

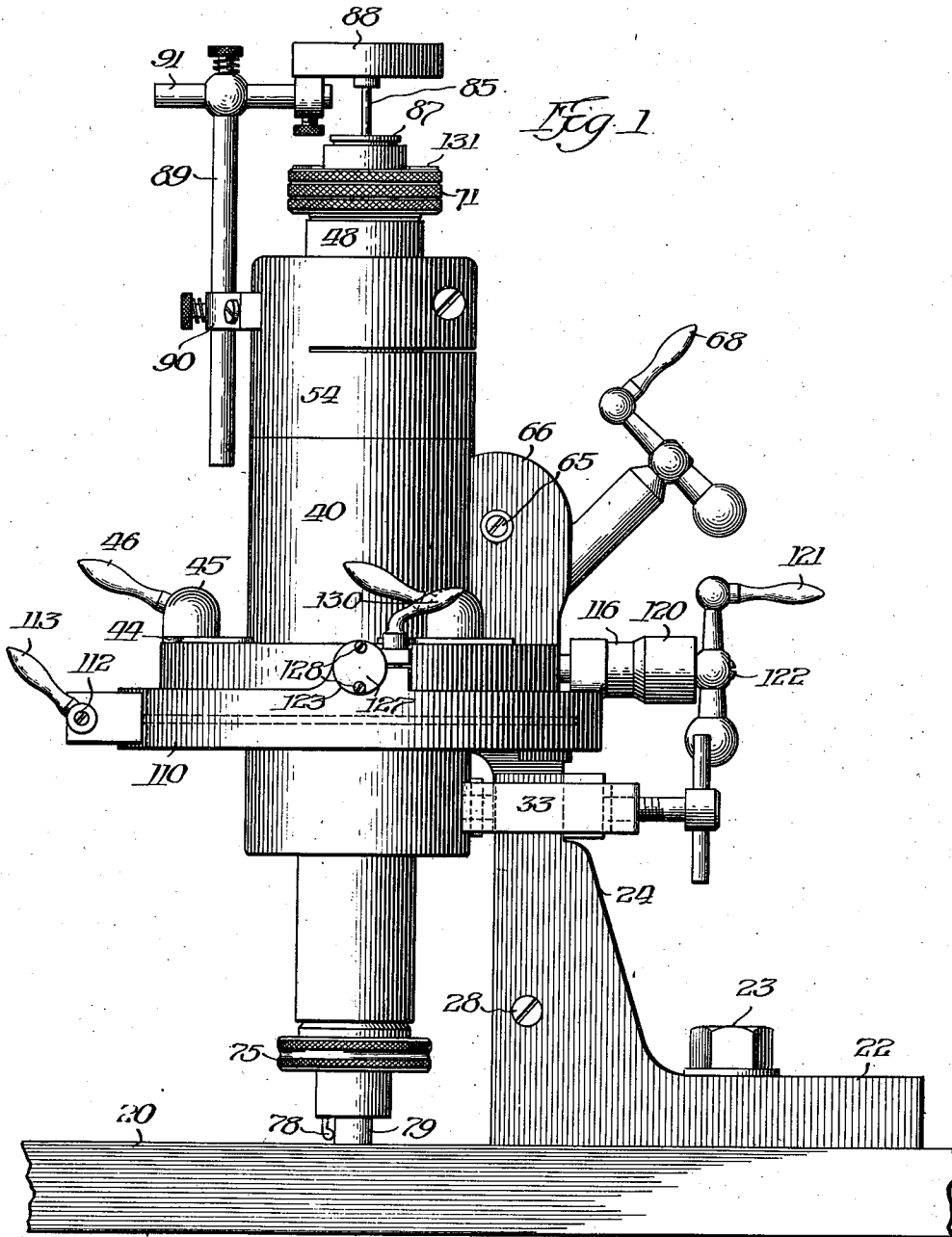
E. J. SCHENDEL.
POSITIONING DEVICE.

APPLICATION FILED FEB. 21, 1918.

1,290,789.

Patented Jan. 7, 1919.

4 SHEETS—SHEET 1.



WITNESS

Ed. Marion

INVENTOR.

