Feb. 24, 1925. 1,527,705

F. M. ROGERS

DRILLING MACHINE

Filed Aug. 18, 1923 2 Sheets-Sheet 1

Fig. 1

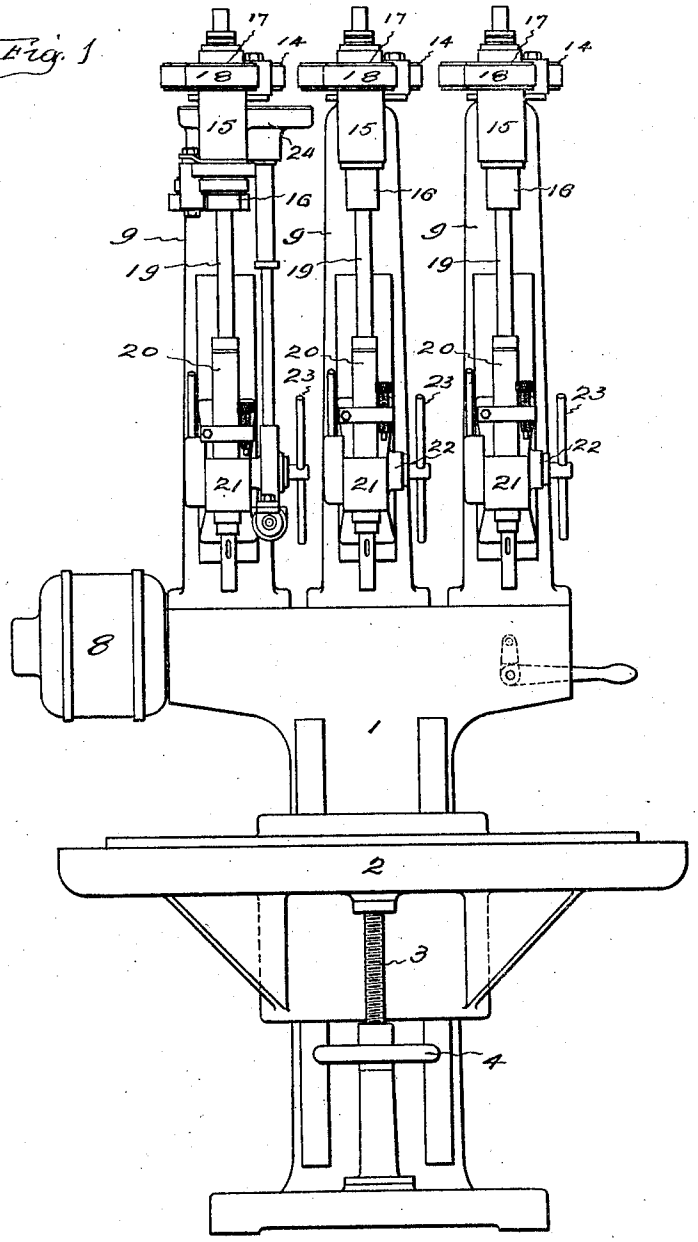

Fig. 4

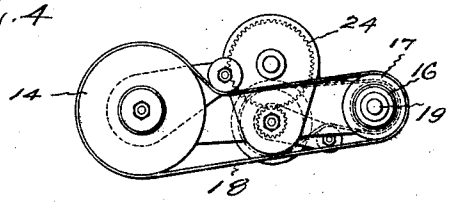

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Fig. 2.

