Aug. 30, 1932. W. D. ARCHEA 1,874,846

MILLING MACHINERY

Filed March 25, 1929 3 Sheets-Sheet 1

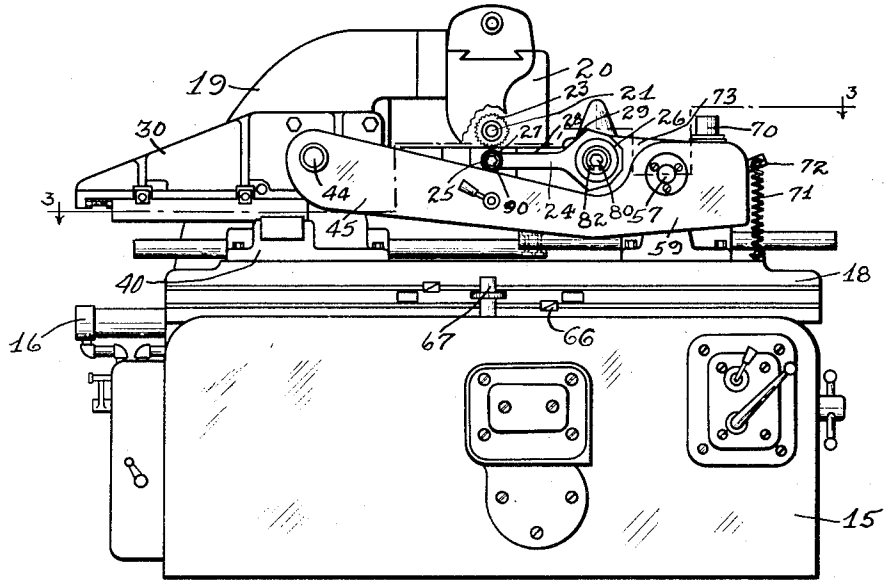


Fig. 1.

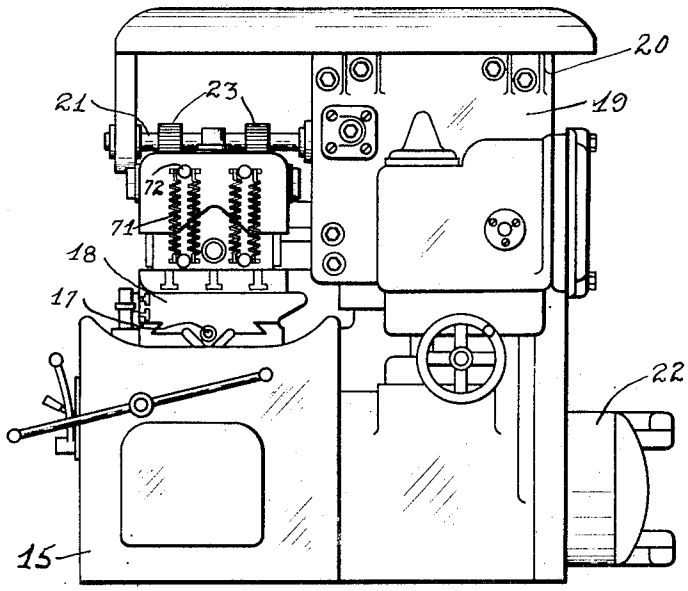


Fig. 2.

