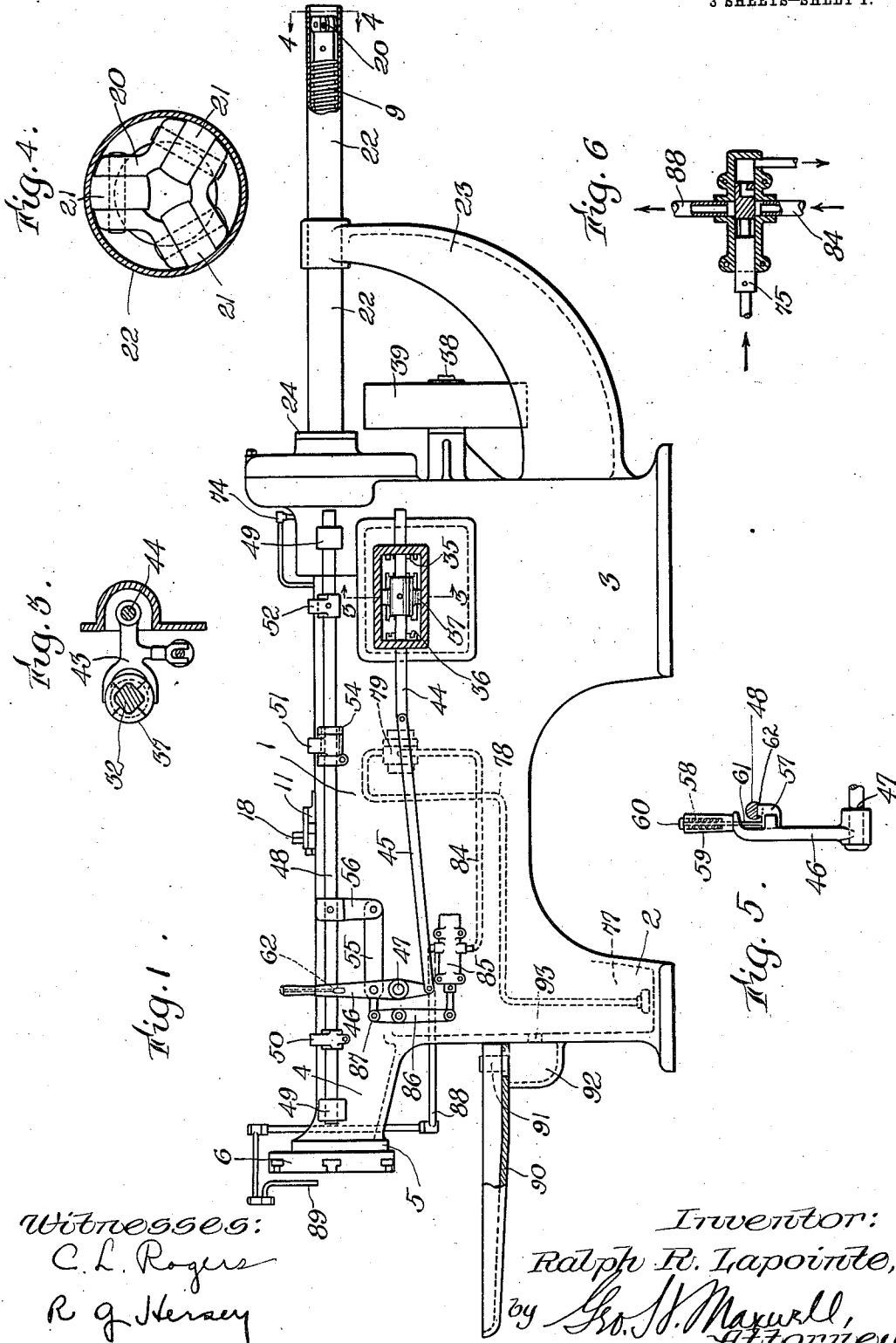


R. R. LAPOINTE.
BROACHING MACHINE.
APPLICATION FILED NOV. 14, 1911.

1,028,825.

Patented June 4, 1912.

