

June 7, 1949.

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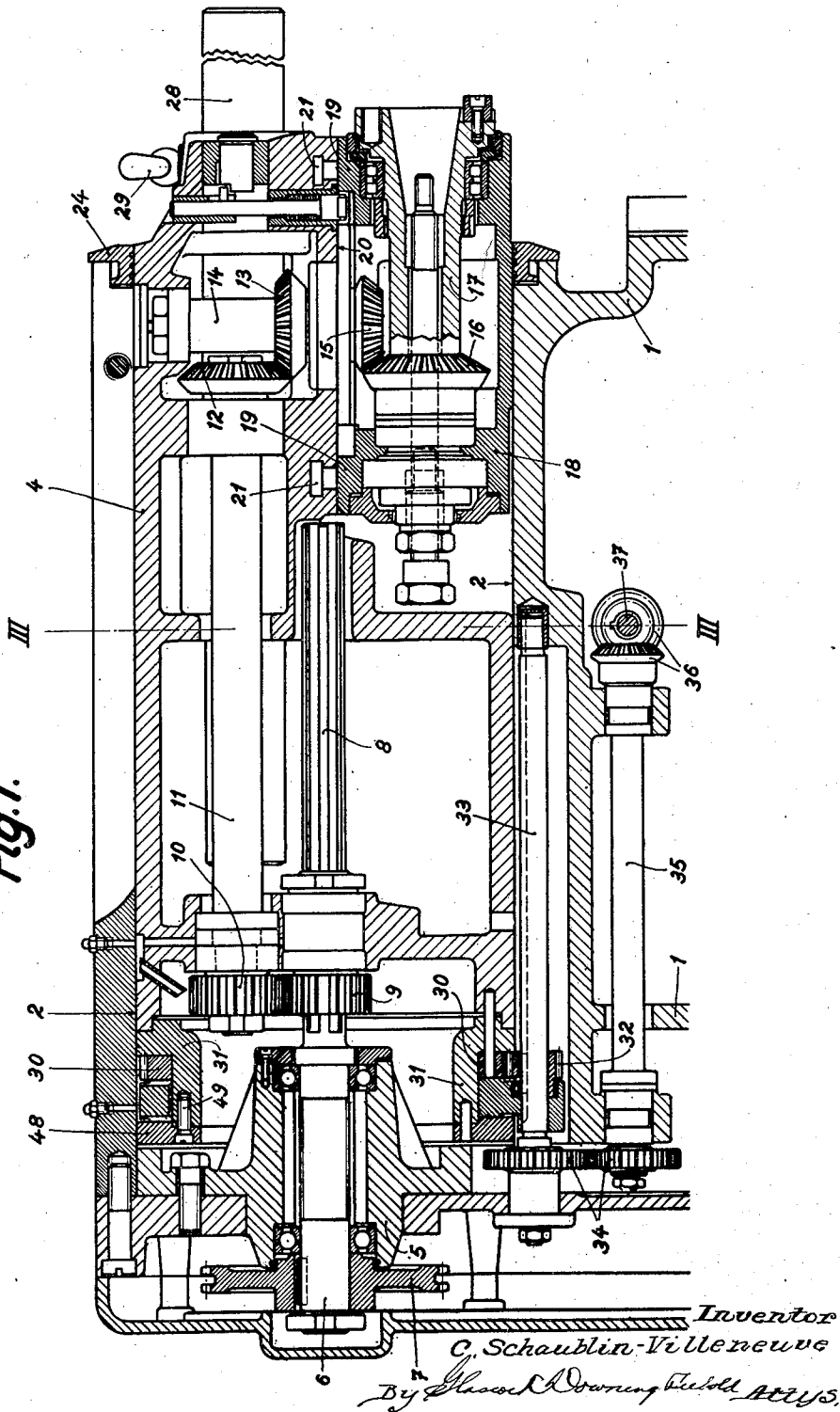
2,472,345

MILLING MACHINE WITH PIVOTING AND SLIDING HEAD

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Fig. 1.



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Fig. 2.

