A. VERNET.

MULTIPLE MILLING MACHINE.

APPLICATION FILED FEB. 20, 1909.

988,231.

Patented Mar. 28, 1911.

4 SHEETS—SHEET 1.

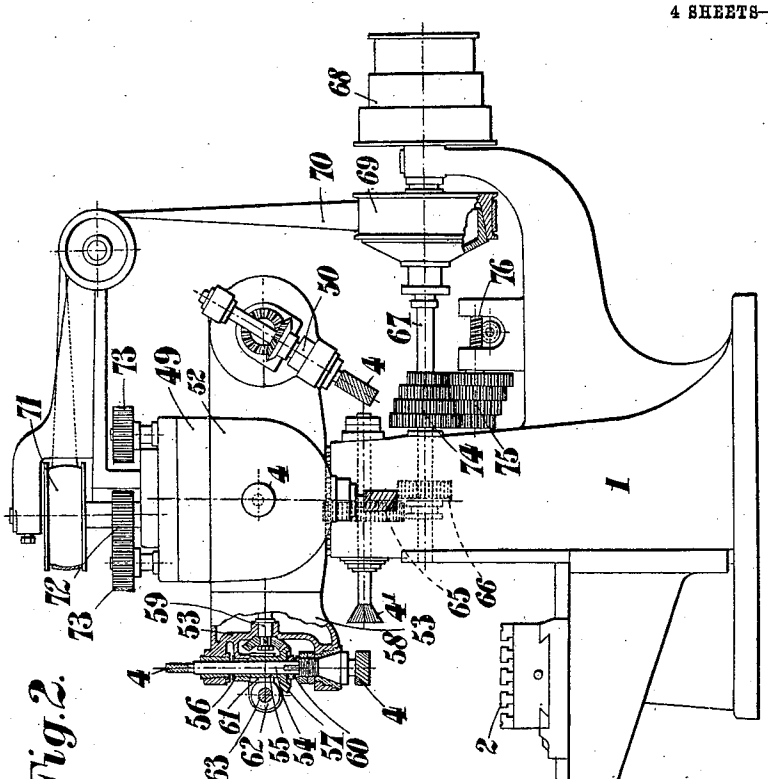

Fig. 2.

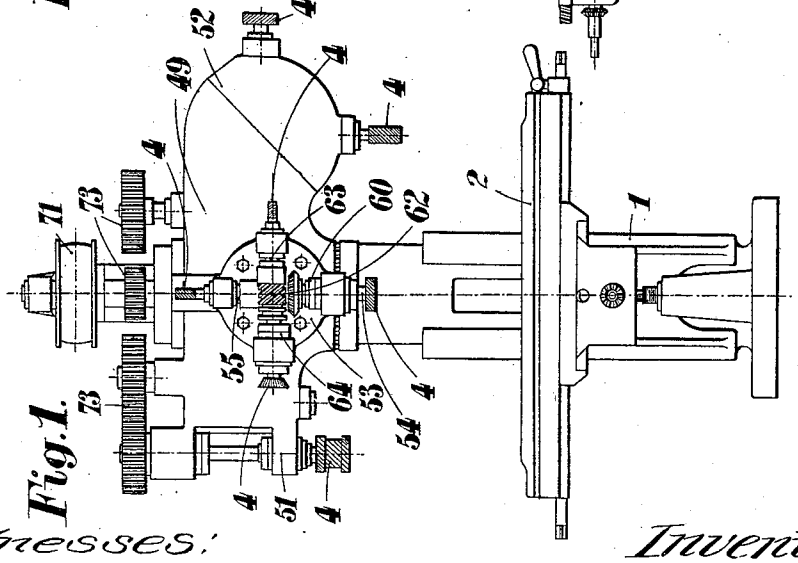

Fig. 1.

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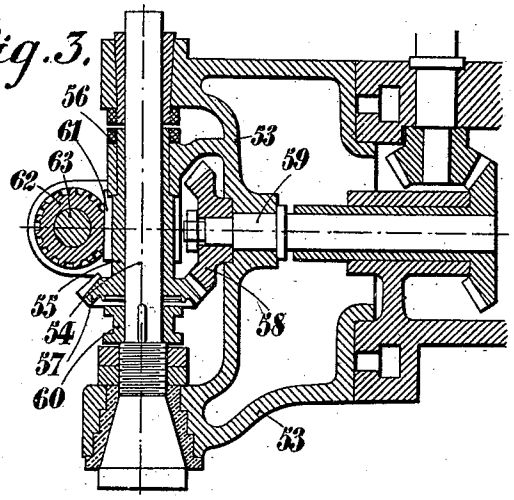
4 SHEETS—SHEET 2.

