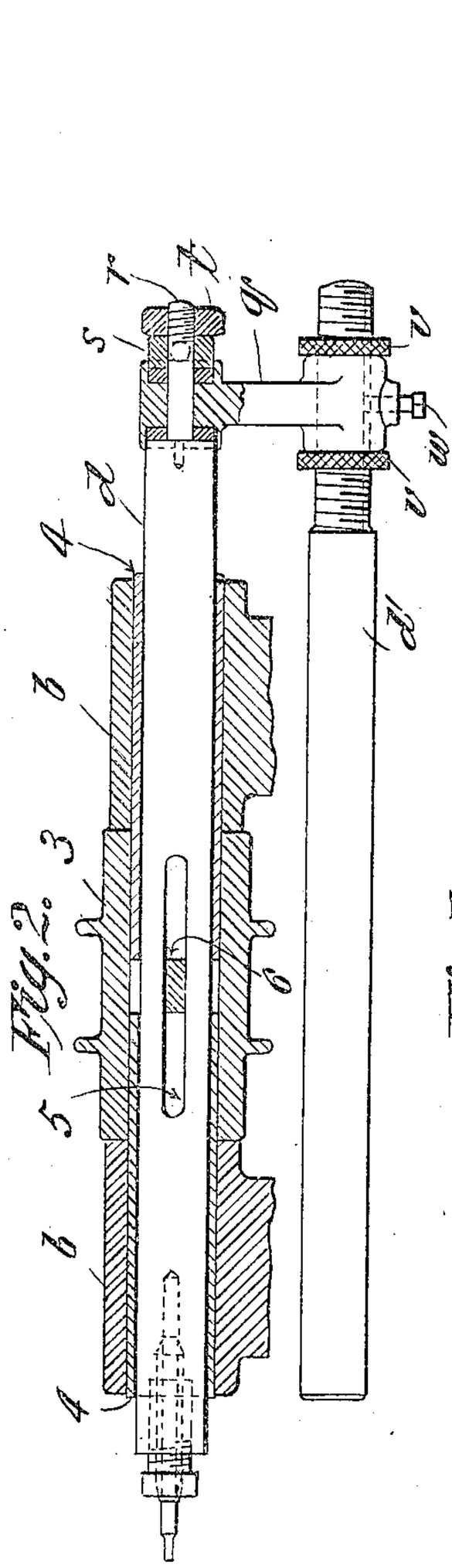
No. 813,351. PATENTED FEB. 20, 1906.

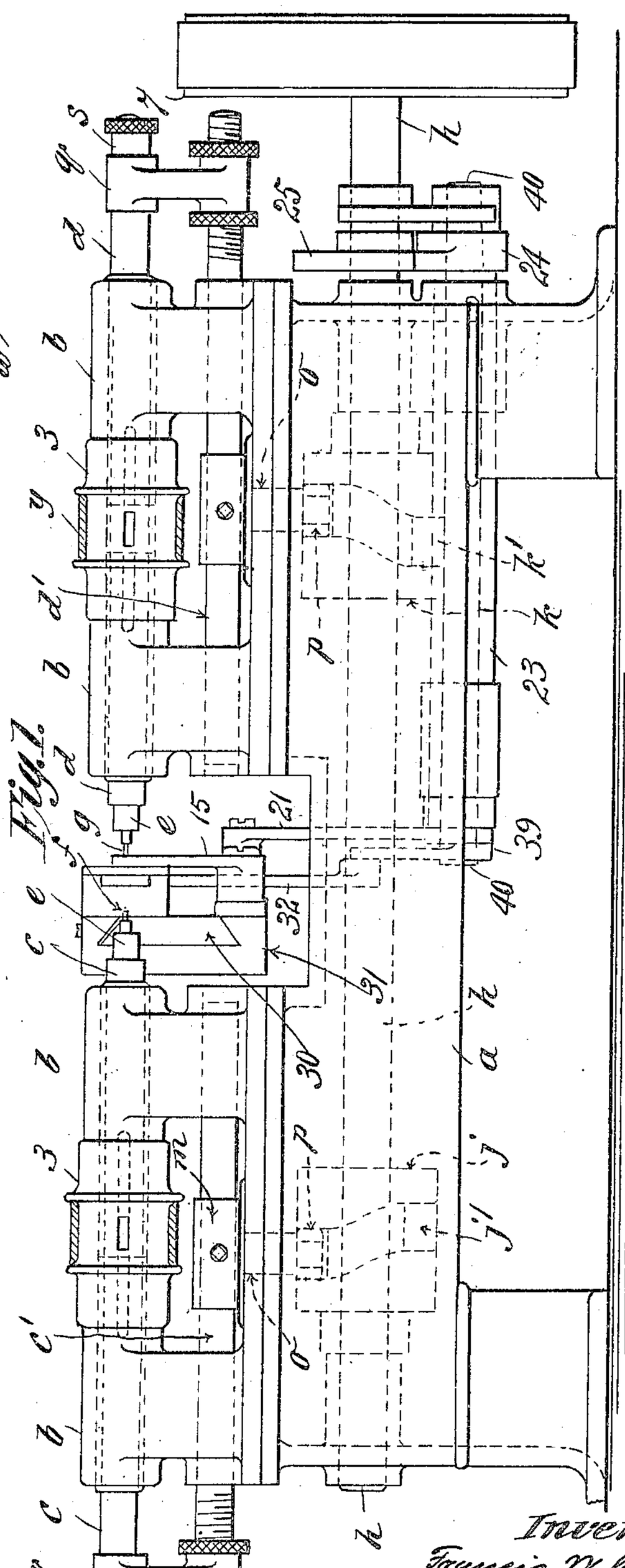
F. W. CLOUGH.

