W. ARTER.

GRINDING MACHINE.

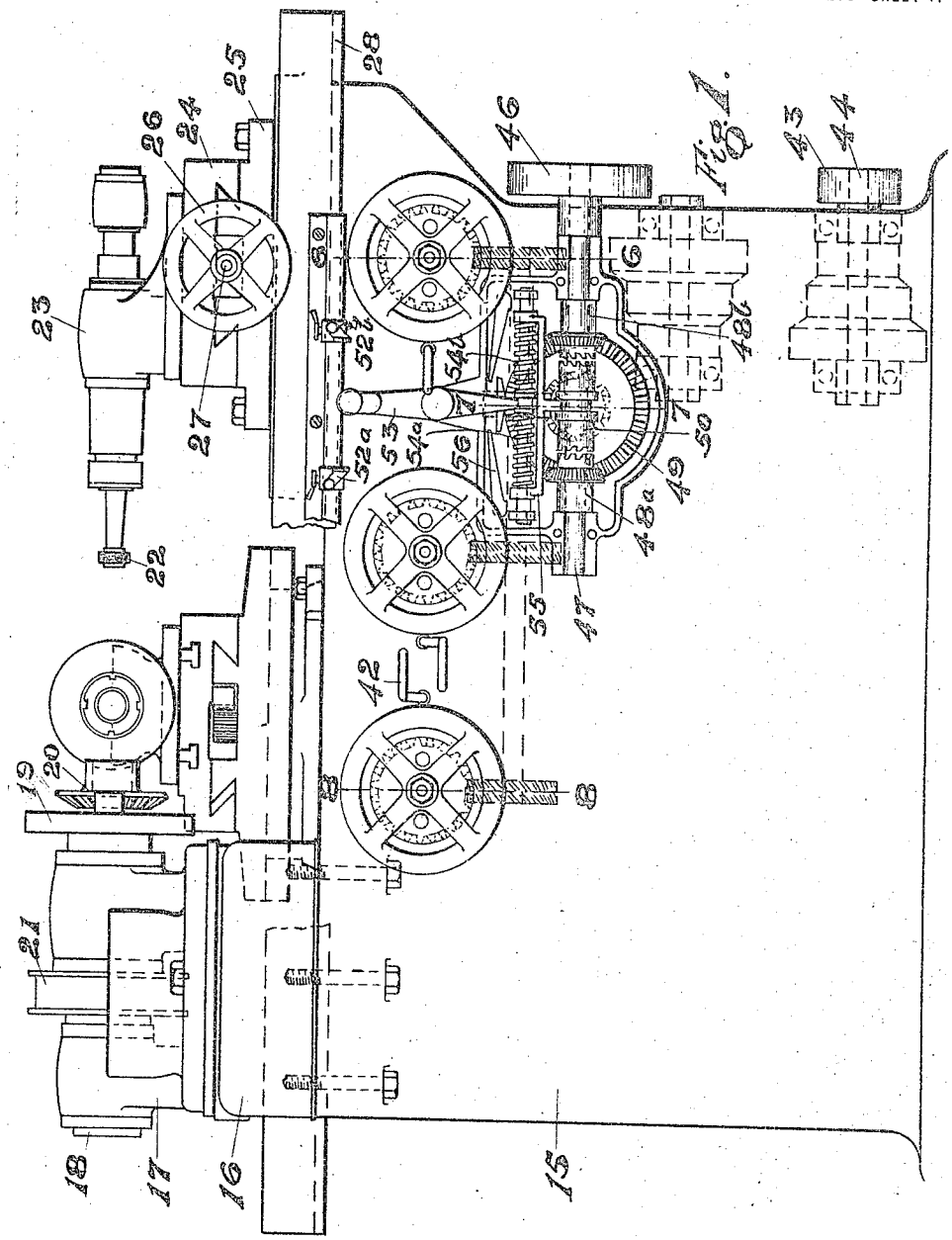
APPLICATION FILED AUG. 28, 1914.

1,294,024.

Patented Feb. 11, 19

5 SHEETS—SHEET 1.

Fig. 1.



