N. MARSHALL.

TAPPING MACHINE.

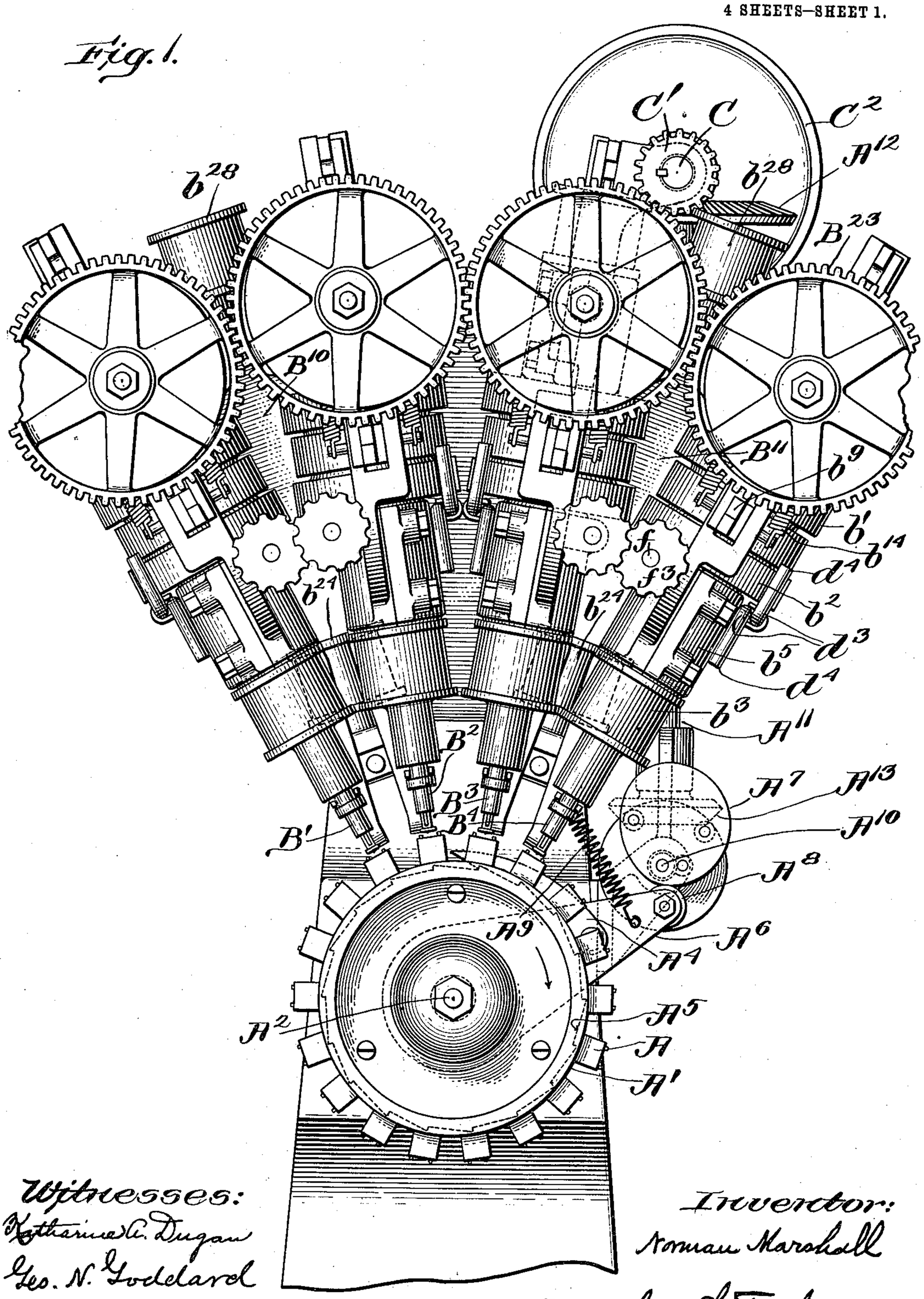
APPLICATION FILED OCT. 18, 1905.

981,665.

