Sept. 11, 1928. 1,684,140

J. L. PERKINS ET AL

BROACH MECHANISM

Filed April 7, 1927

FIG. 1

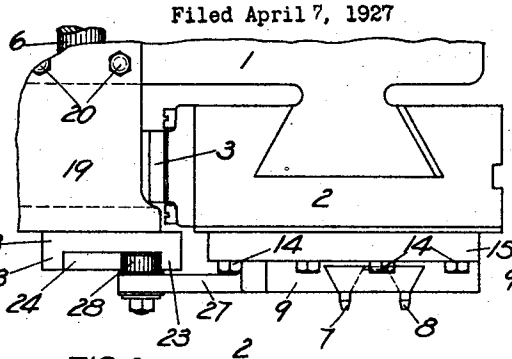


FIG. 5

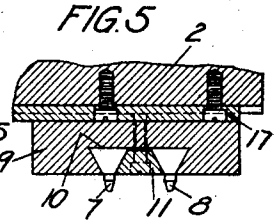


FIG. 2

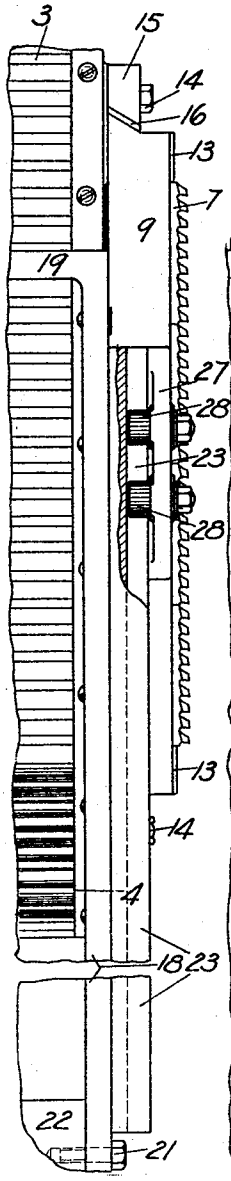


FIG. 3

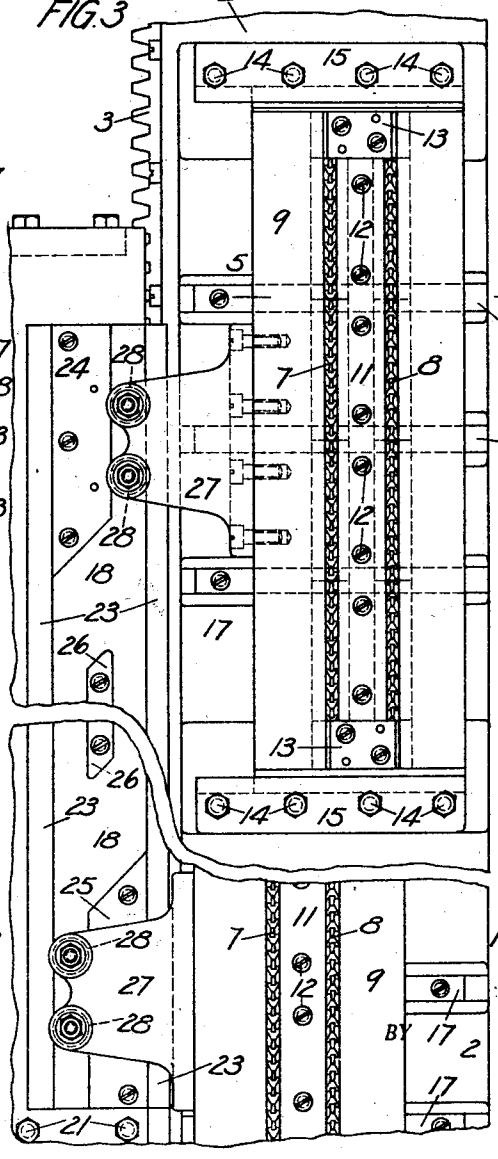


FIG. 6

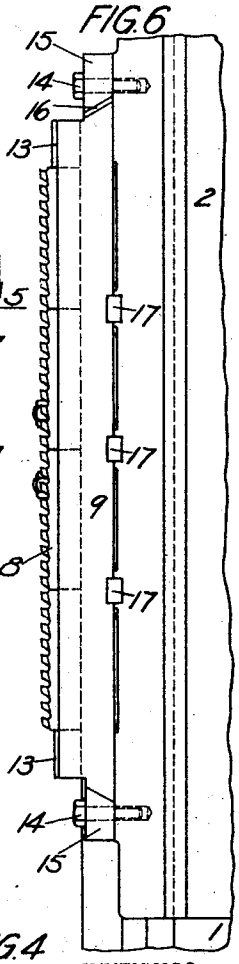


FIG. 4



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Patented Sept. 11, 1928. 1,684,140

# UNITED STATES PATENT OFFICE.

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## BROACH MECHANISM.