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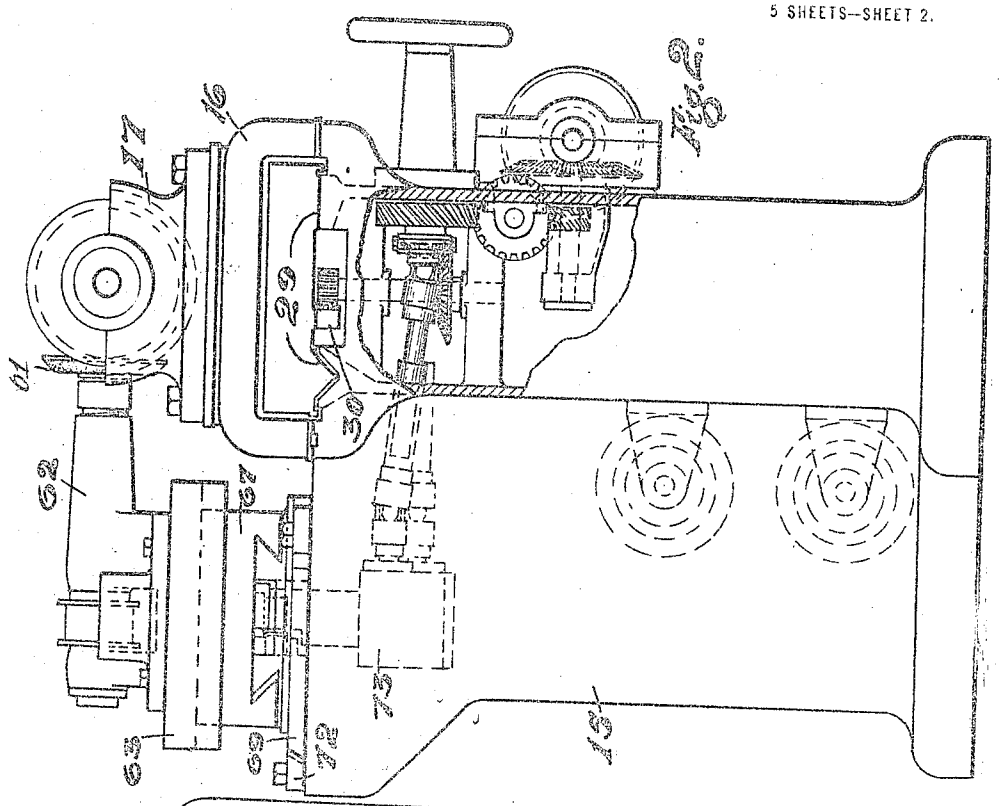
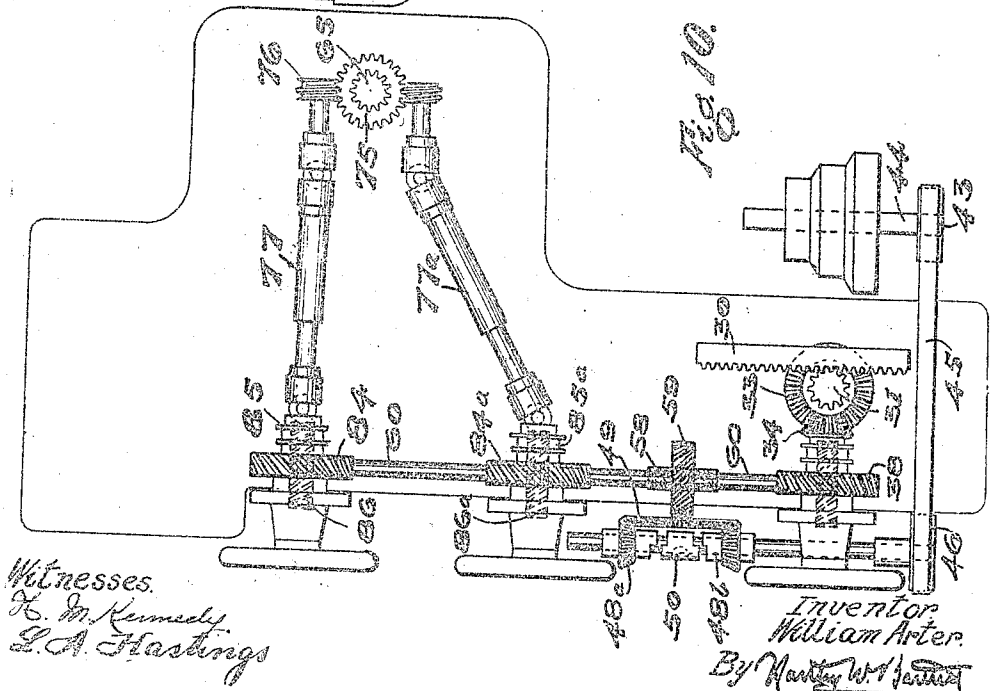


Fig. 10.



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GRINDING MACHINE.