Patented Jan. 17, 1911.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
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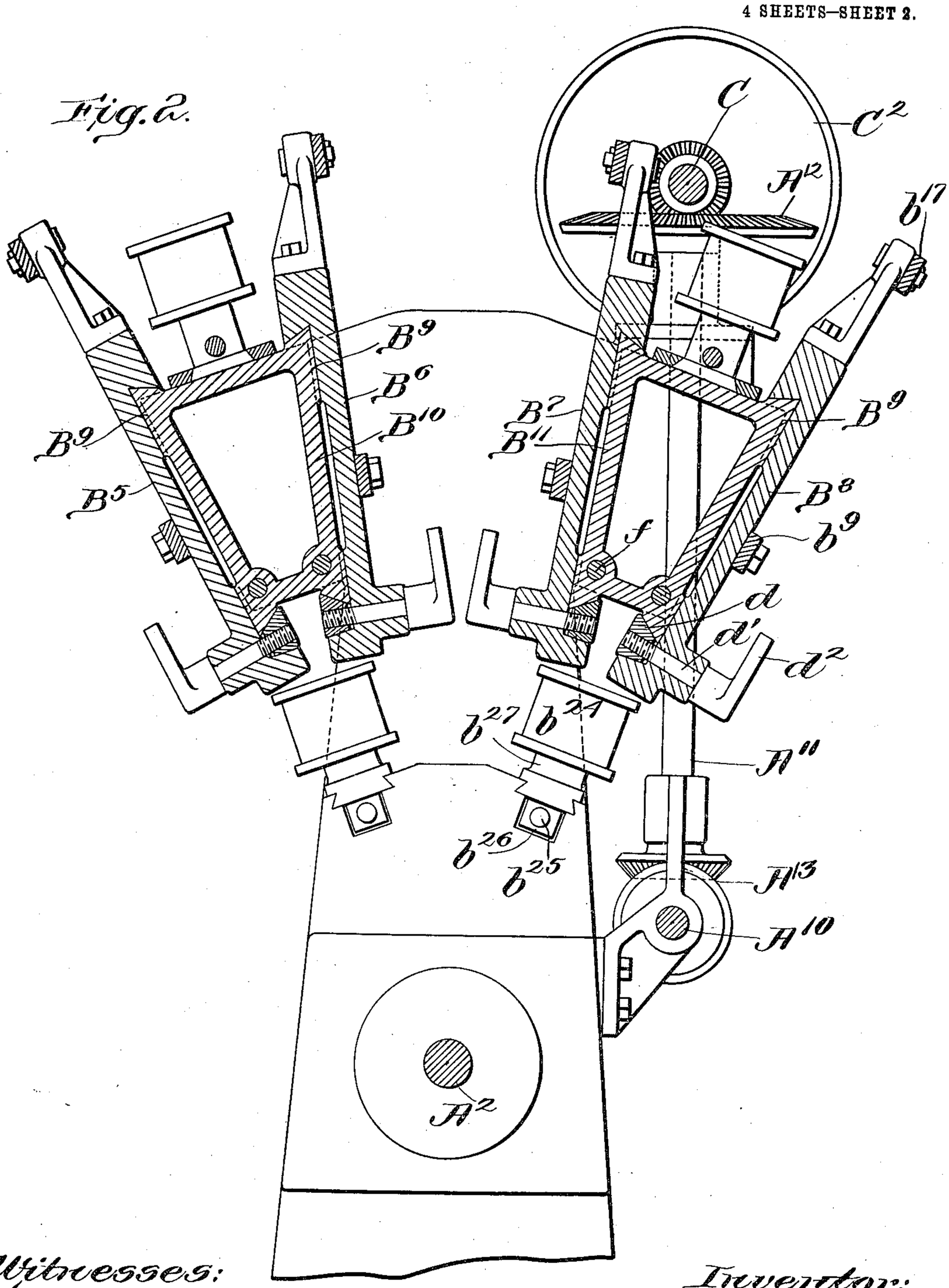
4 SHEETS—SHEET 2.

Fig. 2.



