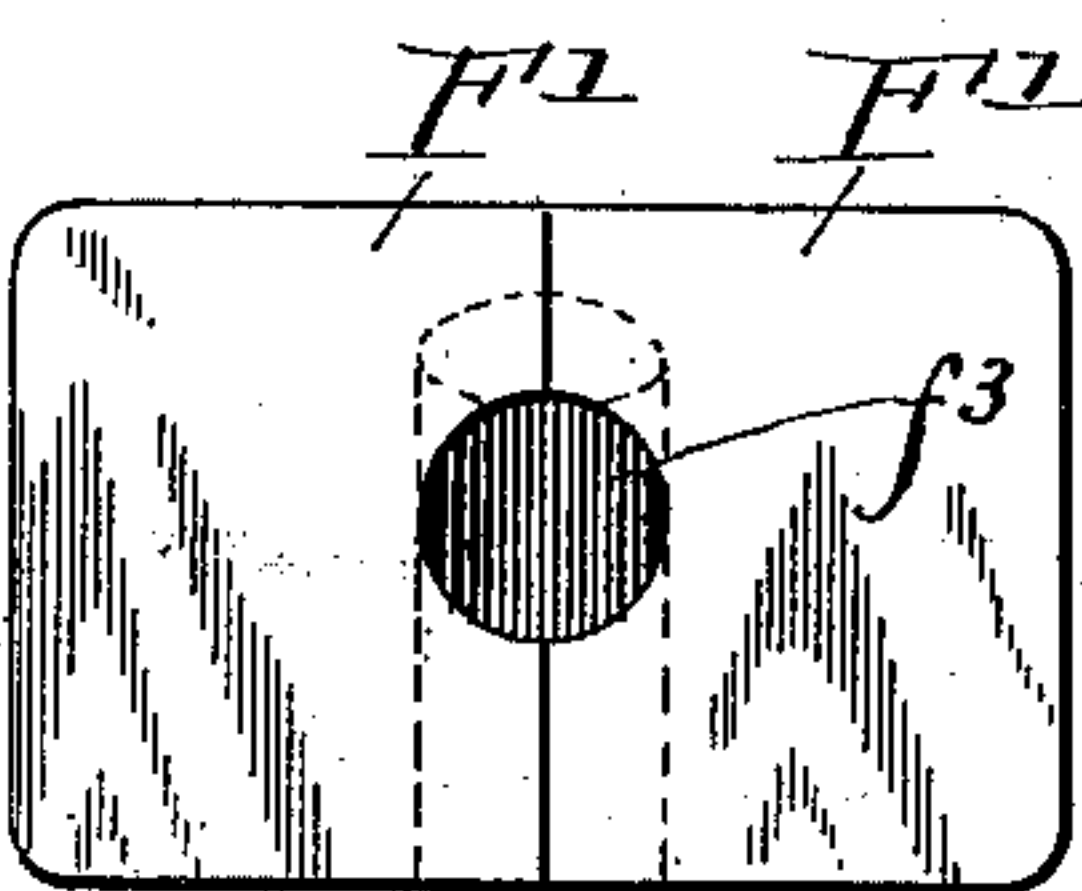
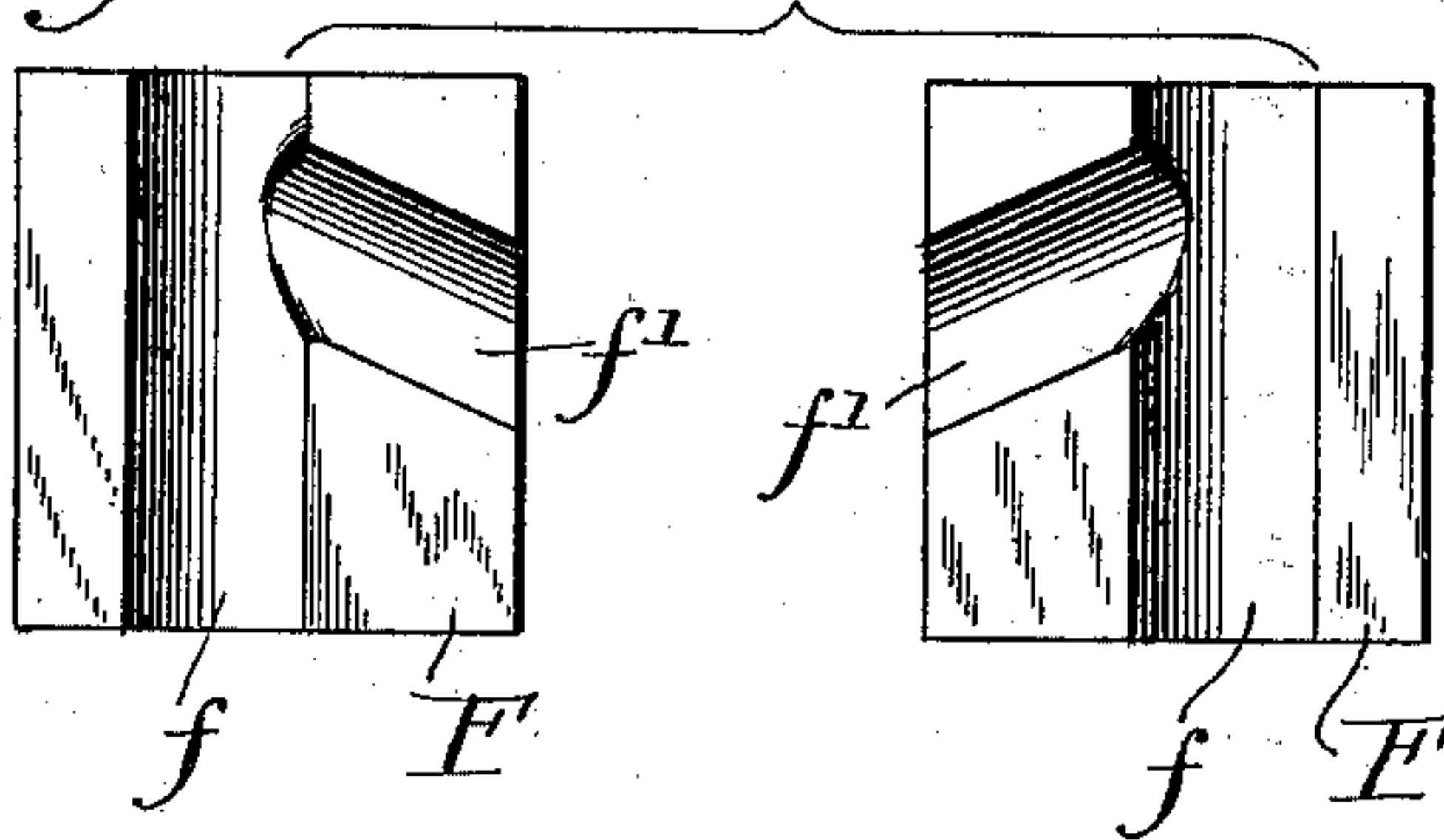