DRILLING MACHINE.

APPLICATION FILED SEPT. 27, 1904.

3 SHEETS—SHEET 1.





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3 SHEETS—SHEET 2.

Fig. 3.

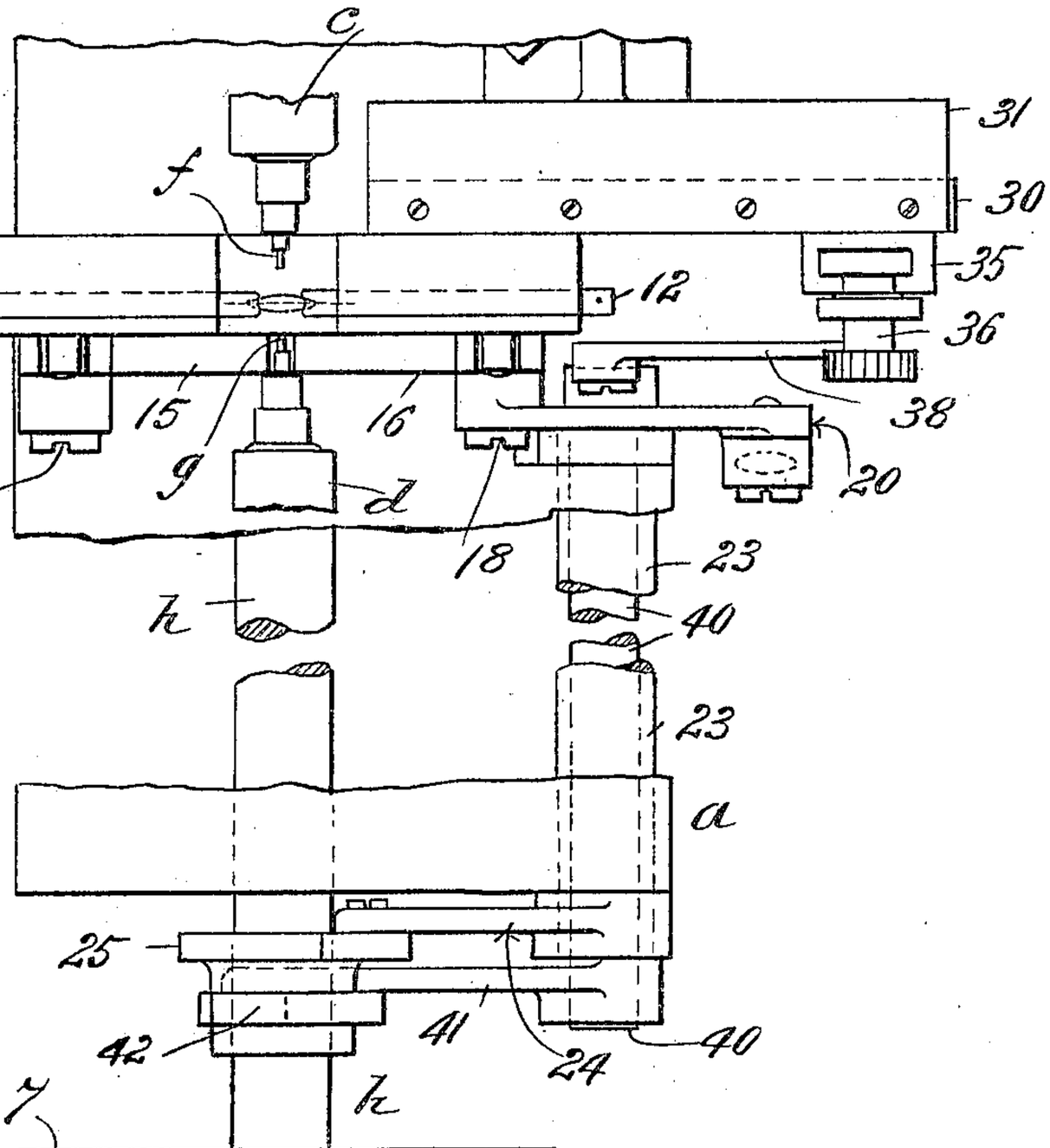
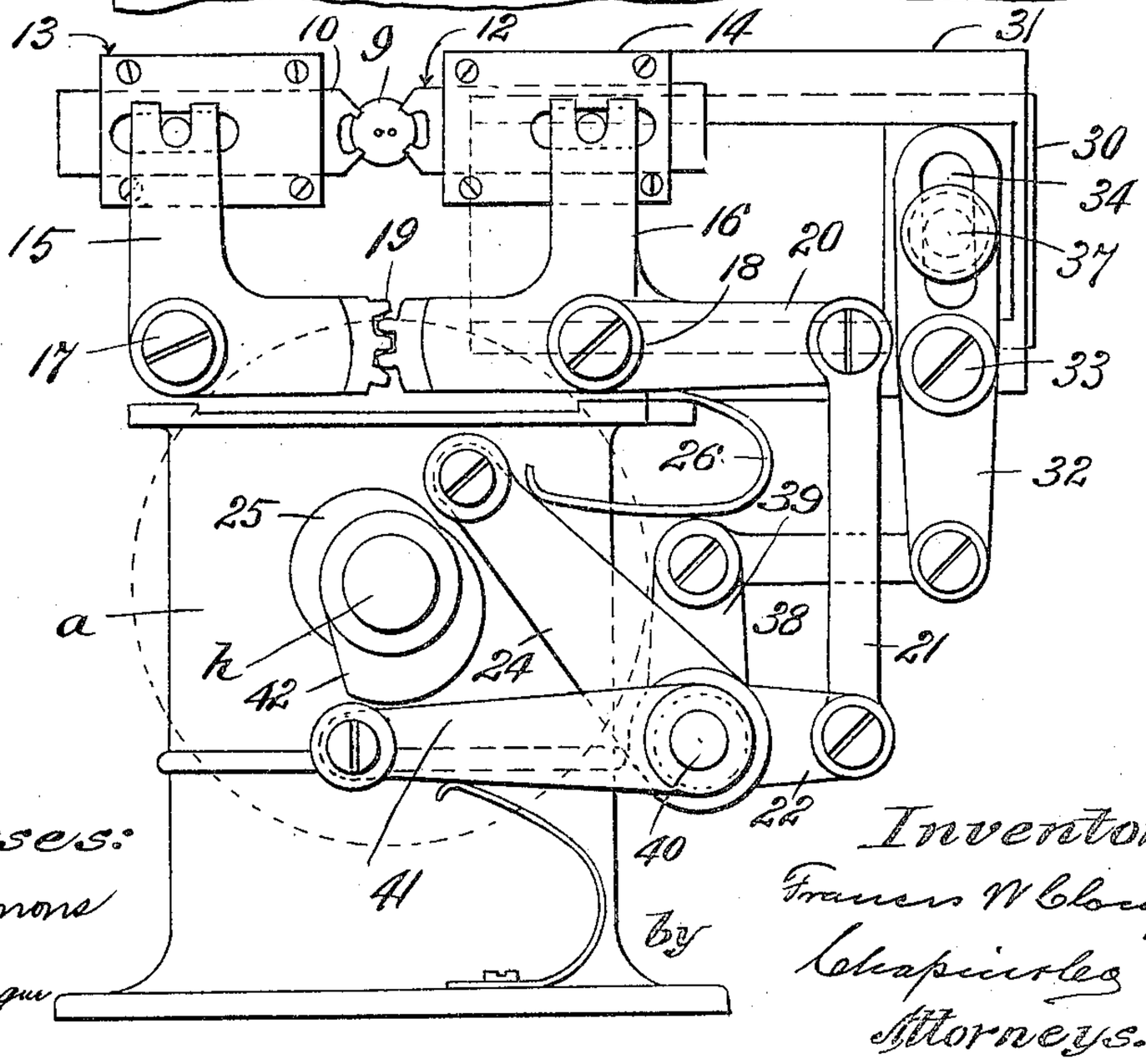


