No. 684,216. Patented Oct. 8, 1901.

F. N. GARDNER & A. B. CADMAN.

SWAGING MACHINE.

(Application filed Dec. 19, 1900.)

(No Model.) 4 Sheets—Sheet 1.

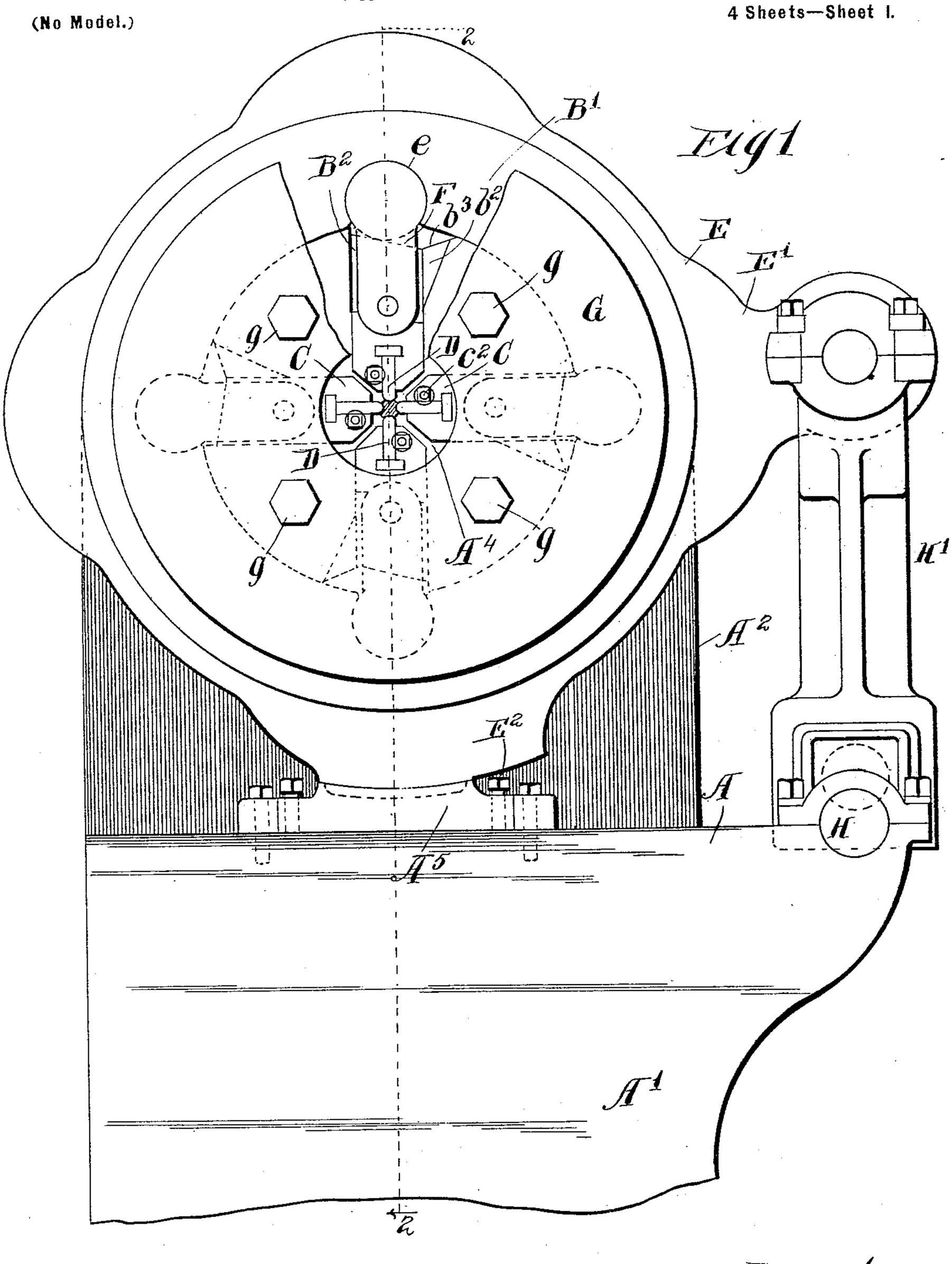

Fig 1

Witnesses:
Carl D. Crawford
William L. Hall.

Inventors:
Frederick N. Gardner
A. Benjiman Cadman
by Poole & Brown their Attorneys

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(No Model.) 4 Sheets—Sheet 2.