Fig-15

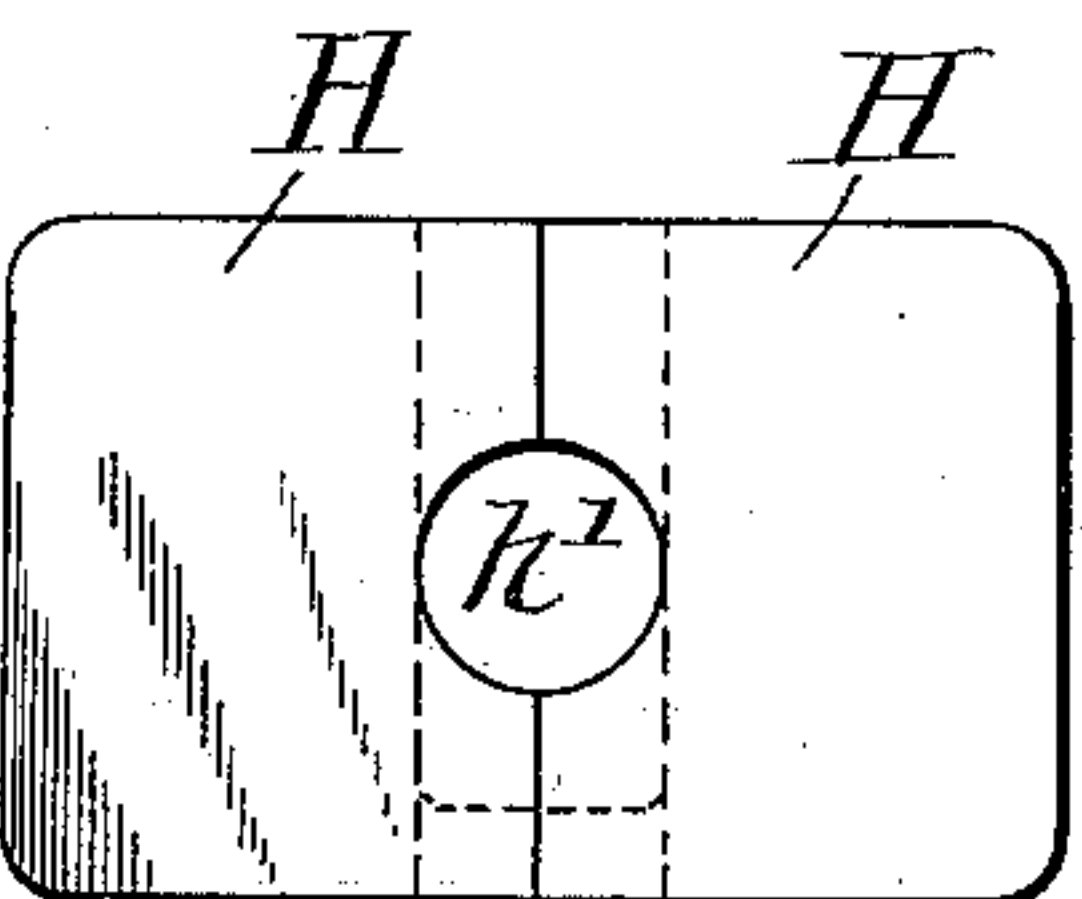
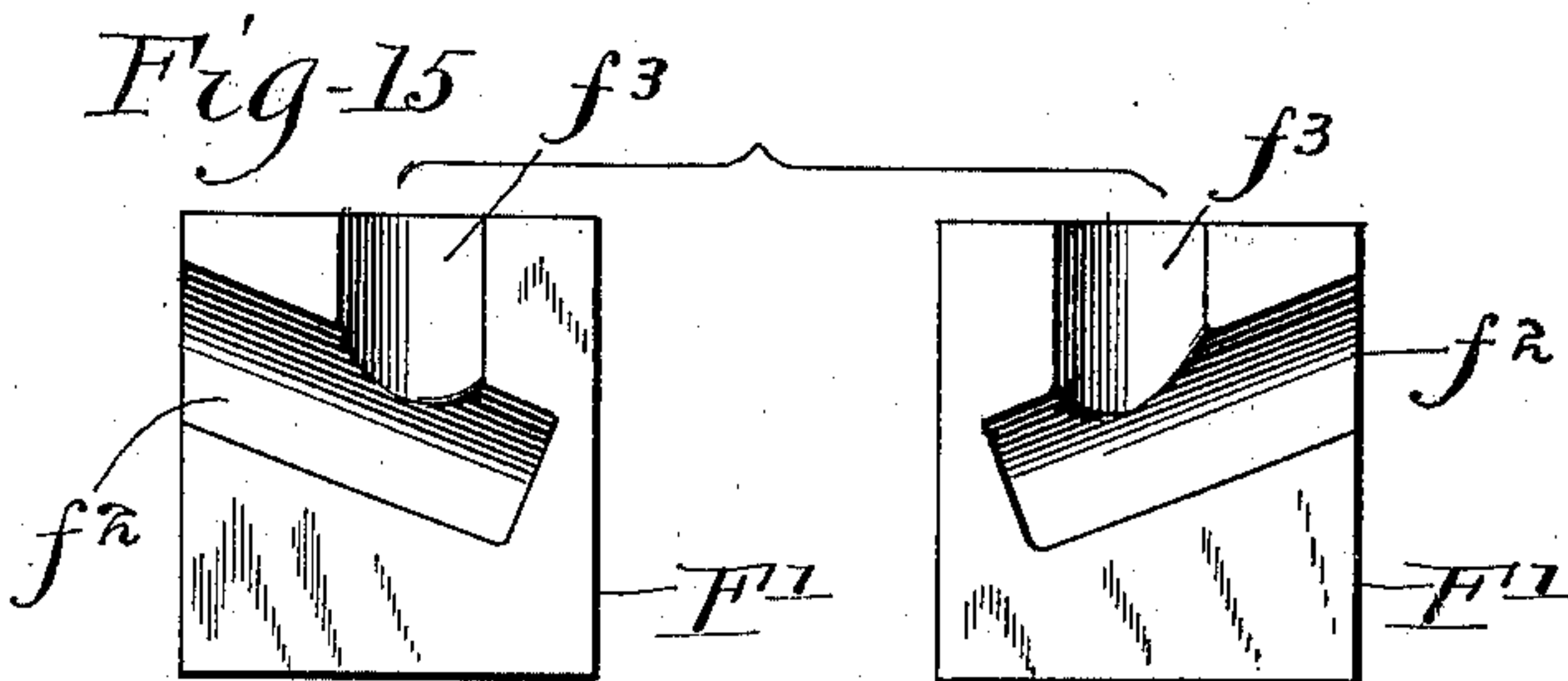