Fig. 3.



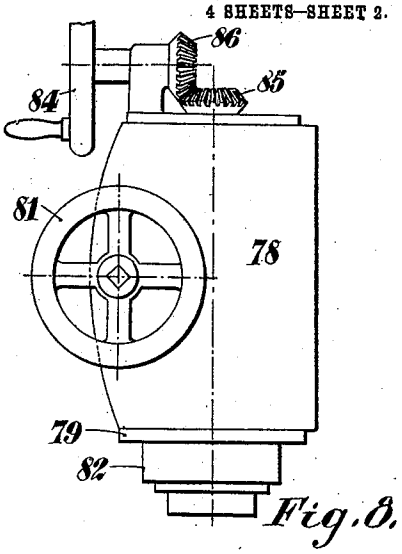


Fig. 8.

Fig. 7.

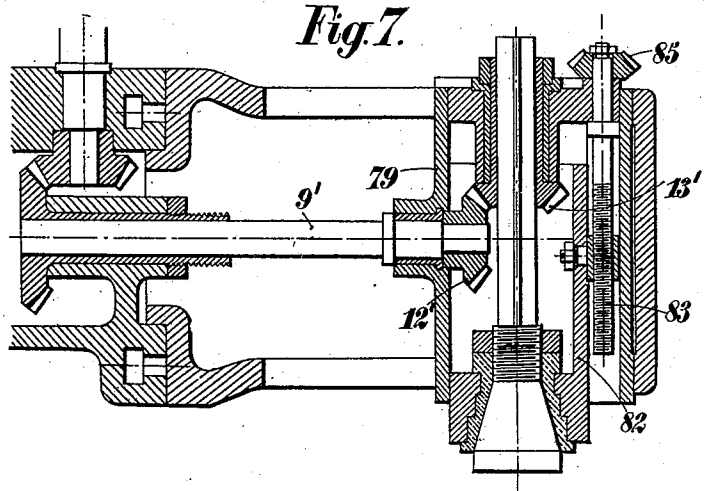
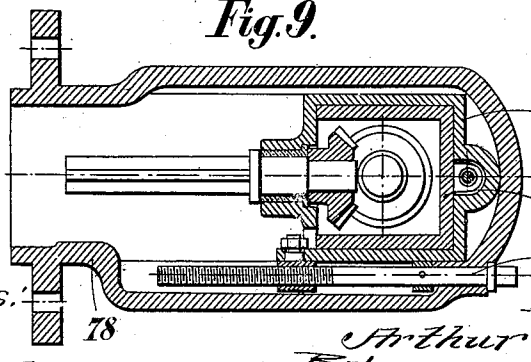


Fig. 9.



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4 SHEETS—SHEET 3.

Fig. 4.

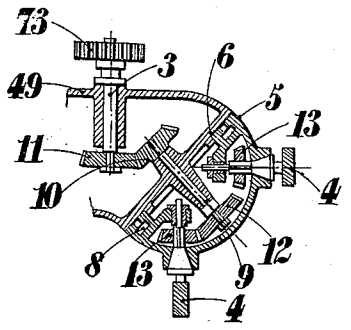


Fig. 5.