Fig 4

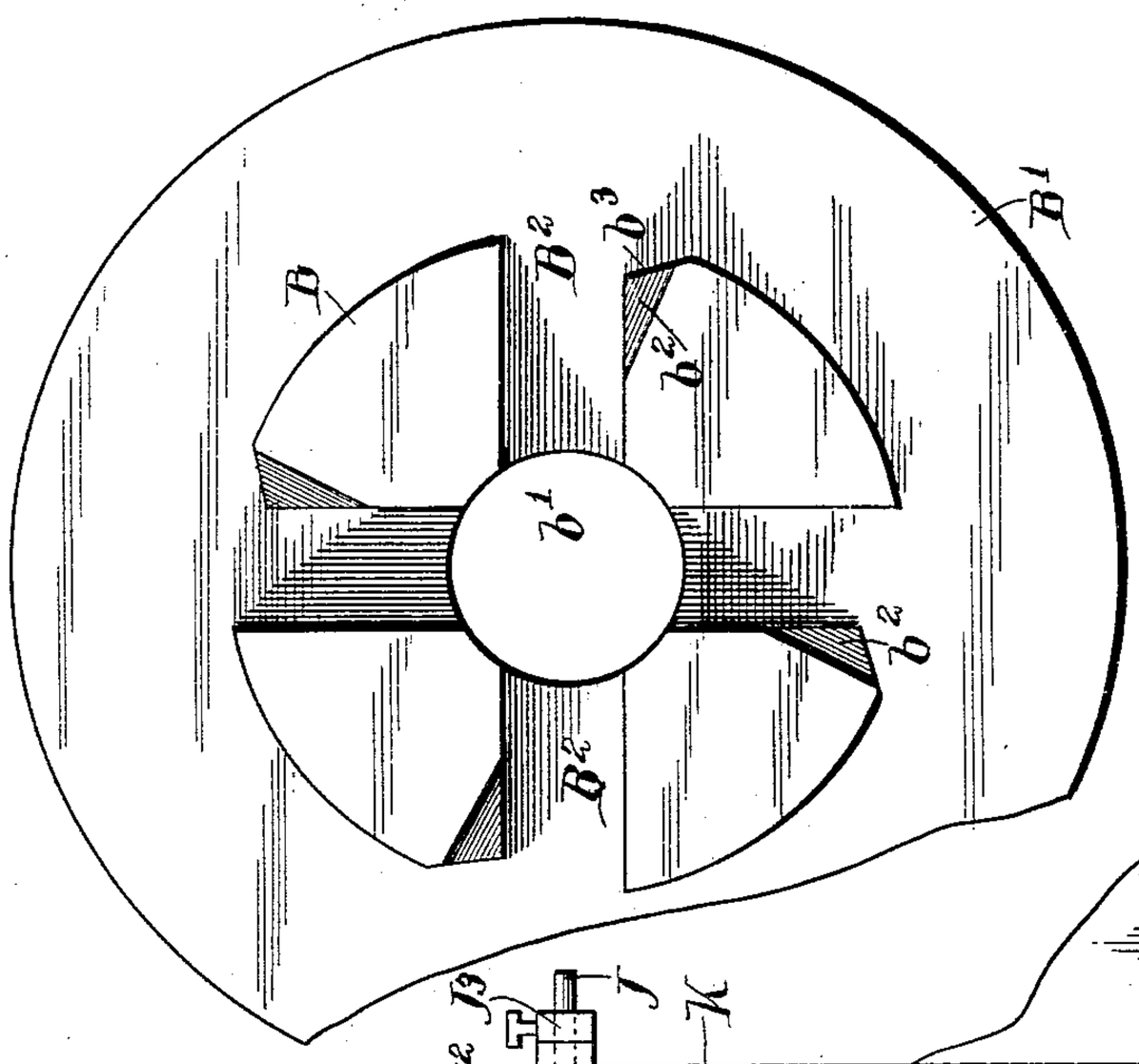

Fig 2

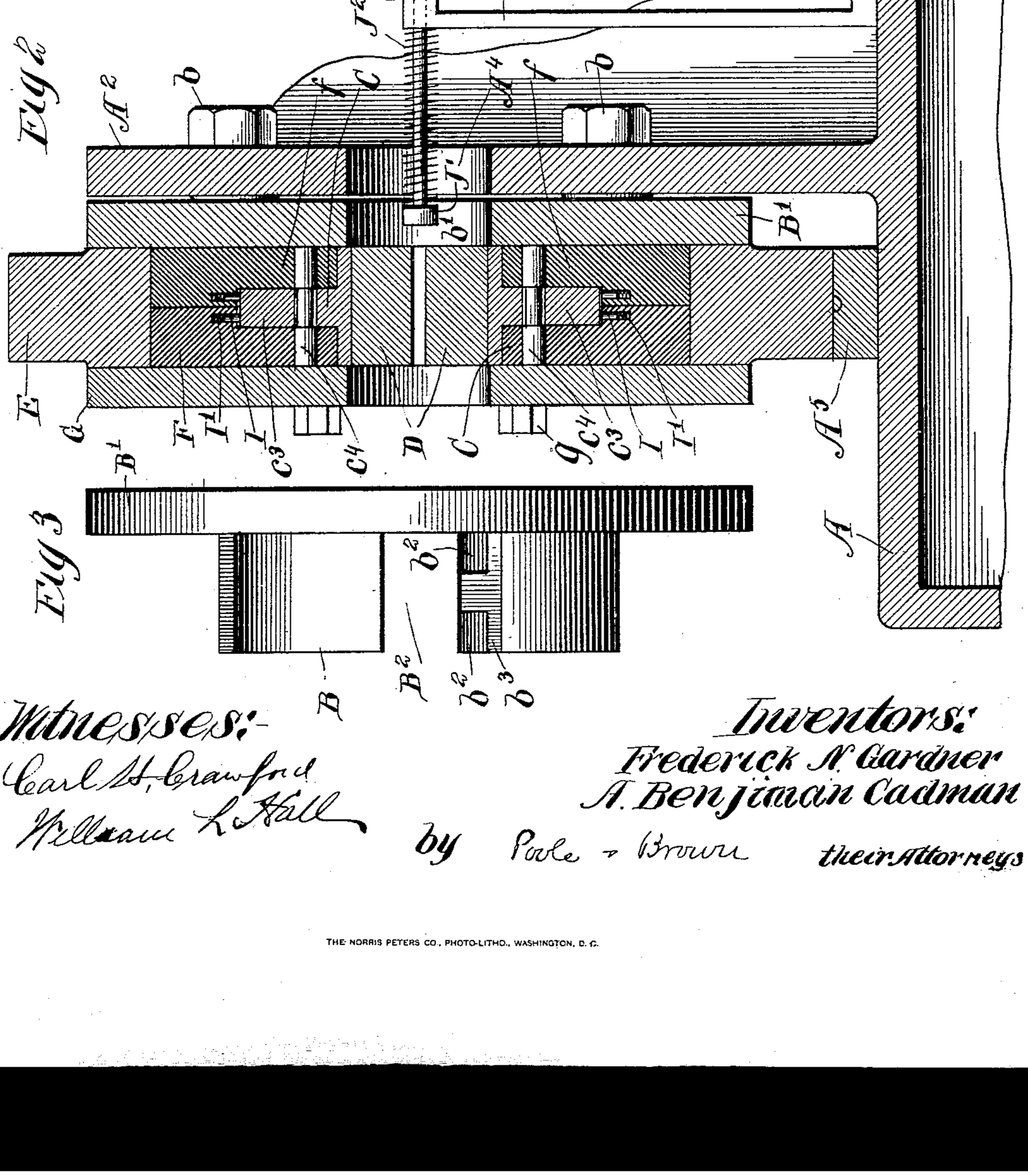

Fig 3

Witnesses:-
Earl St. Crawford
William L. Hall

Inventors:
Frederick N. Gardner
