

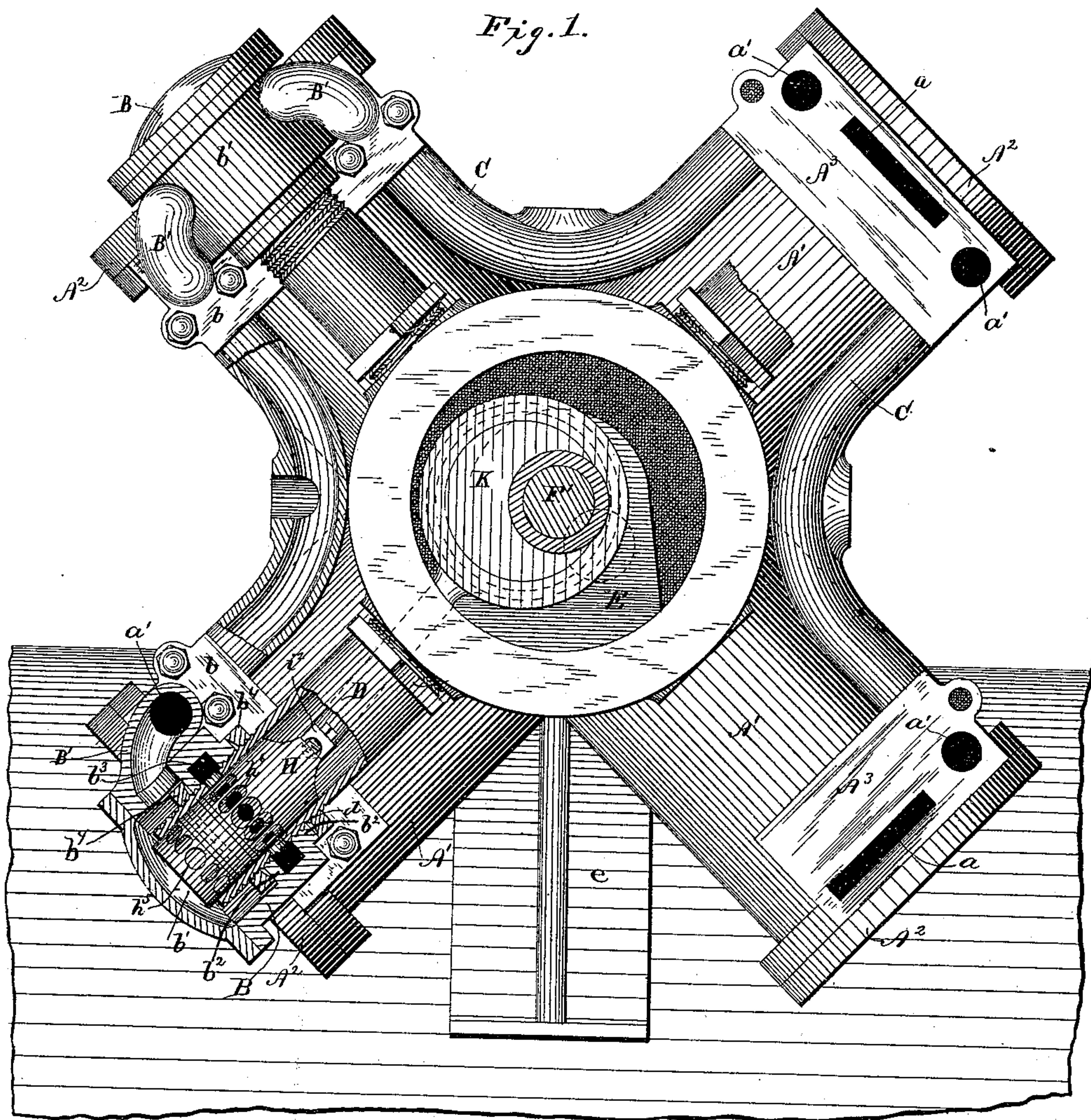
(No Model.)

6 Sheets—Sheet 1.

M. N. LYNN.
STEAM ENGINE.

No. 335,530.

Patented Feb. 2, 1886.



WITNESSES

Chas. R. Burr

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INVENTOR

Mirabeau N. Lynn
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his Attorneys

(No Model.)

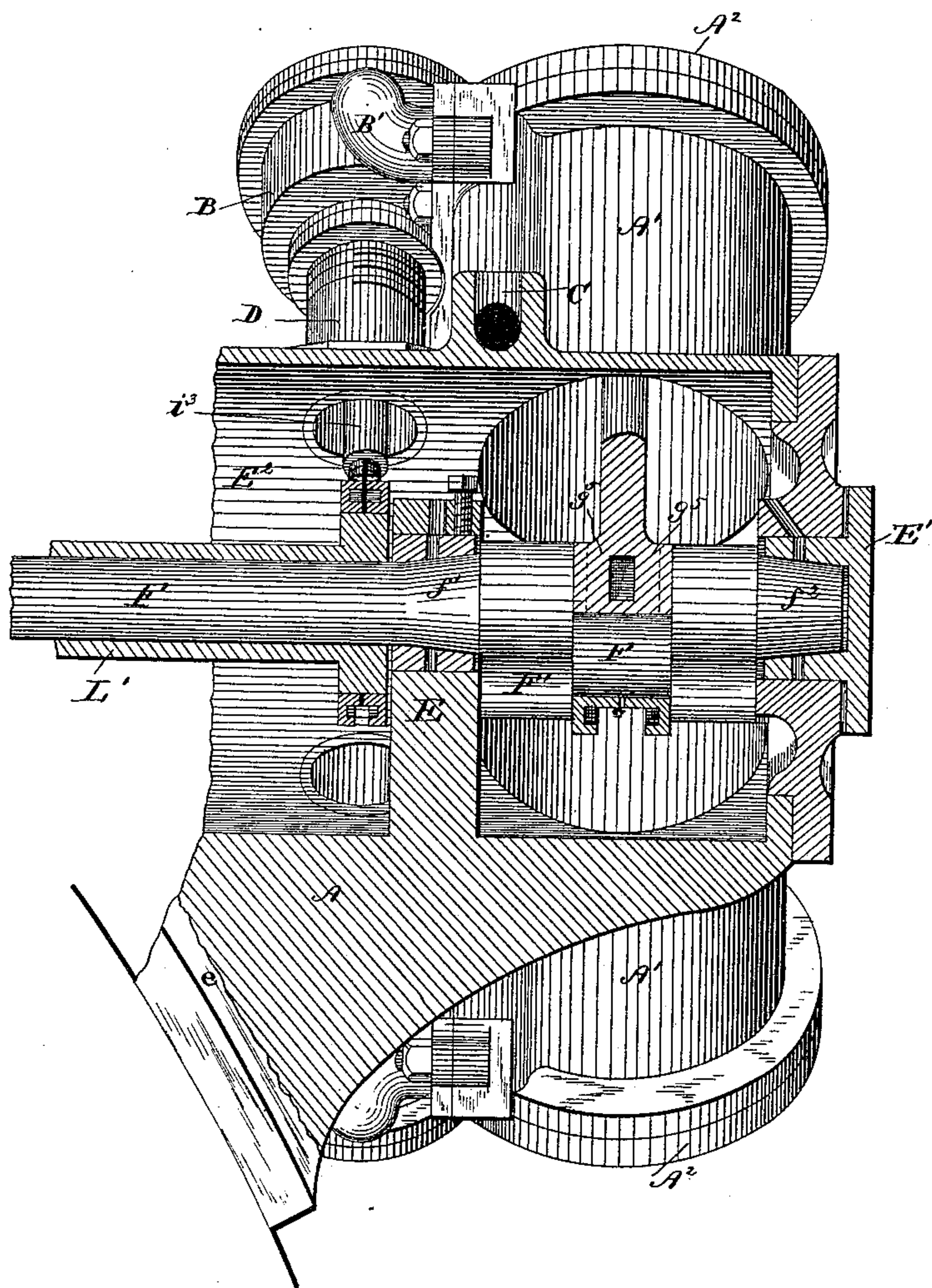
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Fig. 2.