Fig-16

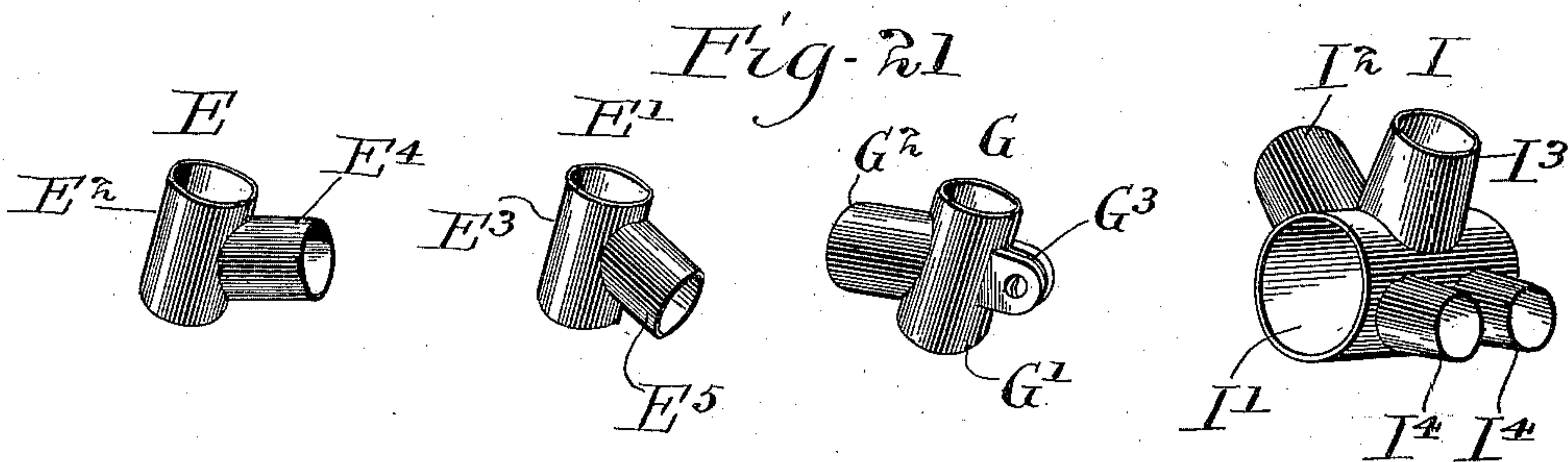
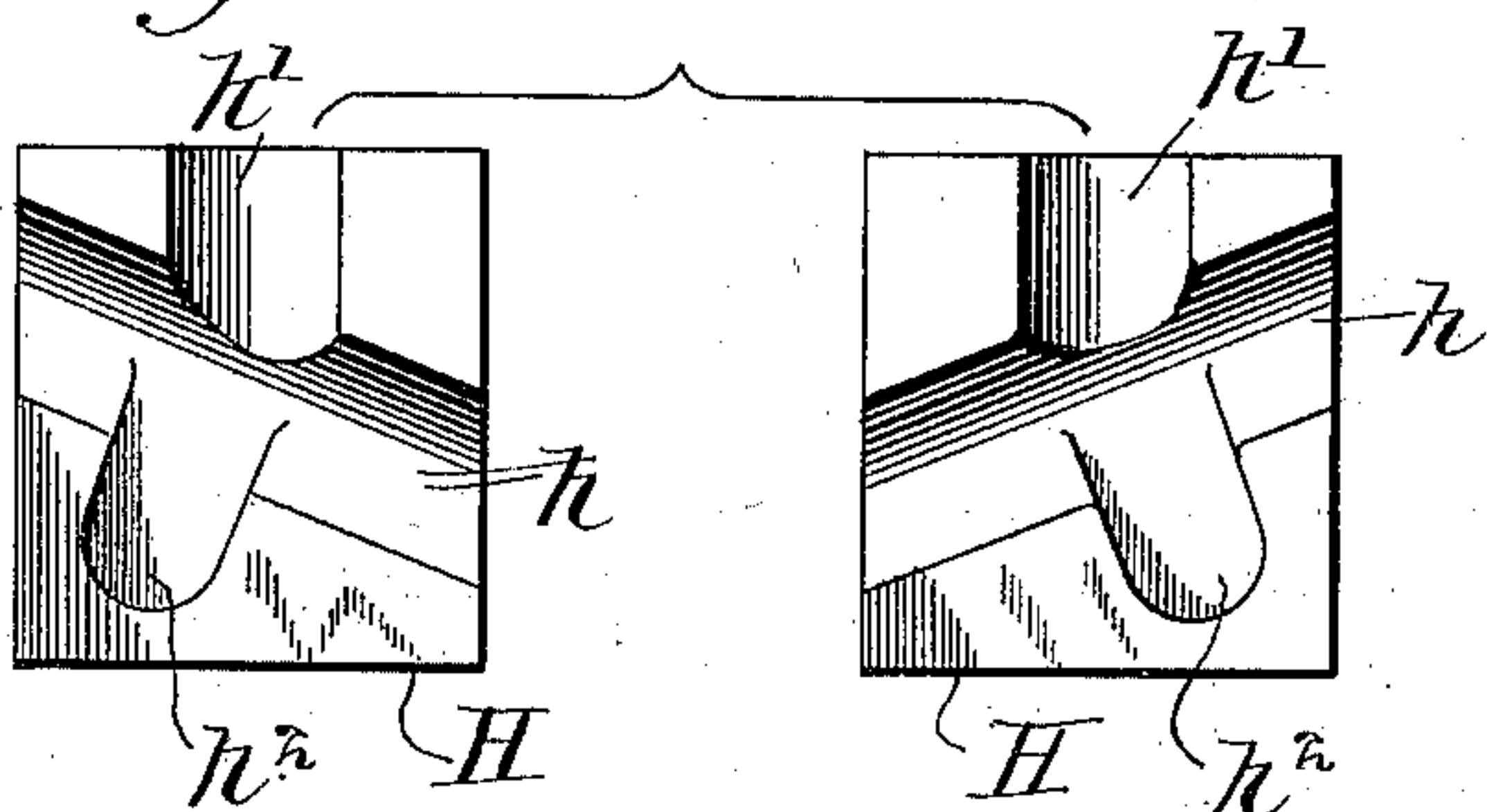