A. Benjamin Cadman.

by Poole & Brown their Attorneys

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(No Model.) 4 Sheets—Sheet 3.

Fig 4

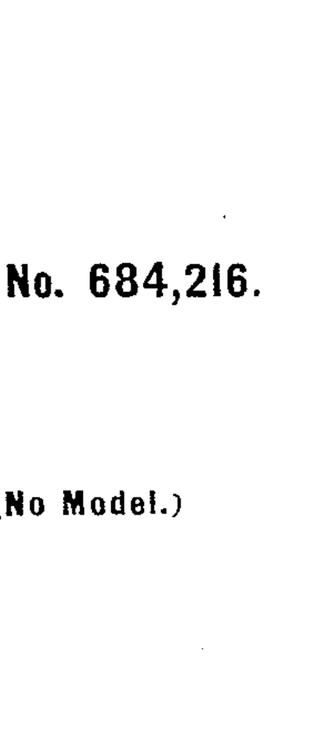


Fig 7

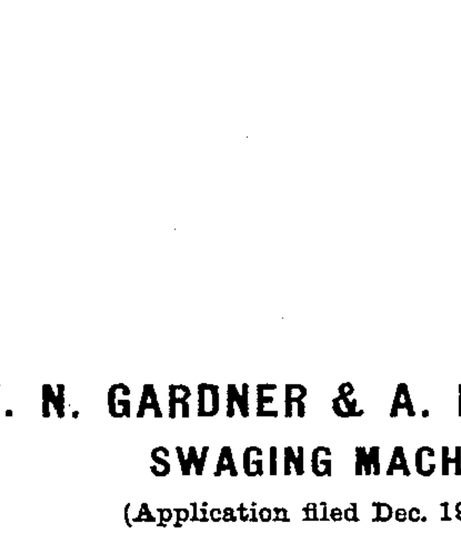


Fig 8

Fig 5

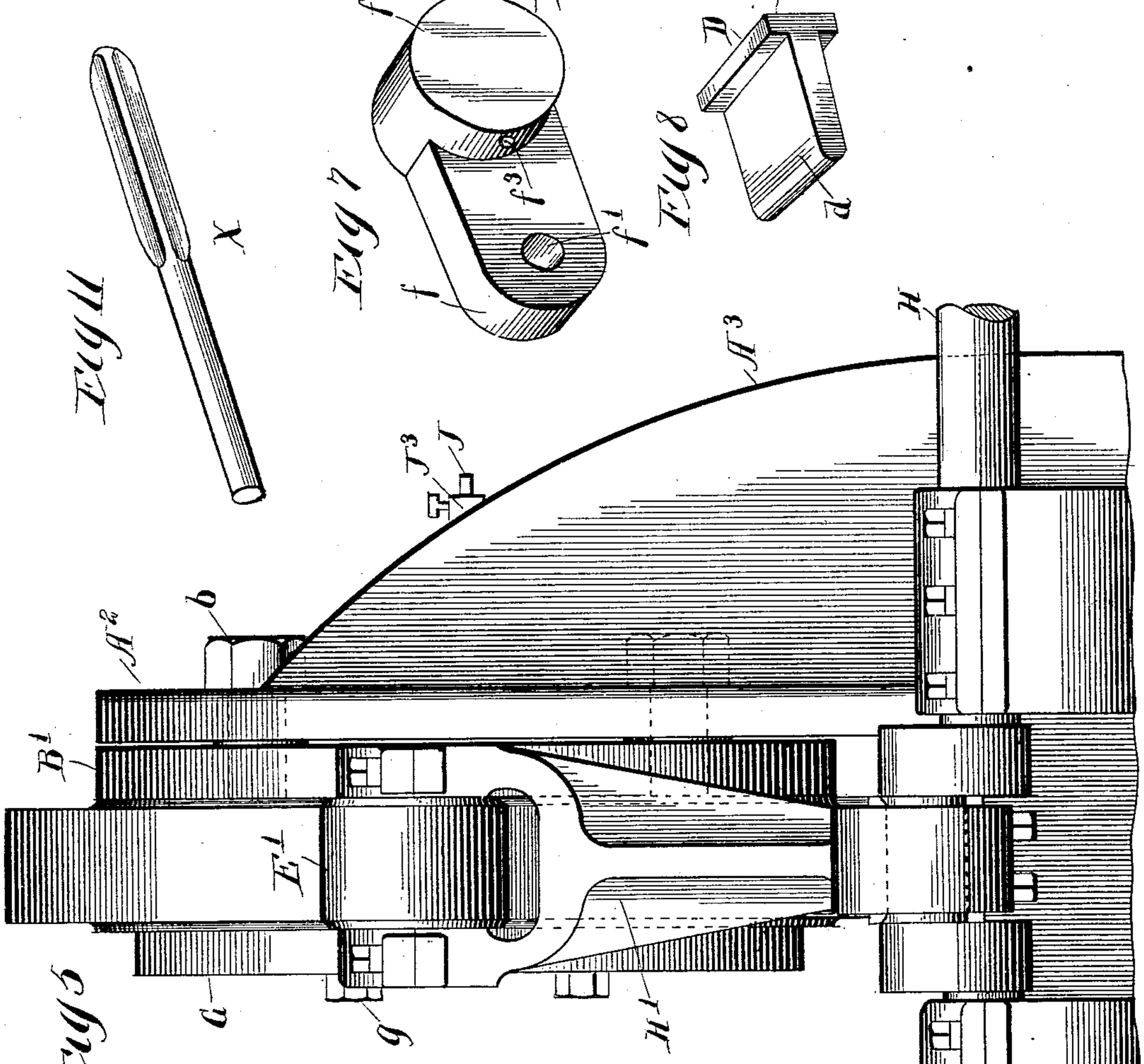
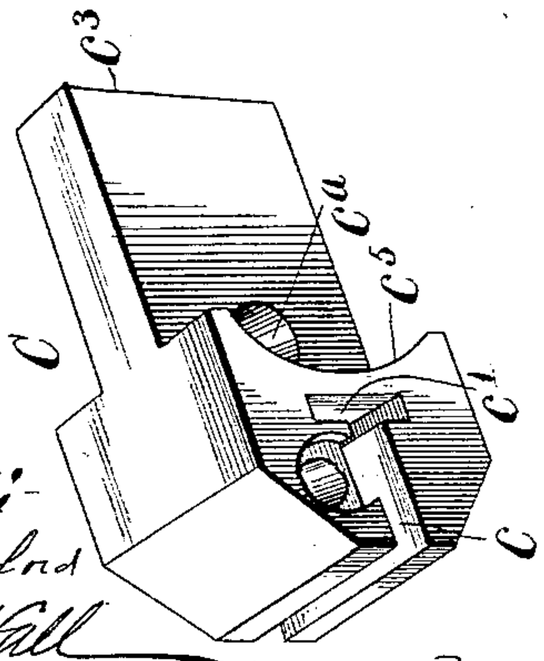