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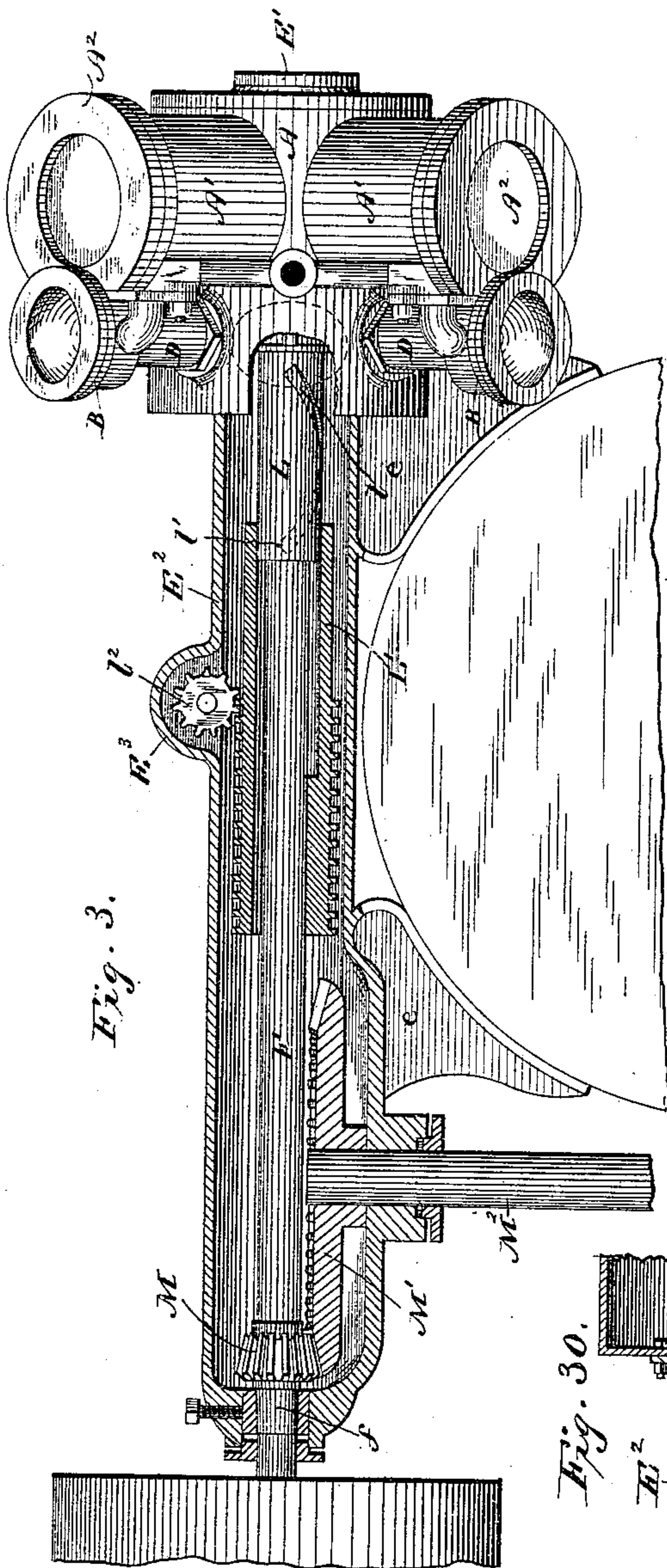


Fig. 3.

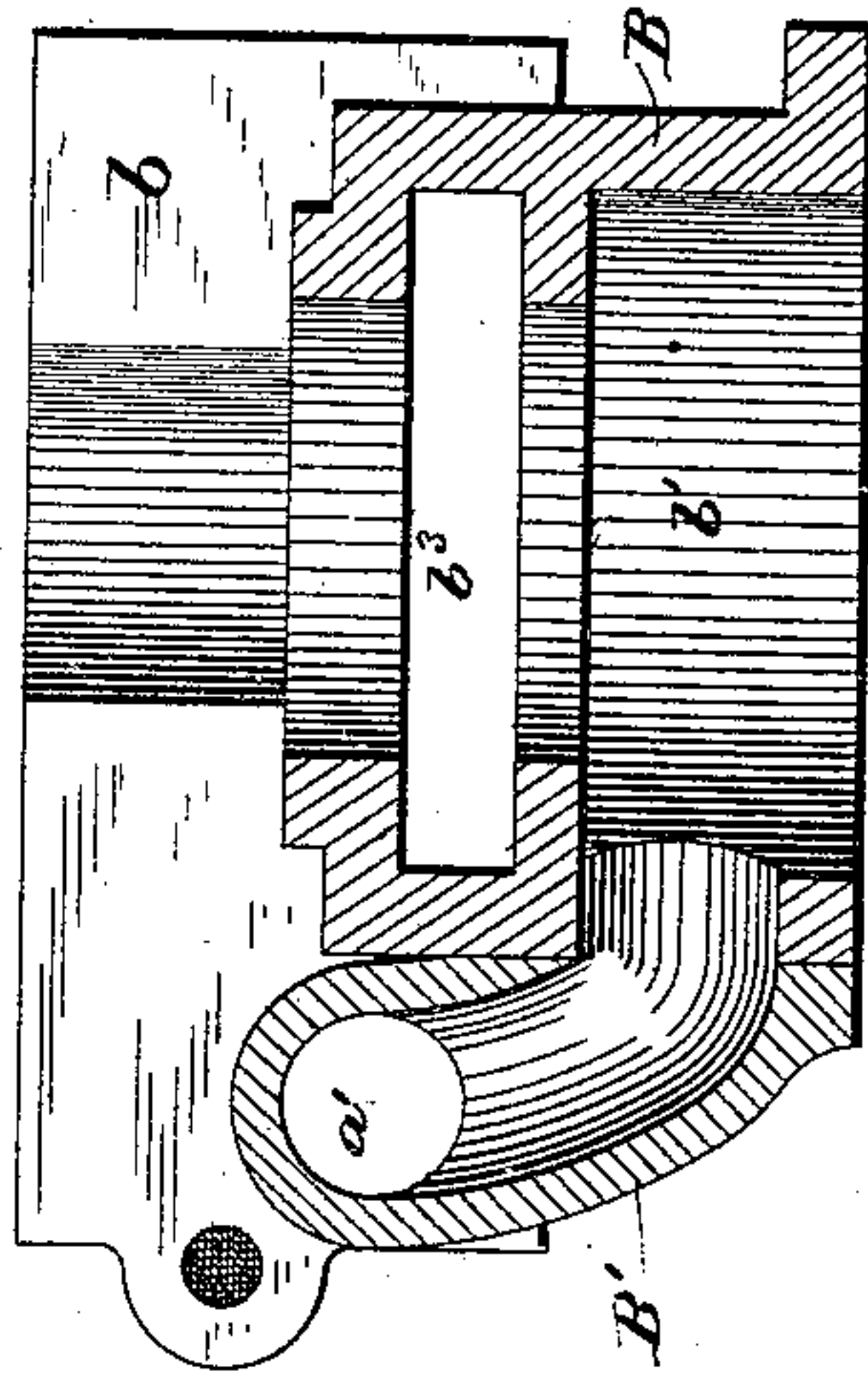


Fig. 4.