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

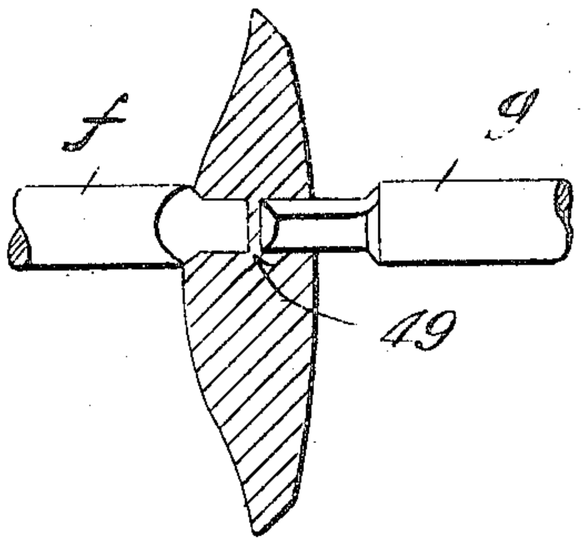


Fig. 6.

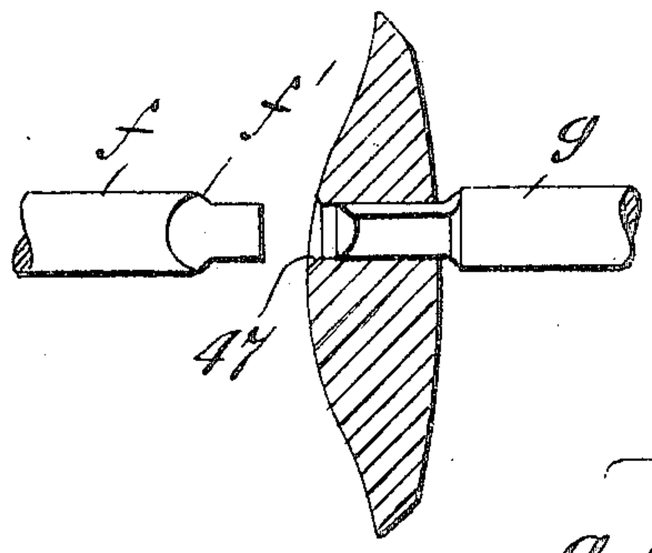
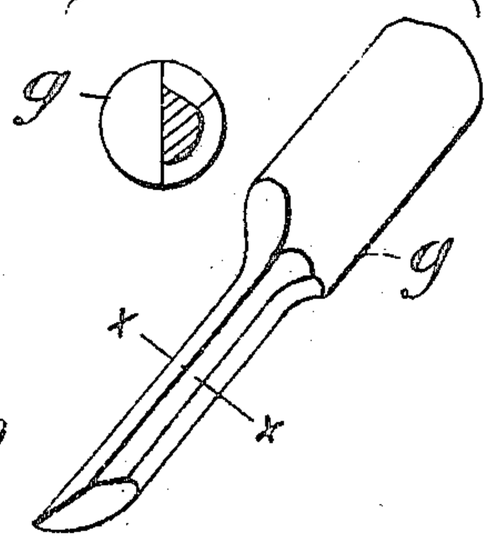


Fig. 7.