Fig-21

Witnesses

Harold A. Bennett,
Edmund H. Starnes

Inventor

Joseph Nathaniel Halifax

by Poole & Brown

his Attys.

No. 625,726.

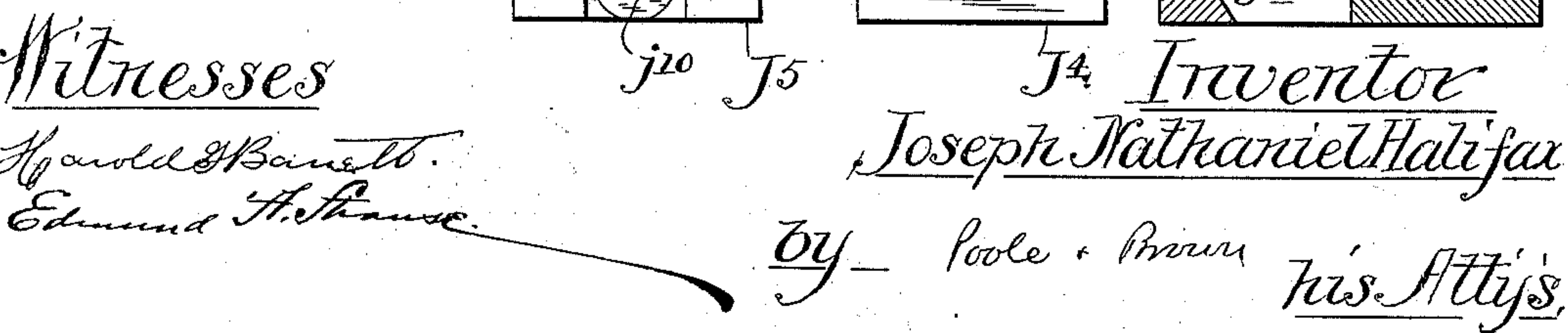
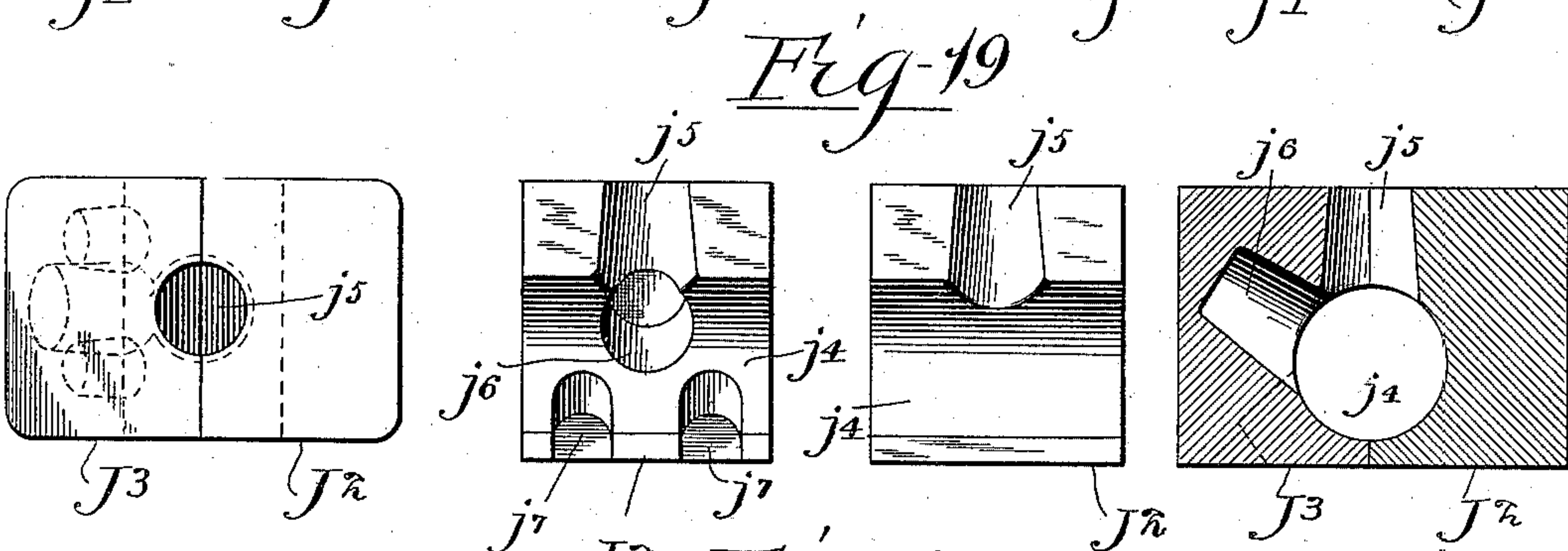
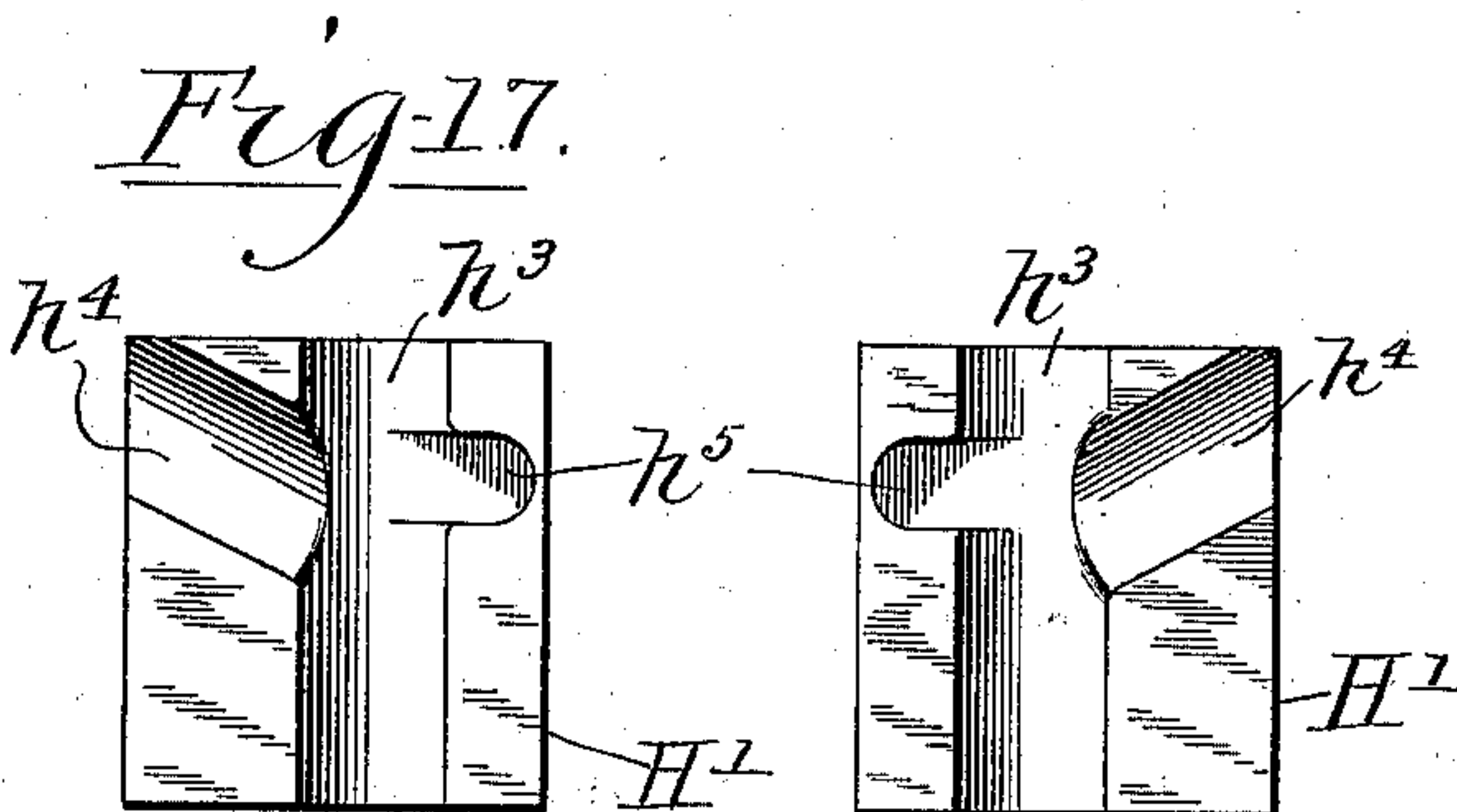
Patented May 23, 1899.