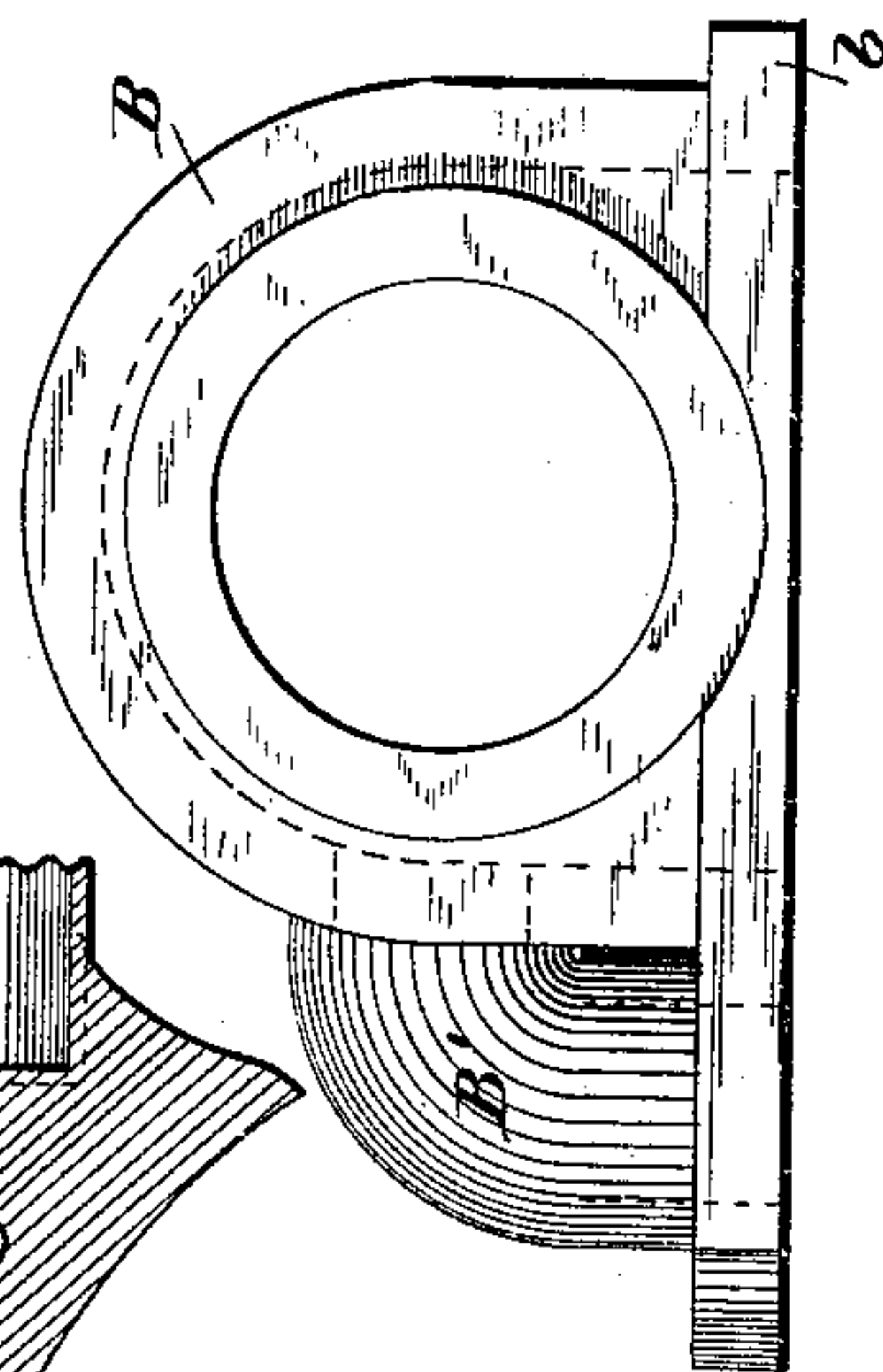


Fig. 5.