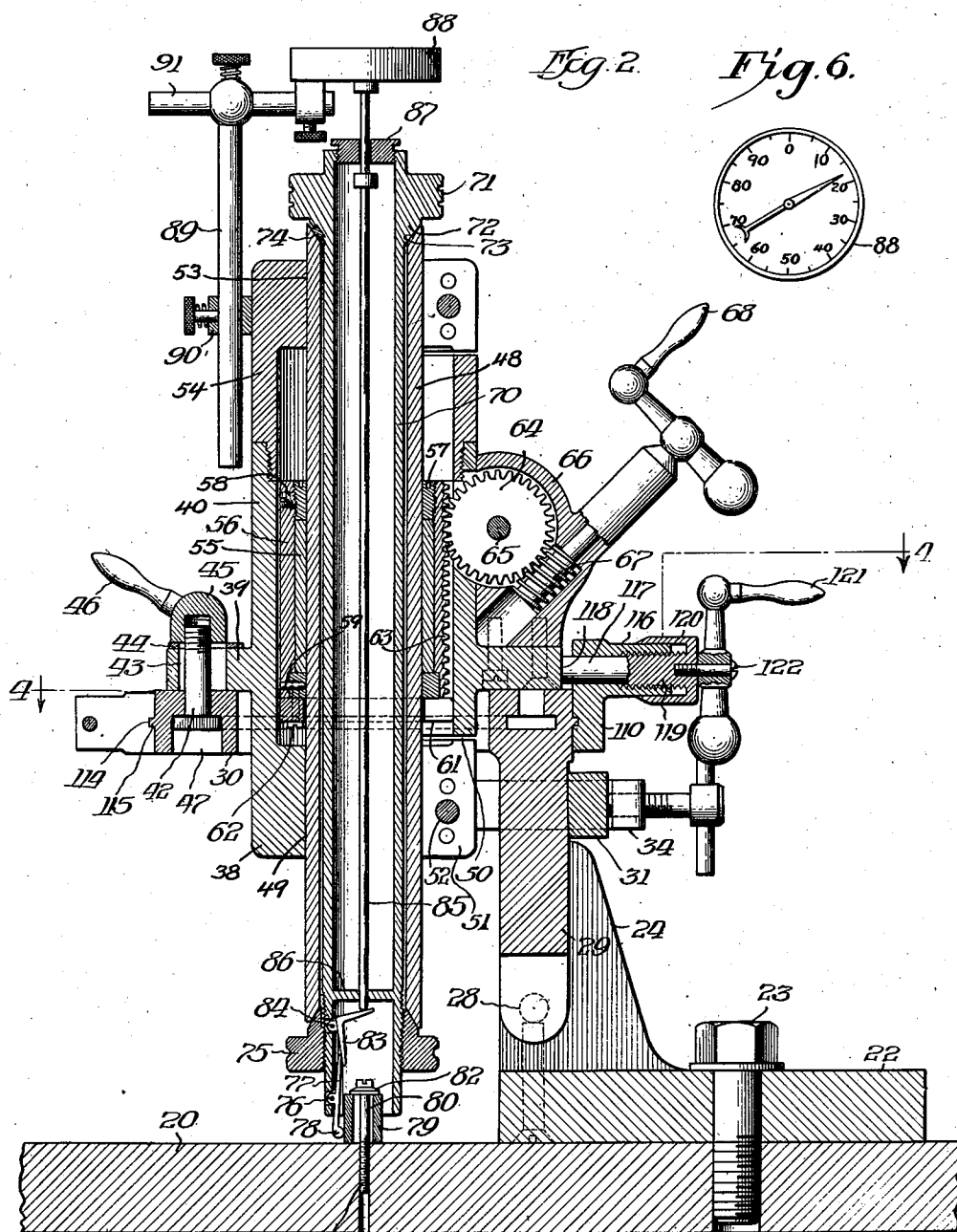
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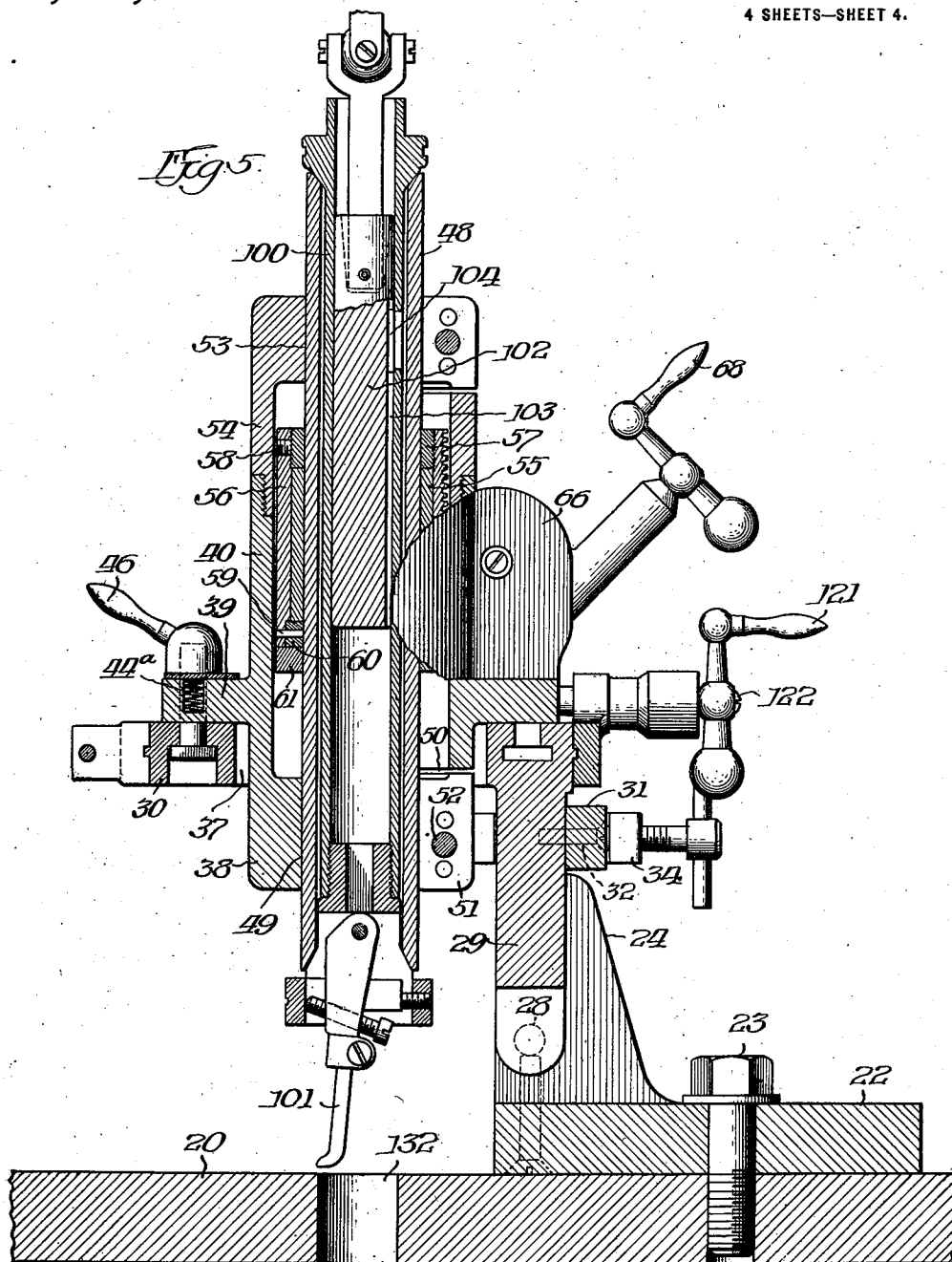
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4 SHEETS—SHEET 4.