J. N. HALIFAX.
NURLING MACHINE.

(Application filed Mar. 4, 1898.)

(No Model.)

5 Sheets—Sheet 5.



Witnesses

Harold G. Barnett.
Edmund H. Thawse

J^d. Inventor
Joseph Nathaniel Halifax

By Poole & Brown his Attys.

UNITED STATES PATENT OFFICE.

JOSEPH NATHANIEL HALIFAX, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE
GEO. L. THOMPSON MANUFACTURING COMPANY, OF SAME PLACE.

NURLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 625,726, dated May 23, 1899.

Application filed March 4, 1898. Serial No. 672,481. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH NATHANIEL HALIFAX, of Chicago, in the county of Cook and State of Illinois, have invented certain
5 new and useful Improvements in Nurling-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of
10 reference marked thereon, which form a part of this specification.

This invention relates to an improved apparatus for roughening or nurling the cylindrical inner surfaces of tubular bodies, and is
15 designed more especially for operating upon a tubular body into which is to be inserted an internal tubular part which is to be thereafter expanded or distended into close contact with the inner knurled surface of the external
20 body, so as to form interlocking recesses and projections between said inner and outer parts to provide a rigid joint between the same.

The apparatus herein illustrated is designed
25 to knurl or roughen the interior surfaces of the thimbles or sockets of junction pieces or fittings of angularly-connected frames, such as bicycle-frames, into which the ends of the tubular parts of the frame fit and by means
30 of which said frame members are joined together in angular relation in the manner set forth in my prior application for United States Letters Patent, Serial No. 656,875, filed by me October 30, 1897; but such apparatus may
35 be employed wherever it is desired to produce a rigid joint between two tubular parts. Said apparatus, as illustrated, is designed to effect one stage of the process of assembling bicycle-frames in the manner set forth, the subsequent stages being effected by suitable expanding means by which the ends of the tubular members of the frame which fit into the sockets of the junction-pieces are distended into interlocking relation with said sockets—such, for instance, as shown in my prior applications for United States Letters Patent, Serial Nos. 663,516 and 663,517, filed by me December 27, 1897.

50 An apparatus embodying my invention embraces as its main or principal features a die made of such form as to closely conform to

the exterior surface of and to embrace the tubular part to be acted upon, a nurling-tool adapted to enter said tubular part and provided on its exterior surface with suitably-arranged projections and intervening recesses, said tool being adapted to engage with an outward pressure the opposite sides of the inner surface of said tubular body, so that when either the tool or body is rotated with respect to the other part the projections of said tool will form upon the inner surface of the tubular body reversely-arranged projections and recesses and clamping means for holding rigidly and in proper relation said die and contained tubular part. Said die will be preferably made separable and in parts or halves, which are provided in their proximate faces with depressions of such form that when said parts are brought together with said depressions opposite each other they form recesses or sockets of such shape as to closely embrace the tubular part and when engaged by the clamping means will support said tubular part against lateral flexure under the outward pressure of the tool when the latter is forced into the same.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings I have shown a convenient form of apparatus for nurling the sockets or thimbles of junction pieces or fittings for bicycle and other frames, said apparatus embracing as a means for actuating the nurling-tool and supporting the die a drill-press of ordinary form. I have also in said drawings illustrated the various forms of dies required for use in nurling the different thimbles for said junction pieces or fittings which are employed in bicycle-frames of ordinary construction, it being understood that each fitting requires a separate die for each socket or thimble to be knurled.