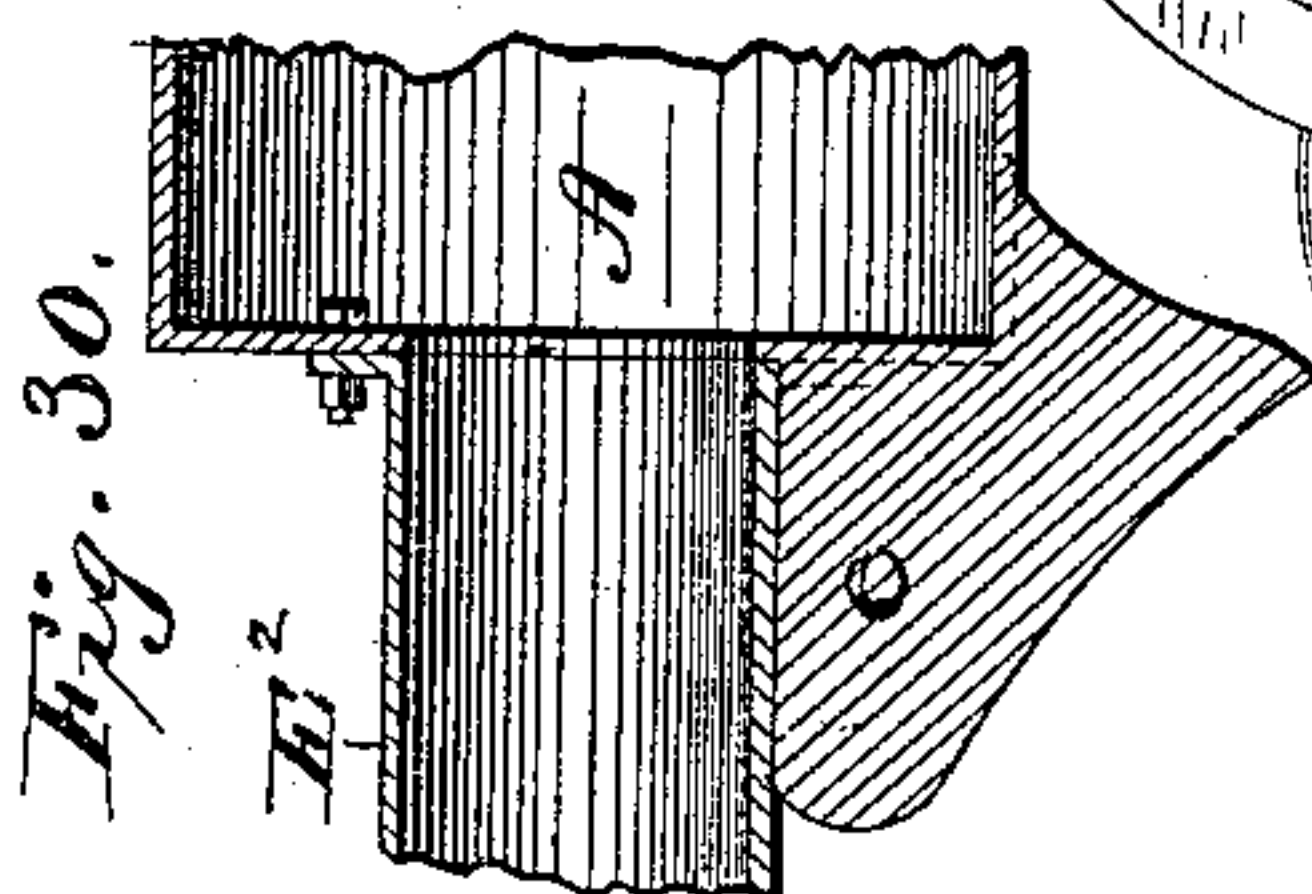


Fig. 30.

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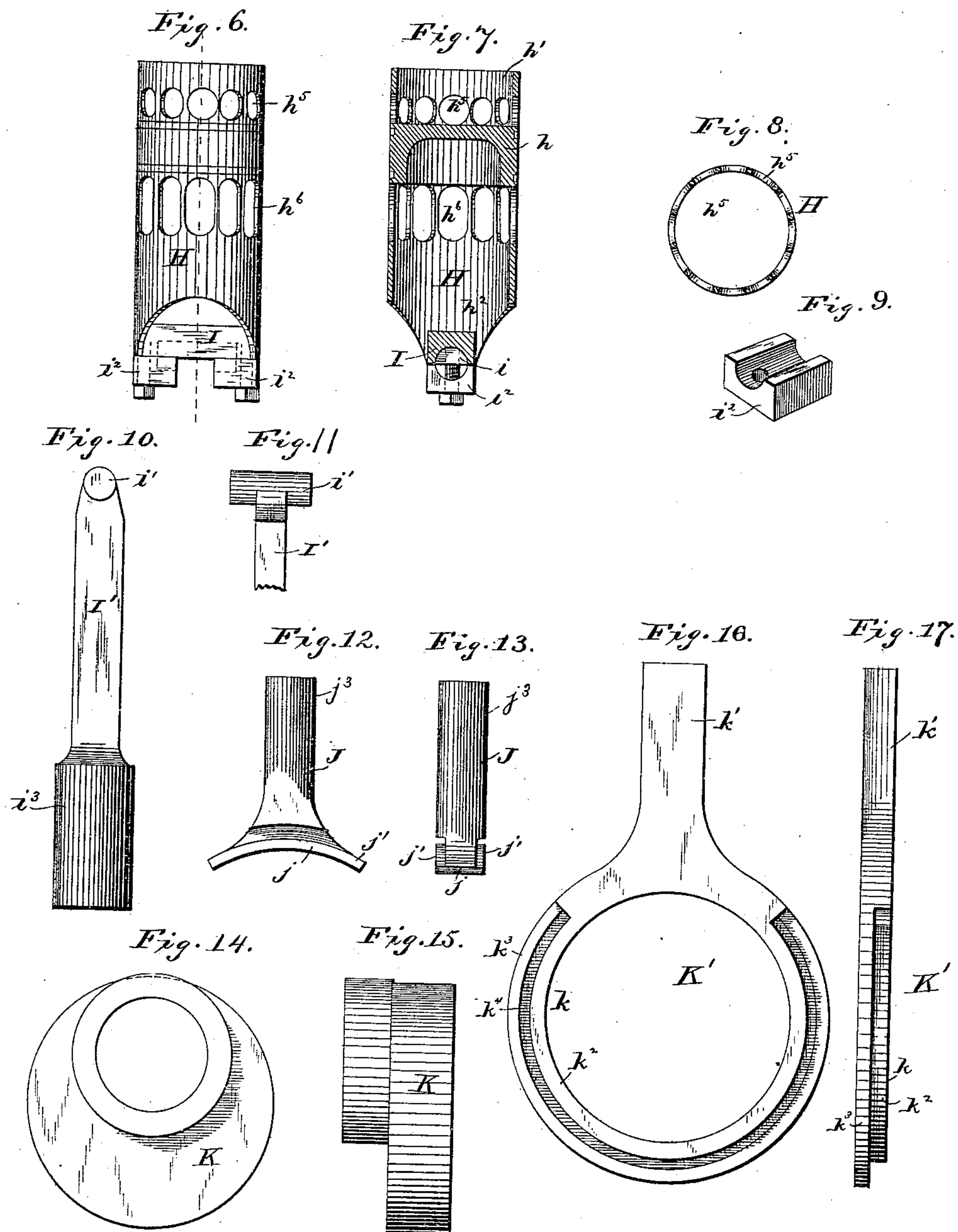
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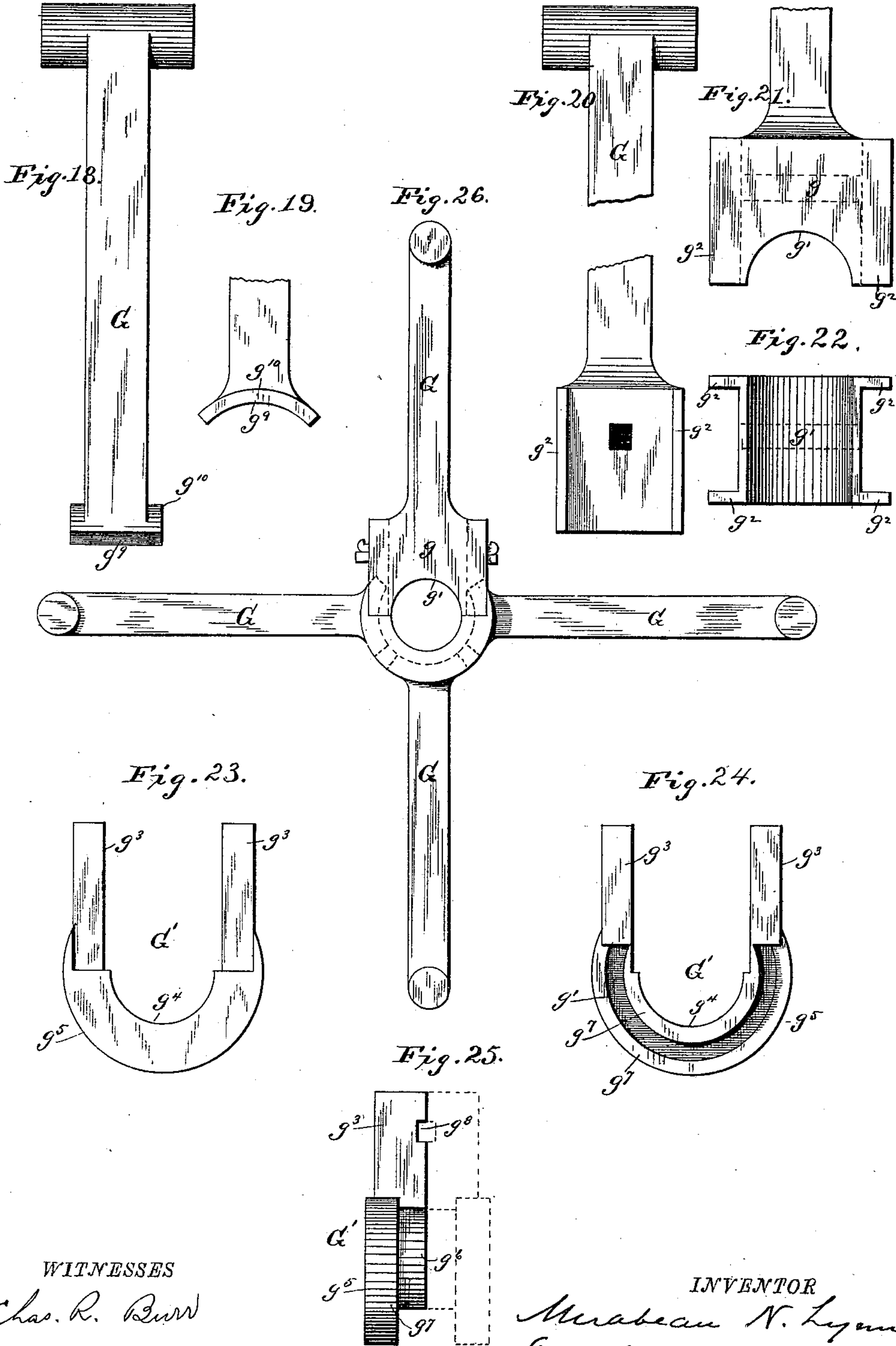
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Fig. 27.