Fig 6



Witnesses:-
Carl C. Crawford
William L. Hall

Inventors:-
Frederick N. Gardner
A. Benjiman Cadman
by Poole & Brown their Attorneys

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Fig 9

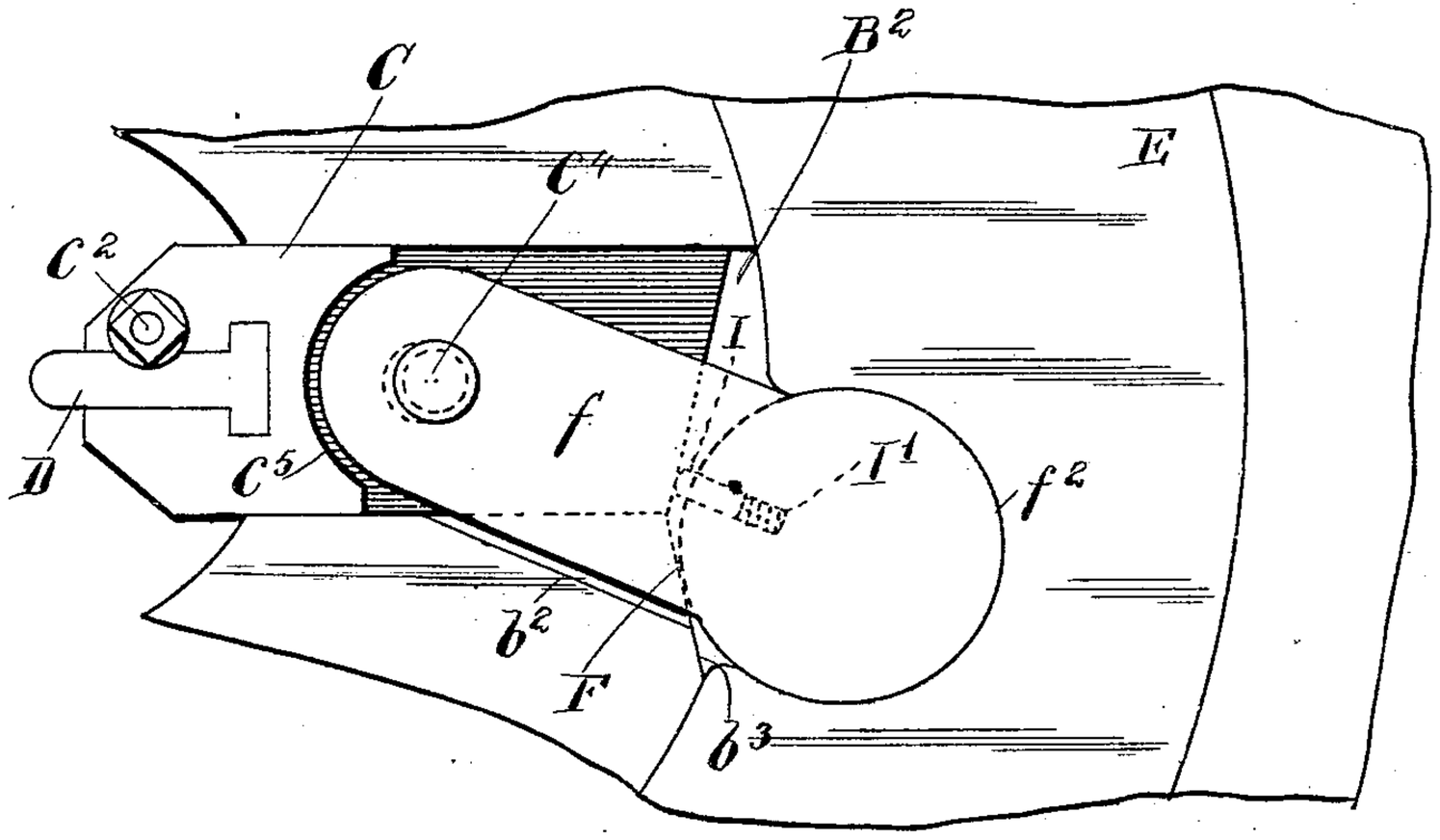
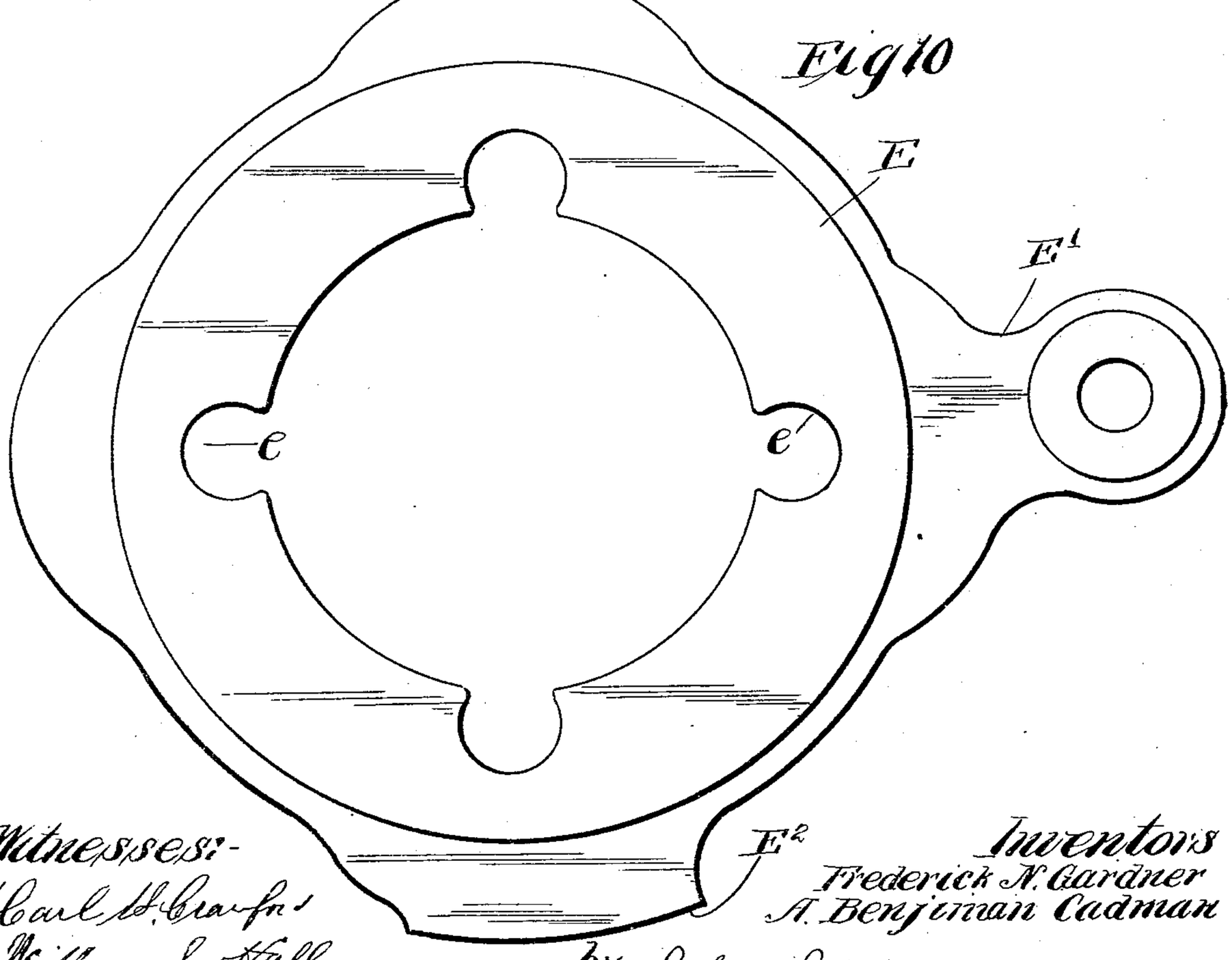


Fig 10



Witnesses:-
Carl H. Crawford
William H. Hall.

Inventors
Frederick N. Gardner
A. Benjiman Cadman
by Poole & Brown
their Attorneys

UNITED STATES PATENT OFFICE.

FREDERICK N. GARDNER AND ADDI BENJIMAN CADMAN, OF BELOIT, WISCONSIN, ASSIGNORS TO CHARLES H. BESLY, OF CHICAGO, ILLINOIS.

SWAGING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 684,216, dated October 8, 1901.

Application filed December 19, 1900. Serial No. 40,378. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK N. GARDNER and ADDI BENJIMAN CADMAN, of Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Swaging-Machines; and we 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 reference marked thereon, which form a part of this specification.