In said drawings, Figure 1 illustrates in side elevation a drill-press of ordinary construction provided with my invention. Fig. 2 is a perspective view of the clamping means for holding the dies in position. Fig. 3 is a plan view of the same on a reduced scale. Fig. 4 is a cross-section taken on line 4 4 of Fig. 3. Fig. 5 is a longitudinal section taken

on line 5 5 of Fig. 3. Fig. 6 is a side elevation of one form of nurling-tool. Fig. 7 is a bottom plan view thereof. Fig. 8 is a detail section taken on line 8 8 of Fig. 7. Fig. 9 is a detail section taken on line 9 9 of Fig. 7. Fig. 10 is a side elevation of another form of nurling-tool. Fig. 11 is a bottom plan view thereof. Fig. 12 is a detail section taken on line 12 12 of Fig. 11. Fig. 13 is a cross-section taken on line 13 13 of Fig. 10. Figs. 14 and 15 illustrate different views of the dies for use in nurling the upper and lower fittings of the front fork-head members. Figs. 16 and 17 illustrate different views of the dies for nurling the seat-post fitting. Figs. 18, 19, and 20 illustrate different views of the dies for use in nurling the different thimbles or sockets of the crank-hanger. Fig. 21 illustrates the various fittings which are to be treated by the machine herein illustrated.

As shown in said drawings, A designates a drill-press of ordinary form provided with a vertically-arranged driving-spindle A', a counter-shaft A², and a work-supporting table or bed-plate A³. Said shaft A² is adapted to be driven from any suitable source of power to give rotary motion to the spindle A', and said spindle is provided with a sleeve A⁴, which has sliding, but non-rotative, engagement therewith, which is provided with means by which it may be raised and lowered and is also provided in its lower end with a tool-holding chuck A⁵.

Now referring to the parts constituting my invention, B designates as a whole a nurling-tool which is secured in the chuck A⁵, C a die which is adapted to embrace the fitting to be knurled and which is made of two parts or halves in order to receive the fitting, and D is a clamping device by which the two parts of the die are clamped together and the fitting held in position to be acted upon by the nurling-tool. The clamping device is mounted upon a supporting-block E⁶, which is secured rigidly in any suitable manner upon the work-supporting table or bed-plate A³ of the press. Said clamping devices consist of a stationary jaw D' and a movable or swinging jaw D², which is pivoted at one end to the stationary jaw, so as to swing in a horizontal plane. Said clamping-jaws are secured to the supporting-block E by means of bolts or studs d d', which have screw-threaded engagement with the block, the bolt d' passing through the hinged portion of the jaws and forming the pivot-pin therefor and the bolt d being engaged with a bolt-aperture formed partly in the stationary and partly in the movable jaw at the opposite ends thereof. Said movable jaw is conveniently provided with a handle d³, by which it may be swung toward and away from the stationary jaw. The movable jaw is locked in its closed position by means of a locking-bar D³, which is pivotally secured at one end to one of the jaws—the stationary jaw in this instance—by means of a pivot-pin d⁴, and is provided at its opposite end

with a nut D⁴, placed on the screw-threaded end of said locking-bar and adapted to be tightened against the outer side of the movable jaw when the latter is in its closed position, said nut D⁴ being conveniently provided with a handle D⁶, by which it may be turned and the locking device may be manipulated. Preferably the adjacent ends of the jaws will be provided with recesses d⁵, adapted to receive the bar D³ when in its locking position. Said jaws are provided in their proximate faces intermediate their ends with oppositely-arranged recesses or depressions D⁵, which form when said jaws are closed a socket to receive the die C, said socket being herein shown as of rectangular shape and being of proper size to receive said die with a close fit, so that it will be held immovable between said jaws. All of the dies which are to be used in the apparatus described will be of the same exterior conformation and size, so as to fit the said socket. Said dies, as before stated, are made of two parts or halves, and as a preferable construction means are provided for retaining each half thereof in fixed relation with the jaw with which it is engaged, so that when the movable jaw is swung away from the stationary jaw the parts of the die will be separated, so as to release the fitting previously held thereby without detaching the same from the jaws. This is accomplished in the present instance by means of tap-bolts d⁶, which are inserted through the opposite sides of the jaws and engage at their inner ends screw-threaded apertures in the die. With this construction, it will be necessary to set the die but once in the clamping-jaws while operating upon fittings of a certain design, the parts or handles thereof being separated to release the fittings when the movable jaw is swung away from the stationary jaw and being brought together to clamp a new fitting therein when said jaw is swung back into its closed position.

The tool by which the inner surface of the fitting is knurled or roughened consists of a shank having a tapered portion B' and a cylindric portion B², and having in its upper end a flattened portion B³, which fits into an angular socket in the chuck A⁵. The operative portion of the tool, or that which engages the inner surface of the tubular fitting to be operated upon, consists of two nurling-wheels B⁴ B⁴, made in the form of short sleeves or cylinders rotatively mounted in any suitable manner upon the end of the shank, with their axes of rotation parallel with the axis of rotation of said shaft. Said nurling-wheels are located upon opposite sides of the central axis of the cylindric portion B² of the shaft, with their opposite outer sides projecting beyond the planes of the outer sides of the shaft, and, as herein shown, are mounted to rotate upon pins b, which fit into longitudinal sockets in the inner end of the shank and are provided on their outer ends with shoulders or heads b', between which and the