3 SHEETS—SHEET 1.



Witnesses:
C. L. Rogers
R. G. Hervey

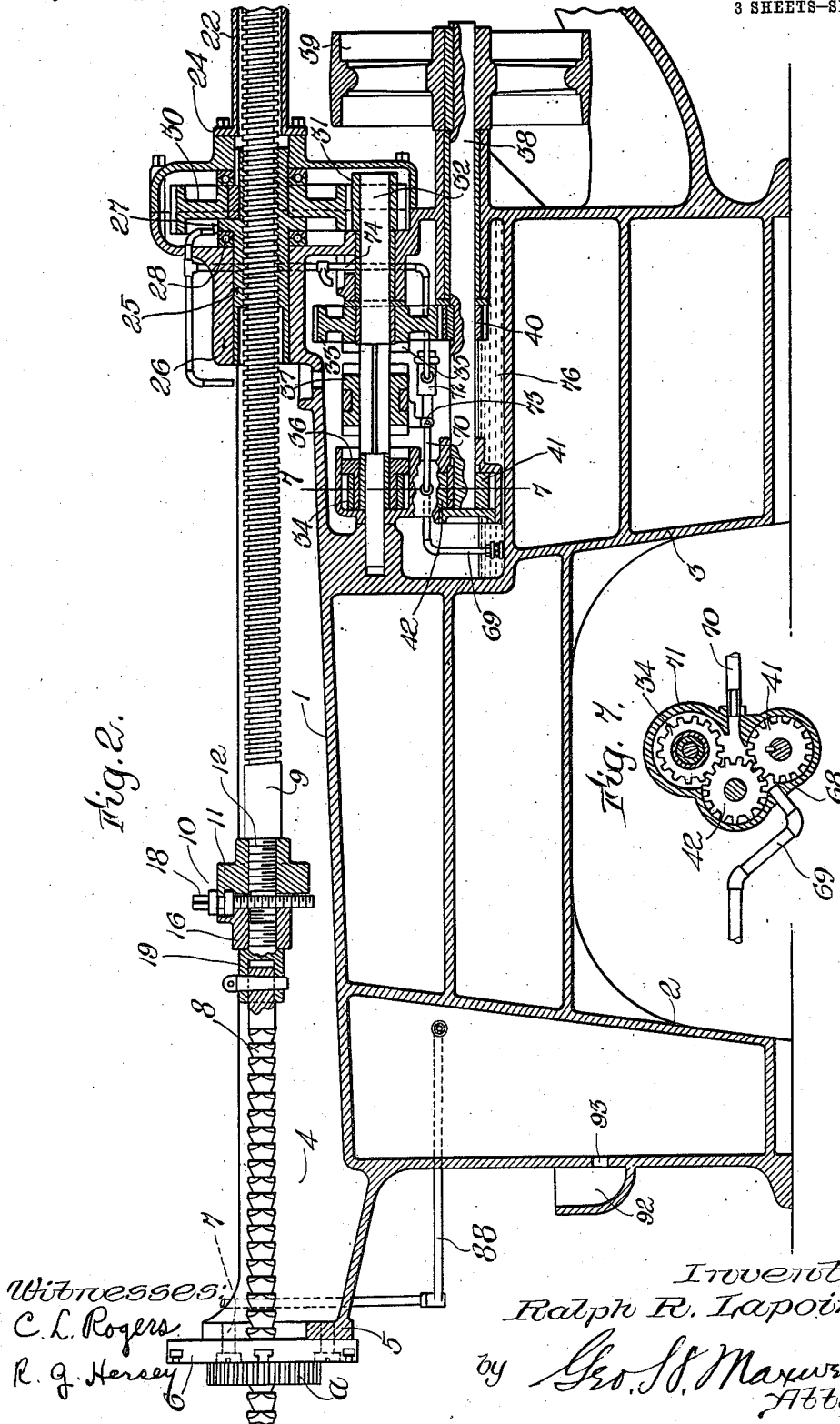
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3 SHEETS-SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 8.