WITNESS

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UNITED STATES PATENT OFFICE.

ERNEST J. SCHENDEL, OF FOREST PARK, ILLINOIS.

POSITIONING DEVICE.

1,290,789.

Specification of Letters Patent.

Patented Jan. 7, 1919.

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To all whom it may concern:

Be it known that I, ERNEST J. SCHENDEL, a citizen of the United States, residing at Forest Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Positioning Devices, of which the following is a specification.

My invention pertains to appliances for very accurately positioning tools with reference to the work, or part to be operated upon by the tool, whereby the action of such tools and the results of their operations may be predetermined with great precision.

One of the leading objects of the invention is the provision of an apparatus of this kind which is simple in structure, relatively economical to produce, and which may be employed with a considerable saving of time but without sacrificing accuracy of results accomplished.

Assuming that it is desired to bore a hole in a metal-plate, such as a jig or templet, and that the position of the hole must be secured with exactness, the workman, by means of a scribe or marker and a micrometer, vernier, or size-blocks, lays out the intersecting center-lines of the hole on the plate by the usual precise methods known to skilled mechanics. Then a small hole is drilled in the plate approximately concentric with the crossing of such lines and the hole is tapped. Thereupon, a cylindrical button of ordinary style and of exactly known dimensions, is adjusted and its position accurately determined by the customary precision instruments, such as a micrometer, so that its axis is in exact register with that of the hole to be bored, in which position the button is firmly held against displacement by a screw engaging the tapped hole in the usual way. Such button having been thus positioned with extreme accuracy in exact coincidence with the hole to be bored, it is now necessary to so adjust the location of the holding or positioning device for the boring-tool that it shall be in faultless and complete register with the button. It is in the construction of such a locating device that my invention resides. Its quill or hollow-sleeve for holding the tool by the improved means provided is, by a few manipulations, brought into exact or perfect register or alinement with the button. Then this positioning device is swung or rocked back

out of the way to permit the removal of the button from the plate and the drilling of a hole of slightly smaller diameter than the final hole required in approximate register only with the center-lines, the previously tapped hole acting as a guide for the drill.

After such drilling operation is consummated the positioning appliance and its quill or hollow-sleeve is again swung back into place, the boring-tool inserted therein, and coupled with the driving-means. Inasmuch as the positioning device is rigidly held in place, the boring must occur in correct register therewith, which, of course, is in precise register with the position which the button formerly occupied. The hole is, therefore, bored in the absolute position required, which nevertheless may be very slightly eccentric to the approximately-positioned drilled hole, depending upon how far the center of the tapped hole was from the real position required. It need be only approximately in register with the intersection of the center lines.

In order that those skilled in this art may have a full and complete understanding of the improved and novel appliance constituting the subject-matter of this invention and may understand its various structural and functional advantages, I have illustrated in the accompanying drawings a desirable embodiment of the invention and throughout the various views of such drawings like reference characters refer to the same parts.

In the drawings:

Figure 1 is an elevation of the apparatus; Fig. 2 is a substantially-central, vertical section through the appliance showing the same equipped with the test device;

Fig. 3 is a plan view of the structure shown in Fig. 2 with the test-indicator removed, its supporting rod being shown in section;

Fig. 4 is a horizontal section on line 4—4 of Fig. 2;

Fig. 5 is a view similar to Fig. 2 showing the boring-bar in position and illustrating the plate operated upon already equipped with the drilled hole preliminary to the boring operation; and

Fig. 6 is a face view of the dial of the test indicator.