outer end of the shank said wheels are located. Said pins b are secured in place by means of locking-pins b^7 , which are inserted into apertures in the shank and engage transverse recesses in said pins. Said nurling-wheels B^4 are herein shown as provided on their outer surfaces with inclined or spirally-arranged ribs and intervening grooves, which ribs and grooves on one wheel extend in a direction opposite to those on the other wheel. The wheels being independently rotative upon the shank and engaging opposite sides of the inner surface of the fitting, will, when said shank is rotated with respect to the fitting and moved endwise therein, turn in opposite directions against the opposite sides of the inner surface of the fitting, so that the ribs of one wheel will cut a plurality of parallel spiral grooves which extend in one direction, while the oppositely-arranged ribs in the other will cut a plurality of spiral grooves which intersect the grooves cut by the first wheel in crisscross arrangement. Obviously the outer or nurling surfaces of the tool may be made of other form than that herein shown. In order that the nurling-tool may readily enter the tubular fitting, said wheels are made of outwardly-tapered form, so that the distance between the opposite sides of the outer ends thereof will be slightly less than the inner diameter of the fitting to be knurled, it being the intention that the mean distance between said opposite sides of the wheels shall be substantially equal to the inner diameter of said tubular fittings. Means are also provided for varying the distance between the opposite sides of said nurling-wheels, whereby the tools as a whole may be used on tubular fittings of different internal diameters. This is accomplished in the present instance by dividing the outer end of the shank into two parts by means of a slit B^5 , terminating in a weakening-aperture B^6 , which construction permits the opposite halves of the shank on each side of the slit B^5 to be sprung away from each other, said shank being made of a metal which will permit of such movement of the two halves thereof. The means for spreading the two parts of the shanks to increase the distance between the opposite sides of the nurling-wheels consist, as shown in Figs. 6 to 8, inclusive, of two expanding-screws b^2 b^2 , which engage interiorly-screw-threaded sockets which intersect the slit B^5 and are formed partly in one and partly in the other of the two halves of the shank. The outer ends of said sockets are conical and are engaged by the conically-shaped heads b^3 b^3 of said screws. Said screw-heads are provided with transverse slots, by means of which they may be engaged by a suitable tool for moving the same inwardly and outwardly within the sockets.

In Figs. 10, 11, 12, and 13 is shown a somewhat-modified form of means for expanding the outer end of the shank. The expanding-

screw b^4 in this instance, instead of being located between the wheels B^4 , engages a transverse aperture which extends through the shank from one side to the other thereof above said wheels and intersects said slit B^5 . Said aperture is made at both ends of conical or outwardly-flaring shape and is engaged at one end by the conical head b^5 of the expanding-bolt b^4 and at its other end by a conically-shaped nut b^6 , which has screw-threaded engagement with the bolt, said head and nut being made of such size as to be contained entirely within said aperture. With this construction when the bolt is turned into the nut it will act to move both the conical head and nut inwardly, with the result of expanding or spreading the opposite parts of the shank away from each other. The last-described construction is desirable where the tubular part of the fitting is of relatively small diameter and where the nurling-wheels are so close together as to leave insufficient space between them for the expanding-bolts, while the first-described construction may be employed for fittings having tubular parts of greater diameter. In said last-mentioned construction the cylindric portion B^2 of the shank is reduced, as shown in Fig. 10, to a diameter less than that of the conical upper part thereof.

In Figs. 14 and 15 are illustrated the dies for holding the fitting or junction-piece which joins the upper horizontal member of the frame with the upper end of the steering-head member and for also holding the fitting or junction-piece which joins said steering-head member with the lower oblique member of the frame. Said fittings (shown in Fig. 21) are designated as E and E' , respectively, and consist of main cylindric portions E^2 E^3 and branch cylindric thimbles E^4 E^5 . Said fittings are identical in their construction, but are reversed with respect to the angles which the branch thimbles bear with respect to the main body of the fitting or that portion which engages the steering-head member when said fittings are assembled in the frame. The die shown in Fig. 14 is designed to hold said upper and lower fittings of the steering-head member while the interior surface of the main body portions E^2 or E^3 are being knurled. Said dies, as before stated, are made of two parts or halves F F and are provided on their proximate faces with semicylindric depressions f f , which when the parts of the die are brought together form a cylindric recess or socket adapted to receive the main body portion E^2 or E^3 of said fittings. Said proximate faces of the parts F F of the die are also provided with other semicylindric depressions f' , each of which intersects at its inner end at an angle the depression f and opens into one of the outer faces of the die, said depressions f' forming when the parts of the die are brought together a cylindric recess or socket adapted to receive the branch portions E^4 or E^5 of said fittings E' or E^2 . Said die will be

made of greater vertical depth than the length of the main body portions of the fittings to be received thereby, in order to afford space inside of said fittings to permit the tool to pass entirely through the fittings, so that the interior surface of said body portions may be knurled throughout their entire length. Fig. 15 illustrates in detail a die employed for holding said fittings E and E' in such manner as to present the branch or thimble portions E⁴ or E⁵ to the nurling-tool. The parts or halves F' F' of said die are provided in their proximate faces with obliquely-arranged semicylindric depressions *f*² *f*², which form when the parts are brought together a socket or recess to receive the body portions of the fittings, and with other semicylindric depressions *f*³ *f*³ perpendicular to the outer face of the die, which intersect said depressions *f*² and form sockets to receive the branch portions of thimbles E⁴ or E⁵ of the fittings.

In Figs. 16 and 17 are shown in detail dies for holding the seat-post fitting G, which is shown in Fig. 17, and consists of a main cylindrical tubular body portion G', a branch tubular thimble G², to which the rear end of the upper horizontal member of the frame is attached, and laterally-separated rearwardly-directed lugs G³, to which are attached the rear oblique members of the frame. Fig. 16 illustrates a die which is adapted to hold the fitting G in position for the tool to enter the branch portion or thimble G² thereof. The two parts or halves H constituting said die are provided with obliquely-arranged semicylindric depressions *h* *h*, which when brought together form a socket or recess to receive the main body portion G' of the fitting, and other depressions *h*' *h*', which intersect the depressions *h* and extend to the outer face of the die, perpendicularly thereto, and form when the parts are brought together a socket or recess to receive the branch portion G² of the fitting. Said parts of the die are provided also in their proximate faces with short angular depressions *h*² *h*², which intersect the depressions *h* in such relation as to form when the parts are brought together a recess or socket to receive the lugs G³ of the fitting. Fig. 17 illustrates a die adapted to hold the fitting G in position for the tool to enter the main body portion thereof, the parts or halves H' H' of said die being provided in their proximate faces with semicylindric recesses or depressions *h*³ *h*³, perpendicular to the outer face of the die, and intersecting semicylindric recesses *h*⁴ *h*⁴, which when brought together form recesses or sockets to receive the main body portion and the branch portion or thimble of the fitting, respectively, and are provided with angular depressions *h*⁵ *h*⁵, so formed with respect to the depressions *h*³ *h*³ as to provide when brought together a socket for the lugs G³.