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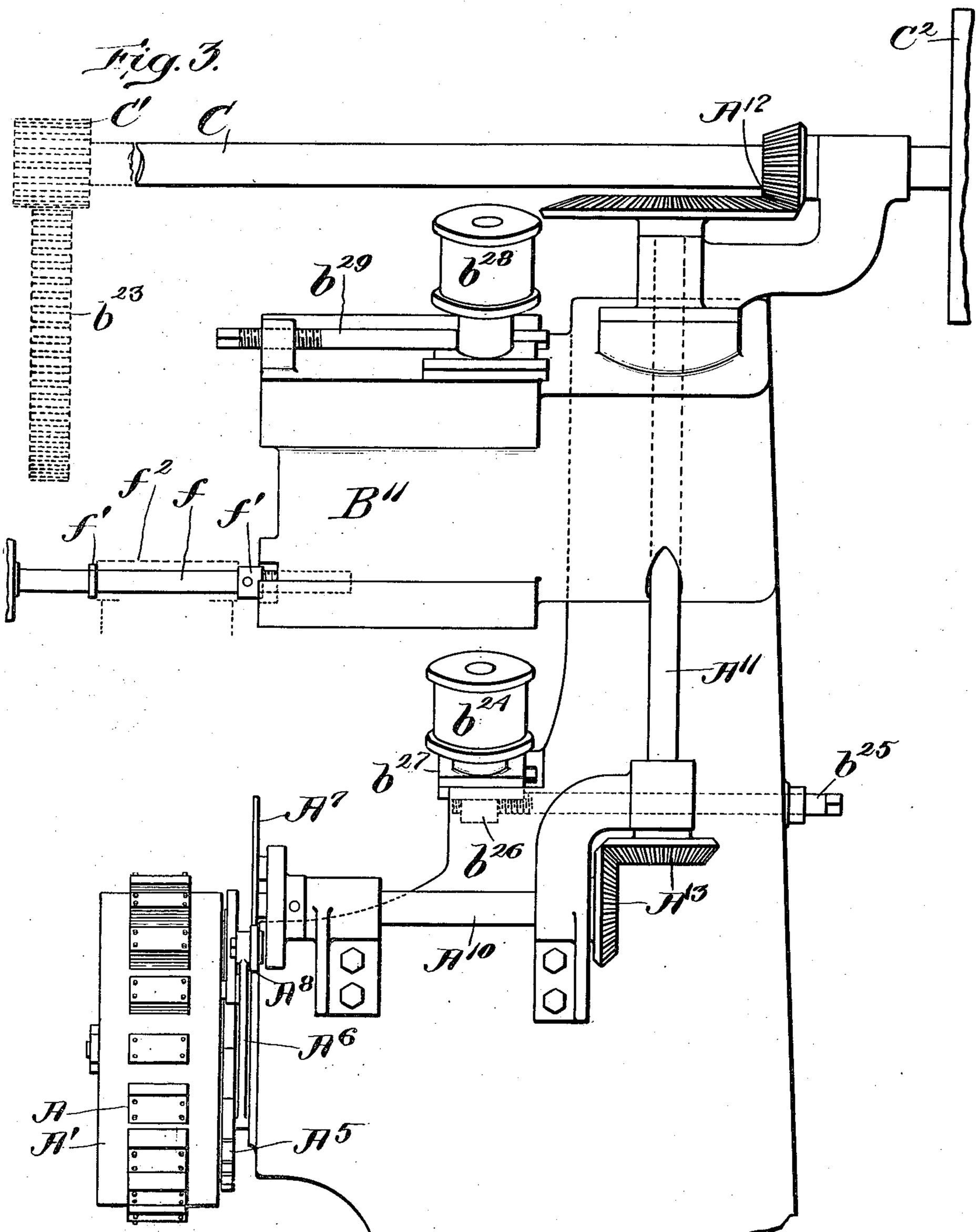
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 7.