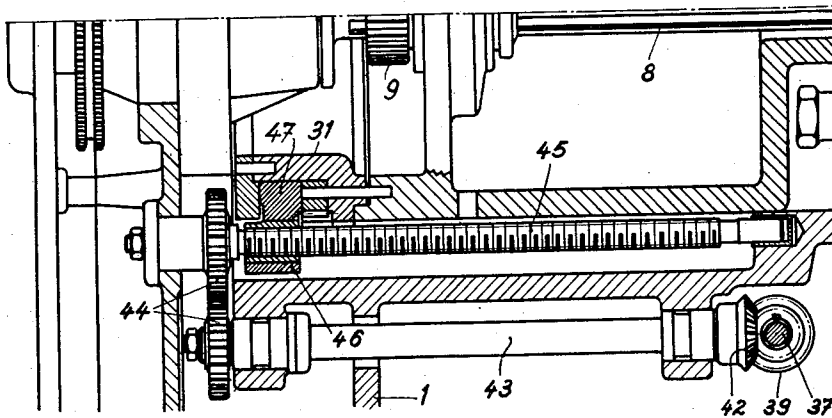
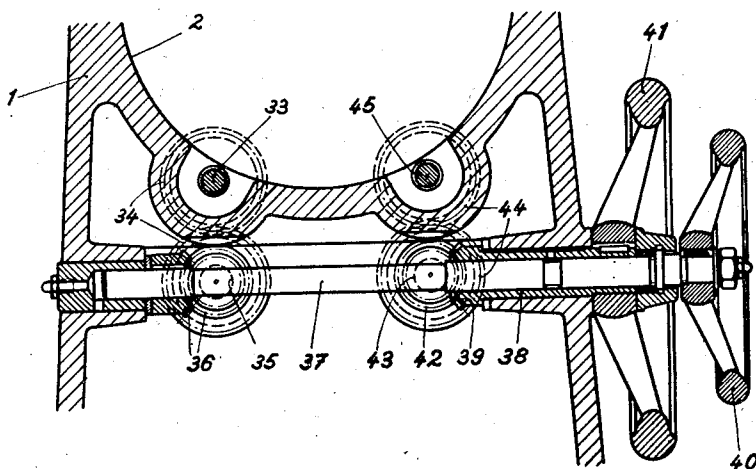


Fig. 3.



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Fig. 4.

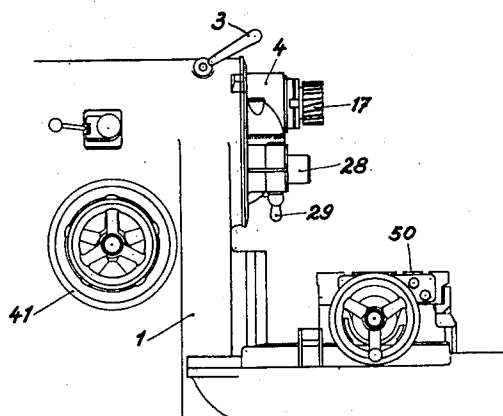


Fig. 5.

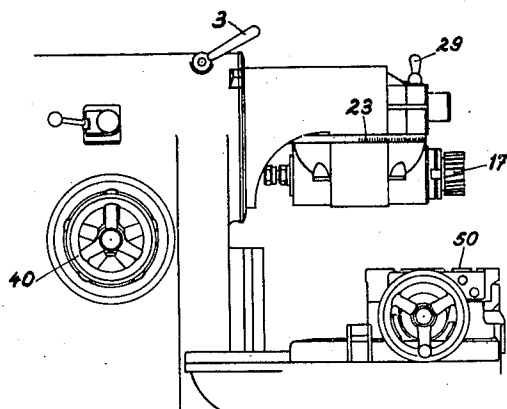
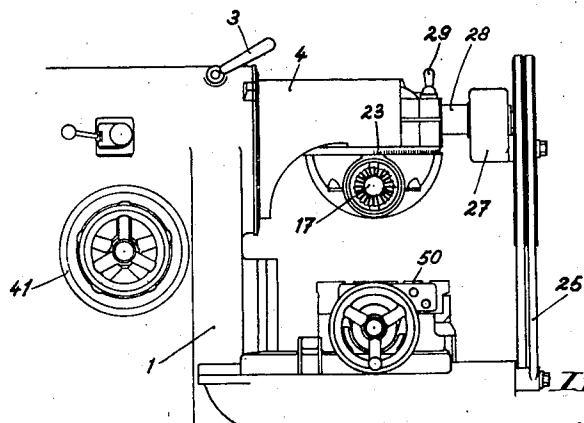


Fig. 6.



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Fig. 7.