Application filed April 7, 1927. Serial No. 181,841.

Our invention relates to improvements in mechanisms for automatically changing the positions of reciprocating broaches, and consists generally of means for holding broaches, means for attaching said first-named means to a reciprocating member in such a manner that movement of the broaches at right-angles to the movement of said member is permitted, means automatically to shift said first-named means each time said member approaches either end of its travel, and means to hold said broaches against lateral movement while either is passing through the cutting field, together with such other parts and members as may be necessary or desirable in order to render the mechanism complete and serviceable in every respect, all as hereinafter set forth.

The primary object of our invention is to provide comparatively simple, yet strong, durable, and highly efficient, mechanism for automatically shifting laterally, first in one and then in the other direction, two broaches or two lines of broaches to locate them alternately or one after the other in the cutting field or broaching position, to the end that the cutting or broaching operation is practically continuous, that is to say, when the two broaches or two lines of broaches descend one of them makes a cut, and when they ascend the other makes a cut, and the operation of broaching is thereby materially accelerated, and the production of the machine equipped with our mechanism correspondingly increased.

Another object is to produce a mechanism of this character which is positive and accurate in its operation.

Other objects and advantages will appear in the course of the following description.

This mechanism is designed to be incorporated with broaching machines of the types disclosed in Letters Patent of the United States, No. 1,642,593.

We attain the objects and secure the advantages of our invention by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top view of broach mechanism which embodies a practical form of our invention, showing the same in connection with the closely associated parts and members of a broaching machine; Fig. 2, a left-hand side elevation of said mechanism and said parts and members, with portions broken out and broken away; Fig. 3, a front elevation of said mechanism, or enough of the same to show its disposition when the broaches are at the upper end of their travel; Fig. 4, a similar view showing the disposition of said mechanism when said broaches are at the lower end of their travel; Fig. 5, a cross section through portions of said mechanism, taken on lines 5—5, looking down, in Fig. 3, and, Fig. 6, a right-hand side elevation of said mechanism.

Similar reference characters designate similar parts throughout the several views.

The old parts and members shown in connection herewith as necessary for a complete understanding of the present invention comprise a column 1, a ram 2 arranged to reciprocate vertically on said column, and provided on one side with a rack 3, and a pinion 4 intermeshing with said rack, said pinion being mounted on a shaft 6. From any suitable source of motive power the shaft 6 is caused to rotate, and, through the medium of the pinion 4 and the rack 3, to actuate the ram 2 on the column 1. Reversing means for the shaft 6, and means to bring about the operation of said reversing means each time the ram 2 arrives at either end of its travel, are required, but these are not shown because the nature of the same is well understood. In this connection, however, reference may be had to said patent.

Broaches such as are used in this art are usually made up in sections arranged end to end, so that the separate sections or individual broaches, to all intents and purposes, form one broach, and they will herein be so considered. Two broaches of this character are represented at 7 and 8, respectively, the broach 7 being at the left and the broach 8 at the right. The broach 7 cuts on the down stroke and the broach 8 cuts on the up stroke.

A vertical holder 9 is provided for the broaches 7 and 8. This holder is mounted on the face of the ram 2 in the manner hereinafter described, and has in the longitudinal center thereof a slot 10 to receive the bodies of the broaches 7 and 8, each of which bodies in cross section is dove-tail in form. The

sides of the slot 10 are undercut to receive the outermost inclined sides of the bodies of the broaches 7 and 8, and a wedge bar 11 is received in said slot with the inclined sides of said bar against the inclined inner sides of said bodies. The depth of the slot 10 is greater than the thickness of the wedge bar 11, and screws 12 are employed to secure said bar to the holder 9 and force the bodies of the broaches, by the action of said bar thereon, tightly into place in said slot. Abutment blocks 13—13 are secured by screws or other means to the holder 9 above and below the broaches, said blocks being seated in the slot 10. Thus it is seen that the two broaches are rigidly secured in parallel relation to each other in the holder 9, with their teeth projecting beyond said holder.