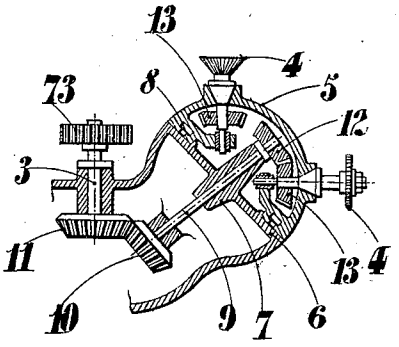
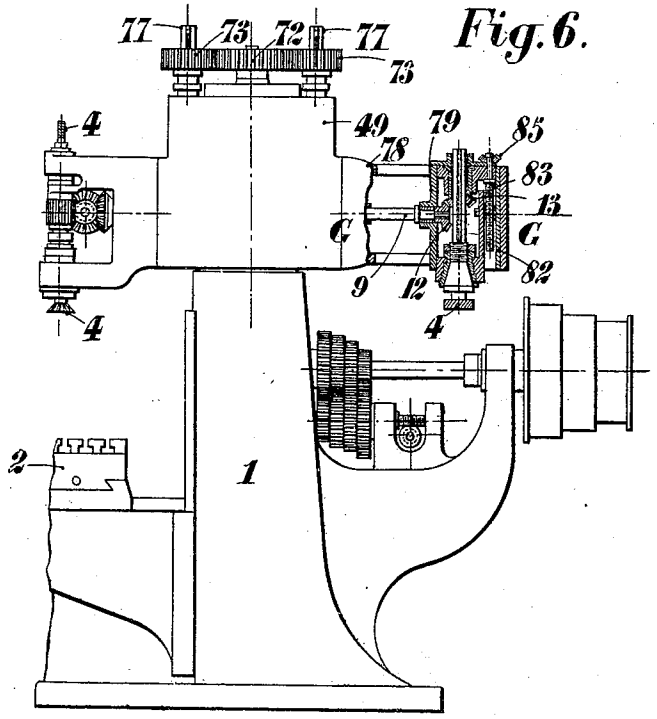


Fig. 6.



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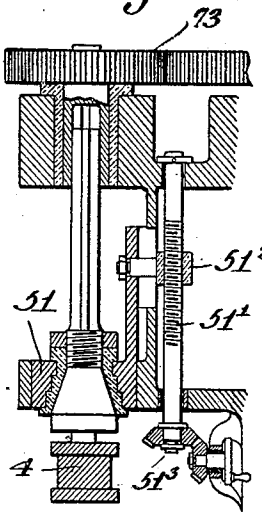
4 SHEETS—SHEET 4.

Fig. 4a.



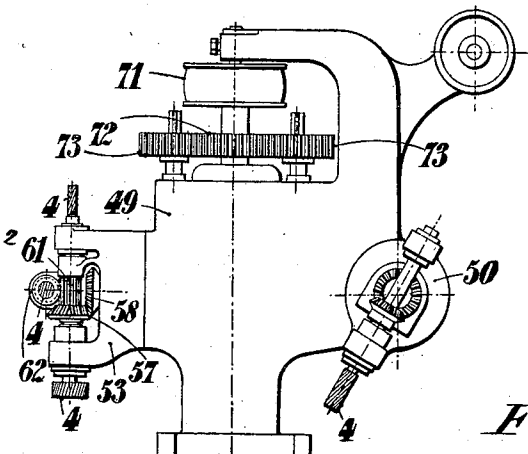


Fig. 10.

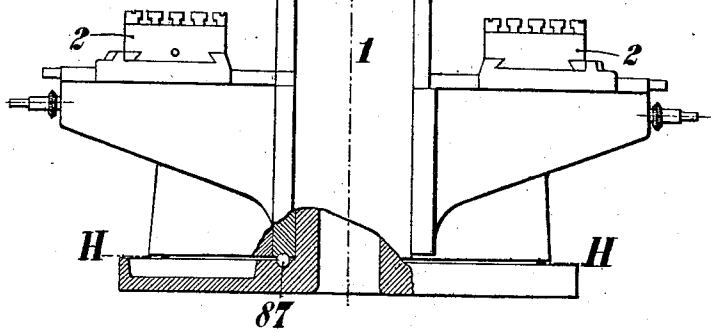
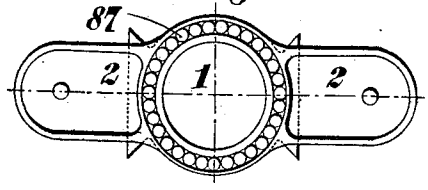


Fig. 11.



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UNITED STATES PATENT OFFICE.

ARTHUR VERNET, OF DIJON, FRANCE.

MULTIPLE-MILLING MACHINE.

988,231. Specification of Letters Patent. Patented Mar. 28, 1911.

Original application filed August 13, 1907, Serial No. 388,378. Divided and this application filed February 20, 1909. Serial No. 479,205.