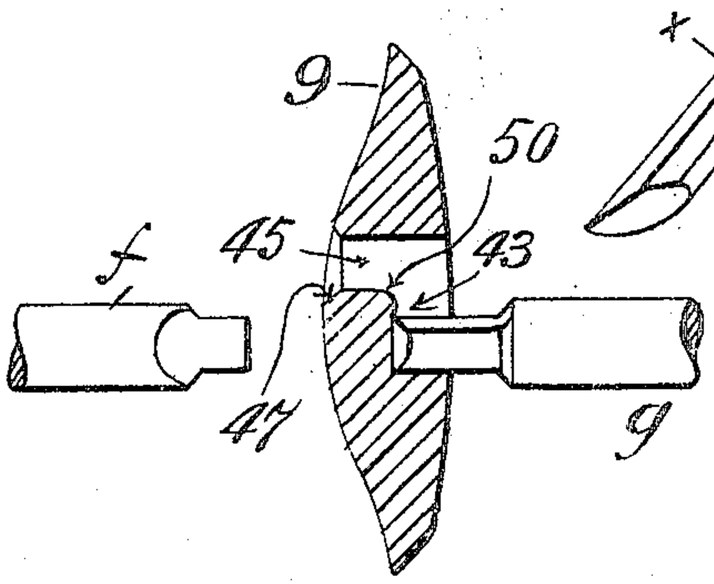


Fig. 8.

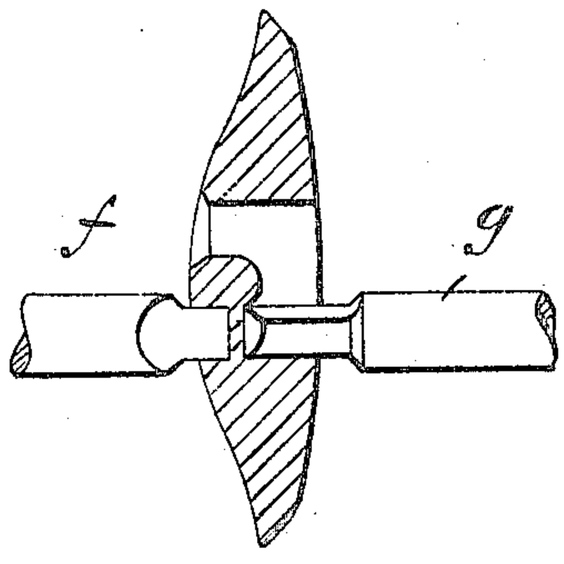


Fig. 9.

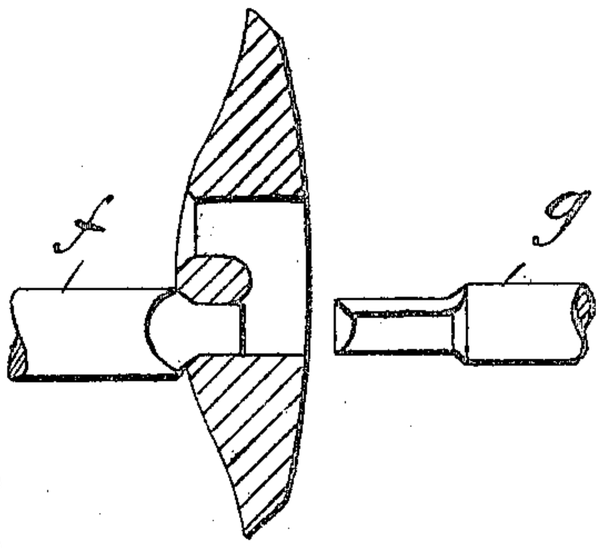


Fig. 10.

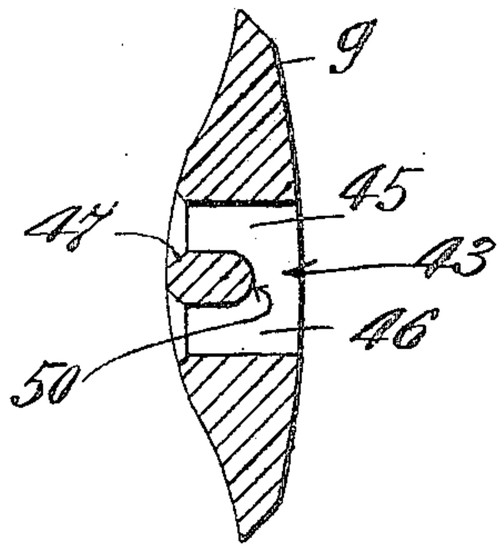


Fig. 11.

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UNITED STATES PATENT OFFICE.

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DRILLING-MACHINE.

No. 813,351. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed September 27, 1904. Serial No. 226,147.

To all whom it may concern:

Be it known that I, FRANCIS W. CLOUGH, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Drilling-Machines, of which the following is a specification.

This invention relates to the manufacture of buttons, and has special reference to improved means for drilling eyes in button-blanks and in routing out a channel between said eyes.