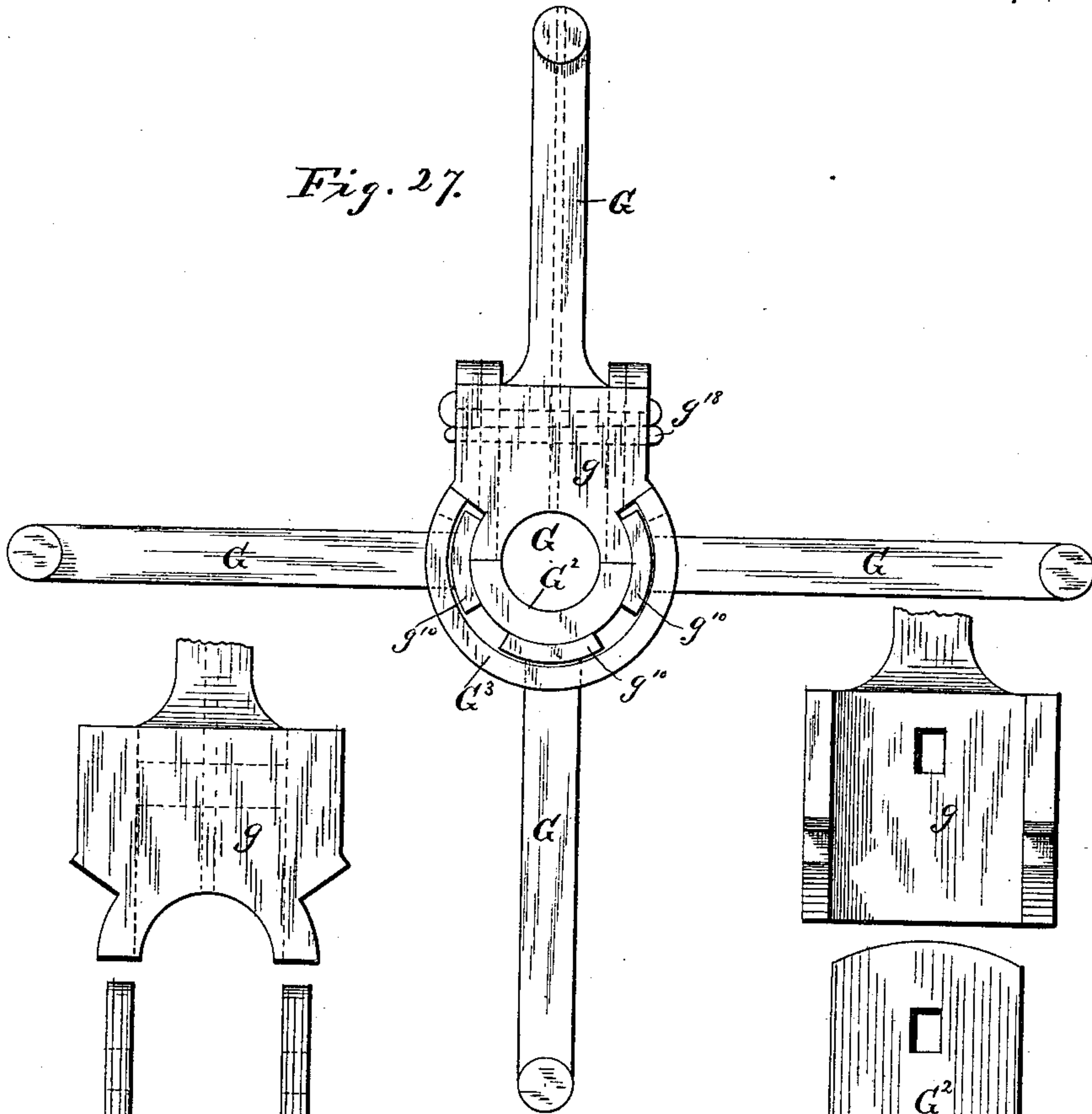


Fig. 28.