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MILLING MACHINERY

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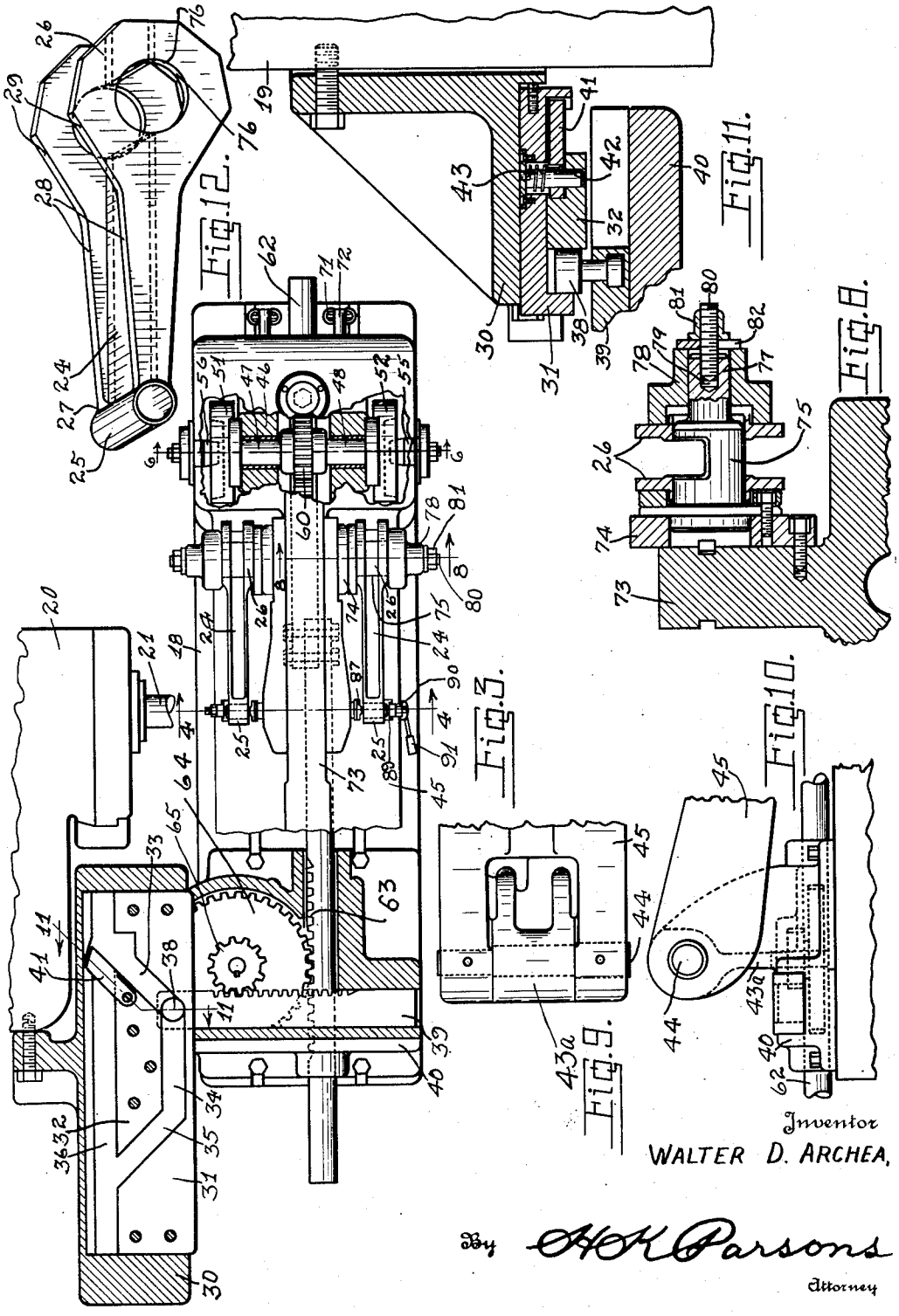


Fig. 12.

Fig. 11.

Fig. 8.

Fig. 3.

Fig. 10.

Fig. 9.