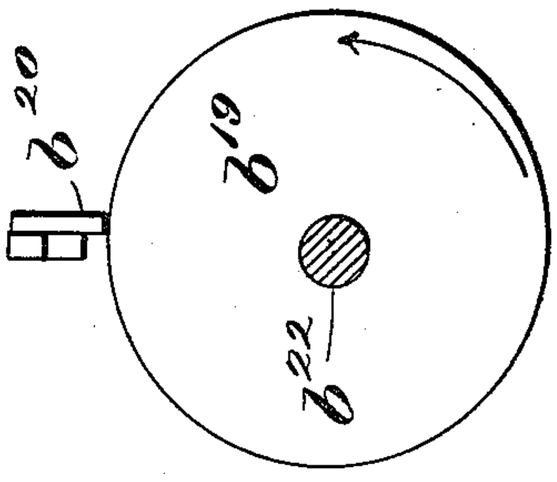
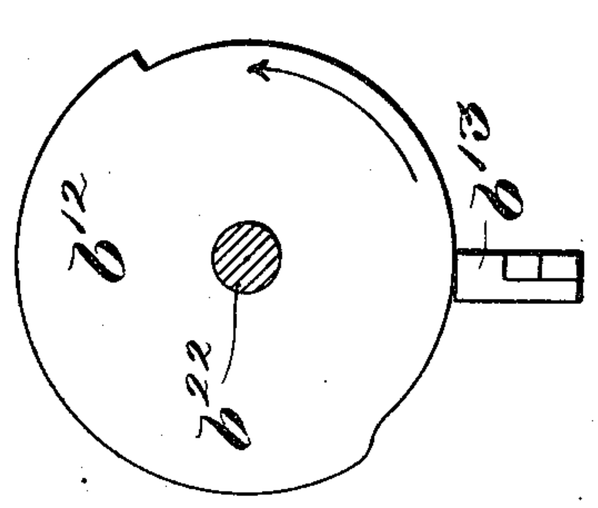


Fig. 8.