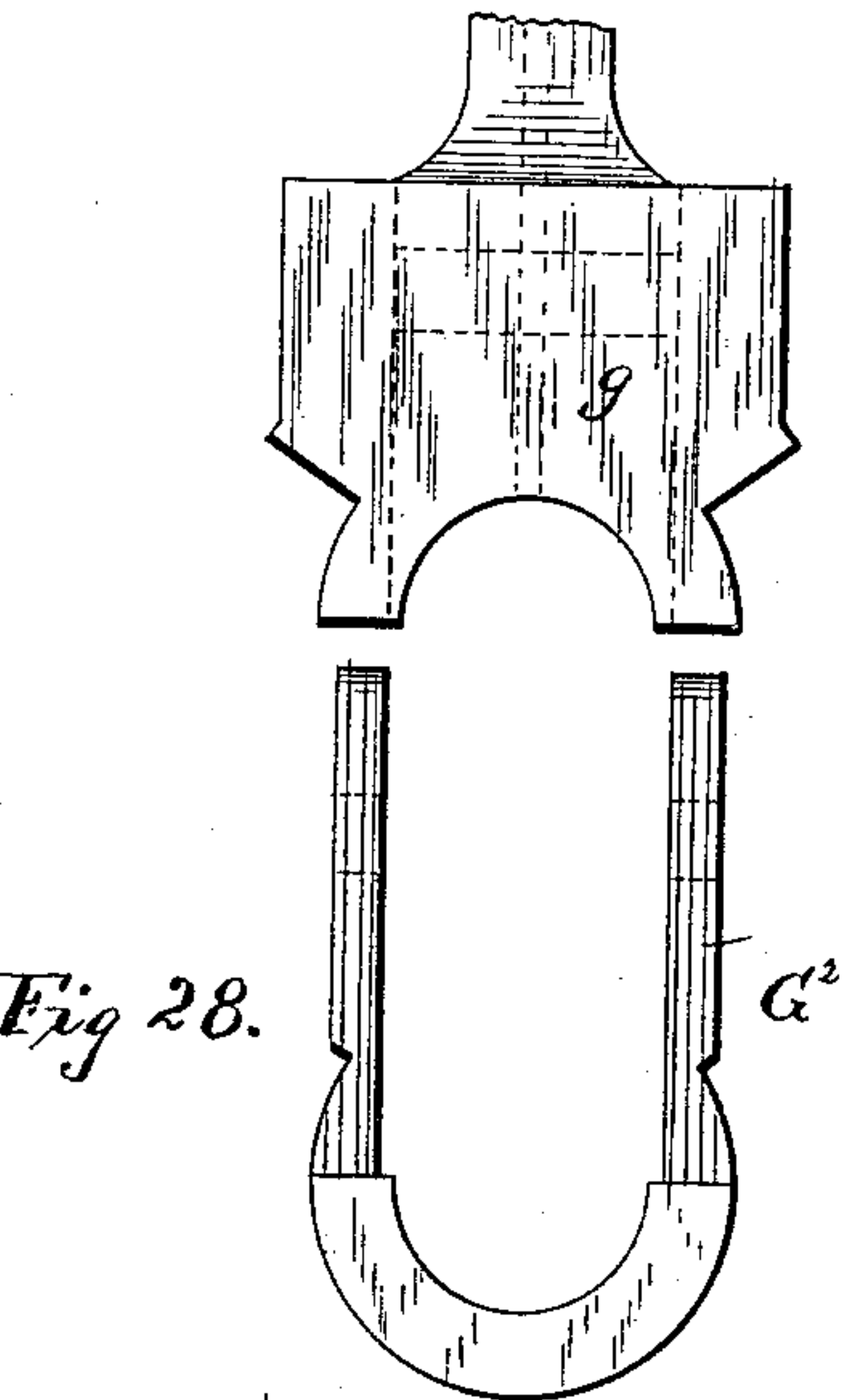
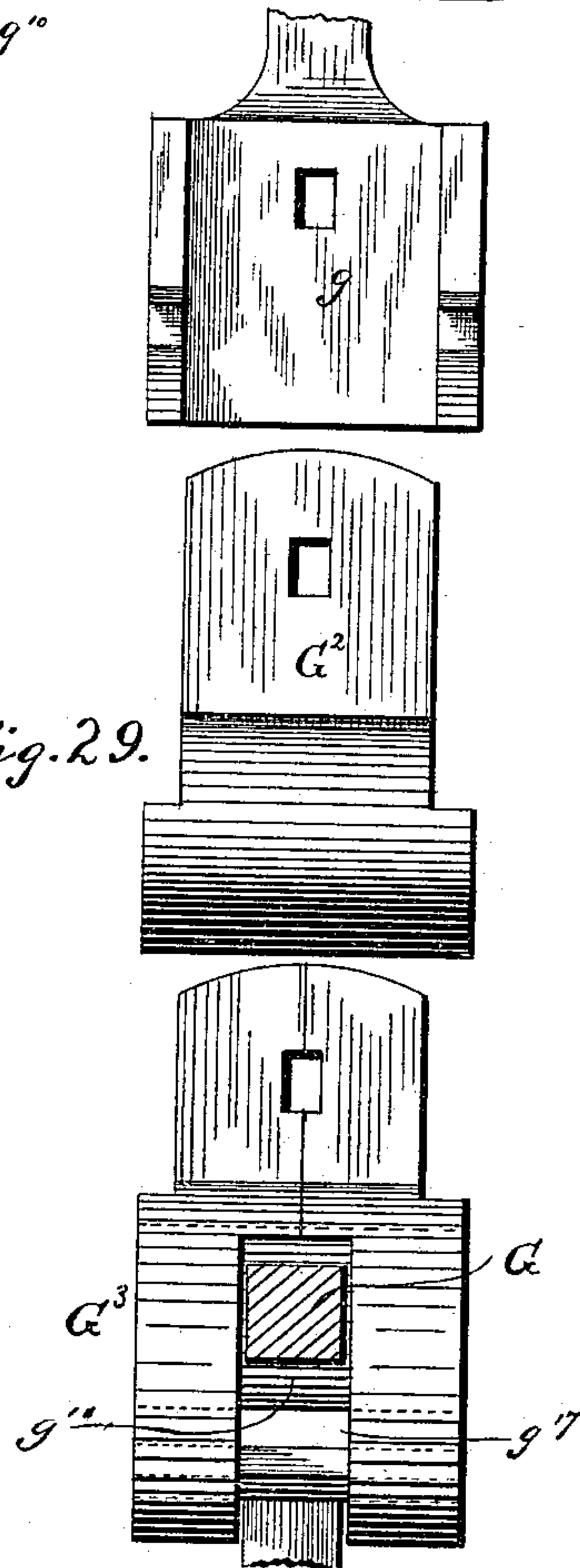


Fig. 29.



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UNITED STATES PATENT OFFICE.

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STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 335,530, dated February 2, 1886.

Application filed December 31, 1884. Serial No. 151,636. (No model.)

To all whom it may concern:

Be it known that I, MIRABEAU N. LYNN, of Rising Sun, in the county of Ohio and State of Indiana, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

The present invention relates more especially to that class of steam-engines wherein a number of separate cylinders and pistons are combined to actuate a single main driving-shaft; and it consists in the several novel combinations, arrangements, and constructions of parts, as hereinafter more fully described, and pointed out in the claims, whereby the number of necessary parts is reduced, the construction simplified, and the efficiency of the engine correspondingly increased.

In the accompanying drawings, illustrating my invention as applied to a four-cylinder engine, for use as a farm or portable engine, Figure 1 is a side elevation, partly in section; Fig. 2, a longitudinal section; Fig. 3, a sectional view of the reversing mechanism applied to the eccentric. Fig. 4 is a longitudinal section of one of the valve-cylinders. Fig. 5 is an end view of one of said cylinders. Fig. 6 is a side view, and Figs. 7 and 8 longitudinal and transverse sections, respectively, of the valve. Fig. 9 is a detail showing one of the bearing-blocks for attaching the valve to its pitman. Figs. 10, 11, 12, and 13 are details of the valve-rod or pitman; Figs. 14 and 15, side and edge views of the valve-eccentric; Figs. 16 and 17, side and edge views of the eccentric strap or yoke; Figs. 18 to 24, inclusive, details of the piston-rods or pitmen and collar; and Fig. 26 a view of the piston rods or pitmen and attachments for application to the crank or wrist pin. Fig. 30 is a sectional view illustrating a convenient mode of detachably securing the supplemental to the main casing.