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MILLING MACHINERY

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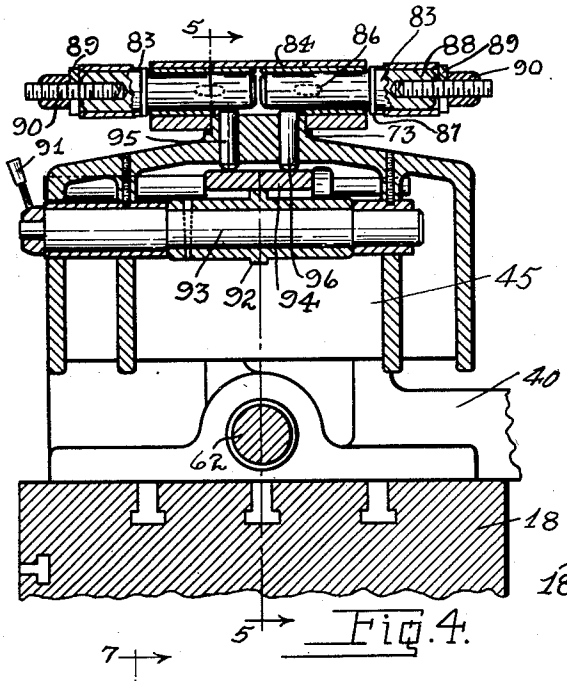


Fig. 4.

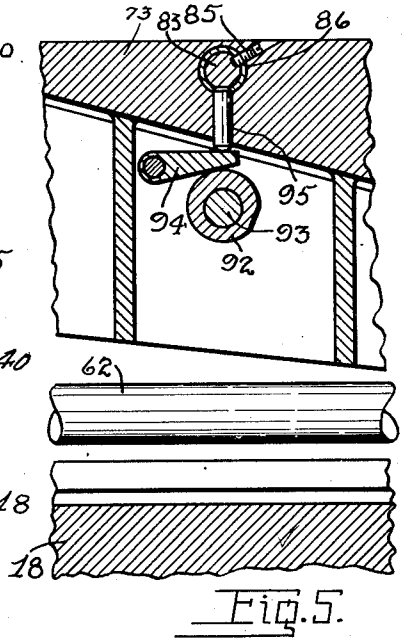


Fig. 5.

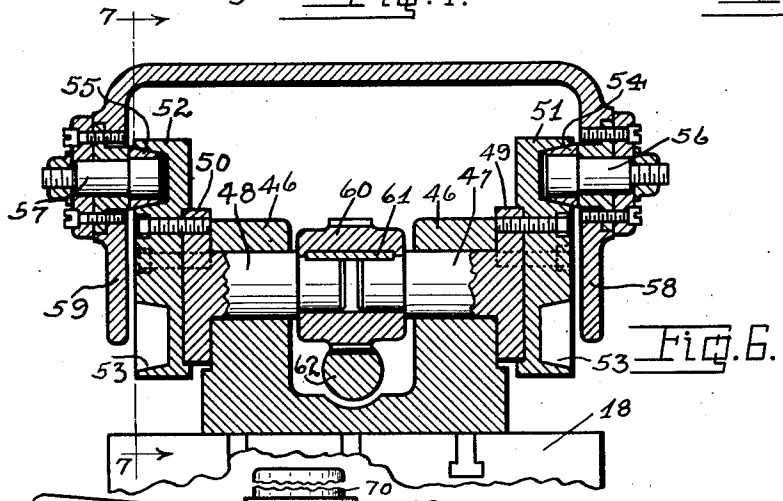


Fig. 6.

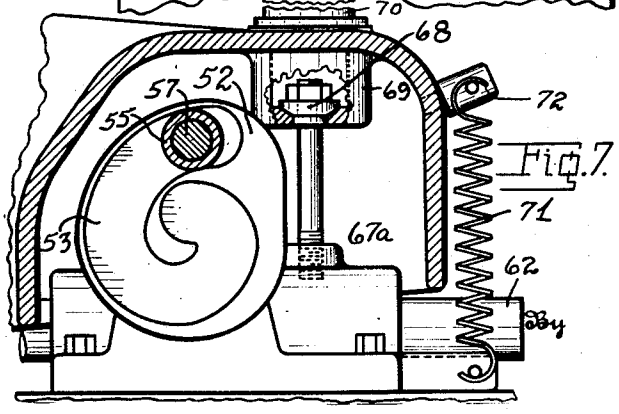


Fig. 7.