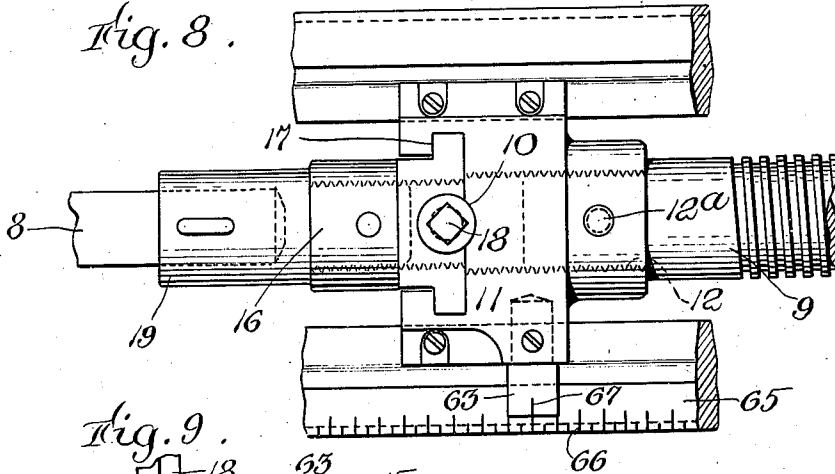


Fig. 9.

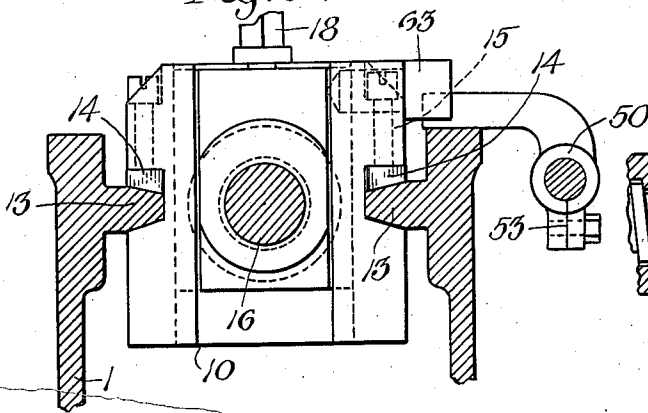


Fig. 10.

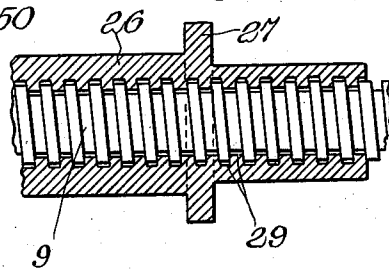
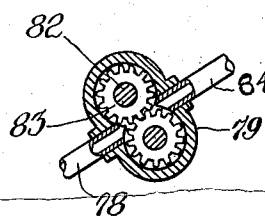
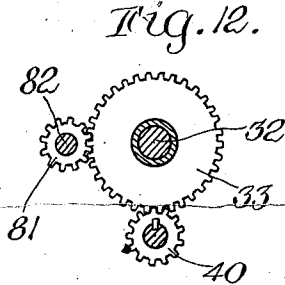


Fig. 11

Fig. 12.



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UNITED STATES PATENT OFFICE.

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BROACHING-MACHINE.

1,028,825.

Specification of Letters Patent.

Patented June 4, 1912.

Application filed November 14, 1911. Serial No. 660,235.

To all whom it may concern:

Be it known that I, RALPH R. LAPOINTE, a citizen of the United States, and resident of Hudson, county of Middlesex, State of Massachusetts, have invented an Improvement in Broaching-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to broaching machines of a type adapted to enlarge holes in metal blanks and shape the same to any desired cross-section, and, among other uses, is well adapted for broaching out key-ways in gears and other wheels.

Among the objects of the invention are to provide a mounting of the operating draw screw which insures its accurate alinement and proper coöperation with the broach, this mounting being arranged to support the screw independently of the nut which imparts its reciprocation so that the screw has a free bearing in said nut enabling proper lubrication to be assured, and preventing the possibility of any binding between these parts.

Another object of the invention is to provide effective and adequate lubricating mechanism both for the tool and for the operating drive, with a control adapted to supply the lubricant only when needed.

A still further object of the invention is to provide a simple and effective means for controlling the movements of the broach and locking its operating mechanism in inoperative position after a cutting stroke.

The above and other features of the invention will be better understood from the following detailed description, taken in connection with the accompanying drawings, and will be thereafter pointed out in the appended claims.