The upper and under edges of the holder 9 are inclined divergently, and bolted at 14 to the face of the ram 2 respectively above and below said holder are two horizontal guide bars 15 the adjacent edges of which are undercut to correspond with the beveled edges at the top and bottom of the holder, said bars being in position to receive the holder between them with a sliding fit. At 16 is represented an ordinary shim which may be used between one of the bars 15 and the adjacent edge of the holder 9. The bars 15 serve the double purpose of retaining the holder 9 against the face of the ram 2, and of affording guides for said holder when the same is moved laterally.

In order to provide additional guiding means for the holder 9 in its lateral movement, and further insure the straight-line accuracy of such movement, one or more bars 17 are provided, there being three in the present example. These bars are let into the contiguous sides of the ram 2 and the holder 9, at different elevations between the bars 15. Each bar 17 is secured by screws or other means to the ram 2.

From the foregoing it is clear that the holder 9, with the broaches 7 and 8, can be moved both to the right and to the left on the ram 2, or at right-angles to the reciprocating movement of said ram which carries said broaches up and down in the direction of their length.

An upright 18 is located at the left of the ram 2, and has at the top a rearwardly-extending flange 19 that is bolted at 20 to the column 1. The upright 18 has its lower end bolted at 21 to a fixed part 22 of the frame of the machine. On the face of the upright 18 adjacent to the longitudinal edges thereof are vertical guide ribs 23. Secured by screws or other means to the face of the upright 18 adjacent to its upper end is a cam plate 24, and similarly secured to said face of said upright adjacent to the lower end thereof is a cam plate 25. The bottom end of the cam plate 24 inclines from above downwardly and outwardly, and the upper end of the cam plate 25 inclines from below upwardly and inwardly. Secured by screws or other means to the face of the upright 18, between the ribs 23, is a vertical cam bar 26. The inner edge of the cam bar 26 is in line with the inner edge of the cam plate 24, and the outer edge of said bar is in line with the outer edge of the cam plate 25; and the upper end of the bar is parallel with the adjacent end of the upper plate, and the lower end of the bar is parallel with the adjacent end of the lower plate. The spaces between the cam bar 26 and the guide ribs 23 are equal to each other in width; and the spaces between the adjacent ends of said bar and the two cam plates are also equal to each other.

Secured by bolts or otherwise to the left-hand edge of the holder 9 is a bracket 27. The bracket 27 extends out over the upright 18, and is provided on the back side, at the left-hand edge, with two anti-friction rolls 28, one directly above the other. The diameter of each roll 28 is approximately equal to the width of any of the channels between the cam plates 24 and 25, the cam bar 26, and the ribs 23, and the length of a line passing through the axes of the rolls 28 and extending from the top of the periphery of the upper roll to the bottom of the periphery of the lower roll is approximately equal to the width measured vertically of either of the spaces between adjacent ends of said plates and said bar.

With the parts disposed as in Fig. 3, the broach 7 is in the broaching position or the cutting field, and with the parts disposed as in Fig. 4, the broach 8 is in said position or field.

Starting with the movable parts disposed as in Figs. 1, 2, 3, and 6, and assuming that the ram 2 is descending to make a cut with the broach 7, the complete operation of the mechanism at each cycle of the machine is described as follows:

The rolls 28 initially are in the channel between the right-hand rib 23 and the cam plate 24, and said rolls remain in contact with said rib until the ram approaches the lower end of its travel, passing from said channel into the channel between said rib and the cam bar 26. By the time the rolls 28 are in the intermediate channel the broach 7 begins to make its cut. Directly after the cut is completed the lower roll 28 encounters the inclined end of the cam plate 25 and is actuated thereby to the left, this and the companion roll 28 passing through the space between the adjacent ends of said plate and the bar 26, and into the channel between said plate and left-hand rib 23. In moving to the left the rolls 28 carry with them the bracket 27 and the holder 9, the latter sliding between the guide bars 15 and on the guide bars 17. The movement to the left imparted to the holder 9, when the rolls 28 pass from

the channel between the right-hand rib 23 and the bar 26 into the channel between the left-hand rib 23 and the cam plate 25, is just the right amount to position the broach 8 in the cutting field.