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UNITED STATES PATENT OFFICE

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MILLING MACHINERY

Application filed March 25, 1929. Serial No. 349,588.

This invention relates to improvements in milling machines and has particular reference to machines for the production of other than plain, non-interrupted surfaces.

One of the principal objects of the present invention is the provision of an improved control mechanism applicable to standard types of milling machines which will facilitate the rapid and accurate production thereon of angularly related or other non-continuous surfaces.

A further object of the invention is the provision of means for variably shifting a work piece during a cutting operation for the production of a desired configuration thereon which shall be non-functioning on the return stroke of the machine and will thus facilitate the rapid retraction of the completed work piece for removal thereof.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification, considered in conjunction with the accompanying drawings and it is to be understood that I may make any modifications in the specific details hereinafter described within the scope of the appended claims without departing from or exceeding the spirit of the invention.

Figure 1 is a front elevation of a machine embodying the invention.

Figure 2 is an end view thereof.

Figure 3 is a view partially in plan and partially in section as on the lines 3—3 of Figure 1.

Figure 4 is a section through the clamp mechanism for one end of the work piece as on the line 4—4 of Figure 3.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a vertical section through the main actuating cam mechanism as on line 6—6 of Figure 3.

Figure 7 is a section at right angles to Figure 6 on the line 7—7 of said figure showing one of the control cams in elevation.

Figure 8 is a fragmentary sectional view of the clamp mechanism for the opposite end of the work piece as on the line 8—8 of Figure 3.

Figure 9 is a fragmentary plan view of the trunnion or pivotal support connection for the oscillating fixture.

Figure 10 is an enlarged fragmentary elevation thereof.

Figure 11 is a section through the oscillator cam and switch detent as on line 11—11 of Figure 3, and

Figure 12 is a perspective view of a work piece.

In the drawings the numeral 15 designates the bed of a milling machine which has been shown as hydraulically actuable by means of suitable fluid introducable into cylinder 16 for operation of piston rod 17 carried by table member 18, these parts being of well known and conventional construction. Rising adjacent bed 15 is the column 19 adjustably supporting the head stock 20 bearing spindle 21 suitably driven from prime mover 22. This spindle supports cutters 23 in fixed position for operation upon a work piece.

The work piece to be operated upon by the machine as illustrated in perspective in Figure 12 is a heavy connecting rod or like article having a channel or I beam section portion as at 24 with a tubular portion 25 at one end adapted for example to engage a piston pin and at the opposite end the enlarged irregular shaped head portion 26. The particular portions of the article desired consecutively milled in the present instance comprise the fillet as at 27, the longitudinally extending inclined faces 28 of the side flange and the flaring faces 29 of the continuation of the flange at the head end of the work piece.

The mechanism for supporting and properly presenting the several portions of the work piece to the milling cutter 23 include a bracket member 30 for attachment to column 19 and a fixture member for application to the reciprocating table 18 of the machine. The bracket 30 bears templets 31 and 32 providing a cam slot having a riser at 33, a portion 34 extending parallel with the direction of movement of the table and a descending portion 35. At the rear of the bracket is an additional communicating groove 36 whereby a complete continuous path is provided about the trapezium templet 32. Groove 36 is extended beyond its intersection with

grooves 33 and 35 to prevent interference with additional movement of roller 38. Roller 38 is carried by rack bar 39 slidably supported in bed plate 40 carried by table 18 whereby as the table is reciprocated the roller moving in the several portions of the cam groove thus provided will impart a back and forth or reciprocating movement to rack 39 at right angles to the direction of reciprocation of the table. To insure roller 38 entering groove 33 at the beginning of the working stroke use is made of the switch detent member 41 pivoted on stud 42 carried by bracket 30 and disposed to swing idly out of the way of roller 38 on the return stroke of the table against actuation of spring 43 but being swung into the path of the roller and positively laterally deflecting same on the working stroke or inward movement of the table as respects the cutters 23.