Referring to the drawings, Figure 1 is a side elevation of a broaching machine wherein my invention is incorporated, certain parts being broken away in section. Fig. 2 is a longitudinal vertical section through the machine, showing the operating mechanism, portions at the end being broken away. Fig. 3 is a detail sectional view on line 3—3 of Fig. 1. Fig. 4 is an enlarged detail section on line 4—4 of Fig. 1. Fig. 5 is a detail showing the construction of the controlling lever. Fig. 6 is a sectional detail showing

the valve control of the lubricant. Fig. 7 is a sectional view taken on line 7—7 of Fig. 2. Fig. 8 is an enlarged fragmentary plan view showing the slide head. Fig. 9 is a transverse section through the slideways, showing the character of engagement between the operating screw and its nut. Fig. 10 is a detail hereinafter referred to. Fig. 11 is a detail sectional view of a lubricant forcing pump, and Fig. 12 is a detail showing the connections for operating such pump.

In the illustrative embodiment shown, wherein the invention is applied to a horizontal draw cut broaching machine, the bed 1 extends generally in a lengthwise direction and is supported on a front pedestal 2 and a rear pedestal 3, the latter being the larger to support and steady the driving mechanism. This bed has an open top, as seen at 4, and its front end has a vertical face 5 to which a face plate 6, with usual T-slots in its outer face, is removably secured as by screw bolts 7. This face plate construction enables special fixtures or jigs to be engaged in the T-slots so that odd shaped work may easily be clamped to the face plate to be operated on by the broach.

The broach 8 may be of usual or any desired form and guided through the face plate 6 to operate on a piece of work shown as a gear *a* by any usual or suitable guiding arbor. The broach is connected with a long, heavy screw 9 to be actuated thereby, by means of a slide head 10. This head is composed of a block 11 having a threaded aperture in which a threaded extremity 12 of the screw is fitted, the screw being held from turning in operation by a transverse locking pin or screw 12^a. The block 11 extends between and is guided along tapered ways formed on ribs 13 which extend inward at either side from the framework 1. These ways, as shown in Fig. 9, are tapered both from beneath and above, and to provide for a continued close fit of the head along these ways, adjustable wear blocks or gibs 14 are fitted for adjustment against the upper tapered surfaces by means of screw bolts 15.

The broach is engaged with the slide head by means of a head portion 16 interlocked with the part 11 for vertical adjustment as seen at 17, this vertical adjustment being effected by a screw bolt 18 swiveled in the block 11 and having threaded en-

gagement with the portion 16. The immediate connection of the broach with the portion 16 may be effected in any suitable manner, as by a connector 19 threaded into the
5 portion 16 and keyed to the broach 8 as shown.

An important feature of the invention consists in an arrangement of parts whereby the long heavy draw screw 9 is supported
10 entirely independently of its operating nut so that said nut has at all times a free, and to a certain extent, loose engagement with the threads of the screw whereby friction losses from binding are prevented and a
15 free flow of lubricant through the long nut is insured. For this purpose the screw 9 is supported at its forward end in the slide head 11, as just described, and its rear end has fixed thereto a spacer block or carrier
20 20 in which is mounted a series of peripherally spaced apart rollers 21 adapted to engage the inner walls of a supporting tube 22 mounted in an out board support 23 extending rearwardly from the machine
25 framework and having its inner end also bolted to the gear case, as seen at 24. The rollers 21 hold the screw spaced centrally within the rigidly supported tube 22 and the rollers 21 permit the free movement of
30 the screw in and out of the tube in operation.

The operating nut 25 is preferably of considerable length, so as to engage a considerable extent of the threads of the screw to
35 thus distribute the working thrusts as far as possible, and this nut has mounting in an upstanding bearing 26 rigid and, as shown, integral with the main framework. The nut is flanged to prevent endwise displacement especially on the side toward the
40 broach against which the operative thrusts are received, as seen at 27, and ball bearings 28 may be interposed between the nut and its bearings to minimize friction. As shown
45 most clearly in Fig. 10, the threads of the screw have a free and to a certain extent a loose engagement with the cooperative internal threads of the nut and do not reach to the bottom of the thread spaces, as seen
50 at 29. It will be understood that this free, antibinding engagement of the nut with the screw, which is permitted by the independent supporting of the screw, permits lubricant supplied to the screw to circulate
55 through the thread passages of the nut, especially in the space beyond the bottom of the threads of the screw, and through the thread passages at the bottom of the threads of the screw beyond the threads of the nut
60 engaging therewith; thus all needless binding friction is eliminated and the power required for operating the mechanism is reduced to very near the theoretical minimum. The screw 25 is driven by a gear 30 keyed
65 thereto and this in turn is driven by a pin-