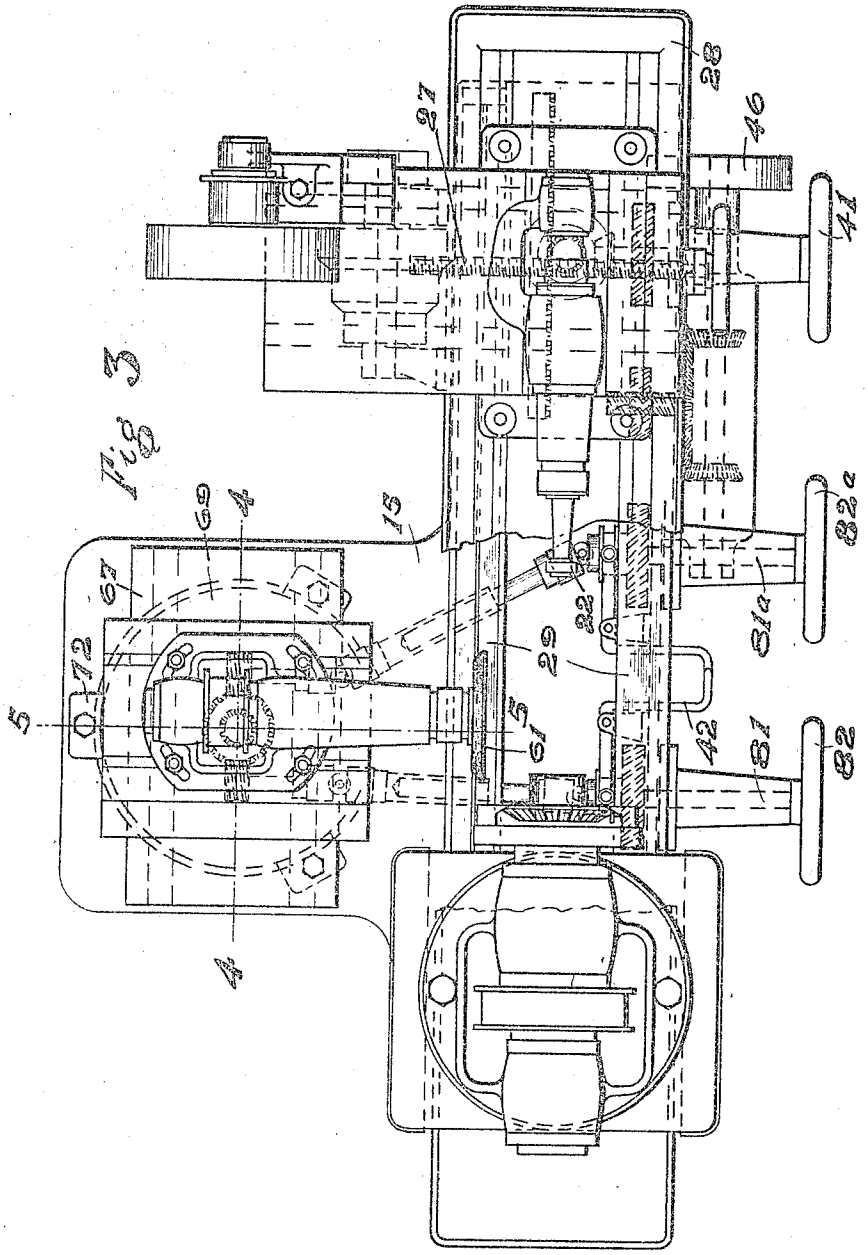
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5 SHEETS—SHEET 3.

Fig. 3



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APPLICATION FILED AUG. 28, 1914.

1,294,024.

Patented Feb. 11, 1919.

5 SHEETS—SHEET 4.

Fig. 4.