Referring now to the mechanism for holding and shifting the work during the cutting operation the bed member 40 is provided with a bracket 43*a* having journaled therein the pivot 44 for oscillatable work supporting carriage 45. The table is provided with another bracket having journals 46 for the oscillating shafts 47 and 48 having terminally flanged portions or heads 49 and 50 to which are secured the face cams 51 and 52 having similar oppositely disposed cam grooves 53 of predetermined contour formed in their faces. These grooves have slightly converged walls for interlocking engagement with the frustro-conical rollers 54 and 55 carried respectively by studs 56 and 57 projecting inwardly from the lateral walls 58 and 59 of carriage 45. Oscillating shafts 47 and 48 are united for joint oscillatory movement by pinion 60 having its hub mounted on the inner reduced ends of the shafts and nonrotatably connected thereto as by key 61. It will thus be seen that the outer or right hand end of the work supporting fixture as viewed in Figure 1 is maintained in adjusted position depending on the rotation of the cam members 51 and 52. To effect this rotation a rack 62 meshing with pinion 60 has an angularly related rack portion as at 63 engaging gear 64 having a central pinion 65 meshing with rack 39. As a result on reciprocation of the table an in and out movement is imparted to rack 39 through the cam groove of bracket 30 and cooperating roller 38 will produce a multiplied or increased degree of movement of rack member 62 which is movable with and relative to the supporting table 18. This movement relative to the table is in turn transmitted through pinion 60 to the pair of controlling cams causing a vertical oscillation of carriage 45 about its pivot 44. The particular configuration of groove 53 is such that the combined vertical swinging movement imparted to the carriage through the cams and the longitudinal movement effected by movement of the table will swing the fixture or carriage upward as the table advances during the movement of roller 38 in slot 33 to bring the corner or fillet at 27 in engagement with cutter 23 so that the stock can be properly cut away or milled out at this point. During movement of roller 38 along wall 34 the carriage will be held in its definite upward position and a straight level face will be formed on the flanges at 28. Further movement of the table will then bring roller 38 into portion 35 of the groove when a reverse rocking of the cam shafts and cams will take place. This reverse rocking is at such a rate that the proper angle of inclination will be milled off on surfaces 29 by the combined effect of the advancing component of the progress of the table and the receding effect of the particular configuration of cam groove 53. When the outer end of the carriage has dropped sufficiently to clear the cutters and the milling operation has been completed roller 38 will have moved into and slightly longitudinally of groove 36. At this point one of the dogs 66 on the table by engagement with automatically controlled trip 67 will cause a rapid reversal of the table, during which movement roller 38 will have a direct linear motion parallel with that of the table in groove 36 snapping past detent 41. In this position the mechanism is ready for initiation of a new operative stroke when the detent will again deflect the roller into groove 33 and the operation aforesaid be repeated.

To insure maximum rigidity of the parts during performance of the longitudinal milling operation on the portions 28 of the flanges, use is made of the adjustable stop screw 67*a* carried by member 40 and bearing on its upper end the flange nut 68. This screw slides through a suitable aperture in the depending boss 69 of carriage 45, an overlying tubular cap 70 preferably being utilized to protect the adjustment screw chamber thus provided.

To further steady the carriage during the several shifting movements thereof and supplement the effect of gravity or weight of the parts in preventing play or chatter use may be made of the heavy tension coil springs 71 having one end secured to the projecting lugs 72 on the carriage and the other end suitably secured to the base 40.