ion 31 on a countershaft 32 journaled in suitable bearings in the framework beneath the screw. The shaft 32 has loosely mounted thereon a larger pinion 33 and a smaller
70 pinion 34. The inner sides of pinion 33 and pinion 34 are provided with clutch faces 35, 36 spaced apart so that a double faced clutch sleeve 37 slidably splined on a non-circular portion of the shaft 32 may
75 engage either of these clutch faces, but not both at the same time. The pinions 33 and 34 are continuously driven from a prime drive shaft 38 journaled in the framework beneath shaft 32 and having a driving
80 pulley 39 fixed thereto. The pinion 33 is driven directly from shaft 38 by a relatively small pinion 40 fixed thereon, while the pinion 34 is driven in the opposite direction from a larger pinion 41 fixed on the
85 shaft 38 and indirectly connected with pinion 34 through an intermediate pinion 42. Thus with the clutch sleeve 37 moved to engage the pinion 33, the broach may be moved with a relatively slow and powerful
90 movement on its cutting stroke to the right in Fig. 2, while when the clutch is shifted so that the drive is imparted through pinion 34 the broach is returned on its idle stroke at a relatively rapid rate.

A further feature of my invention provides improved means whereby the broach
95 movement may be started by hand and then stopped automatically at a predetermined point, or at the end of its travel, as desired. To this end the clutch sleeve 37 is engaged by
100 a shipper fork 43 fixed to a rod 44 slidably mounted in the framework and connected for operation through a link 45 from a lever 46 pivoted at 47 near the front of the machine.
105 The automatic disconnecting of the driving mechanism is effected by means of a rod 48 slidably carried in bearings 49 and extending lengthwise of the frame near the top thereof. This rod has stops 50, 51, and 52
110 fixed thereon, the stop 50 near the front end being adjustably clamped to the rod, as seen at 53, the intermediate stop 51 being mounted to swing into and out of operative position on a sleeve 54 adjustably clamped to the
115 rod, and the stop 52 near the rear end being permanently fixed thereto. The rod 48 is connected to the lever 46 by means of a link 55 pivoted to the lever 46 and to a lug 56 fixed to the rod 48. The lever 46 is provided
120 with a slidable upwardly extending detent 57 directly underneath rod 48 normally urged up against the same by a coil spring 58 housed in the handle portion 59 and pressing against a knob 60 at the upper end
125 of a rod 61 extending upward from the detent. The rod 48 is formed with an inset or recess 62 at a point where it is engaged by the detent 57 when the lever 46 is in mid-position, i. e. extending vertically. As seen
130 in Fig. 5, the knob or button 60 extends up

a little above the top of the handle portion 58 so that it may be readily pressed downward to disengage the detent 57 from the inset 62 when it is desired to move the lever to start the machine. It will be understood that by reason of the link connection 55 of the rod 48 with the lever 46 being much nearer the pivot 47 of said lever than the inset 62, the tendency of the rod 48 to move said lever through the link 55 is at a much higher rate than that through the interengaging connection of the detent 57 with the inset 62, and that thus when the detent 57 engages inset 62 the parts are locked from movement, this position being, as seen in Fig. 1, one to hold the clutch sleeve in intermediate position and disengaged from both the pinions 33 and 34. When it is desired to set the machine in operation the button 60 is pushed in to disengage the detent from the inset 62 and the lever 46 moved to engage the clutch sleeve with the pinion 33, assuming the broach to have been in retracted position. The broach is thereupon drawn through the work until a lateral projection 63 on the slide head 10 engages the stop 51 if this be in operative position, or otherwise the stop 52, when the rod 48 is operated to move the parts to the position shown in Fig. 1 where they are locked by the detent again engaging the inset 62. The broach may be then retracted by disengaging the detent and moving the lever in the opposite direction and at the end of this movement the projection 63 engaging the stop 50 again moves the clutch to intermediate position, where it is locked in the manner before described. The three stops 50, 51, 52 have laterally extending portions similar to that shown at 64 for the stop 50 in Fig. 9. These lateral projections fit over a smooth, finished, horizontal way 65 on the framework support at one side of the slide head, this way being provided with a graduated scale 66 with which a mark 67 on the projection 63 coöperates to indicate different definite predetermined positions at which the broach may be stopped. To effect this stopping of the broach at different desired positions without being drawn entirely through the work, the movable stop 51 is employed. As before stated, this stop is adapted to be turned on its sleeve 54 down to operative position so as to be engaged by the projection 63 and it, with its sleeve, may be adjusted along the rod 48 so that the stop mechanism will be operated at the precise instant desired, as determined by the scale 66 which may be graduated so as to be legible with reference to the dimensions of the broach employed.