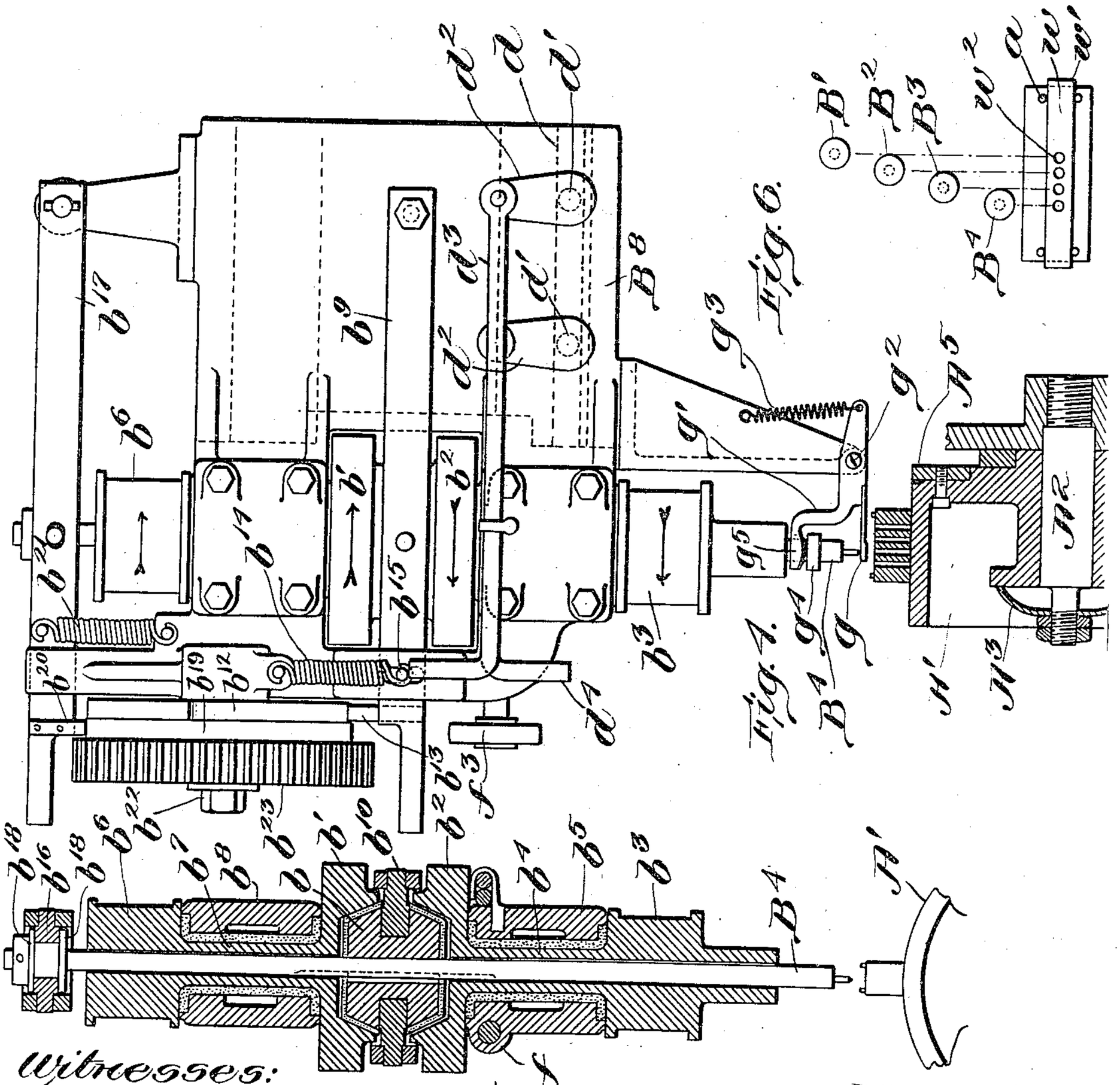


Fig. 6.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

NORMAN MARSHALL, OF NEWTON, MASSACHUSETTS.

TAPPING-MACHINE.

981,665. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed October 18, 1905. Serial No. 283,354.

To all whom it may concern:

Be it known that I, NORMAN MARSHALL, citizen of the United States, and resident of Newton, county of Middlesex, Massachusetts, have invented certain new and useful Improvements in Tapping-Machines, of which the following is a specification.

The invention relates to a machine for tapping holes in metallic pieces of work and its object is to provide a machine by which this class of work may be conveniently and rapidly done with a resulting economy in its production.

In the manufacture of lamp sockets, cut-outs, switches and other electrical devices, numerous metallic pieces are used which are provided with one or more tapped holes for the reception of binding and securing screws, and many of such pieces are provided with a plurality of tapped holes arranged in line. The machine in which I have embodied the various features of my invention is designed especially for operating upon this class of work, and the features of invention will be explained with reference to this machine. It will be understood however, that this machine may be utilized for other classes of work and that various features of the invention may be embodied in machines differing in the specific construction and arrangement of parts from this machine, and especially adapted for different classes of work, the construction and arrangement of the parts being modified to best suit the conditions under which the features of the invention are to be employed.

The various features of the invention will be readily understood from the following detailed description of the machine in which I have embodied them and will be set forth in the claims.

In the drawings Figure 1 is a front elevation of the machine in which I have embodied the various features of my invention in the form in which I prefer to use them. Fig. 2 is a vertical sectional view showing the manner of mounting the slides which carry the spindles. Fig. 3 is a side elevation with the spindle carrying slides removed to more clearly show the other parts. Fig. 4 is a side elevation of a spindle carrying slide and also showing the work carrying drum in section. Fig. 5 is a vertical sectional view through the axis of one of the spindles. Fig. 6 is a diagrammatic view showing the relative arrangement of the spindles with relation to the path of travel of a work carrying jig when four holes arranged in line are to be tapped. Fig. 7 is a detail showing the cam for advancing and retracting a spindle; and Fig. 8 is a detail showing a cam for controlling the direction of rotation of a spindle.

In the machine shown in the drawings the pieces of work are presented in position to be operated upon by the tap carrying spindles by a series of work carrying jigs A which are secured upon the periphery of a carrier drum A'. These jigs are brought by the movement of the carrier drum successively into position to register with each of the four spindles B' B^2 B^3 B^4 with which the machine is provided. These spindles are arranged progressively along the path of travel of the jigs and are so mounted that they may be adjusted transversely of the path of the jigs to bring them into position to register with the holes in the pieces of work which are to be tapped.