The object of the invention is to provide a machine adapted to this work in which the button may be drilled and said channel properly formed between the eyes on the face of the button-blank and the eyes countersunk on the other side of the blank by the use of two drills in axial alinement and movable one toward the other, together with means to move the button transversely of the axis of the drills to form the channel between the eyes by means of one of the drills.

A further object of the invention is to improve the construction of the machine in several particulars, all as fully hereinafter set forth, but more especially in the construction of the spindles and their adjustments.

In the drawings which embody the preferred construction of the invention, Figure 1 is a side elevation of a machine embodying this invention. Fig. 2 is a longitudinal, partly sectional, elevation showing the spindle construction on a somewhat enlarged scale as compared with Fig. 1. Fig. 3 is a plan view of the right-hand end of the machine shown in Fig. 1 with the spindle and its supports removed therefrom. Fig. 4 is an end elevation of the portion of the machine shown in Fig. 3. Figs. 5, 6, 7, 8, and 9 show the relative positions and movements of the two axially-disposed drills in drilling two eyes through a button and in routing out a channel between the contiguous ends of said eyes on one side. Fig. 10 is a sectional view of a button after the drilling of the eyes and the formation of the channel between the ends thereof. Fig. 11 is a perspective view and a sectional view of the preferred form of drill and routing-tool, the section being on the line $x\ x$ of the perspective view.

Briefly stated, the essential characteristics of this machine consist in two spindles having a common axis each provided with a drill and with suitable mechanism whereby they may be moved simultaneously one toward the other to effect the drilling of an eye through the button from opposite sides of the latter and in mechanism to move the button transversely of the axis of the spindles after one of the drills has been completely withdrawn and the other nearly so.

Various adjustments of the parts are provided to adapt the machine to drill buttons of different diameters and having different thicknesses.

In carrying out my invention a suitable bed a is provided, on each end of which is mounted a head consisting of a casting having the bearings b thereon for two spindles c and d, which are located in the bearings b in axial alinement one with the other, the spindles being movable one toward the other in the manner hereinafter described, but rotatable on a fixed axis. The contiguous ends of these spindles are provided with suitable chucks e, in which are mounted, respectively, the drills f and g, the drill f in the spindle c and the drill g in the spindle d.

The drill g is shown in Fig. 11 in perspective and in section and is not only a drill, but so constructed as to constitute a routing-tool as well. The drill f is designed only to operate as a drill and countersink and is provided with the shoulder f' at a proper distance from the point thereof to perform the countersinking operation on the end of the eye located on the back side of the button.

The bed a is hollow and the drive-shaft h (which is also the main shaft of the machine) extends therethrough longitudinally, as shown in Figs. 1 and 4. Within the bed a there are secured thereon two cams j and k, which are shown only in dotted lines in the drawings, and each is provided with a suitably-disposed cam-groove j' and k', which is so arranged that by means of suitable connections, to be described, between these cams and the spindles the latter may be moved toward and from each other at the proper time to drill the eyes through the button and to countersink the rear ends thereof and rout out a channel between the eyes on the face of the button.

The spindles proper are mounted in the upper portions of the bearings b, as stated, and below the spindles in the same vertical plane

bearings are provided in the standards of the bearings *b* for the shafts *c'* and *d'*, through the medium of which endwise movement may be imparted to the spindles and the endwise adjustment of the latter effected. These shafts are, by means of a collar *m* and a depending arm *o*, connected directly with the cams *j* and *k*, there being a roller *p* on the lower ends of these arms *o* to enter the cam-grooves *j'* and *k'*, respectively, the collars *m* being of course rigidly secured to the shafts *c' d'* in any suitable manner, as by a set-screw.

The rear ends of the spindles *c* and *d* and their actuating-shafts *c' d'* each extend somewhat beyond the end of the machine and are connected together by a yoke *q*, which is connected to the ends of the spindles in such manner as to permit the free rotation of the latter, the preferred mode of construction being that shown in section in Fig. 2, in which the yoke fits over the end of a pin *r*, located axially on the end of the shaft, on which pin is a nut *s* and a check-nut *t*, suitable washers being interposed on either side of the yoke, as shown. By means of this construction all lost motion may be taken up, the spindle being at the same time freely rotatable in the end of the yoke.

The lower end of the yoke slides freely over a screw-threaded portion of the shaft *d'*, there being a check-nut *v* on the side of the yoke, the shaft having a spline-groove therein, and a screw *w* extending into it from the lower side of the yoke to prevent the rotation of the shaft *d'*.