An important feature of my invention consists in improved means for supplying lubricant to the broach and other operating mechanism. For this purpose, as seen in

Figs. 2 and 7, the driving pinion 41 and the intermediate pinion 42 of the reverse drive gear train are arranged to constitute a force pump for supplying lubricant to the driving gearing. To this end these pinions are closely fitted in a gear case 68 and an oil supply pipe 69 leads to the point where these pinions separate, while an oil delivery pipe 70 leads from the opposite side where they come together. The upper pinion 34 has a clearance space 71 between it and its surrounding casing and the operation is that the oil, being drawn into the tooth spaces from pipe 69 as pinions 41, 42 rotate, is carried around their casings and that carried by pinion 41 is delivered directly to pipe 70, whereas that carried by pinion 42 is, upon the meshing of the teeth thereof with teeth 34, caused to circulate around the clearance space 71, thus finally also entering pipe 70. The pipe 70 has its delivery controlled by a piston valve device 72, the piston thereof being connected to be moved with the clutch sleeve 37 as seen at 73. This piston valve construction is of the type shown in Fig. 6 and is adapted to direct the oil up through a distributing pipe 74 to the various operating parts, with the piston 75 in one position, and to divert the oil back to the supply tank with the piston in the other position. As shown at 76 the machine framework is formed with a holding tank or pan for oil at the base of the driving gearing; this pan is thus in position to catch the oil as it drips back from the various bearings, and also that returned from the valve 72, while the oil is drawn up therefrom for circulation by the gear pump as described through the pipe 69, having a suitable strainer at its inlet. By reason of the connection of piston 75 with the clutch sleeve 37, it will be observed that oil is supplied to the bearings only when the machine is doing work, and at other times while the gearing is running idly it is by-passed back to the tank.

The oil supply to the broach is taken from a tank formed in the front pedestal of the framework, as seen at 77, a suction pipe 78 leading thence to a rotary force pump 79. This pump is of the intergeared piston type and is driven from gear 33 which engages a pinion 81 on an extension of shaft 82 to which one of the geared pistons 83 of the pump is fixed. The pump 79 delivers through a conduit 84 to a piston valve controller 85 similar to the controller 72 and likewise controlled from the clutch shifting mechanism through a lever 86 connected to an extension of link 55 as seen at 87. This piston controller, acting in similar manner to the controller 72, is adapted to deliver the oil through a pipe 88 to the point 89 where the broach operates on the work, while the broach is being operated, and at

other times returns the oil to the tank 77. The oil delivered to the broach after lubricating the same drips down on to a table tray 90 swingingly mounted on a pivot 91, so as to be capable of being turned into operative position, or out of the way, as required, and thence the oil passes down through catch-pockets 92 and through an aperture 93 of the main frame work to the tank 77, this aperture 93 being some little distance above the top of the pockets 92 so that sediment and cutting debris may settle down to be removed at intervals.