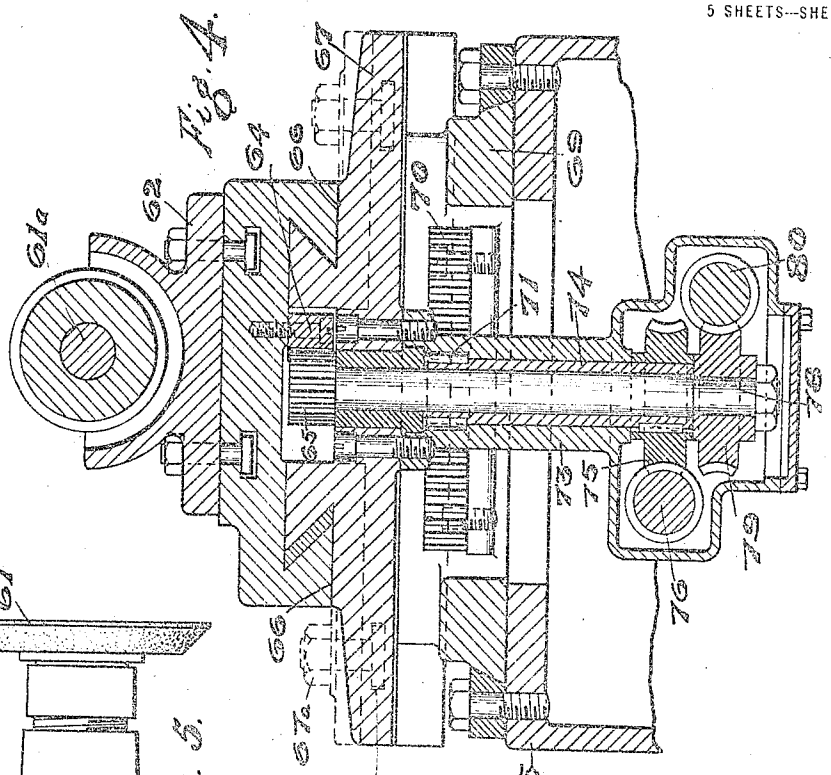
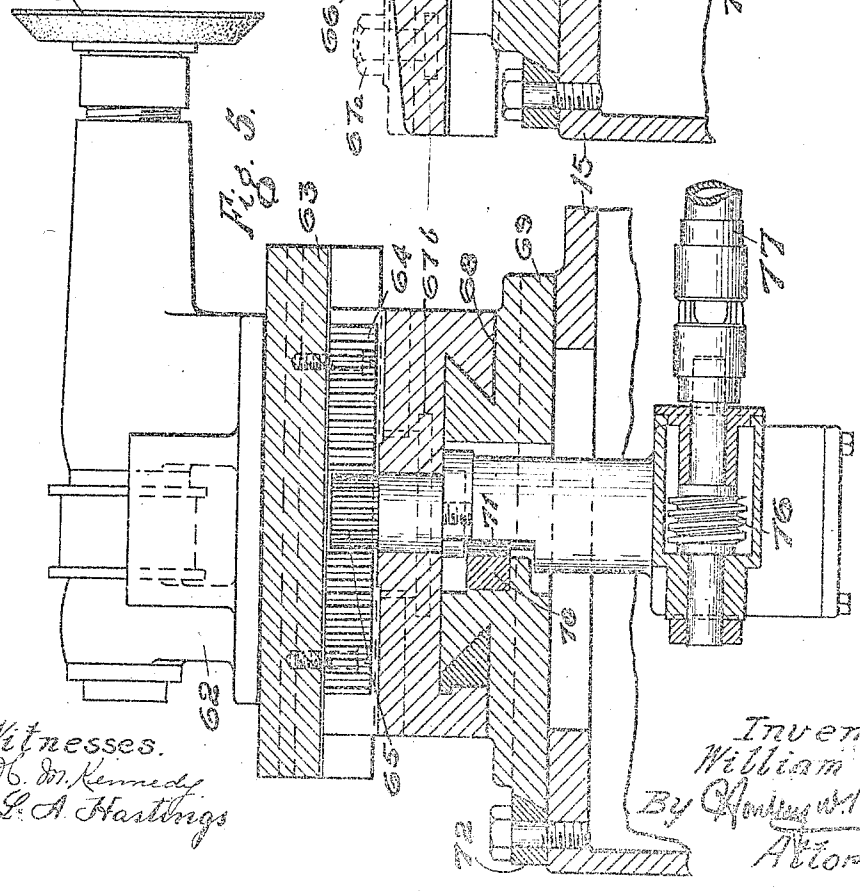


Fig. 5.



Witnesses.
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GRINDING MACHINE.

APPLICATION FILED AUG. 28, 1914.

1,294,024.

Patented Feb. 11, 1919.

5 SHEETS—SHEET 5.

Fig. 6.

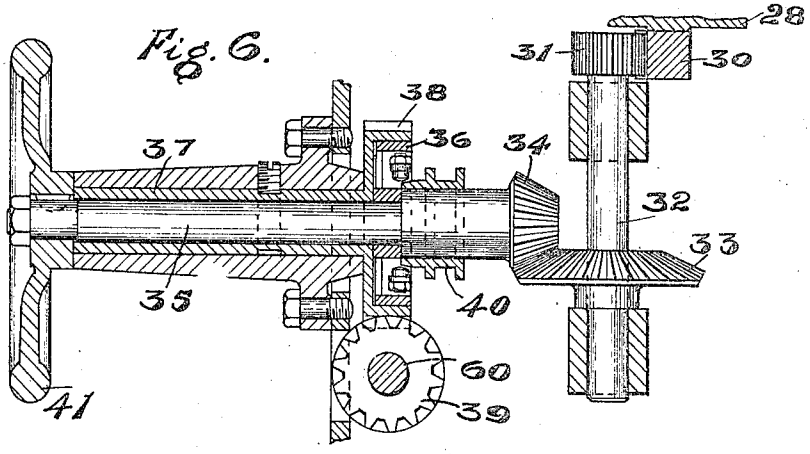


Fig. 7.