In Figs. 18, 19, and 20 are shown dies which are employed for holding the crank-hanger

fitting in the several positions required to present the several thimbles or sockets to the action of the nurling-tool. The crank-hanger, which is shown in Fig. 21 and designated by the letter I, consists of a main body portion I', a forwardly-extending thimble I², to which the rear end of the front oblique member of the frame is attached, an upwardly-directed thimble I³, to which the lower end of the said member is attached, and two rearwardly-directed thimbles I⁴ I⁴, to which the forward ends of the bottom fork members are attached. Fig. 18 illustrates the die which is adapted to hold the fitting in position for the tool to enter the branch portion or thimble I³. The two parts or halves J J' of said die are provided on their proximate faces with relatively wide and deep semicircular depressions *j* *j*, which extend to the laterally opposite faces of the die, and with other depressions *j*' *j*', which intersect the depressions *j* *j* and extend to the outer face of the die and perpendicular thereto. Said depressions *j*' *j*' are tapered to form when the parts of the die are brought together a tapered socket to receive the exteriorly-tapered thimble I'. The part J of the die is provided with two tapered sockets *j*² *j*², adapted to receive the thimbles I⁴ I⁴ of the fitting, and the part J' thereof is provided with an oppositely-extending tapered socket *j*³, adapted to receive the thimble I² of said fitting. Fig. 19 illustrates a die adapted to hold the fitting I, so that the tool may enter the thimble I² thereof. Said die consists of two parts or halves J² J³, which are provided in their proximate faces with opposite semicylindric depressions *j*⁴ *j*⁴, which extend from one side face to the other of said die and are adapted to receive when the parts are brought together the main body of the fitting, and is provided also with other semicircular depressions *j*⁵ *j*⁵, which intersect said depressions *j*⁴ *j*⁴ and are adapted to receive when the parts are brought together the thimble I² of the fitting and to hold it in proper relation to the nurling-tool. The part J³ of the chuck is provided with tapered sockets or recesses *j*⁶ and *j*⁷ *j*⁷, adapted to receive the seat-post thimble I³ and the rear-fork thimbles I⁴ I⁴, respectively. Fig. 20 illustrates the die adapted to hold the fitting so as to present the rearwardly-directed thimbles I⁴ I⁴ of the fitting to the nurling-tool. Said die consists of two parts or halves J⁴ J⁵, which are provided in their proximate faces with oppositely-arranged semicylindric depressions *j*⁸ *j*⁸, which extend from one side face to the other of the die and adapted to receive when the parts are brought together the main body portion I³ of the fitting. Said parts are also provided in their proximate faces with other oppositely-arranged parallel depressions *j*⁹ *j*⁹, which intersect said depressions *j*⁸ *j*⁸ and are adapted to receive when the parts are brought together the thimbles I⁴ I⁴ of the fitting. The part or half J⁵ of the die is provided also with ta-

pered sockets J¹⁰ J¹¹, which are adapted to receive the thimble or branch portions I² I³ of the fitting when engaged by said chuck.

I claim as my invention—

5 1. An apparatus for nurling the interior surface of tubular bodies comprising a separable die which is adapted to closely embrace the body, a nurling-tool adapted to be inserted into the tubular interior of the body to
10 engage the interior surface thereof, and means for clamping said parts of the die together and for holding the same in proper position with respect to the nurling-tool, comprising clamping-jaws provided on the proximate faces with
15 oppositely-arranged recesses adapted to receive said die, and means for locking said jaws together.

2. In an apparatus for nurling the interior surface of tubular bodies, the combination
20 with a rotative and endwise-movable nurling-tool, a separable die adapted to receive and closely embrace said tubular body, clamping-jaws for clamping said parts of the die together and for holding the same in proper
25 relation to the nurling-tool, and screw-threaded bolts passing through said jaws and each engaging at its inner end the adjacent part of the die for detachably connecting the same with the jaws.

30 3. In an apparatus for nurling the interior surface of tubular bodies, the combination with a die adapted to receive and closely embrace said tubular body, a nurling-tool adapted to enter the interior of said body
35 comprising a rotative shank, laterally-separated nurling-wheels rotatively mounted on the advance end of said shank and provided on their outer surfaces with oppositely-disposed spiral grooves and ribs, said wheels being
40 conical and smaller at their outer than at their inner ends.

4. In an apparatus for nurling the interior surface of tubular bodies, the combination
45 with a die adapted to receive and closely embrace said tubular body, a nurling-tool

adapted to enter the interior of said body, comprising a rotative shank, laterally-separated nurling-wheels rotatively mounted on the advance end of said shank with their axes of rotation parallel with the axis of the shaft, 50 and provided on their outer surfaces with oppositely-arranged spiral ribs and intervening grooves, said wheels being conical and smaller at their outer than at their inner ends and means for varying the distance between said 55 cutting-tools.

5. In an apparatus for nurling the interior surface of tubular bodies, the combination with a die adapted to receive and closely embrace said tubular body, of a nurling-tool 60 adapted to enter the interior of the body, comprising a rotative shank, laterally-separated nurling-wheels rotatively mounted on the advance end of said shank, said shank being provided between said wheels with a longitudinal slit, and means engaging said slit to vary the distance between said wheels. 65

6. In an apparatus for nurling the interior surface of tubular bodies, the combination with a die adapted to receive and closely embrace said tubular body, of a nurling-tool 70 adapted to enter the interior of the body, comprising a rotative shank, laterally-separated nurling-wheels rotatively secured to the advance end of said shank, said shank being provided between said tools with a longitudinal slit, and means engaging said slit to separate said tools, comprising an expanding-screw having a conical head adapted to engage tapered surfaces at either side of said 75 slit in the shaft. 80

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 25th day of February, A. D. 1898.

JOSEPH NATHANIEL HALIFAX.

Witnesses:

C. CLARENCE POOLE,
TAYLOR E. BROWNE.