The advantages of the machine have already been quite fully described in connection with the description of the operating parts and need be only briefly summarized. The broach having its end supported and accurately guided by slide head 10, which is fitted to the tapered guide ribs 13, vibration is reduced and chattering in the work prevented and this result is possible even after a long period of use by reason of the fact that the slide head is still accurately and closely guided along its guide ways by adjustment of the gibs 14 to take up wear. It is to be noted that the bed at the end to which the face plate 6 is fitted is open so that machining of the guide ribs or ways within the bed can be readily effected. Also the face plate 6 being detachable, enables different types of face plates or work supports to be provided, as required by different forms of work. The special mounting of the draw screw, whereby it is supported independently of the nut permitting the provision of clearance spaces at the bottom of the threads in connection with the lubricating system, which keeps the active portion of the screw bathed in the lubricant, results in great economies as to the amount of power required and the direct rigidly mounted train of drive connections for the screw in the base further contributes to this result. By utilizing the driving gear train as a pump, a separate pumping outfit is dispensed with, it being noted that the driving train is arranged to perform its pumping function without any considerable modification.

While all the several features of my improved mechanism cooperate as set forth to produce a particularly compact, efficient and economically operable machine, it is to be understood that certain of the features described are capable of use apart from others, and I therefore do not desire to be limited to the complete illustrative embodiment of the invention herein disclosed except as required by the scope of the claims. It is likewise to be understood that the structural details of the various parts can be widely modified within the limits of the claims without departing from the spirit of the invention, and I therefore do not desire

to be limited as to these, or in any other respects, except as set forth in the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A machine of the kind described, comprising a framework having lengthwise guide-ways, a slide head fitted to said guide-ways and adapted to receive a broach, a screw fixed to said slide head, and a nut with driving connections having bearing in the frame engaged with said screw, said nut having a lateral flange adapted to withstand the cutting thrusts.

2. A machine of the kind described, comprising a bed frame having lengthwise extending slide-ways at a recessed open top thereof, said bed having its front end open to permit access to said ways, a face plate removably secured to said front end, a slide head fitted to said ways, and an operating screw with driving connections engaged with said slide head.

3. A machine of the kind described, comprising a bed frame, an operating screw having connections to operate a reciprocating tool, a nut engaged with said screw and having bearing in the bed frame, and means for supporting said screw on its ends whereby the nut is relieved of all strains or pressures from said screw, except working thrusts.

4. A machine of the kind described, comprising a bed frame having slide-ways, a slide head fitted thereto adapted to engage a broach, an operating screw supported at one end of said slide head, a support for the other end of said screw, and a nut fitted in the bed frame for operating said screw, the end bearings of said screw supporting the same independently of said nut.

5. A machine of the kind described, comprising a bed frame, an operating screw, a nut engaged with said screw, the threads being shortened to leave clearance spaces, and guide bearings carried by the bed frame for the opposite ends of said screw adapted to support it for alined reciprocation, whereby it is supported in fixed relation to the nut and independently thereof.

6. A machine of the kind described, comprising a bed frame having longitudinal slide-ways formed therein, a slide head fitted to said ways adapted to receive a broach, an operating screw fixed for support at one end to said slide head, an out board bearing arranged to support the other end of said screw for alined reciprocation, and a nut engaged with said screw with the threads arranged to leave clearance spaces, said nut having bearing in the bed frame and with driving connections thereto.

7. A machine of the kind described, comprising a bed frame having lengthwise ex-

tending guide-ways, a slide head fitted thereto and adapted to carry a broach, a screw fixed for support at one end to said slide head, an out board bearing for the other end of the screw in the form of a tube carried by the bed frame and adapted, in connection with said slide head, to support the screw for alined reciprocation, an elongated nut having bearings in the bed frame engaged with said screw, and driving connections mounted in the bed frame, having provision to impart rotation to said nut in opposite directions at will.

8. A machine of the kind described, comprising a bed frame, a head slidably mounted thereon with a broach fixed thereto at one side and an operating screw at the other, an out board bearing carried by the bed frame for the other end of said screw arranged in conjunction with said head to support the same for alined reciprocation, and an elongated nut having bearing in the bed frame engaged with said screw, the threads of the nut and of the screw being shortened to provide clearance spaces for the passage of lubricant.

9. A machine of the kind described, comprising a bed frame, an operating screw having a slidable guide for its inner end on the bed frame, with provision for attachment of a broach thereto, an out board bearing for the outer end of said screw, consisting in a tube fixed to the bed frame with a roller spacer fixed to the screw to engage the tube, whereby the screw is supported for alined reciprocation, and a nut engaged with said screw, said nut having bearing in the bed frame and with driving connections mounted therein.