By properly adjusting the spindles the machine may be utilized to tap any four holes which are arranged in line in a piece of work or which occur in different pieces of work and are brought into line by the arrangement of the pieces of work upon the jig or jigs secured to the carrier drum. For the purpose of illustration I have shown jigs adapted to hold a metallic bar W having its ends bent at right angles as at W' and provided with a series of four closely arranged holes W^2. These bars are held upon the jigs by the engagement of the bent ends W' with the ends of the jigs and by the four pins *a* arranged to engage opposite sides of the bars. It will be understood however, that jigs may be provided for supporting any desired piece of work and that such jigs may be substituted for the jigs shown. For instance, if the piece of work to be operated upon is provided with but one hole, four jigs adapted to support such piece of work may be secured to the drum in place of each of the jigs shown, the four jigs being so arranged that the four holes to be tapped will be in line longitudinally of the drum. These four jigs may be constructed to support the same piece of work or may be of different form and adapted to support pieces of work which differ from each other or different jigs in each series of four may be

constructed to support the same piece of work in different positions in case the piece of work is provided with two or more holes which are to be tapped.

In the machine shown the four spindles are arranged progressively along the path of travel of the jigs and are separated by a space equal to the distance between successive jigs in the series. The machine is adapted therefore to tap four holes which are in line. By providing means for adjusting the spindles in the direction of travel of the jigs as well as transversely of their travel, the machine may be adapted to tap holes which are not in line if it is found desirable to make provision for such operation.

The tap carrying spindles are arranged radially of the work carrying drum and are advanced and retracted along radial lines. During the advance movement of the spindles each spindle is rotated in a direction to drive the tap into the work and as the tapping is completed the direction of rotation of the spindle is reversed and the spindle retracted to run the tap out of the work.

The tap carrying spindles are carried by four similarly constructed slides B^5 B^6 B^7 B^8 which are mounted for transverse adjustment upon guideways B^9 formed on opposite sides of two arms B^{10} B^{11} which project from the frame of the machine, the slides B^5 B^6 being mounted upon the opposite sides of the arm B^{10} and the slides B^7 B^8 being mounted upon the opposite sides of the arm B^{11}, Fig. 2.

The mechanisms for operating and controlling the spindles and the devices for adjusting and clamping the slides are substantially the same for each spindle and slide and it will be sufficient to describe in detail the mechanisms for operating the spindle B^4 and the devices for adjusting and clamping the slide B^8.

The spindle B^4 is rotated through a clutch member b connected with the spindle by a key and key-way so that the spindle is free to move longitudinally through the clutch member while rotating therewith. The clutch member b is arranged between two clutch members b' b^2 and is provided with conical frictional clutch surfaces to coöperate with corresponding surfaces upon the clutch members b' b^2. The clutch member b^2 is rotated in a direction to drive the tap carried by the spindle B^4 into the work by means of a belt passing over a pulley b^3 connected with the clutch member b^2 through the bearing sleeve b^4. The bearing sleeve b^4 is mounted in a bearing b^5 formed on the lower part of the slide B^8 and is held in position in said bearing by the engagement of the clutch member b^2 and pulley b^3 with the ends of the bearing. The clutch member b' is driven in a direction to run the tap carried by the spindle B^4 out of the work by means of a belt passing over a pulley b^6 connected with the clutch member b' by a sleeve b^7 and the sleeve b^7 is mounted in a bearing b^8 formed upon the upper part of the slide B^8.

The clutch member b is shifted from one driving clutch member to the other to reverse the direction of rotation of spindle through a shifting lever b^9 pivoted to the slide B^8 and connected with the clutch b by means of pins b^{10} extending from the lever into an annular groove in the clutch. The shifting lever is operated at the proper time by means of a cam b^{12} arranged to operate upon shoe b^{13} carried by the outer end of the lever b^9. The shifting lever is held in engagement with the cam by means of springs b^{14} connected to the slide B^8 and to pins b^{15} projecting from the shifting lever.