This invention relates to a novel swaging-machine for giving shape to metal articles through the medium of radially-movable dies.

The machine herein shown as one embodiment of our invention is constructed to effect one step in the process of manufacturing screw-taps wherein the blank from which the tap is made is first grooved between the working faces or lands to provide the required clearance-spaces and the working faces or lands are thereafter screw-threaded to form the completed tool, said machine being used in such process for the purpose of forming the longitudinal clearance-grooves in such blank.

The machine herein shown as embodying our invention embraces as its main operative feature a set of radially-movable dies which have sliding engagement with a suitable head or support and are constructed to be simultaneously moved radially inwardly and outwardly toward and from the blank operated upon in such manner as to effect equal and simultaneous pressure on said blank when moved inwardly.

The features constituting the invention will be hereinafter described and specifically pointed out in the claims appended hereto.

In the drawings, Figure 1 is a front elevation of the machine made in accordance with our invention with parts broken away. Fig. 2 is a central vertical section thereof on line 2 2 of Fig. 1. Figs. 3 and 4 are side and front elevations, respectively, of the tool-supporting head, the latter view being fragmentary. Fig. 5 is a side elevation of the machine. Fig. 6 is a perspective view of the die-carrier. Fig. 7 is a perspective view of a toggle-link forming part of the actuating mechanism. Fig. 8 is a perspective view of the die. Fig. 9 is a fragmentary face view of some of the parts shown in Fig. 1 and indicating said parts in changed positions. Fig. 10 is a face view of the actuating-ring by which the dies are moved inwardly and outwardly. Fig. 11 is a perspective view of the blank after having been subjected to the pressure of the dies.

As shown in said drawings, A indicates the bed-plate of the machine, supported at the upper end of a suitable standard A', and A^2 indicates a vertical plate which rises from the bed-plate and supports the principal parts of the die-holding and die-actuating mechanism. Said plate A^2 is braced by means of vertical ribs or webs A^3, herein shown as cast integral with the bed-plate and the supporting-plate. Said supporting-plate is provided centrally with a circular opening A^4.

Attached to the front face of the plate A^2 is a tool-supporting head B, provided at its rear end with a radially-extending annular flange B', by means of which it is attached to the supporting-plate A^2, said head being attached to the plate by means of bolts *b*, passing through the flange B' and through said supporting-plate. Said tool-head is provided centrally thereof with an annular opening b', which coincides with the opening A^4 of the supporting-plate A^2. The part of said tool-supporting head projecting from the flange B' thereof is cylindric and is provided outside of said flange with a plurality of guide-grooves B^2, herein shown as four in number, extending from the perimeter of said cylindric part of the head to and intersecting the central opening b' thereof. Within each groove B^2 is located a die-carrier C, separately shown in Fig. 6, which carries at its inner end a swaging-die D. Said die-carriers fit closely in said grooves and are adapted to slide radially inwardly and outwardly to carry the die toward and away from the work, which latter is centrally located with respect to the tool-holding head. Said dies D each consists of a flat body *d*, of a width equal to the length of the groove or re-

cess to be formed in the tap-blank X and suitably shaped at its inner end to give proper form to said grooves, and a transverse head d' at the rear end thereof of slightly greater width than the body. The carrier is provided at its outer end with a socket for the die, consisting of a slot c to receive the body of the die and a transverse slot or groove c' at the rear of the slot c to receive the head d', said parts fitting tightly within said grooves. Said die is slipped laterally into the socket and is held from lateral displacement therein by means of a bolt c^2, passing through the carrier, said bolt having a head at one end thereof and a nut or washer at the other end thereof, both of which overlap the body of the die, as clearly shown in Fig. 9. The bolt-aperture in the carrier is countersunk at its ends to receive the head and nut of the bolt, and the countersunk portions intersect the slot c in the carrier to permit the head and nut of the bolt to project into said slot.

The die-carriers are given radially reciprocatory movement in the grooves of the tool-carrying head through the medium of an oscillatory actuating-ring E, which fits over and has partial rotative or oscillatory movement on the projecting cylindric part of the head B and a plurality of toggle-links F, connected at their outer ends with the actuating-ring and at their inner ends with the die-carriers. One of said toggle-links is separately shown in Fig. 7. Each of said toggle-links consists of a stem f, provided at its inner end with a bearing-aperture f' and a particylindric head f^2 at its outer end of greater width than the stem. Said head f^2 is made of greater thickness than the stem, the excess of thickness being located on the inner face of the link, so that when the heads of two links are fitted together a space is left between the stems to receive the outer end of the carrier, which latter is reduced in thickness to form a shank c^3 to fit between said stems. Said links and carrier are connected by a pivot-pin c^4, passing through the bearing-apertures f' in the said links and an aperture c^a in the shank of said carrier. The inner end or head of the carrier C is equal in thickness to the combined thickness of the heads of the links, said thickness being approximately equal to the depth of the groove or way B^2 in the head B in which said parts are located. The shoulders c^5 between the body of the carrier and the shank thereof on each side of the carrier are curved, and the outer end of the links F are similarly curved, thereby permitting free angular movement between said parts about the pivot-pin c^4, as will hereinafter more fully appear. As a means of connecting the outer ends of said toggle-links with the actuating-ring said ring is provided on its inner cylindric surface with a plurality of particylindric sockets e, as clearly shown in Fig. 10, within each of which fits the outer correspondingly-shaped ends of two associated links. Said sockets comprise, in cross-section, the greater part of a circle, and the rounded outer ends or heads of said links are slipped laterally thereinto, so that when in place therein radial movement of the links with respect to the ring is prevented, while said links are free to turn or oscillate about an axis concentric with the centers of the heads f^2. Said links and die-carriers are held in place in said grooves by means of an apertured face-plate G, placed over the outer surface of the head and overlapping at its margin the ring E, the same being secured to the head by means of bolts g, which pass through the plate and into the head B. The overlapping relation of the plate G and the ring E also prevents said ring from slipping laterally off the head, as will be clearly understood by inspection of Fig. 2.