Similar letters of reference in the several figures indicate the same parts.

Upon the hollow main frame or casing A of the engine are mounted the cylinders A', four in number, whose inner ends communicate

with the interior of the said casing, their outer ends being closed by the removable heads A², bolted or otherwise suitably secured thereto in any well-known manner. On the side, and near the outer end of each cylinder, is formed a seat, A³, to receive the valve-cylinder B. The valve-cylinder B, Figs. 1, 4, and 5, are each provided with a seat, b, corresponding with the seat A³ on the cylinder, a steam-chest, b', and two collars, b², between which latter is formed an annular chamber, b³, all of which parts, with the addition of the branch steam pipe or fitting B', extending from the seat b to the steam-chest b', may, if desired, be cast in one piece. The annular chamber b³ of the valve-cylinder communicates with the interior of the cylinder A' through the steam-port a in seat A³, while the pipe B' connects with the steam-pipe C through an opening, a', in said seat.

Two of the valve-cylinders B of the series have but a single branch pipe, B', while the intermediate cylinders have two such pipes, as shown in Fig. 1, whereby the several steam-chests b' are all put in communication through the connecting steam-pipes C, to any one or all of which the steam-supply pipe is attached.

Each valve-cylinder B is connected to the casing A by a cylinder or tube, D, attached to the said casing, and extending through the collars b² into the steam-chest b'. These cylinders are removably secured to the casing A, and are screw-threaded into the collars b², the permanency of the connection or joint at this point being secured by the application of the jam-nuts or threaded collars b⁴, between which latter and the collars b² suitable packing material may be placed, if desired. A series of perforations, d, are formed in the tube D opposite and communicating with the annular chamber b³.

Within the casing A is arranged a bearing-block, E, for the main driving-shaft, and the ends of the said casing are closed, the one by a removable head, E', and the other by a similar head, or, as in the present instance, by the hollow extension or casing E², as shown in Fig. 3. The casings E² and A may be cast integral, or they may be made separate and bolted or otherwise secured together, as cir-

cumstances require. When the engine is adapted for use in connection with a farm-engine, as shown, the casings are provided with the dependent flanges $e e$, which conform to 5 and rest upon the boiler.

The main driving-shaft F extends longitudinally through the casings A and E^2 , and is supported in cone-bearings $f f' f^2$. The bearings f and f' , the former secured in the end 10 of casing E^2 and the latter in the bearing-block E , open out in the same direction, and the bearing f^2 , which is secured to the head E' of the casing A , opens in the opposite direction, and the crank F' is located intermediate the 15 bearings $f' f^2$.

It will be observed that as thus constructed and arranged the main shaft and its connecting mechanism is entirely covered and enclosed within the casing, and the end bearings 20 can readily be adjusted to compensate for wear without taking the machine apart, and when it is desired to insert or remove the shaft it can conveniently be accomplished by removing the bearing f^2 and sliding the shaft through 25 the head of the casing A .

Within each cylinder A' is contained a piston, to which is pivotally attached a pitman or connecting rod, G , after the manner indicated in my application No. 127,383, filed 30 April 10, 1884, and the several pitmen are combined and applied to the crank F' in the following manner: One pitman is provided with a head, g , having a semicircular groove or bearing, g' , fitting the crank-pin, and flanges 35 g^2 on opposite sides, forming a way to receive the arms g^2 , of a sectional strap or yoke, G' , which embraces the crank-pin and contains the other half-bearing, g^4 . This yoke G' is divided longitudinally into two half-sections, 40 g^5 , each formed with an inner flange or shoulder, g^6 , and an outer flange or shoulder, g^7 , the latter narrower but projecting in the same direction and concentric with the inner flange, g^6 , as shown in Fig. 24. The sections 45 g^5 , when brought together, as shown in Fig. 25, are applied to the head g , as indicated in Fig. 25, and secured in place by the gibs and keys passing through said head and the keyway g^8 , formed in the proximate faces of the 50 sections g^5 . The remaining pitmen G are each provided with a curved bearing, g^9 , fitting the outer surface of flange g^6 , and with a flange or shoulder, g^{10} , on either side, concentric with the bearing g^9 , and adapted to fit the space or 55 groove g^{11} between the flanges g^6 and g^7 .

In applying the pitmen to the crank those having the flanges g^6 are first placed in position with their flanges between the flanges g^7 and g^7 of the sections g^5 , and the latter are 60 brought together until their inner flanges, g^6 , make contact. The yoke G' and the head g of the remaining pitmen are next applied to the crank-pin, and the whole is clamped and firmly secured in position by the gib and key passed 65 through the head g and the keyway g^8 in the section g^5 . Thus by the simple removal of the

key all the pitmen may be readily detached from the crank-pin.

The pistons are single acting, the steam under pressure being admitted to the outer ends 70 of the cylinders only, the exhaust-steam being delivered into the hollow casing, where, together with the oil, it serves to lubricate the several bearings.

The valves H , for controlling the passage of 75 steam to and from the cylinders A' , are tubular in form and operate within the cylinders D , connecting the valve-cylinders with the casing A . All the valves are alike, and each is composed, essentially, of a piston or dia- 80 phragm, h , provided with or having secured thereto two tubular extensions, the piston serving to divide the valve into two cup-shaped sections, the outer, h' , communicating with the steam-chest b' , and the inner, h^2 , with 85 the casing A , through the cylinder D . A series of circular openings or ports, h^5 , are formed in the section h' above the piston, and a similar series of openings or ports, h^6 , preferably elongated to increase their area, are 90 formed in the section h^2 below the piston. As thus constructed, arranged, and applied, the valves H being reciprocated by appropriate mechanism and at proper intervals within the 95 tube D , the steam is first admitted to the cylinder A' and above the piston, through the ports h^5 , perforations d , and chamber b^3 . The return-stroke of the valve closes the perforations d , allowing the steam in the cylinder to act expansively until the openings or ports h^6 100 below the piston arrive opposite the perforations d , when the steam contained in the cylinder is exhausted into the cylinder D and passes to the interior of the casing A .

The mechanism which I prefer to employ 105 for actuating the valves H is constructed and applied as follows: Upon the lower or inner end of the valve is secured or formed a cross-piece, I , provided with a concave bearing, i , adapted to receive the cross-head i' on the 110 pitman I' , Fig. 11, the said cross-head being held in place by the bearing-blocks i^2 , bolted to ends of the cross-piece I . The several pitmen I' are formed with sockets i^3 on the end, Fig. 10, adapted to receive and retain by 115 screw-threads or otherwise the detachable heads J , Figs. 12, 13, 16, and 17, which latter are applied to the eccentric, as hereinafter described.