The mechanism for securing the work pieces in position in pairs on the swinging carriage is particularly illustrated in Figures 4, 5 and 8. To retain heads 26 carriage 45 has a rib 73 supporting clamp plates 74 for positioning studs 75 of diameter to just properly fit into the shaft aperture 76 of the work piece. The stud is shown as formed with the reduced terminal portion 77 to receive the clamping cap 78 and having the threaded socket 79 for clamp screw 80. This

screw has a suitable nut member 81 adapted to be tightened against the horseshoe washer 82 for pressing the cap tightly against head 26 of the work piece. On loosening of the clamp screw or its nut, washer 82 can be quickly withdrawn and cap 78 and the clamped work piece removed from the stud. The large end of the work piece is therefore rigidly clamped in absolutely definite relation to the supporting carriage. The opposite end of the work piece is slipped over a second stud 83 retained in sleeve 84 on flange 73 by a set screw 85 engaged in the longitudinal slot 86 of the stud. This slot therefore permits of limited longitudinal movement of the stud with respect to the carriage. The stud has a retaining flange as at 87, and cylindrical portion 88 of size to fit the tubular end 25 of the work piece. A horseshoe washer 89 and nut 90 facilitates quick clamping of said cylindrical portion against flange 87. In mounting the work piece, the portions 25 and 76 are placed on their respective studs and clamped in position. Lever 91 is then rocked to actuate cam 92 carried by rock shaft 93. This cam engages the pivoted plate 94 adapted to jointly engage the pair of clamp plungers 95 and 96 with an equalization of pressure thereagainst. These plungers firmly lock studs 86 in position preventing rotary or longitudinal movement thereof, and thus insure most rigid retention of the work piece during a cutting or milling operation and permit compensation for any slight dis-alignment of the connecting rods which might otherwise interfere with proper secure clamping thereof.

From the foregoing description, considered in connection with the accompanying drawings the construction of the present improved machine should be readily understood and it will be seen that I have provided a simple and efficient mechanism which will facilitate ready clamping of a pair of work pieces in position for simultaneous engagement by the cutter members, and which will properly advance the clamped work piece into engagement with the cutters in such manner that a filleted portion, a first plain surface and a second angularly related plain surface may be milled on the work piece as a continuous operation and in which the desired necessary relative movement of the work piece and cutter will be effected by suitable translating mechanism operable from the normal relative reciprocation of cutter and work support to the end that the desired operations may be efficiently effected through utilization of a standard type milling machine.

It will further be noted that the mechanism in question is so constructed as to minimize the movement imparted to the several units and render the work carriage oscillating mechanism effective only on the power or feeding stroke of the machine, and inoperative on the return stroke to facilitate rapid return of the table at a rate impractical with oscillation of the work fixture whereby idle time of the machine may be reduced.

I claim:—

1. The combination with a milling machine including a tool support and a work table mounted for translatory movement relative the tool support, of a work supporting carriage secured to the table for movement therewith and oscillation relative thereto, cam means for effecting oscillation of the carriage, an operating cam carried by the tool support, and motion translating mechanism coupling the tool support cam with the carriage oscillating cam for actuation of the latter on relative movement of the table and tool support.

2. The combination with a milling machine including a tool support and a work table mounted for translatory movement relative the tool support, of a work supporting carriage secured to the table for movement therewith and oscillation relative thereto, cam means for effecting oscillation of the carriage, an operating cam carried by the tool support, motion translating mechanism coupling the tool support cam with the carriage oscillating cam for actuation of the latter on relative movement of the table and tool support, said tool support cam having a positive actuating path and an inoperative return path, and a switch member interrupting the inactive path substantially as and for the purpose described.

3. In mechanism of the character described, the combination with a bed member of a carriage pivoted thereto, spaced rollers on the carriage, cam members rotatably supported by the bed for cooperation with the individual rollers, said cam members having coaxial supporting shafts, a pinion member jointly engaging said cooperating shafts for simultaneous actuation thereof, and means for rotating the pinion to correspondingly shift the cam members.

4. A mechanism of the character described including a bed, a carriage pivoted to the bed, cam means for oscillating the carriage with respect to the bed, and an adjustable stop member in opposition to the actuating cam for limiting the movement imparted to the carriage by said cam whereby said cooperating parts rigidly lock the carriage in operative position.