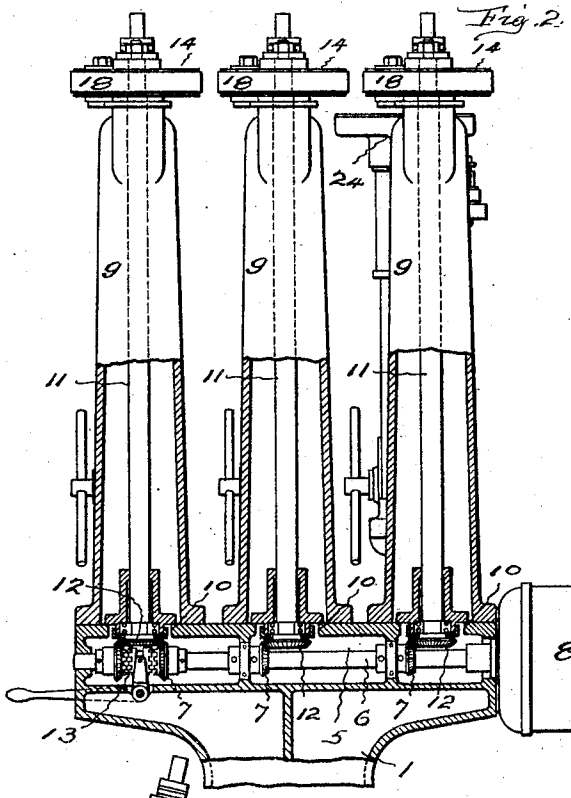


Fig. 3

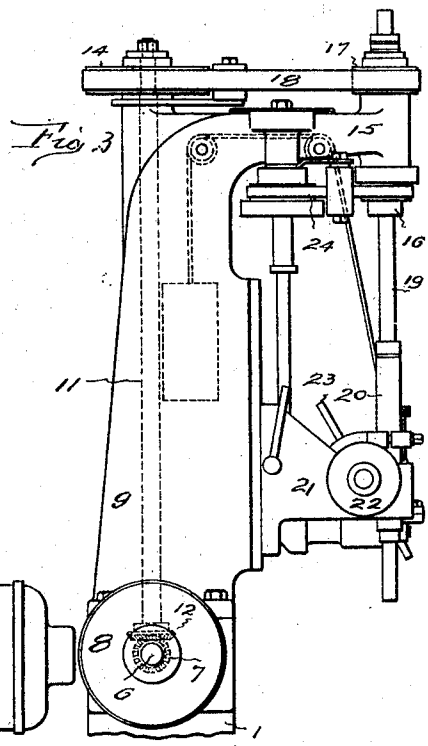


Fig. 5.

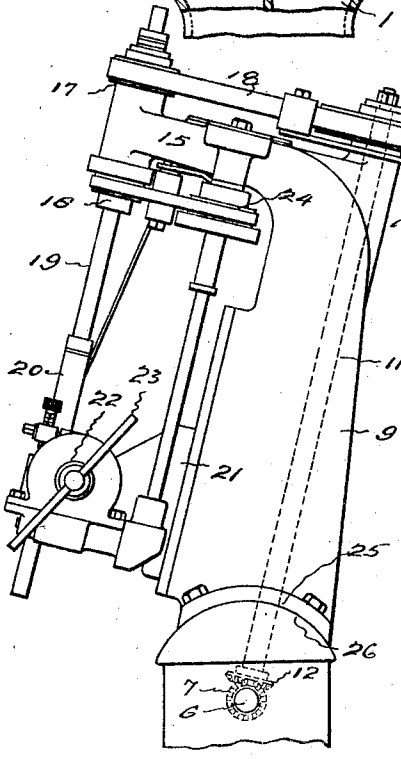
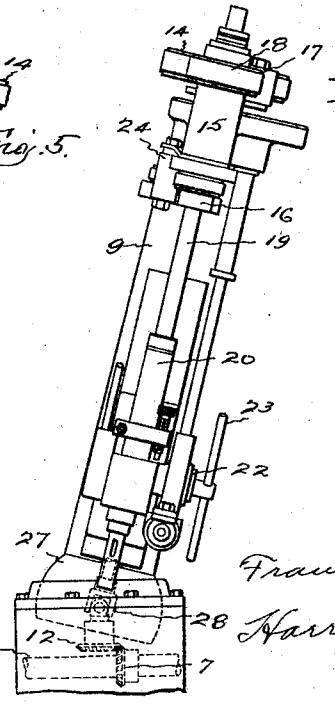


Fig. 6



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UNITED STATES PATENT OFFICE.

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DRILLING MACHINE.

Application filed August 18, 1923. Serial No. 658,006.

To all whom it may concern:

Be it known that I, FRANK M. ROGERS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Drilling Machines, of which the following is a specification.

This invention relates to those machines for drilling, boring, threading, tapping and performing similar operations on metal, which have rotatory tool spindles that are fed vertically toward the work and are belted to vertical shafts which are geared to horizontal motor driven shafts.