Referring to these drawings, it is to be assumed that the metal-plate 20 is the one through which a hole of definite size is to be

bored, the accurate location of the hole being determined by the new appliance about to be described in detail as to structure and function.

5 Such apparatus comprises a bracket 21 including a base-portion 22 adapted by means of a screw 23, or in any other suitable manner, as by clamps, to be fixedly and immovably secured to the top face of plate 20, the bracket having two, spaced, upstanding
10 posts 24 and 25 having exactly alined plane surfaces 26 and 27 respectively.

At 28 on these standards or posts 24 and 25 a right-angle bracket is hinged, such bracket
15 comprising a part 29 directly pivoted or hinged to the posts and a circular or bed portion 30 adapted to support the major part of the accurate adjusting means to be described. This hinged bracket is adapted
20 to be swung back out of the way or be turned up into operative position with the circular bed portion 30 parallel to plate 20. In order to maintain the bracket in such latter position rigidly and without possibility of
25 displacement, the portions 29 thereof have a cross-bar 31 fastened thereto by screws 32, its projecting ends being adapted to bear against the surfaces 26 and 27 and be held firmly thereagainst by a pair of clamps 33
30 and 34 hinged to the posts at 35 and 36, such hinge mounting of the clamps permitting them to be released and swung out of the way to allow the bracket to be turned back.

The flat circular bed 30 of the bracket has
35 a relatively-large opening 37 therethrough for the accommodation of a depending, hollow, cylindrical portion 38, of smaller diameter than the hole 37, of a member comprising in addition to the part 38 a circular flat-
40 plate or outstanding flange 39 and an upwardly-extending barrel 40. This intermediate plate section 39 has a plane under surface resting on and supported by the corresponding plane upper face of bed 30, and
45 the construction is such that the supported member may move or slide in any direction on its supporting bed.

In order to clamp it fixed on such bed in any adjusted position, the latter is equipped
50 in its top face with a circular undercut or inverted T-shaped groove 41 adapted to receive the heads or enlarged portions of three bolts 42, each of which projects up through its radial slot 43 in the plate-portion 39, and
55 a hole in a washer 44, above which its threaded shank is fitted with a clamp-nut 45 provided with a manipulating handle 46. To the end of permitting the introduction of such bolts into their round or circular
60 groove, the plate portion or flat-flange 39 has an entrance cavity 47 (Fig. 2) through which the bolts may be inserted, and then the part 30 shifted to destroy the register of the bolt and recess. If desired, although it
65 is not absolutely essential, each of the flat-

curved washers 44 may be backed up by a pair of springs 44^a (Fig. 5) housed in recesses in the top face of the part 39.

The composite member 38, 39, 40, is designed to revolvably accommodate a hollow,
70 cylindrical sleeve or quill 48 and provide bearings therefor, whereby such sleeve or quill may be turned when required. Accordingly, the part 38 has such a bearing 49, and in order that its diameter may be
75 adjusted to accurately fit the sleeve or quill at all times, the member 38 is transversely slit at 50 and longitudinally split or divided at 51, suitable constricting means 52 being
80 provided for adjusting the diameter of the bearing. A like bearing 53 for the upper portion of the sleeve or quill is supplied in a cap-member 54 screwed into the top end of barrel 40.

At about its middle, the sleeve or quill 48
85 is externally equipped with a collar 55 tight thereon and surrounding this is a sleeve 56 provided internally at its upper end with a spanner nut 57 held against unscrewing by a transverse set-screw 58, the nut holding the
90 sleeve in fixed relation to the collar by bearing on its upper end. The lower end of sleeve 56 is pinned at 59 to a ring 60 bearing against the bottom face of the collar. Obviously, in this way, the sleeve 56 and the
95 quill 48 are held against relative longitudinal displacement but rotatable relatively to one another. As illustrated in Fig. 2, a split, expansion friction-ring 61 is mounted by one or more screws 62 on and below
100 ring 60, exerting an outward pressure against the inner cylindrical surface of the member 38, 39, 40, thus permitting ready rotation of the quill by hand without danger of even slight longitudinal displacement, because this friction ring prevents the station-
105 ary sleeve 56 from shifting lengthwise which might otherwise be possible to the small extent permitted by the back lash between the pinion 64 and rack 63.

One side of sleeve 56 has rack teeth 63 in mesh with a gear 64 on a short shaft 65 in a lateral housing 66, the gear being rotated by a worm 67 revoluble by a handle
115 68 mounted on its shaft. By turning such handle the quill may be fed up or down as desired.

The quill is adapted to removably accommodate either a test device or a boring appliance or other tool. In Fig. 2 it is shown
120 equipped with the test appliance comprising a tube 70 having an enlarged knurled head 71 with a tapered or beveled portion 72 fitting in a similarly flared end 73 of the quill. To prevent the tube from turning in the
125 quill it has a key 74 coöperating with a keyway in the quill. The lower end of the quill is externally threaded for the reception of a nut 75 of substantially the same construction as the portions 71, 72 of the tube, being
130

knurled and beveled and fitting in a correspondingly-shaped end of the tube. By these means the tube is firmly held demountably in the quill, being rotatable therewith.