5. A mechanism of the character described including a bed, a carriage pivoted to the bed, cam means for oscillating the carriage with respect to the bed, an adjustable stop member in opposition to the actuating cam for limiting the movement imparted to the carriage by said cam whereby said cooperating parts rigidly lock the carriage in operative position, and resilient means opposing the

cam for steadying the carriage when the stop is disengaged thereby.

6. A milling machine including a bed or support, a work table moveable thereover, a work supporting carriage pivotally supported by the table for movement therewith and relative thereto, cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, and a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table.

7. A milling machine including a bed or support, a work table moveable thereover, a work supporting carriage pivotally supported by the table for movement therewith and relative thereto, cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table, and means for yieldably resisting the movement of the carriage with respect to the table.

8. A milling machine including a bed or support, a work table moveable thereover, a work supporting carriage pivotally supported by the table for movement therewith and relative thereto, cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table, means for yieldably resisting the movement of the carriage with respect to the table, and additional means for positively limiting said relative movement.

9. A milling machine including a bed or support, a work table moveable thereover, a work supporting carriage pivotally supported by the table for movement therewith and relative thereto, cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table, the supporting cam having a variable shaped active portion, a non-actuating portion and means operative on movement of the stud relative the cam in one direction for deflecting the stud into engagement with the active portion of the cam.

10. A milling machine including a bed or support, a work table moveable thereover, a work supporting carriage pivotally supported by the table for movement therewith and relative thereto, cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table, the supporting cam having a variable shaped active portion, a non-actuating portion and means operative on movement of the stud relative the cam in one direction for deflecting the stud into engagement with the active portion of the cam, said means comprising a resiliently urged switch member yieldable to permit passage of the stud therebeyond on movement of the stud in the opposite direction.

11. A milling machine including a bed or support, a work table moveable thereover, a working supporting carriage pivotally supported by the table for movement therewith and relative thereto cam means rotatably supported by the table for effecting an oscillation of the carriage about its pivot, a pinion member coupled with said cam means, a rack mounted for reciprocation with and relative

to the table and having a portion engaging the pinion, a gear member additionally engaging the rack and having a pinion portion, a second rack member meshing with the pinion portion and having a cam stud, a fixed cam member carried by the bed or support and projecting in position to engage the cam stud whereby reciprocation of the table will move the stud relative the cam to actuate the carriage oscillating cam mechanism on the table, the supporting cam having a variable shaped active portion, a non-actuating portion and means operative on movement of the stud relative the cam in one direction for deflecting the stud into engagement with the active portion of the cam, said means comprising a resiliently urged switch member yieldable to permit passage of the stud there-beyond on movement of the stud in the opposite direction, said supporting cam member having a shoulder portion engaging the member to limit positively its movement in one direction whereby the member forms an active continuation of the adjacent cam surface.

12. A milling machine having a bed, rotatable cutter means thereon, a work table reciprocably mounted on the bed for movement relative to said cutter means, a work supporting carriage pivoted about an axis on said table, cam means for effecting oscillation of the carriage about its pivot and relative to said cutter means including a member having a cam path therein, a roller in engagement with said path, one of said members being fixed to the bed, and motion transmitting connections coupling the other member to the carriage to effect oscillations thereof during reciprocation of the table.

13. A milling machine including a main supporting unit, a work support and a cutter support mounted thereon for reciprocation one with respect to the other in a given path and for additional movement one with respect to another in a second path, a guide cam and a cooperating follower respectively fixed to the relatively shiftable parts for relative movement one with respect to the other during translation of the parts along the first mentioned path, a second cam means for effecting the relative translation of the parts in the second path, and motion transmitting connections between said cam and follower and the second cam for actuation of the latter upon relative movement of the cam and the follower as effected by relative translation of the parts along the first mentioned path.

In testimony whereof I affix my signature.

WALTER D. ARCHEA.