By means of this construction it will be noted that the shafts *c'* and *d'* having once been adjusted require no further attention, all adjustments of the spindle relative to the shaft endwise being effected by means of the check-nuts *v* on the threaded end of these actuating-shafts.

The spindles, in order that the drills may perform their work properly and cut cleanly, have to be run at a high rate of speed, and they are rotated by means of belts *y*, running over pulleys 3, mounted between the bearings *b*.

To properly support the spindles between the bearings against the draft of the belts *y*, there is mounted in each bearing a long sleeve 4, (see Fig. 2,) which extends entirely through each bearing and part way through the pulley 3 from each end thereof.

The spindle at that portion thereof lying within the pulley is provided with a longitudinal slot 5, extending therethrough, and a pin 6 is passed transversely through the pulley and between the ends of the sleeves 4 and through the slot 5 in the spindle, thereby connecting the latter with the pulley. In this manner the pulley will rotate in a fixed plane between the inner ends of the bearings *b*, and yet the spindles while being rotated thereby may be moved endwise through the sleeves 4 with great facility, as the entire strain of the pulley is on the sleeves.

On the end of the main shaft *h* is a driving-pulley 7, the belt of which may lead to the same counter-shaft that drives the spindles or to some other suitable shaft. The rotation of the spindles, preferably, is entirely independent of the shaft *h*, and the spindles may be rotated in any suitable manner which will give the drills the proper cutting speed. The button-blank 9 to be drilled is grasped between two jaws 10 and 12, which have a sliding movement toward and from one another in the bearing-blocks 13 and 14, which movement is imparted to the jaws by means of two elbow-levers 15 and 16, which are pivotally supported on screws or bolts 17 and 18, all as clearly shown in Figs. 3 and 4.

The levers 15 and 16 extend toward each other between their axes and have a toothed connection or engagement one with the other, as at 19, whereby when one of the levers is swung on its axis to move one of the jaws in one direction the opposite lever will move the opposite jaw in the contrary direction. The lever 16 is the one which is actuated to open and close the jaws 10 and 12, and this lever has an extension 20, from which a connecting-rod 21 extends toward and is pivotally connected to an arm 22, secured to a tubular shaft 23, (see Fig. 3,) which extends toward the end of the bed *a*, being properly supported in suitable bearings therein. On this shaft is a cam-arm 24, which bears on a cam 25 on the shaft *h*, being held thereagainst by a suitable spring, as 26. The cam-arm 24 is fast on the end of the tubular shaft 23. This button-holding mechanism is so timed relative to the movement of the spindles that the jaws 10 and 12 will open when the spindles are moved one away from the other after the holes have been drilled through the button-blank, and the operation being completed the jaws will close again to grasp a new button fed thereto by any suitable means prior to the movement of the spindles toward one another to drill the first hole through the blank.

The jaws are opened by the cam 25 and against the resistance of the spring 26, which bears on the arm 24, and when the latter runs off the cam it is therefore the spring 26 which closes the jaws 10 and 12, these coming to a bearing on opposite sides of the button before the roller on the end of the cam-arm 24 comes to a bearing against the cam 25. By means of this button-grasping construction buttons of different diameters may be inserted between the jaws, as required in the operation of the machine, the parts being so proportioned that when working on the smallest buttons the end of the arm 24 will be just free from the cam 25 at the time the jaws grip the button, and the cam is so proportioned that the jaws will open wide

enough to permit the largest button to be inserted between them.

The bearing-blocks 13 and 14 form part of or are rigidly attached to a slide 30, having endwise movement transversely of the spindles in its support 31, which is secured to the bed *a* in any suitable manner, the screws 17 and 18 entering this slide, to the end that the whole of the button-grasping mechanism may move with the slide transversely of the spindles. Movement is imparted to this slide 30 by means of a lever 32, pivoted on a screw or bolt 33, which enters the support 31, the upper end of this lever being provided with a slot 34. Back of this slotted end of the lever 32 a block 35 is secured to the slide, in which block is a vertically-disposed T-slot, in which is located the head of a bolt 36, which extends outwardly through the slot 34 in the lever 32, the bolt being provided with a nut 37, whereby it may be secured at any point in the slot 34. The lower end of the lever 32 is, by an arm 38, connected with a lever 39, secured to the end of the shaft 40, which extends through the tubular shaft 23, there being on its end which extends beyond the end of the shaft 23 a cam-lever 41, which by a spring 41[a] is held against a cam 42 on the shaft *h*, whereby oscillatory movements may be imparted to the shaft 40 and the slide 30 thus moved in its support at the proper time to shift the button-grasping mechanism transversely of the spindles.