The actuating-ring E is given oscillatory motion about an axis concentric with the tool-holding head B through the medium of a crank-shaft H, journaled in the bed-plate, and a connecting rod or pitman H', connected at one end with said crank-shaft and at its other end with an arm or projection E' on the actuating-ring. Preferably the lower part of said actuating-ring is provided with a concentric bearing-surface E^2, which rides on a block or shoe A^5, attached to the upper surface of the bed-plate. Said shoe carries a large part of the weight of the ring, which is desirable in view of the fact that the head is cut away at its top to a considerable extent to form the upper guide-groove, and in the absence of the shoe undue pressure would come on the upper lateral parts of the head, with consequent friction and liability of wear.

In the operation of the device when the actuating-ring is in position to bring the toggle-links parallel with the carriers, as shown in Fig. 1, the connection between the parts is such that the carriers will be moved to the innermost limits of their travel, so that if a tap-blank be in position in the machine the dies will engage said blank to form the desired longitudinal depressions or recesses therein. The continued rotation of the shaft acts to partially rotate or oscillate said ring, so as to depress the part thereof adjacent to the crank-shaft, and such movement of the ring serves to swing the links F out of parallel with the carriers, as shown in Fig. 9. By reason of the fact that the links are pivoted to the carriers at points between the connection of the ring with said links and the center of oscillation of said ring, and therefore the radii on which said links swing are shorter than the radius of oscillation of the ring, such oscillation of the ring causes the links to move bodily outwardly, and by reason of their connection with the carriers moves said carriers radially outwardly in the guide-grooves B^2 in the head B and retracts the dies from the work. In order to permit movement of the toggle-links into angular relation to the carriers, said head is provided at the outer ends of the guide-grooves B^2 with beveled parts b^2 b^3, forming recesses to receive the outer parts of the links

when the latter are in inclined positions, as more clearly shown in Figs. 1, 3, 4, and 9. The oscillation of said ring to the opposite extremity of its movement again brings the links parallel with the carriers and causes said carriers to be moved inwardly and the dies carried thereby to be moved into contact with a blank inserted into the machine.

The connection between the carriers and toggle-links is such that when the parts assume their parallel relation, as shown in Fig. 1, and move the dies inwardly against their work the inward thrust of the links is communicated to the carriers through the shoulders c^5 of said carriers without reliance upon the pivot-bolts c^4 thereof.

As a further and separate improvement a limited yielding connection is provided between the dies and links, whereby when the links are moved to project the dies to their work said dies will be permitted to yield backwardly a limited extent before positive thrust of the parts is brought upon the dies. This construction is provided to effect an automatic centering of the blank before the dies are brought positively against the same, and thereby prevent an unsymmetrical disposition of the grooves in the blank. The construction here shown for effecting this result is made as follows: The pivot-bolts c^4 fit loosely in the bearing-apertures of the carriers, said bolts for this purpose being reduced in diameter in their parts engaging said bearing-apertures. Between the links and carriers are interposed spring-pressed parts which act to yieldingly project the carriers from the links, so that when the dies are retracted, as shown in Fig. 9, the inner ends of the links are slightly separated from the curved shoulders c^5 of the carriers, so that when the links are brought into parallel relation with respect to the carriers and the dies forced against the blank said dies will be permitted to yield until the ends of the links come into contact with the shoulders c^5 of the carriers. As herein shown, the inwardly-projecting parts of the heads are provided on their radially inner surfaces with sockets f^3, which are parallel with the longitudinal axis of the links. Within said sockets are located reciprocating plungers I, which bear at their outer ends against laterally-separated parts of the adjacent ends of the shanks and are engaged at their inner ends by spiral expansion-springs I′, located between the plungers and the bottoms of the sockets.

The action of the spring-pressed plungers when the dies are retracted, as shown in Fig. 9, is to project the carriers from the links and to hold the shoulders c^5 of the carriers slightly separated from the adjacent ends of the links and the outer part of the bearing-aperture in the shank of said carrier in contact with the pivot-pin c^4. When said actuating-ring is oscillated to bring the links into parallelism with the carriers and to move the carriers inwardly, the first effect of such movement of the link acts through the spring-pressed plunger I to move the dies yieldingly against the blank, and thereby center said blank with respect to the dies before positive pressure is brought on the blank. When the outer ends of the links are brought into contact with the shoulders c^5 of the carriers and the parts are therefore in position to transmit positive pressure, the blank will have been centered and the dies will engage the same to form the grooves symmetrically about the blank. It will be seen, therefore, that no strain is brought upon the pivot-bolt c^4 when the dies are positively thrust against the blank. The ends of the carrier-shanks are inclined with respect to their length, said shanks being made longer at their sides away from which the links swing in order to provide as long a bearing as practicable between said sides of the carrier and the adjacent sides of the guide-grooves. The yielding connection between the links and dies may be otherwise constructed.