5 On its top surface head 71 has fixed there-to an arrow 131 in the same vertical plane as the lever 77 and with its head in the direction of such lever and its knob 78.

At 76 in the side-wall of the tube a small
10 lever 77 with a small knob end 78 is fulcrumed intermediate its ends, the knob being located below the end of the tube and adapted to cooperate with a cylindrical button 79 secured to plate 20 by a screw 80 engaging
15 a tapped hole 81 in the plate, the screw having the usual washer 82 between its head and the flat top surface of the button. The upper end of this lever 77 engages one arm of a bell-crank 83 fulcrumed at 84 in the
20 tube, the other bell-crank arm being in contact with the lower end of a rod 85, centrally-located and vertically-slidable in the tube and guided in such movements by a bearing in a partition-wall 86 at the lower
25 portion of the tube and a similar bearing in a plug 87 screwed into its upper end. The top end of the rod is intended to co-act with a test-indicator 88 of the usual construction having a needle cooperating with a circular
30 scale, each graduation of which represents a one-thousandth part of an inch movement of the knob or finger 78. Such indicator is detachably mounted on cap 54 by a rod 89 adjustable in a clamp 90 and carrying at its
35 top end a horizontal rod 91 supporting the indicator.

In place of such testing appliance the quill may accommodate a boring or grinding device or similar tool. A boring appliance
40 of this kind has been shown in place in the quill in Fig. 5. Its tube 100 is held in place in the quill in much the same way that the tube 70 is retained therein, the tube at its lower end carrying an adjustable boring-tool
45 101 of any suitable construction. The tube internally receives a shaft 102 fitted with a keyway 103 receiving a key 104 on the inside of the tube, such shaft at its upper end being operatively connected to a jointed shaft or
50 one having one or more universal joints permitting the quill to be rotated by means not in exact register therewith.

A clamp-ring 110, split at 111, and equipped with a tightening or clamping
55 screw 112 provided with a handle 113, encircles the round-bed 30 and has an internal groove 114 coacting with and receiving a circular tongue or rib 115 on such bed. Diametrically opposite its split or cut 111 such
60 ring carries an integral, outstanding, radially-disposed housing 116 internally screw-threaded and equipped with a rod 117 having a flat end 118 adapted to bear against the cylindrical surface or periphery of the
65 flange or plate 39 and having a threaded

section 119 (Fig. 2) engaging the threads of the housing, this screw-threaded rod having a shell portion 120 fitting over the round housing 112 and also having a handle 121 secured thereto by a screw 122. It will be
70 apparent that when the plate or flange 39 and its associated parts are free to move on the bed or support 30, the turning of handle 122 to feed the screw inwardly can be employed to shift or modify the position of the
75 quill and its movable mounting.

On ring 110 at diametrically-opposite points and at exactly right-angles to the axis of rod 117 there are two split-bearings 123 and 124 each housing a cylindrical pin,
80 rod, or plunger 125 having a flat or plane end bearing against the periphery of the cylindrical flange or plate 39 and yieldingly pressed toward such flange by a spring 126 contained in the bearing, the outer end of
85 the latter being closed by a cover 127 held in position by screws 128. Each of such divided or split bearings has a screw 129 provided with a handle 130 by which the bearing may be tightened on the plunger to
90 hold it fixedly in place. When such screws are released the plungers under the action of their springs always maintain tangential contact with the curved edge of the circular flange or plate.

The operation of the appliance is practically as follows:

The workman marks out on the top surface of plate 20 the center-lines of the hole to be bored. Then he drills a small
100 hole 81 practically, but not necessarily exactly, concentric with the intersection of such lines, whereupon he taps such hole or at least its upper part. He now applies the button 79 to the plate and inserts screw 80
105 in the tapped hole through the button and its washer, positioning the button very accurately and testing it by a micrometer, for example, so that he is certain that it is in exact coincidence with the hole to be bored.
110 Such absolute locating of the button is a matter of no great difficulty when supplemented or tested with precision instruments, it being understood, as is shown in Fig. 2, that the hole through the button is larger
115 than the diameter of the screw, thus permitting sidewise adjustment of the button even though the screw is not capable of such movement.

Now the positioning appliance constituting the basis of this application is placed
120 on the plate and its quill located in practical but not indispensably in exact register with the button, this being easily accomplished by looking down through the empty quill
125 whose relation to the button can be quite accurately determined by the eye only. Thereupon this positioning device is fastened in place by tightening screw 23.