The degree of movement of the slide 30 determines the distance between the eyes of the button, and by varying the position of the bolt 36 relative to the axis 33 of the lever 32 the distance between the eyes of the button may be changed. This movement of the slide 30, above described, is timed to take place when one eye has been drilled in the button and the drill *f* entirely withdrawn and the drill *g* partly withdrawn, to the end that the button may have plowed therein between the eye just drilled and the one to be drilled the channel 43, (shown in Fig. 7 of the drawings,) the button being indicated by 9, the first drilled hole by 45, and the second by 46. After this transverse movement has taken place, movement is imparted to the spindles in substantially the same sequence as when the first eye was drilled, whereupon the spindles are separated, the jaws opening to drop the button and the slide 30 returned to its original position.

Figs. 5, 6, 7, 8, and 9 illustrate the various movements of the spindles *c* and *d* in the drilling operation, and it has not been thought necessary to show in the drawings any development of the cam-grooves *j'* and *k'*, whereby these movements are obtained which in their proper sequence are as follows: The button being introduced between the jaws and the latter having closed thereon, both drills *f* and *g* advance simultaneously one toward the other, as shown in Fig. 5, the drill *f* forming the countersink 47 at this time.

It will be observed that the drills do not quite come together at the center of the button, and for obvious reasons they cannot finish drilling the eye at this point. Therefore, as shown in Fig. 6, the drill *f* is first backed off and the drill *g* is advanced far enough to pierce the thin wall 49 left between the ends of the drills, as shown in Fig. 5.

The drill *f* now remains stationary, and the drill *g* retires half-way of its movement to a position partly out of the button, whereupon the latter is fed transversely and the channel between the two holes is routed out, and during this transverse movement of the button the drill *g* produces one of the rounded edges 50 on the web between the two eyes, as plainly shown in Fig. 7 of the drawings, the other rounded edge of the web being formed by the next slight advance movement of the drill *g*. At this point it will be observed that when the transverse movement of the button is completed and the channel between the two eyes or holes routed out the drill *g* advances but slightly, as shown in Fig. 8, which slight advance movement of the drill is only enough to round the bridge between the eyes, whereupon the drill *g* retires and the drill *f* advances to finish the second eye or hole and form the countersink.

During the second forward movement of the drill *g* the drill *f* is again advanced, the nearest point of approach between the drills being shown in Fig. 8, which position being reached the drill *g* is backed off and the drill *f* advanced still farther, whereby the thin partition of stock which remains between the drills is in this instance bored out by the drill *f*, which at the same time countersinks the rear end of the second eye 46, as shown in Figs. 9 and 10. This completes the operation on the button, and the jaws 10 are now separated and the slide 30 moved again to the position from which it started when the eye 45 was drilled, these operations being repeated for each button.

Preferably the drills are made as shown in Fig. 11, although this is not essential; but it is found in practice that as far as the drill *g* is concerned the routing operation by which the channel 43 is formed is cut more cleanly and quickly with a drill such as shown in said Fig. 11.

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

1. In a button-drilling machine, a drill and a router in axial alinement, a work-holder arranged between said tools, and transversely movable from one position to another, means for intermittently advancing the drill and retracting the same, means for advancing and retracting the router, in unison with the drill, and for maintaining it in partially-advanced

position while the drill is retracted, then again advancing the router in unison with the drill and retracting it to its full extent, and suitable driving mechanism for the drill and router.

2. In a button-drilling machine, two drills in axial alinement and movable toward and from each other, a work-holder, drill-controlling mechanism comprising means for causing both drills to first move toward each other in the operation of forming each eye in the button and then causing one drill to advance and the other retire in the operation of completing each eye, and means for effecting an automatic movement of the work-holder transversely of the axis of the drills while one of the same is in its retired position and the other partly advanced within the plane of the button said movement serving to rout out a channel between the eyes by the latter drill.

3. In a machine of the character described, a spindle, suitable bearings therefor, sleeves in said bearings extending one toward the other, a pulley mounted on said sleeves between the bearings, and a pin extending transversely of the pulley through a longitudinally-disposed slot in said spindle, whereby the latter may move endwise through the pulley and be rotated thereby.

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