The object of the invention is to provide a construction which readily lends itself to the building after the same model of a single spindle machine or a machine having in a row any desired number of tool spindles that may all be rotated from one motor at the same speed or each at a different speed either in the same or different directions, and may be fed by hand or automatically, whereby the manufacturing cost of such machines is much reduced; the driving mechanisms being so designed and arranged that it is not necessary for an operative to go back of the machine, thus reducing operating cost, and being so compact and located that the machines may be placed closely together back to back, thus economizing floor space and thereby effecting a considerable saving of overhead expense, particularly in a shop in which a large number of spindles are used.

This object is attained by building as a unitary structure the supporting base of required width and having the usual work table, with a driving shaft extending horizontally from side to side and provided with bevel gears equal in number to the spindles to be driven, located in an oil compartment in the top of the base, and an electric motor attached to one side of the base with its armature shaft in alignment with and coupled to the horizontal shaft. Mounted on this base unit are one or more pillar units, depending on the desired number of spindles, each of which pillar units comprises a tubular pillar encasing a vertical shaft with a bevel gear at its lower end and a pulley at its upper end, the pillar having at the front arms with suitable bearings carrying a rotatable tool spindle and its feed, which spindle at its upper end has a pulley belted to the pulley on the upper end of the vertical shaft in the pillar. Each pillar unit is independent in all ways of the other and is adapted to be detachably fastened to the base unit with the gear at the lower end of the vertical shaft removably engaging with a gear on the horizontal drive shaft in the base unit. This allows a pillar unit to be set up on or removed from a base unit without interfering with the connections or the operation of the other pillar units of a multiple spindle machine and permits any or all of the units to be mounted so as to be adjustable for the purpose of drilling holes at any desired angle.

In the accompanying drawings Figure 1 shows a front view of a three-spindle machine that embodies the invention, the construction illustrated being such that two tool spindles are hand fed while one tool spindle may be fed automatically, and one tool spindle may be rotated in either direction. Fig. 2 shows a rear view of the same with parts cut in section. Fig. 3 shows a side elevation. Fig. 4 shows a top view of the machine. Fig. 5 shows a side view of a pillar unit mounted so that it may be tilted forward or backward. Fig. 6 shows a front view of a pillar unit mounted on a universal joint so that it may be rotated and tilted at any required angle.

The base 1 of the machine illustrated has attached to its front side a table 2 that is adapted to be raised and lowered in the usual manner by screw 3 and hand wheel 4. At the top of the base in a chamber 5 which is adapted to contain lubricating oil or grease, is a horizontally supported shaft 6 that extends from side to side and is provided with bevel gears 7. Attached to one side of the base is the casing 8 of an electric motor, the armature shaft of which is aligned with and coupled to the horizontal shaft. These elements,—the base, table, horizontal shaft with its gears, and the motor—comprise the base unit which may be made any desired width, according to the number of spindles it is to support.

Each pillar unit comprises a tubular pillar 9 that is detachably fastened to the top of the base over an opening 10 to the chamber containing the horizontal shaft. Arranged in and supported by suitable bearings in each pillar and central with the horizontal shaft is a vertical shaft 11. At the lower end of the vertical shaft which is encased

in the pillar is a bevel gear 12 that is designed to, when the pillar is placed in position, mesh with a bevel gear on the horizontal shaft. The horizontal shaft may be, if desired, provided with two bevel gears for each gear at the lower end of the vertical shaft, either of which may be connected to the horizontal shaft by the clutch 13 depending upon the direction it is desired to rotate the tool spindle. At the upper end of each vertical shaft is a pulley 14. At the top of the pillar is a forwardly extending arm 15 containing the usual spindle drive sleeve 16 that is rotatably supported but held against vertical movement. On the drive sleeve is a pulley 17 that is connected by a belt 18 with the pulley 14 at the upper end of the vertical shaft. Extending through the spindle drive sleeve and adapted to be rotated thereby but having an independent vertical movement is the common tool spindle 19. The lower end of the spindle is supported by the usual feed sleeve 20 mounted in the arm 21 that is fastened to the front of the pillar and carries the feed mechanism 22. The spindle feed may be operated by the common form of hand bar 23 or by a power feed 24. The particular form of feed mechanism forms no part of this invention and consequently is not explained in detail, it being merely illustrated and referred to as showing the possibilities of varying the feeds of the spindles of the independent pillar units of a multiple machine of the character described.