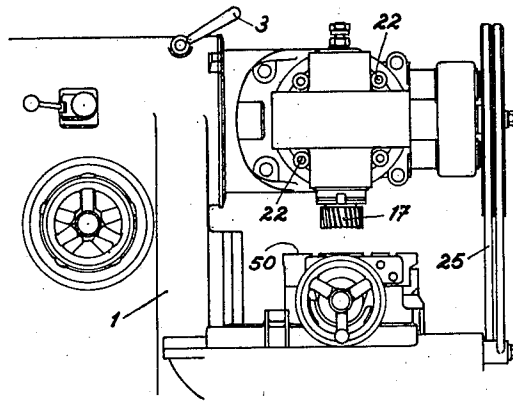


Fig. 8.

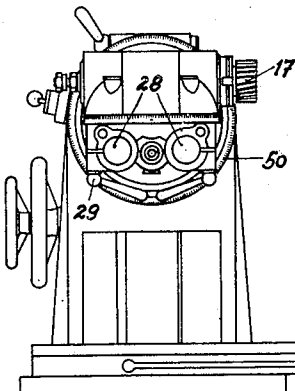
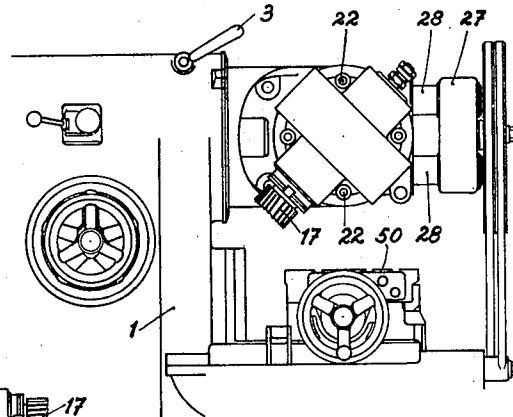
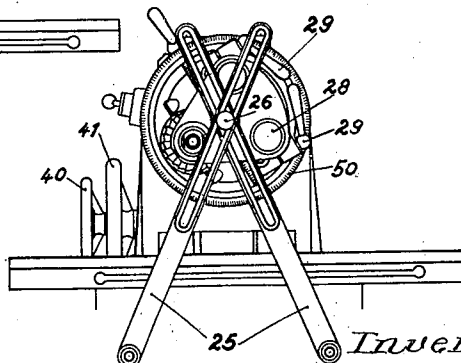


Fig. 10.

Fig. 9.



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UNITED STATES PATENT OFFICE

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MILLING MACHINE WITH PIVOTING AND
SLIDING HEAD

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7 Claims. (Cl. 90—17)

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This invention relates to milling machines with pivoting and sliding head. Machines of this kind, permitting the tool carrier to be brought at a certain distance from the frame without changing anything in the transmission means driving the mainshaft, are well-known. In certain types of these machines, the spindle can also be adjusted around a centre lying, in general, on the axis itself of the head. Hence it follows that the cutting plane of the tool can have very different directions. Milling machines of this kind are, however, not sufficiently rigid for certain works. Besides this, the distance between the table of the machine and the cutting plane of the tool is almost limited to the stroke of the table itself. These machines require special devices for holding the head, when this latter is at its maximum distance from the frame.

The milling machine according to the invention is characterised in that it comprises a spindle adjustable around an axis perpendicular to a separating plane going through the axis around which the sliding head pivots. Owing to this disposition the distance between the table and the tool can, with regard to this distance in the above-mentioned machines, be augmented or reduced by the distance separating the axis of the sliding head from the axis of rotation of the spindle. Besides this, a diameter and a weight can be given to the bearings of the spindle, sufficient for great output and high speed work without risking vibrations injuring the quality of the work done.

The accompanying drawings illustrate by way of example one embodiment of the object of invention.

Fig. 1 is a vertical section through the mainshaft of the head of the milling machine.

Fig. 2 is an analogous section but seen from the other side of the machine.

Fig. 3 is a partial section along line III—III of Fig. 1.

Fig. 4 is a partial view of the machine on a smaller scale than the preceding figures, showing the head in a certain position.

Figs. 5 to 9 inclusive are views similar to that of Fig. 4 but with the head in other positions.

Fig. 10 is an end view of the head of the milling machine, the spindle being in its highest horizontal position.

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Referring now to Figs. 1, 2 and 3, the frame 1 has, on its upper part, a cylindrical, longitudinally split bore 2 of great size in which a hollow cylinder 4 is adjusted with sliding seat, forming the outer envelope of the sliding and pivoting head of the milling machine. This cylinder 4 can be locked in different positions by means of a single handle 3 (Figs. 5 and 6). At the top of the frame 1 a bearing 5 is mounted in which the mainshaft 6 of the machine rotates. This shaft carries a pulley 7 moved by non-represented transmission means connecting this pulley either with a gear box or a motor, according to kind of drive chosen.