The spindle B^4 extends loosely through the pulleys b^3 and b^6 and their connected clutch members and is supported at its upper end in a bearing block b^{16} which is carried by a lever b^{17}. The spindle is held from longitudinal movement in the bearing block b^{16} by the engagement of the collars b^{18} on the spindle with the opposite sides of the bearing block b^{16} and the bearing block is pivoted in the lever b^{17} to accommodate the movement of the spindle as the lever is raised and lowered. The spindle B^4 is advanced and retracted by the action of a cam b^{19} upon a bearing shoe b^{20} secured to the lever b^{17}, the bearing shoe being held in engagement with the cam by a spring b^{21}.

The cams b^{12} and b^{19} for controlling the direction of rotation of the spindle and for advancing and retracting the spindle are secured upon a short shaft b^{22} which is mounted in the slide B^8 and this shaft is continuously driven through a gear b^{23}.

The gears b^{23} through which the cams for the different spindles are driven are engaged with each other and this train of gears is driven from a shaft C through a pinion C′ which engages the gear b^{23} for the spindle B^3. The face of the pinion C′ and the faces of the gears b^{23} are of sufficient breadth to enable the spindles to be adjusted laterally without disengaging the gears. The shaft C′ is the main driving shaft of the machine and is continuously driven by means of a belt passing over a driving pulley C^2.

The operating and controlling cams for the spindles are so timed that during the advance movement of the spindle the clutch b is in engagement with the clutch member b^2 and the spindle is rotated in a direction to drive the tap carried by the spindle into the work. As the advance movement of the spindle is completed the clutch b is quickly shifted into engagement with the clutch member b' thus reversing the direction of rotation of the spindle and during the re-

tracting movement of the spindle it is rotated in a reverse direction to run the tap out of the work.

In order that the position of the spindle may be varied transversely of the path of travel of the jigs to bring the spindle into accurate register with the hole which is to be tapped, the slide B^8 is adjustably mounted upon the bearing ways B^9. The slide is held in its adjusted position upon the ways by means of a clamping gib d mounted in the slide and operated by two clamping bolts d'. These bolts extend through bearings in the slide B^8 and are screw-threaded into the gib d as indicated in Fig. 2. The bolts are provided at their outer ends with arms d^2 to which are connected the operating bars d^3 which extend toward the front of the machine and are provided with handles d^4 arranged within convenient reach of the operator. By operating the bars d^3 the bolts d may be turned to loosen or tighten the gib d and thus release or clamp the slide B^8 to the ways. When the slide B^8 is released it may be adjusted upon the ways by means of an adjusting rod f, the inner end of which is screw-threaded into the arm B^{11}. The rod f is provided with two collars f' which engage opposite ends of a boss f^2 on the bearing b^5 which is formed on the lower part of the slide B^8. The rod f is provided at its forward end with an operating handle f^3 arranged within convenient reach of the operator and by which the rod may be turned to adjust the slide B^8 backward or forward upon the ways.

The belt for driving the pulleys b^3 for the spindles B^3 B^4 is led around an idle pulley b^{24} as it passes from one pulley b^3 to the other and this pulley is made adjustable to take up or let out the belt as the spindles are adjusted laterally. The means for adjusting the pulley b^{24} consists of a screw-threaded adjusting rod b^{25} engaging a nut b^{26} which is connected to the bearing block b^{27} upon which the pulley b^{24} is mounted. The belt which drives the pulleys b^6 for the spindles B^3 B^4 is led over an adjustable pulley b^{28} which is adjusted by means of a screw-threaded rod b^{29} in a manner similar to the adjustment for the pulley b^{24}. Similar adjustable pulleys b^{24} and b^{28} are provided for the belts which drive the pulleys b^3 and b^6 for the spindles B′ B^2.