To all whom it may concern:

Be it known that I, ARTHUR VERNET, citizen of the French Republic, residing at Dijon, Department of Côte-d'Or, in France, have invented certain new and useful Improvements in Multiple-Milling Machines, of which the following is a specification.

This invention has for its object means for mounting the tools of milling machines, rendering it possible to subject the work mounted upon the tables of the machine, which may be either fixed or movable, to several successive operations.

To this end the invention consists in a multiple milling machine of the kind adapted to subject a piece of work to the operation of successive tools and comprising a central driving shaft provided with a gear wheel adapted to drive various tools through the intermediary of gear wheels and shafts extending parallel thereto, and is characterized by the fact that the tools are driven from said parallelly arranged shafts by shafts arranged at right angles or at an inclination thereto whereby tools may be utilized which operate not only vertically but also horizontally or in inclined position.

In the accompanying drawings: Figure 1 is an elevation of a milling machine with multiple cutter holders. Fig. 2 is a side elevation partly in section of the same machine. Fig. 3 is a view of a detail of Fig. 2 to an enlarged scale. Fig. 4 shows a mounting device for cutter holders. Fig. 4ª is a detail sectional view of one of the displaceable cutter holders. Fig. 5 is a similar device in which the cutters act horizontally. Fig. 6 is a side elevation partly in section of a modification of the preceding machine. Fig. 7 shows a detail of Fig. 6 to an enlarged scale. Figs. 8 and 9 are views of a special cutter holder adapted for this machine; Fig. 8 is an elevation and Fig. 9 a section on the line G—G of Fig. 6. Fig. 10 is a side elevation partly in section through another machine. Fig. 11 is a sectional plan on the line H—H of the preceding figure.

The stand 1 of the machine shown in Figs. 1 and 2 ends in a vertical pillar which is surmounted by a general cutter support 49. This support is provided with a number of arms extending laterally and each supporting a cutter holder. These cutter holders may either be single and rotatably mounted (50) or single and vertically displaceable (51) or they may carry a number of tools (52) with plane of rotation at 45° as it will be explained further. They may also carry several tools mounted on two shafts arranged at right angles 53 in different parallel planes, these two shafts being capable of independent rotation. As regards the displaceable cutter holders 51, it may be stated that their vertical movements are effected through their connection with a threaded shaft 51′ by way of a block 51^2, this block having a threaded opening through which the shaft extends. Said shaft may be rotated in any suitable manner, as, for instance, by intermeshing bevel gears 51^3. On one of the shafts 54 of this cutter holder a sleeve 55 suspended from the cutter holder 53 by the intermediary of a ring 56 solid with this sleeve is mounted loosely. This sleeve ends at its lower part in a bevel pinion 57 meshing with the bevel wheel 58 mounted upon the shaft 59 of the cutter holder. The pinion 57 is provided at its lower part with claws with which the claws of a sleeve 60 mounted with a longitudinal feather on the shaft 54 may be caused to engage in such a manner as to enable this shaft to rotate with the pinion 57. In its median part the sleeve 55 carries helicoidal teeth 61 meshing with a wheel 62 with similar teeth loosely mounted upon the second shaft 63 of the cutter holder. This wheel is likewise provided with claws which may be brought into engagement with the claws of a sleeve 64 mounted with a longitudinal feather on the shaft 63 so as to cause this shaft to participate in the rotation of the screw.

A separate cutter 4′ driven by the gear wheels 65 and 66 may be added to the machine, gear 66 being mounted with a longitudinal feather on the shaft 67 participating in the rotation of the pulley cone 68 of the machine. On this shaft 67 there is provided a friction clutch, the female part 69 of which is loose upon the shaft. This part forms a pulley receiving a belt 70 driving the pulley 71 controlling the rotation of the cutters mounted upon the general support 49. The shaft of the pulley 71 is eccentric relatively to the axis of rotation of the support 49, and upon it there is keyed a toothed wheel 72 with which there en-

gages automatically the pinion 73 of that one of the cutter holders which is brought into operative position (53 in the present case) and this one only.

The movement of the cutter holders may be controlled automatically. For example, the shaft 67 has four pinions 74 keyed upon it; these pinions mesh respectively with one of the pinions 75 mounted loosely upon a hollow shaft 76, any one of which pinions 75 may be made fast to said shaft by suitable clutch mechanism, (not shown). The movement of shaft 76 may then be transmitted to the cutter holders by means of appropriate mechanical connections, the illustration of which is considered unnecessary, and is, therefore, omitted.