The mainshaft 6 is lengthened towards the inside of the hollow cylinder 4 by a part having key ways 8 along which can slide non-represented keys provided in a pinion 9 engaging another pinion 10 keyed on the end of the countershaft 11 journaled in the hollow cylinder 4 and extending from one cylinder end to the other. The other end of this shaft 11 carries a bevel wheel 12 engaging another bevel wheel 13 fixed to a shaft 14 journaled in the end of the hollow cylinder 4 and whose axis is perpendicular to a plane going through the longitudinal axis of the hollow cylinder. This shaft 14 carries on its end a bevel wheel 15 meshing with another bevel wheel 16 fixed to the spindle 17. This latter rotates in a bearing body 18 having a foot 19 adjusted on a flat surface 20 perpendicular to the axis of the shaft 14. The foot 19 is held on this flat surface by means of bolts 22 (see Figs. 7 and 8) whose heads can slide in grooves 21 concentric to the shaft 14. Hence it follows that the spindle 17 can rotate around the axis of the shaft 14 and can be adjusted in any position whatever around this shaft.

On the foot 19 a graduation 23 (Figs. 5 and 6) is provided allowing of an exact inclination of the spindle relatively to a position in which its axis is parallel to the surface 20, that is, parallel to the axis of the countershaft 11.

The bearing body 18 of the spindle 17 is of such a height that it finds place in half the room disposable in the end of the cylindrical bore 2. In the position shown in Fig. 1 where the cylinder 4 is completely inside this bore, the non-represented cutter fixed to the end of the spindle is very near the frame of the machine. The hol-

low-cylinder is of such dimensions that its moment of resistance is a multiple of those generally used in sliding heads of similar machines. In the position shown in the Fig. 1 it can, therefore, receive without vibrations the total reaction occurring when the cutter cuts a work piece. However, when the hollow cylinder is moved out of the bore 2 in order to adapt the position of the cutter to the working requirements, as is, for instance, shown in Figs. 6, 7, 8 and 9, the head is held by means of supports 25 of well-known construction through the slots of which a central pin 26 passes, provided on the outer side of a counterbearing 27 having two bores. These bores receive the end of two supporting arms 28. There are on each side of the countershaft 11 passages and guides necessary for these supporting arms which can be drawn back at will into the hollow cylinder 4. On the end of the head hand screws 29 (Figs. 4 to 10) are provided by means of which the supporting arms 28 can be locked.

Owing to the fact that the distance of these two supporting arms 28 around the mainshaft of the machine remains always the same and that the central pin 26 is coaxial to the mainshaft 6 the whole head, i. e. the cylinder 4 and all parts connected to it, can be rotated around the mainshaft without dismounting of any part becoming necessary, even when the supports 25 are in place on the central pin 26.

The adjustment of the hollow cylinder 4 around the mainshaft 6 is effected by means of a toothed rim 30 fixed to a tubular lengthening 31 of the hollow cylinder 4. This toothed rim 30 engages a pinion 32 rotated by a shaft 33 along which it can slide in order to follow the longitudinal movements of the hollow cylinder 4. Shaft 33 is coupled with a gearing 34, one toothed wheel of which is fixed to the end of another shaft 35 journaled in the frame 1 and, by means of two bevel wheels 36, in connection with a shaft 37, perpendicular to the shaft 35. A hand wheel 40 is keyed to this shaft 37, by means of which the shaft 33 can be rotated and the toothed rim 30 be acted upon in order to bring the hollow cylinder 4 into any position whatever around the mainshaft 6. It is understood that adjustment can be made in one or the other rotating direction. A graduation in degrees 50 (Figs. 9 and 10) is provided on a disc 24 on the end of the head, which allows the position of the hollow cylinder 4, thus of the whole head relatively to an initial position in which the shaft 14 is exactly perpendicular to the table of the milling machine, to be determined very exactly.

Shaft 37 is inserted into a hollow shaft 38 which carries on one end a pinion 39 and, on the other end, a hand wheel 41. This pinion 39, which is especially seen in Figs. 2 and 3 meshes with a pinion 42 fixed to the end of a shaft 43 which, by means of a gearing 44 is in connection with a screw 45 parallel to the shaft 43. Screw 45 and shaft 33 are arranged symmetrically with regard to a vertical plane going through the axis of the mainshaft. On this screw 45 runs a threaded ear 46 fixed to a ring 47 freely rotatable on the tubular lengthening 31 by the side of the toothed rim 30. The ring 47 is held in place by means of a ring 48 and screws 49.