The work carrying drum A′ upon which the work carrying jigs are secured is mounted upon a stud A^2 and is frictionally held in position by means of the spring disk A^3 arranged to engage the hub of the drum. The drum is intermittently advanced to bring the jigs successively to the spindles by means of a pawl A^4 arranged to operate upon the teeth of a ratchet wheel A^5 which is secured to the drum. The pawl is pivoted upon a pawl carrying arm A^6 and is operated at proper intervals by means of a cam A^7 arranged to engage a roll A^8 carried by the pawl carrying arm and held in engagement with the cam by means of a spring A^9. The cam A^7 is secured to the end of a shaft A^{10} which is continuously driven from the driving shaft C through a vertical shaft A^{11} connected with the driving shaft through gears A^{12} and with the cam shaft A^{10} through gears A^{13}.

In the operation of the machine a piece of work is presented to each spindle at each advance movement of the work carrying drum and during the interval between successive advance movements of the drum each spindle is operated and taps a hole in the work. Thus at each operation four holes are tapped and these holes may be in the same piece of work or in different pieces of work as may be desired. The work may be held in position upon the jigs during the tapping operation if found desirable by means of a presser foot arranged to engage the upper surface of the work after it has been brought into register with the spindle and to be removed from engagement with the work after the tapping operation. I have shown one form of such a presser foot which consists of a plate g projecting from a lever g' which is pivoted at g^2 to a bracket depending from the slide B^8 and is forced yieldingly toward the work by a spring g^3. The engagement of the plate g with the work is controlled by means of a collar g^4 on the spindle B^4 which underlies the arms g^5 of a yoke formed on the lever g'. When the spindle is in its raised position the collar g^4 acting upon the lever g' holds the plate g above the path of the work. When the spindle descends the collar g^4 releases the lever g' so that the spring g^3 forces the plate g against the work and holds it firmly upon the jig during the tapping operation and during the running out of the tap until the spindle nearly reaches its retracted position when the collar g^4 again engages the lever g' thus raising the plate g from the surface of the work so that it will not interfere with the advance of the work to the next spindle. By properly adjusting the spindles a plurality of holes may be tapped which are arranged in close proximity to each other, and this class of work as well as the tapping of single holes in pieces of work may be rapidly and economically performed.

While I prefer to mount the work carrying jigs upon a carrier drum and to arrange the spindles radially of the drum, as shown in the drawings, this construction and arrangement is not essential to the broader features of my invention, and it will be understood that the work carrying supports may be otherwise mounted and may be arranged to travel in any suitable path. It will also be understood that the spindles

may be differently arranged, the arrangement being modified to suit the particular arrangement of the work carrying support or supports and the path of travel of such support or supports.

The arrangement of the work carrying jigs to travel in a vertical plane or in a plane which is approximately vertical is of advantage in that it admits of the jigs being so constructed that the work will free itself from the jigs by its own weight after it has been presented to the spindles and during the return of the jigs to the position where the operator places the work upon the jig. The arrangement of the jigs upon a drum is of further advantage in that it admits of a compact and convenient arrangement of the spindles and an arrangement of the parts where they are conveniently accessible to the operator.

What I claim and desire to secure by Letters Patent is:—

1. In a tapping machine the combination of a work carrying drum, an arm provided with ways parallel to the axis of the drum, a slide adjustably secured on the ways, a spindle mounted on the slide with its axis extending radially of the drum, mechanism for operating said spindle, and mechanism on the slide for reciprocating said spindle.

2. In a tapping machine the combination of a work carrying drum, an arm provided with ways on its opposite sides parallel to the axis of the drum, a slide adjustably secured on the ways on each side of the arm, a spindle mounted on each slide with its axis extending radially of the drum, mechanism for operating each spindle, and mechanism on each slide for advancing and retracting the spindle thereon.

3. A tapping machine, having, in combination, a traveling work support, a spindle support mounted for adjustment transversely of the path of travel of the work, a spindle mounted on the spindle support, mechanism for advancing and retracting the spindle mounted on the spindle support, oppositely driven driving members for the spindle mounted on the spindle support, a clutch for alternately connecting the driving members with the spindle, and mechanism for operating the clutch mounted upon the spindle support.

In witness whereof, I have hereunto set my hand, this 5th day of October 1905.

NORMAN MARSHALL.

In the presence of—
IRA L. FISH,
KATHARINE A. DUGAN.