Upon the eccentric K , borne by the main 120 shaft, is fitted a divided collar or ring, K' , Figs. 16 and 17, the two sections $k k$ whereof are each formed or provided with a semi-cylindrical arm, k' , and two concentric flanges, 125 $k^2 k^3$, forming an annular groove, k^4 . The outer flange, k^3 , is narrower than the inner flange, k^2 , and when the two sections are brought together the arms k' can be inserted within one of the sockets, i^3 , thereby retaining the sections in place, with their inner flanges, 130 k^2 , in contact, forming a central bearing concentric with the eccentric, and with a flange,

5 k^3 , on either side thereof. Upon the bearing thus formed by the inner flanges, k^2 , is fitted the arc-shaped bearing or saddle j of the detachable heads J, the flanges j' thereof being received under the flanges k^3 on either side of the collar or ring k' . It will thus be seen that the several heads, J, (each provided with a shank, j^3 , fitting the socket i^3 in one of the pitmen I' ,) are independently mounted or supported upon the collar or ring K' in such manner as to be free to move thereon between the collars k^2 k^3 , and that they are all clamped and held in position by the bringing together of the two sections k and the insertion of the arms k' into one of the sockets i^3 of the pitman, whereby the several pitmen may readily be disconnected from the eccentric by the withdrawal of the pitman from the arms k' of the collar K' and the separation of the two sections k .

The detachable heads J are duplicates of each other, and can readily be replaced when worn or broken, and the same is true of the valves and their several connected parts.

25 The eccentric K may be mounted upon and connected to the main shaft in any well-known manner; but I prefer the following arrangement, as providing an efficient mechanism and means for reversing the eccentric, and hence the direction of rotation.

30 The eccentric K is formed upon or attached to a sleeve, L, embracing the main shaft, and provided with a spiral groove or slot, l , into which a stud or pin, l' , attached to a second sleeve, L' , projects. This sleeve L' fits over and slides upon the sleeve L, being connected to rotate with the main shaft by a feather and groove. It is further provided with a series of parallel teeth cut or formed on its external surface, constituting a circular rack, with which the teeth of a pinion, l^2 , mesh, said pinion being mounted upon a transverse shaft provided with a hand-wheel (not shown) and operating within the casing E^3 .

45 When the engine is in operation, the sleeve L' , revolving with the main shaft, communicates motion to the eccentric through the medium of the pin and the groove in the sleeve L, thereby actuating the valves. To reverse the position of the valves it is only necessary to reciprocate the sleeve L by means of the pinion l^2 , as by so doing the pin or stud l' , acting against the walls of the spiral groove in the sleeve L, will produce a partial rotation of the latter, and with it the eccentric and valves.

Although the engine proper is adapted for use in other connections, as is apparent, I have shown it herein as especially modified and adapted to be applied upon the horizontal boilers of a farm-engine, and to that end the extension E^2 of the casing A is employed. This extension or casing E^2 is designed to inclose not only the shaft and the reversing mechanism, but also the driving-pinion M and gear M' on the vertical shaft M^2 , which latter communicates motion to the traction mechanism.

By thus inclosing the working parts not only are they protected from dirt and injury, but they are subjected to the lubricating action of the exhaust-steam and the oil carried therewith from the cylinders, when, as is usual, the oil is fed in with the live steam.

The engine thus constructed and arranged combines many valuable and important qualities. It is simple in construction, compact, noiseless, self-lubricating, protected from injury, can readily be taken apart and expeditiously set up, is practically noiseless in operation, and most of its parts are interchangeable and can be removed and replaced at comparatively little cost.

By supporting the shaft in cone bearings, as described, and the outer bearing in the head of the main casing or exhaust-cylinder A the bearings can readily be "set up," and when desired the shaft can be withdrawn through the end of the casing.

In Figs. 27, 28, and 29 I have illustrated what I deem a modification of the means for applying the several pitmen or piston-rods to the crank. Instead of dividing the strap or yoke G' longitudinally and grooving it, as described, to receive the T or flanged head of the pitman, as described with reference to Figs. 18 to 26, inclusive, two straps, G^2 G^3 , are employed, the inner strap, G^2 , applied directly to the crank or wrist pin and furnishing the bearing for the heads of pitmen G, while the outer strap, G^3 , slotted as at g^{17} , for the reception of the pitmen, is placed over the strap G^2 and the two united to the head g by the gib and key g^{18} . As thus constructed the pitmen have their bearing upon the inner strap, and are held in place and guided by the outer strap, G^3 , between which and the strap G^2 the flanges g^{10} on the pitman are confined.

I am aware that multiple cylinder-engines have been devised wherein the crank-pin has been formed upon or attached to the end of the shaft and connected to drive shifting valve-operating mechanism, the whole being contained within an inclosing-case constituting the main frame, beyond which latter the shaft is extended and the driving gear or mechanism applied thereto at some point beyond the main frame, as disclosed in Patent No. 185,293, and the construction as thus described and illustrated in said patent is herein disclaimed as representing a different invention from that herein claimed.

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

1. In combination with the main casing, the cylinders mounted thereon, and exhausting into said casing, the main shaft having bearings therein, and the reversing mechanism and driving-gears located in the supplemental casing applied to the main casing, and communicating therewith, as described, whereby all the working mechanism is protected and subjected to the lubricating action of the exhaust-steam and oil, substantially as described.

2. In combination with the main and supplemental casing connected and mounted upon the boiler, as described, the driving-shaft extending through said casing and supported in bearings therein, the crank-pitman and cylinders located at one end, and the driving-gear at the opposite end and within the said casing, substantially as and for the purpose set forth.

3. In combination with the main shaft, the crank located at one end, and the driving-gears at the other, the eccentric and shifting mechanism located intermediate the crank and driving-gear, and the casing inclosing the shaft and the operating mechanism, substantially as described.

4. In a direct-acting steam-engine, a frame for the actuating mechanism, consisting, essentially, of a main casing, to which are applied the piston and valve cylinders, as described, and provided with bearings for the main shaft, and the supplemental casing applied to and forming an extension of the main casing, said supplemental casing being provided with bearings for the main shaft and counter-shaft, substantially as and for the purpose set forth.

5. In a direct-acting steam-engine, the main frame having the main casing carrying the piston and valve cylinders, and adapted to inclose the crank on the driving-shaft, and the supplemental casing applied to the end and forming a continuation of the main casing, said supplemental casing being adapted to receive the devices for shifting the eccentric, and both of said casings with bearings to support the shaft, and a flange or bracket, *e*, for application to the boiler, substantially as described.

6. The combination, in a direct-acting steam-engine, of the main casing carrying the ra-

dial piston and valve cylinders, the supplemental casing applied to and forming an extension of the main casing, a driving-shaft extending through both of said casings and supported in bearings therein, devices, such as described, mounted upon the driving-shaft, for reversing the valve-eccentric, and located within the supplemental casing, and a crank to which the pistons are connected, located within the main casing, substantially as described.

7. In a direct-acting steam-engine, the combination, with the main casing carrying the radial piston and valve cylinders, and the supplemental casing applied to and forming an extension of the main casing, of the crank-shaft extending through both of said casings, and carrying the adjustable valve-eccentric, said shaft having its bearings in the ends or heads of the two casings, with a third bearing intermediate the crank and valve eccentric, substantially as described.

8. In a direct-acting steam-engine wherein the operating parts are inclosed, the combination of the main and supplemental casings, the piston and valve cylinders applied to the main casing, the main shaft extending through both casings, the crank and valve-eccentric applied to the said shaft at one end and within the main casing, the driving-gear applied to the opposite end, and within the supplemental casing, and the valve-adjusting mechanism applied intermediate the said crank and gear, substantially as described.

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