The effect of the pressure of the dies against the blank to form the grooves therein is to spread the metal of the blank both longitudinally and laterally. We prefer to use two or more dies to produce a groove of given size, the first die having a comparatively thin working face to form an initial groove narrower than the groove to be finally made and each succeeding die being of greater thickness, the last die being made of the proper thickness and shape to produce the size of groove desired. By this procedure the expansion of the metal of the blank is almost wholly lateral instead of longitudinal, as would be true if the groove be formed at once by a single pressing operation. In any case, however, some longitudinal expansion of the blank occurs, and we have herein shown a yielding stop at the rear of the machine against which the end of the blank rests when held in position to be operated upon by the dies and which yields to permit such longitudinal expansion of the blank. Said stop in the present instance consists of an endwise-movable spring-pressed rod J, located at the rear of the machine, having a head J′, located just in rear of the opening in the tool-holding head B and adapted to be engaged by the end of the blank. Said rod has endwise sliding engagement with an eye in the upper end of a standard K, which rises from the bed-plate A, and the rod is held projected by means of a spiral expansion-spring J^2, interposed between the head J′ and the upper end of said standard. The rod is provided in rear of the standard with a sliding collar J^3, adjustably affixed thereto, as by a set-screw, and whereby the position of the head J′ may be adjusted forwardly and rearwardly with respect to the dies.

The blank to be operated upon may be held

in place in the machine either by hand or by a device attached to the machine for that purpose. The rod from which the blank is to be formed before being placed in position to be operated upon by the dies is heated to the proper temperature, whereby the dies may be slowly pressed thereinto to give the proper depth of grooves at one operation of the machine. The heated rods from which the blanks are formed are therefore successively placed into the machine, given shape by the dies, and removed. If more than one set of dies is employed to give a desired depth and shape of groove, all the blanks of a given kind to be made are first formed by one set of dies, said dies substituted by larger ones, and the unfinished blanks fed to the machine as before, and so on until the grooves are made of the proper depth and size.

We claim as our invention—

1. A machine for the purpose stated comprising a base-plate, a vertical plate rising therefrom, a cylindric tool-holding head projecting forwardly from said plate provided with a central opening and on its face with radial grooves intersecting said opening, die-carriers in said grooves, an actuating-ring surrounding said head and operatively connected with said carriers, and a bearing projection on the ring supported on said base-plate.

2. A machine for the purpose stated comprising a stationary tool-holding head provided with a central opening and on its face with radial grooves intersecting said opening, radially-movable die-carriers in said grooves, an actuating-ring surrounding said head, and oscillating about an axis coincident with the central axis of the head, and toggle-links pivotally connected at their outer ends with said ring and at their inner ends with said carriers, said toggle-links and carriers being connected in a manner to permit a limited relative longitudinal movement between the same.

3. A machine for the purpose stated comprising a stationary tool-holding head provided with a central opening and on its face with radial grooves intersecting said opening, radially-movable dies in said grooves, an actuating-ring which oscillates about a center coincident with the central axis of the head, and operative connections between said ring and dies, said connections being constructed to afford a limited backward yielding of the dies when brought into contact with the work being operated upon to center the work in the machine.

4. A machine for the purpose stated comprising a stationary tool-holding head provided with a central opening and on its face with radial grooves intersecting said opening, die-carriers movable radially in said grooves, an actuating-ring surrounding said head and oscillating about an axis coincident with the central axis of the head, links connecting said dies with said ring, said links having relative longitudinal movement with respect to the carriers and yielding connections between the links and carriers.

5. A machine for the purpose set forth comprising a tool-holding head provided with a central opening and on its face with radial grooves which intersect said opening and extend to the periphery of the head, radially-movable die-carriers in said grooves, an actuating-ring surrounding and turning on said head and provided on its inner surface with particylindric sockets, and toggle-links pivoted at their inner ends to said carriers and provided at their outer ends with heads which engage said sockets of the ring.

6. A machine for the purpose stated comprising a stationary tool-holding head provided with a central opening and on its face with radial grooves, die-carriers located in said grooves, an actuating-ring surrounding said head and oscillating about an axis coincident with the central axis of the head, each of said carriers being connected with the ring by means of two laterally-separated toggle-links, pivoted at their inner ends to the carriers, one on each side of the carrier, said toggle-links being pivotally connected at their outer ends with the rings, and the head being provided at the outer ends of the grooves with inclined portions forming recesses to provide clearance to permit angular movement of the links.

7. A machine for the purpose stated comprising a tool-holding head provided with a central opening, and on its face with a plurality of radial grooves, die-carriers in said grooves, a ring surrounding and turning on said head and oscillating about a horizontal axis coincident with the central axis of the head, and a supporting-shoe located beneath and adapted for contact with said ring.

8. A machine for the purpose stated comprising a tool-holding head provided with a central opening and on its face with radial grooves which intersect said opening, radially-movable die-carriers in said grooves provided with dies, an actuating-ring mounted on said head, and oscillating about an axis coincident with the central axis of the head, operative connections between said ring and carriers, the outer face of said actuating-ring being flush with the outer face of the head, and a face-plate fitted over said head and overlapping the actuating-ring.

9. A machine for the purpose set forth comprising a tool-holding head provided with a central opening and on its face with radial grooves which intersect said opening and extend to the periphery of the head, radially-movable die-carriers in said grooves, an actuating-ring surrounding and turning on said head, and provided on its inner surface with particylindric sockets, toggle-links pivoted at their inner ends to said carriers and provided at their outer ends with heads, which

engage said sockets of the ring, the outer face of said ring being flush with the outer face of the head, and a face-plate applied over said face of the head and overlapping at its margin said ring.

In testimony that we claim the foregoing as our invention we affix our signatures, in presence of two witnesses, this 9th day of November, A. D. 1900.

FREDERICK N. GARDNER.
A. BENJIMAN CADMAN.

Witnesses:
CHAS. KENDALL,
L. W. KENDALL.