With the described construction having as one unit the drive shaft arranged horizontally in a chamber in the top of the base and the motor directly connected to this drive shaft and attached to the side of the base, and having independent pillar units, each comprising the pillar that contains the vertical shaft and supports the spindle which may be fed in any desired manner, pillar units for a large number of machines may be made up at one time and applied to the base units as desired by simply locating them in position and securing them in place, for the gears at the ends of the vertical shafts are positioned so as to intermesh with the gears on the common horizontal shaft when the pillars are properly set up. Any desired number of pillar units may be placed on a base, the base of course being sufficiently wide to receive them, and the gears may be proportioned and intermeshed in such manner as to produce the required speed and the desired direction of rotation. The gears on the horizontal shaft may, as illustrated on one side of Fig. 2, be arranged in pairs and provided with a clutch adapted to connect either one or the other of the gears according to the work required. This would enable the spindle so geared to be used for carrying a threading head or tapping tool. The pulleys at the upper ends of the vertical shafts and the spindles can be set up originally or removed and changed to obtain the required speed of rotation of the spindles.

One or more of the pillars may be, as illustrated in Fig. 5, mounted so as to be capable of being tilted forward or backward for the purpose of drilling holes at an angle. In this case the lower end 25 of the pillar is curved and fitted upon a curved surface 26 on the top of the base, the centers of the curves being the axis of the horizontal drive shaft in the base so that the gears on the lower end of the vertical shaft in the pillar and the horizontal shaft in the base will remain in mesh regardless of the angular adjustment of the pillar.

With this arrangement of unitary pillars independently mounted upon the base and driven from a common horizontal drive shaft, it is also possible to support one or more of the pillar units so as to be capable of tilting forward and back or from side to side. To accomplish this, as illustrated in Fig. 6, the lower end of the pillar may be provided with a spherical head 27 which is fitted into a spherical cavity in the top of the base. In this case it is necessary to provide a universal joint 28 in the vertical shaft in the gear carried by the pillar unit, so that the gears on the vertical shaft and horizontal shaft will mesh regardless of the adjustment of the pillar.

The several pillar units in a multiple machine of the character described are so independent that the spindles may be rotated and fed at the desired speeds all the same or each different from the other. As there are no belts or other means which require adjusting or attending to at the back of the machine, it is unnecessary for an operative to ever get behind the machine and this being the case the machines may be placed closely together back to back so as to economize floor space in a factory. If desired any one of the pillar units of this machine may be removed and replaced without interfering with the operation of the other units, and one or more of the pillar units may be mounted on the base unit so as to be able to drill a hole at a required angle.

The invention claimed is:—

1. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base, a gear on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, and a pillar detachably fastened to the top of the base, said pillar encasing a vertical shaft that has a gear at its lower end, said pillar also supporting a rotatable and vertically mov-

able tool spindle, gearing connecting the vertical shaft and the tool spindle, and means for feeding the tool spindle vertically, said pillar, vertical shaft, spindle and spindle rotating and feeding means being applied as a unit to and adapted as a unit to be removed from the top of the base, the gear at the lower end of the vertical shaft removably engaging with a gear on the horizontal shaft when said pillar unit is located on the base.

2. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base, gears on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, and a plurality of pillars detachably fastened to the top of the base, each of said pillars encasing a vertical shaft that has a gear at its lower end engaging a gear on the horizontal shaft in the base and each of said pillars supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle, and means for feeding the tool spindle vertically, said pillars being independent detachable units each having a tool spindle, vertical driving shaft and a gear engaging a gear on the common horizontal drive shaft in the base.

3. A drilling machine comprising a base unit having a driving shaft extending horizontally from side to side in a chamber in the top, gears on said horizontal shaft in said chamber, and a motor attached to one side at the top with its armature shaft aligned with and coupled to the horizontal shaft, and a plurality of independent pillar units fastened to the top of the base, each of said pillar units having an encased vertical shaft with a gear at its lower end engaging a gear on the horizontal shaft, and a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle, and means for feeding the tool spindle vertically.