Instead of turning about a horizontal axis, the cutter and holder 53 might rotate around a vertical axis, or one arranged at any desired degree of inclination.

Fig. 4 shows the mounting of the cutter holder 52 in Fig. 1. The cutters are mounted in a hemispherical cap 5 mounted on a plate 6 cast with the frame together with the socket 7 which passes through it. It is inclined at 45° and provided with T-shaped projections engaged in a corresponding circular groove 8 formed beneath the cap 5. In the socket 7 there rotates a shaft 9 carrying a bevel gear wheel 10 meshing with the pinion 11 mounted at the end of the driving-shaft 3, and a pinion 12. The inclination of this shaft is such that when a cutter is brought into the vertical position, its pinion 13 meshes automatically with the pinion 12, while the pinions of the other cutters are separated from this same pinion. The vertical cutter is therefore the only one driven by the motor.

The cutter holder represented in Fig. 5 is similar to that just described, except that the cutters are not actuated except when they are horizontal. The cap 5 is suspended from the plate 6 in the same manner as before.

The mounting device hereinbefore described may of course be used in the case of a milling machine with a single cutter holder. In this case, either the frame or the table may be adjustable and controlled by suitable means.

The machine represented in Fig. 6 is a modification in which the control is central. The stand 1 of the machine ends in a vertical pillar which is surmounted by the rotatable support 49 which rests thereon and is provided with a number of lateral arms, each supporting a cutter holder of a special type, varying with the work to be effected. The toothed wheel 72 is mounted upon a vertical shaft arranged in line with the axis of rotation of the general support 49, and the pinions 73 of the cutter holders are engaged with it, or disengaged from it by causing them to slide upon their respective shafts 77. Owing to this arrangement any cutter 4 may be controlled in any position of the support 49.

The machine is provided with a special cutter holder represented in Figs. 7, 8 and 9, the method of mounting which enables the distance between the cutter and the center of the pillar and also the vertical height of the tool to be varied. It is constituted by a box 78 fixed to the general support 49 by T-shaped parts capable of sliding in an appropriate circular groove formed in the support. This box is provided with two rectangular openings formed from top to bottom in which a carriage 79 may be displaced horizontally by means of a screw 80 controlled by a hand wheel 81. Inside this carriage the cutter holder 82 properly so-called is able to slide vertically under the influence of a screw 83 connected with the operating hand wheel 84 by the pinions 85 and 86. The cutter receives its movement by the intermediary of the shaft 9′, connected by an appropriate transmission to the pinion 72 and carrying the pinion 12′ in mesh with the pinion 13′ of the cutter. It should be noted that all the other cutter holders already described might be fitted to this machine according to the work to be effected. The rotation of the general support 49 might likewise be controlled either manually or automatically.

In the arrangement represented in Figs. 10 and 11, the general support 49 is integral with the stand 1 of the machine and it is the tables 2 which are able to rotate on ball bearing 87 to enable the work to be brought into operative position. The machine should then be controlled entirely from above, but the other arrangements are similar to those in Figs. 1 and 2.

In particular this machine renders it possible either to treat simultaneously two similar or different parts by two similar or different cutters or to effect simultaneously a succession of similar operations on two similar parts or while one part is being milled on a table to effect the mounting of another part upon the second table which has remained free.

It should be noted that all the rotating parts of the milling machines may be mounted upon ball bearings.

I claim:

1. In a multiple milling machine, the combination, with a turret and a work table, one of which elements is rotatable relative to the other; of a plurality of lateral arms connected to the turret; and a tool holder carried by each arm, certain of said holders being each provided with a plurality of milling tools and being mounted for bodily rotation relative to said turret. to bring any one of the tools carried thereby into operative position.

2. In a multiple milling machine, the com-

bination, with a turret and a work table; of a plurality of lateral arms connected to the turret; and a tool holder carried by each arm, said turret being rotatable relative to said table to bring any one of said holders into operative position with respect thereto, and certain of said holders being each provided with a plurality of milling tools and being rotatable independently of and relative to said turret, to bring any one of the tools carried thereby into operative position.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ARTHUR VERNET.

Witnesses:
HENRI BEURET,
PAUL BLANCHET.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."