By manipulating the hand wheel 41 the screw 45 is rotated and the hollow cylinder 4 acted upon by means of the ear 46 and the ring 47 in order to give it a longitudinal movement. This movement can be imparted whatever the position of

the hollow cylinder around the mainshaft 6 may be.

The two hand wheels 40 and 41 can be manipulated at the same time so that the longitudinal and pivoting movements can be executed simultaneously.

Fig. 4 illustrates the position occupied by the sliding and pivoting head when the hollow cylinder has been rotated by 180° relatively to its position shown in Fig. 1.

In Fig. 5 the head has been considerably advanced, without holding by means of the supporting arms 28 and the supports 25 becoming necessary. The spindle is still parallel to the mainshaft.

In the position shown in Fig. 6 the spindle is turned by 90° relatively to the position which it occupied in Fig. 5, the counterbearing 27 is in place on the end of the supporting arms 28.

In Fig. 7 the spindle 17 is vertical. In Fig. 8 it is inclined. In Fig. 9 still another position of the spindle and use of the supports 25 in combination with the counterbearing 27 is shown.

In Fig. 10 the hollow cylinder is turned by 180° relatively to the position of Fig. 1, and the spindle 17 is likewise turned by 90°.

What I claim is:

1. In a milling machine, a frame with a bore, a hollow cylindrical head slidably and pivotally mounted in said bore, a spindle with its rotation axis in a plane parallel to the rotation axis of said hollow head, a support carrying said spindle and mounted on said head adjustably around a revolving axis perpendicular to the rotation axis of said hollow head, said support having an outer circumference lying, together with said spindle, within the cross sectional area of said bore on said spindle being adjusted parallel to said rotation axis so as to allow withdrawing of said support and said spindle into said bore and driving means for said spindle, going through said hollow head.

2. In a milling machine, a mainshaft, a frame with a bore coaxial to said mainshaft, a hollow cylindrical head slidably and pivotally mounted in said bore, a spindle with its rotation axis in a plane parallel to the rotation axis of said hollow head, driving means connecting said spindle with said mainshaft and going through said hollow head, a support carrying said spindle and mounted on said hollow head adjustably around a revolving axis perpendicular to the rotation axis of said hollow head, said support having an outer circumference lying, together with said spindle, within the cross sectional area of said bore on said spindle being adjusted parallel to said rotation axis so as to allow withdrawing of said support and said spindle into said bore, said hollow head comprising a supporting surface lying in the direction of said mainshaft, said support having an outer surface perpendicular to said revolving axis and movably adjusted on said supporting surface.

3. In a milling machine according to claim 2, a driving wheel in connection with said driving means and keyed to said mainshaft in a manner to allow relative axial movement between said mainshaft and said driving wheel.

4. In a milling machine according to claim 2, a toothed rim in rigid connection with said hollow head, a toothed wheel in engagement with said toothed rim, able to follow said hollow head on its longitudinal movements and a control device in driving connection with said toothed wheel

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for angularly adjusting said hollow head around to rotation axis.

5. In a milling machine according to claim 2, a ring freely rotatable on, but axially fixed relatively to said hollow head, a screw rotatably mounted on said frame and in engagement with said ring, and control means in engagement with said screw for displacing said hollow head longitudinally.

6. In a milling machine according to claim 2, a toothed rim in rigid connection with said hollow head, a toothed wheel in engagement with said toothed rim, able to follow said hollow cylinder on its longitudinal movements, a control device in driving connection with said toothed wheel for angularly adjusting said hollow head around its rotation axis, a ring freely rotatable on but axially fixed relatively to said hollow head, a screw rotatably mounted on said frame and in engagement with said ring, control means in engagement with said screw for displacing said hollow head longitudinally, said control device and said control means comprising together two concentrically arranged shafts and two superimposed hand wheels for operating said control de-

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vice and control means, said screw and said toothed wheel being arranged symmetrically with regard to a vertical plane going through the axis of said hollow head.

7. In a milling machine according to claim 2, a counterbearing, said head comprising guides and locking means on both sides of said driving means, two supporting arms slidably adjusted in said guides and organised to be locked by said locking means and to be fixed to said counterbearing, said counterbearing having a pin coaxial to the rotation axis of said head, and supports with slots passed through by said pin to support said counterbearing.

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