4. A drilling machine comprising a base unit having a driving shaft extending horizontally from side to side in a chamber in the top, gears on said horizontal shaft in said chamber, and a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, and a plurality of independent units each having a vertical shaft with a gear at its lower end engaging a gear on the horizontal shaft, a rotatable and vertically moving tool spindle, gearing connecting the vertical shaft and the tool spindle, and means for feeding the tool spindle vertically.

5. A drilling machine comprising a base unit having a driving shaft extending horizontally from side to side in a chamber in the top, gears on said horizontal shaft in said chamber and a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, and a plurality of independent units detachably fastened to the top of the base unit, each having a vertical shaft with a gear at its lower end engaging a gear on the horizontal shaft, a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and tool spindle, means for feeding the tool spindle vertically, and driving means connecting the spindle with its feeding means.

6. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base, gears on said horizontal shaft in said chamber, means for driving the horizontal shaft, means for shifting the gears on the horizontal shaft, and a plurality of pillars fastened to the top of the base, each of said pillars encasing a vertical shaft that has a gear at its lower end engaging a gear on the horizontal shaft in the base and each of said pillars supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle vertically, said pillars being independent detachable units each having a tool spindle, vertical driving shaft and a gear engaging a gear on the common horizontal drive shaft in the base.

7. A drilling machine comprising a base unit having a driving shaft extendng horizontally from side to side in a chamber in the top and gears on said horizontal shaft, and a plurality of independent pillar units fastened to the top of the base, each of said pillar units having an encased vertical shaft with a gear at its lower end engaging a gear on the horizontal shaft and a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle vertically.

8. A drilling machine comprising a supporting base, and a plurality of independent pillars fastened to the top of the base, each of said pillars encasing a vertical shaft that has a gear at its lower end and supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle vertically, and a common drive shaft arranged horizontally in the top of the base and provided with gears in engagement with the gears at the lower end of the vertical shafts.

9. A drilling machine having a base unit with a driving shaft extending horizontally from side to side in a chamber in the top of the base and gears on said horizontal shaft in said chamber, and a plurality of

pillar units detachably fastened to the top of the base, each pillar unit having an encased vertical shaft with a gear at its lower end adapted to engage a gear on the horizontal shaft in the chamber in the top of the base, a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle vertically, said gears on the horizontal drive shaft being movably fastened thereto whereby they may be engaged with or disengaged from the gears at the lower ends of the vertical shafts.

10. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base, a gear on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, a plurality of pillars mounted on the top of the base, each pillar encasing a vertical shaft that has a gear at its lower end engaging the gear on the horizontal shaft in the base, each pillar also supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle, and means for feeding the tool spindle longitudinally, and means whereby each pillar, vertical shaft and tool spindle may, as a unit, be adjusted angularly with relation to the base and independently of the other units.

11. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base, a gear on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, a plurality of pillars mounted on the top of the base, each pillar encasing a vertical shaft that has a gear at its lower end engaging the gear on the horizontal shaft in the base, each pillar also supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle longitudinally, and means whereby each pillar, vertical shaft and tool spindle may, as a unit, be tilted forward or backward with relation to the base and independently of the other units.

12. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base and supported by bearings fixed in said chamber, a gear on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizonal shaft, a pillar mounted on the top of the base, said pillar encasing a vertical shaft that has a gear at its lower end engaging the gear on the horizontal shaft in the base, said pillar also supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle longitudinally, and means whereby said pillar, vertical shaft and tool spindle, may, as a unit, be oscillated on a horizontal axis and rotated on a vertical axis, which axes are coincident with the axis of the driving shaft and motor shaft.

13. A drilling machine comprising a supporting base, a driving shaft extending horizontally from side to side in a chamber in the top of the base and supported by bearings fixed in said chamber, a gear on said horizontal shaft in said chamber, a motor attached to one side at the top of the base with its armature shaft aligned with and coupled to the horizontal shaft, a pillar mounted on a universally adjustable support on the top of the base, the axis of which support is coincident with the axis of the driving shaft, said pillar encasing a vertical shaft that has a gear at its lower end engaging the gear on the horizontal shaft in the base, said pillar also supporting a rotatable and vertically movable tool spindle, gearing connecting the vertical shaft and the tool spindle and means for feeding the tool spindle longitudinally.

FRANK M. ROGERS.