10. A machine of the kind described, comprising a bed frame, an operating screw having a head at its inner end slidably guided on the bed frame, means for holding a broach or the like secured to said head, with provision for transverse adjustment relative thereto, and means carried by the bed frame for reciprocating the screw.

11. A machine of the kind described, comprising a bed frame, an operating screw having a head at its front end slidably guided on the bed frame, a holder for a broach or the like, having interlocking engagement with said head permitting vertical adjustment with a screw bolt arranged to effect such adjustment, and operating means for said screw mounted on the bed frame.

12. A machine of the kind described, comprising a support, a screw slidably mounted thereon for alined reciprocation with a broach or the like connected thereto, operating gearing for said screw having a disengageable connection, and means for controlling said gearing, said means having interlocking parts adapted to come into action

at a predetermined point to lock the gearing in disengaged position.

13. A machine of the kind described, comprising a bed frame, an operating screw guided thereon for alined reciprocation with a broach or the like fitted thereto, driving gearing for said screw having a disconnecting clutch, and means for moving said clutch to disconnected position after a predetermined broach movement, said moving means having interengaging parts arranged to lock the clutch in disengaged position.

14. A machine of the kind described, comprising a bed frame, an operating screw slidably guided thereon with a broach or the like connected thereto, driving gearing for the screw having a disconnecting clutch, a manually operable lever connected with said clutch, a slidable rod with stops thereon arranged to be controlled by the screw movement, said rod and lever having a link connection, and having a further detachable connection adapted to automatically come into action to lock the parts in clutch disengaged position.

15. A machine of the kind described, comprising a bed frame, an operating screw slidably guided thereon with a broach or the like connected thereto, driving gearing for the screw having a disconnecting clutch, a hand lever connected with said clutch, a slidable stop carrying-rod, controllable by the screw, said rod having a link connection with said lever and a locking recess, and said lever having a detent adapted to engage said recess at a position to lock the clutch in disengaged position, said detent being yieldingly disengageable from said recess.

16. A machine of the kind described, comprising a bed frame, an operating screw slidably guided thereon with a broach or the like connected thereto, driving gearing for said screw having a disconnecting clutch, operating means for said clutch, means for supplying lubricant to the apparatus, said clutch operating means being connected to a controller for the lubricant supply to simultaneously control the same.

17. A machine of the kind described, comprising a bed frame, an operating screw slidably guided thereon for alined reciprocation, operating means for said screw having a disconnecting clutch, and controlling means for said clutch, comprising a rod slidably mounted in position to be controlled by said screw, and stops on said rod, one of said stops consisting in a sleeve adjustable along the rod, and a stop finger mounted on said sleeve for swinging into and out of operative position at will.

18. A machine of the kind described, comprising a bed frame, an operating screw, a slide head mounted on slide ways in said bed

frame and supporting the front end of said screw, driving gearing for said screw having a disconnecting clutch, controlling means for said clutch, including a stop rod with stops thereon adapted to be engaged by a part on said slide head, a broach or the like connected with said head for operation by the screw, and graduations formed along the path of said slide head to permit an accurate setting of the disconnecting mechanism with reference to the broach.

19. A machine of the kind described, comprising a bed frame having lengthwise extending slide-ways formed in its upper portion, a slide head engaged with said ways with an operating screw and a broach or the like to be operated, connected therewith, driving means for said screw having a disconnecting clutch, and controlling means for the clutch having a stop rod with stops thereon in position to be engaged by a part carried by said slide head, a top portion of the bed frame adjacent said slide head being

formed with a smooth, plane surface provided with graduations, and said slide head having a cooperating part provided with a mark for cooperation with said graduations to permit accurate adjustment of the disconnecting mechanism with reference to any particular broach.

20. A machine of the kind described, comprising a bedframe formed with opposite guide ribs with converging tapers at their opposite sides, a slide head fitted to said ribs, with wear gibs adjustable against one of the converging sides of each of said ribs, an operating screw and a broach or the like connected to said slide head, and driving mechanism for said screw.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

RALPH R. LAPOINTE.

Witnesses:

BENJAMIN F. LEVY,
C. L. ROGERS.