Upon the reversal of the ram 2 and the beginning of the ascent thereof, the rolls 28 are moved up in contact with the left-hand rib 23 into the channel between said rib and the bar 26. Before the ram 2 arrives at the upper end of its travel, the upper roll 28 encounters the inclined end of the cam plate 24 and is carried thereby to the right, both this and the companion roll pass between the adjacent ends of said plate and the bar 26 into contact with the right-hand rib 23, and then they move up into the channel between said rib and said plate. This movement of the rolls 28 causes the bracket 27 and the holder 9 to be actuated to the right, between the guide bars 15 and on the guide bars 17 as before, the required distance again to position the broach 7 in the cutting field. Directly the ram 2 is reversed and the double cycle of operation described above is repeated, another reversal of the ram being involved in said double cycle. Thus it is seen that the broach 7 is active at each down stroke of the ram, and the broach 8 at every up stroke of said ram.

While the broach 7 is making its cut, said broach is held securely against lateral movement, because during that time the rolls 28 are in the channel between the guide bar 26 and the right-hand rib 23, and, while the broach 8 is making its cut, said last-named broach is held securely against lateral movement, because said rolls are then in the channel between said bar and the left-hand rib 23.

By changing the wedge bar 11 and the abutments 13 broaches of different lengths and sizes can be substituted for the broaches 7 and 8.

More or less change in the shape, size, construction, and arrangement of some or all of the parts of this mechanism may be made without departing from the spirit of our invention, or exceeding the scope of what is claimed.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In mechanism of the class described, a reciprocating member having a flat face provided with a holder for broaches adapted to cut alternately when moved in opposite directions, and means automatically to move said holder laterally on said face, first in one and then in the other direction, as said reciprocating member approaches the ends of its travel.

2. The combination, in mechanism of the class described, with a reciprocating member having a flat face, of a holder, for parallel broaches, mounted for independent lateral movement on said face, and means automatically to shift the position of said holder, each time said member approaches either end of its travel, whereby said broaches are alternately positioned in the cutting field.

3. The combination, in mechanism of the class described, with a reciprocating member having a flat face, of a holder, for parallel broaches, mounted on said face for movement laterally thereon at right-angles to the reciprocating movement of said member, and means automatically to move said holder, at right-angles to the movement of said member, each time the latter approaches either end of its travel, whereby said broaches are alternately positioned in the cutting field.

4. The combination, in mechanism of the class described, with a reciprocating member provided with transverse guide members, of a holder, for broaches adapted to cut alternately as said first-named member reciprocates, slidingly arranged between said guide members, and automatic means to cause said holder to be moved between said guide members each time said first-named member approaches either end of its travel.

5. The combination, in mechanism of the class described, with a reciprocating member provided with transverse guide members, of a holder, for broaches adapted to cut alternately as said first-named member reciprocates, slidingly arranged between said guide members, automatic means to cause said holder to be moved between said guide members each time said first-named member approaches either end of its travel, and automatic means to hold said holder against movement between said guide members while each broach is making its cut.

6. The combination, in mechanism of the class described, with a reciprocating member provided with lateral upper, under, and intermediate guide bars, of a holder, for broaches adapted to cut alternately as said member reciprocates, in sliding engagement with said bars, and means to actuate said holder on said bars, first in one direction and then in the other direction, as said reciprocating member approaches the ends of its travel.

7. The combination, in mechanism of the class described, with a reciprocating member provided with lateral guide means, and members forming channels parallel with the path of said reciprocating member, and forming communicating passages between said channels at and adjacent to the ends thereof, of a holder, for broaches adapted to cut alternately as said first-named member reciprocates, carried by said guide means, and having a part adapted to engage said channel- and passage-forming members and travel in said channels and through said passages.

8. The combination, in mechanism of the class described, with a reciprocating member provided with lateral guide means, channel- and passage-forming ribs, cam plates,

and a cam bar, of a holder, for broaches adapted to cut alternately as said member reciprocates, carried by said guide means, and provided with a bracket having a projection which is adapted to engage and be guided by said ribs, plates, and bar, whereby the movement of said member in one direction is converted into a movement of said holder in a direction at right-angles to the first.

9. The combination, in mechanism of the class described, with a reciprocating member provided with lateral guide means, an upright having parallel ribs and provided at the top and bottom with cam plates and with a cam bar between said ribs and between said plates, said cam plates being in offset relationship, and with said ribs and bar forming parallel channels which communicate with each other above and below said bar, of a holder, for broaches adapted to cut alternately as said member reciprocates, carried by said guide means, and provided with a bracket having a projection adapted to travel in said channels and through the communicating passages, as said member reciprocates, and thereby to move said holder laterally to position first one broach and then the other in the cutting field, and to hold said holder against lateral movement while either broach is passing through said field.

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