Obviously, it now remains necessary to 130

adjust the quill and its associated parts into perfect and absolute register with the correctly positioned button. This is brought about in the following manner, assuming

5 that the test-indicator operating apparatus has been inserted in the quill and the test-indicator itself mounted on the appliance as shown in Figs. 1 and 2, the knob 78 bearing against the cylindrical surface of the button,

10 as will be readily understood. The quill and its contained testing appliance is slowly turned by hand by means of the knurled part 71. Let us assume that the indicator 88 shows the quill and button to be out of

15 register 30/1000 of an inch, as shown by the indicator. The quill is turned so that its arrow 131 points in the direction of the "high point" that is, the direction in which the quill should be moved to effect such

20 register, this being determined by the reading of the indicator-scale as the quill is turned. Handle 113 is now turned loosening screw 112 and freeing ring 110 so that it may be rotated on the bed on which it is

25 mounted and by such turning of the parts the housing 116 and its rod 117 are brought into the vertical plane of the arrow and into alinement with the tail of such arrow, which has remained stationary during such adjustment of the parts, under which circumstances the two pins or plungers 125 are at

30 right-angles to the arrow. Both handles 130 are now tightened so that the two flat or plane ends of the plungers 125, 125, constitute fixed guides bearing against the cylindrical flange or plate 39 and between which the cylindrical flange may be shifted, only in the direction of the arrow, it being understood that handle 113 had been previously

40 tightened so as to prevent displacement of the parts. The three handles 46 having been turned so as to loosen their nuts 45, the flange 39 and its barrel and contained elements are free to move between the

45 now fixed guides 125, 125, and this movement is brought about by turning handle 121 which screws the rod 117 inwardly, the latter pushing the movable parts in the same direction. This movement of the quill and

50 its mounting is registered or displayed on the indicator 88 and the handle 121 is turned until the quill has been moved approximately one-half the amount that it was out of register, namely 15/1000 of an inch.

55 During such adjustment of the quill and its mounting the latter, although free to move as indicated is held more or less frictionally by the action of the small springs 44^a beneath the washers 44.

60 While this adjustment has tended to bring the quill into exact register with the button it has probably not accomplished it exactly and another test is made by turning the quill. It may now be found that the quill

65 is possibly 8/1000 of an inch out of position

in a direction different from that which it was before. The handles 130 are loosened, the handle 113 loosened, and the ring 110 turned so as to bring the plunger 117 into alinement with the arrow 131 in its new position, indicating the proper direction of movement of the quill, whereupon the handle 113 is tightened, the handles 130 tightened, and the handle 121 again turned so as to push the quill and its associated parts in the direction of the arrow one-half the amount which it was out of register.

This operation is repeated as many times as is required to bring the quill into precise and exact register with the button and under ordinary circumstances this can be accomplished in three or four trials. When in precise register the turning of the quill will give no reading on the indicator 88. During all of such testing operations the quill, while free to turn, is effectively held against longitudinal movement by the action of the friction ring. If such lengthwise movement were permitted, the reading of the test indicator would be unreliable.

Assuming that the quill has been thus properly positioned, and the handles 46 tightened, the clamps 33 are released and swung out of the way, and the whole positioning device turned back on the hinge 28, the indicating mechanism being removed from the quill. Thereupon the button 79 and its screw and washer are removed from the plate and a hole 132 (Fig. 5) of less diameter than the required hole, drilled through the plate, the tapped hole 81 acting to start the drill in proper position. The drilled hole will, of course, be concentric to the hole 81, but not necessarily in exact register with the position which the button occupied. This eccentricity, however, slight though it may be, is overcome by the subsequent boring or grinding. The boring appliance 101 is inserted and secured in the quill, the whole appliance swung back to operative position, and secured fixedly therein by tightening the clamps 33, and then the tube 100 of the boring device has inserted in it the shaft 102 connected by the jointed shaft to any suitable driving mechanism, desirably a drill press. The boring tool and the quill in which it is now fastened are turned by this driving means and the hole bored by the tool 101 to the exact size required, which will be in precise register with the button which was previously in position. During this operation the friction ring 61 serves to take up the lost motion of the spindle so that it produces a smooth finished cut by the boring tool when fed down by the feed handle 68. After such boring the entire appliance is removed and it will be obvious that the hole will have been placed in the plate 20 in the exact position required.

The location of such hole may be determined with great accuracy, say to the ten thousandth part of an inch by a person of relatively little skill and the work is done expeditiously and with great precision.

It is to be understood that this invention is not limited and restricted to the precise and exact features of construction of the device presented as many minor mechanical changes may be made in it without departure from the substance and essence of the invention and without the sacrifice of any of its substantial benefits and advantages.

I claim:

1. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a member bodily adjustable on said support, a tool-holder carried by said member, means to adjust said member in a right-line direction only transverse to the axis of said tool-holder; comprising means to guide said member in a right-line, and means to move the member in such right-line direction, and an angularly adjustable mounting for said adjusting means, whereby said member may be adjusted in its own plane in a right-line in any direction, substantially as described.

2. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a member bodily adjustable on said support, a tool-holder carried by said member, means to adjust said member in a right-line direction only transverse to the axis of said tool-holder, comprising means to guide said member in a right-line and means to move the member in such right-line direction, an angularly adjustable mounting for said adjusting means, whereby said member may be adjusted in its own plane in a right-line in any direction, and means to lock said mounting in adjusted position, substantially as described.

3. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a member bodily adjustable on said support, a tool-holder carried by said member, means to adjust said member in a right-line direction only transverse to the axis of said tool-holder, comprising means to guide said member in a right-line and screw-threaded means to move the member in such right-line direction, an angularly adjustable mounting for said adjusting means whereby said member may be adjusted in its own plane in a right-line in any direction, and means to lock said mounting in adjusted position, substantially as described.

4. In an appliance of the character described, the combination of a support, means to fasten said support to the work, a member bodily adjustable on said support, a tool-holder carried by said member, means

to adjust said member in a right-line direction only comprising means to guide said member in a right-line and screw-threaded means to move the member, an angularly-adjustable mounting for said adjusting-means, whereby said member may be adjusted in its own plane in a right-line in any direction, means to lock said member to said support, and means to lock said mounting against movement, substantially as described.

5. In an appliance of the character described, the combination of a support, a member bodily adjustable on said support, a tool-holder carried by said member, means to adjust said member in a right-line direction only transverse to the axis of said tool-holder including spring-pressed means to engage and guide said member, means to lock said spring-pressed means against movement thereby confining the travel of the member to a right-line direction, and means to move said member, and an angularly adjustable mounting for said adjusting means whereby said member may be adjusted in its own plane in a right-line in any direction, substantially as described.

6. In an appliance of the character described, the combination of a support, a member movable in its own plane on said support and having a cylindrical part, means to adjust said member in its own plane in a right-line direction only on said support including a pair of flat-ended guides engaging diametrically-opposite points of said cylindrical part and means to move said member between said guides, and an angularly-adjustable mounting for said adjusting means whereby said member may be adjusted in its own plane in a right-line in any direction, substantially as described.

7. In an appliance of the character described, the combination of a support, a member movable in its own plane on said support and having a cylindrical part means to lock said member immovably to said support, means to adjust said member in its own plane in a right-line direction only on said support comprising a pair of spring-pressed flat-ended guides engaging diametrically-opposite points of said cylindrical part, means to lock said guides in engagement with said cylindrical part, and means to move said member between said locked guides, an angularly-adjustable mounting for said adjusting-means whereby said member may be adjusted in its own plane in a right-line in any direction, and means to lock said mounting on said support, substantially as described.

8. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a hollow-spindle or quill mounted on said support and adapted to removably accommodate a

test-indicator operating-means or a tool, and means to adjust said quill on said support into register with a button fastened in position on the work while the quill is equipped with the indicator operating-means and the appliance is equipped with a cooperating indicator, whereupon said indicator operating-means in the quill may be replaced by the tool and the operation of the latter performed, substantially as described.

9. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a hollow-spindle or quill mounted on said support and adapted to removably accommodate a test-indicator operating-means or a tool, means to adjust said quill on said member into register with a button fastened in position on the work while said quill is equipped with the indicator operating-means and the appliance is equipped with a cooperating indicator, whereupon the indicator operating-means in the quill may be replaced by the tool and the operation of the latter performed, and a mounting for said support permitting the latter and the parts carried thereby to be moved away from register with the button position and to be returned thereto without disturbing the positioning adjustments, substantially as described.

10. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a hollow-spindle or quill mounted on said support and adapted to removably accommodate a test-indicator operating-means or a tool, means to adjust said quill on said support into register with a button fastened in position on the work while said quill is equipped with the test-indicator operating-means and the appliance is equipped with a cooperating indicator, whereupon the indicator operating-means in the quill may be replaced by the tool and the operation of the latter performed, and a hinged mounting for such support permitting the latter and the parts carried thereby to be swung away from register with the button position and to be returned thereto without disturbing the positioning adjustments, substantially as described.

11. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a revoluble quill or hollow-spindle mounted on said support and adapted to removably accommodate a test-indicator operating-means or a tool, and means to adjust said quill on said support into register with a button fastened in position on the work while the quill is equipped with the indicator operating-means and the appliance is equipped with a cooperating indicator, whereupon the indicator operating-means in the quill may be replaced

with a tool and the operation of the latter performed, substantially as described.

12. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a hollow-spindle or quill revolubly mounted on said support and adapted to removably accommodate a test-indicator operating-means or a tool, a test-indicator operating-means adapted to be mounted in said quill and extend through the same, an indicator adapted to be mounted in operative relation to said operating-means adjacent to the end of the quill remote from the work, and means to adjust said quill on said support into register with a button fastened in position on the work while said quill is equipped with said indicator operating-means, whereupon said operating-means may be replaced by the tool and the operation of the latter performed, substantially as described.

13. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a hollow-spindle or quill revolubly mounted on said support and adapted to removably accommodate a test-indicator operating-means or a tool, a test-indicator operating-means adapted to be fixed to and within said quill and turn with the latter, an indicator adapted to be mounted on the device in operative relation to said operating-means, and means to adjust said quill on said support into register with a button fastened in position on the work while said quill is equipped with the indicator operating-means, whereupon the indicator operating-means in the quill may be replaced by the tool and the operation of the latter performed, substantially as described.

14. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a quill-housing mounted on said support, a quill revolubly mounted in said housing, means to adjust said housing transversely of the axis of the quill, and means to vary the position of said adjusting means angularly about said housing whereby to permit a universal adjustment of the housing and the quill in their own planes, substantially as described.

15. In an appliance of the character described, the combination of a support having a plane surface, a quill-housing mounted on said support and having a plane surface bearing on the plane surface of said support, a quill revolubly mounted in said housing, means to adjust said housing in a right line transversely to the axis of the quill by sliding its said plane surface on that of the support, and means to vary the position of said adjusting means angularly about said housing, whereby to permit a universal

adjustment of the housing and quill in a plane parallel to said cooperating plane surfaces of the housing and support, substantially as described.

5 16. In an appliance of the character described, the combination of a support, a quill-housing mounted on said support and having a circular part, a quill revolvably mounted in said housing, means to adjust
10 said housing transversely of the axis of the quill comprising a pair of members to engage diametrically opposite points of said circular part to limit the movement of the housing to a right-line direction, and means
15 to engage said housing at a point at right-angles to said pair of members and adapted to force the housing in said right-line direction, and means to vary the position of said adjusting means whereby to permit a uni-
20 versal adjustment of the housing and quill in their planes, substantially as described.

17. In an appliance of the character described, the combination of a support, a quill-housing mounted on said support and
25 having a cylindrical portion, a quill in said housing, a supporting-member angularly adjustable on said support, means on said member adapted to engage diametrically
30 opposite points of said cylindrical portion thereby confining the movement of said housing on said support to a right-line direction, and means on said member adapted
35 to engage said housing and adjust the same in said right-line direction, substantially as described.

18. In an appliance of the character described, the combination of a support adapted to be fastened to the work, a quill-housing mounted on said support having
40 a cylindrical portion, a quill revoluble in said housing, a supporting-member angularly adjustable on said support about said housing, means to lock said member in ad-
45 justed position, means on said member adapted to engage diametrically opposite points of said cylindrical portion thereby confining the movement of the housing on
50 said support to a right-line direction, and means on said member adapted to engage said housing and adjust the same in said right-line direction, substantially as described.

19. In an appliance of the character described, the combination of a support
55 adapted to be fastened to the work, a quill-housing mounted on said support and having a cylindrical portion, a quill revoluble in said housing, a supporting-member angularly adjustable on said support, a pair of
60 pins spring-pressed toward and adapted to engage diametrically-opposite points of said cylindrical portion, means to lock said pins against movement thereby confining said housing to a movement between them in a

right-line direction, and means on said member adapted to engage said housing and adjust the same in said right-line direction, substantially as described. 65

20. In an appliance of the character described, the combination of a support
70 adapted to be fastened to the work, a quill-housing mounted on said support and having a cylindrical portion, a quill in said housing, a member angularly adjustable on said support, a pair of sliding pins spring-
75 pressed toward said cylindrical portion and having flat ends adapted to tangentially engage diametrically opposite points of said cylindrical portion, means to lock said pins
80 against movement confining said housing to a movement in a right-line direction between them, means on said member adapted to adjust said housing in said right-line direction, and means to lock said member in adjusted
85 position, substantially as described.

21. In an appliance of the character described, the combination of a support, a cylindrical member movable on said support, a pair of flat-ended pins adapted to
90 engage tangentially diametrically opposite points on the cylindrical surface of said member thereby restricting the movements of said member to a right-line direction, and means to adjust said member in said right-
95 line direction, substantially as described.

22. In an appliance of the character described, the combination of a support, a cylindrical member adjustable thereon, a pair of spring-pressed flat-ended pins
100 adapted to tangentially engage diametrically-opposite points of the cylindrical surface of said member, means to lock said pins against movement thereby confirming the movement of said member to a right-line
105 direction, and means to adjust said member in said right-line direction, substantially as described.

23. In an appliance of the character described, the combination of a support, a cylindrical member movable on said support, an element angularly adjustable on
110 said support, a pair of flat-ended pins on said element adapted to engage tangentially diametrically opposite points on the cylindrical surface of said member thereby re-
115 stricting the movements of said member to a right line direction, and means on said element to adjust said member in a right line direction, substantially as described.

24. In an appliance of the character described, the combination of a support, a quill-housing mounted on said support, means to adjust said housing on said support in a right-line only transverse to the
120 axis of the housing, comprising means to guide said housing in a right-line only, means to move the housing in the direction defined by said guiding means, and an an-
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gularly adjustable mounting for said adjusting means, a quill revolubly mounted in said housing, means to feed said quill lengthwise, and friction means to resist longitudinal movement of the quill in the housing, substantially as described.

25. In an appliance of the character described, the combination of a support, a quill-housing adjustably mounted on said support, a quill revolubly mounted in said

housing and adapted to accommodate a test-indicator operating-means, means to adjust said quill longitudinally in said housing, friction means to prevent unintentional lengthwise movement of the quill in said housing, and means to adjust said housing on said support transversely of the axle of said quill, substantially as described.

ERNEST J. SCHENDEL.