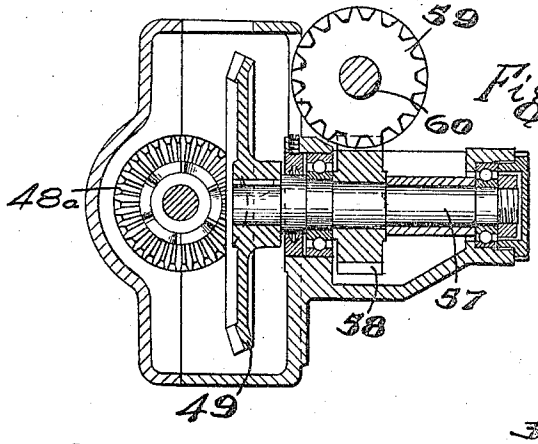
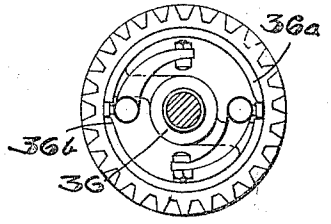


Fig. 9.



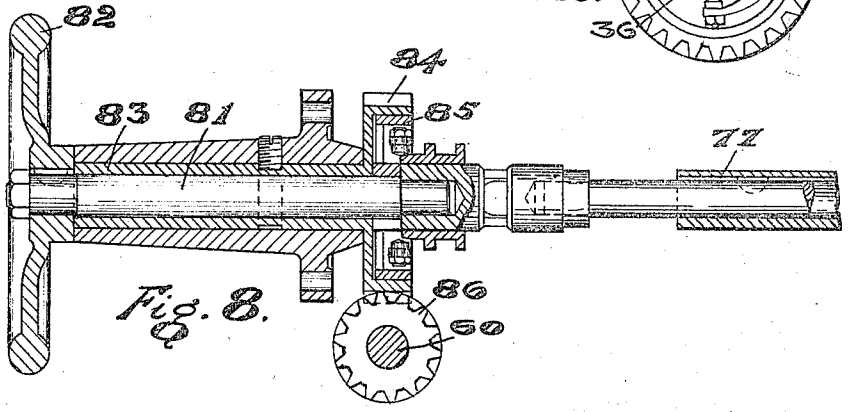


Fig. 8.

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UNITED STATES PATENT OFFICE.

WILLIAM ARTER, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE PERSONS-ARTER MACHINE COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

GRINDING-MACHINE.

1,294,024. Specification of Letters Patent. Patented Feb. 11, 1919.

Application filed August 28, 1914. Serial No. 859,122.

To all whom it may concern:

Be it known that I, WILLIAM ARTER, a subject of the King of England, residing at Worcester, in the county of Worcester, State of Massachusetts, have invented a certain new and useful Improvement in Grinding-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to grinding machines arranged to grind either consecutively, or simultaneously, two surfaces, such as the exterior and interior curved surfaces of a hollow cylinder, and has for its object the grinding of these surfaces at one setting, whether the surfaces are parallel or at an angle to each other.

This object is accomplished by means of two wheel heads, working in conjunction, one, the ordinary operated type wheel head, as commonly used on machines for internal grinding, and the other, what may be known as an auxiliary wheel head, the construction and operating of which is the special feature of this invention.

One feature of this invention is the method of mounting the auxiliary wheel head whereby a reciprocating motion may be obtained in any direction, independently of the travel of the ordinary wheel head.

Other features are the means for operating the various parts of the auxiliary wheel head, the means for transmitting power thereto, and other features which will be fully described hereinafter and included in the claims.

One embodiment of the invention is shown in the drawings in which;—

Figure 1 is a front elevation of the invention complete, with portions removed to show the parts concealed thereby.

Fig. 2, an end elevation.

Fig. 3, plan view.

Fig. 4, section on line 4—4 of Fig. 3.

Fig. 5, section on line 5—5 of Fig. 3.

Fig. 6, section on line 6—6 of Fig. 1.

Fig. 7, section on line 7—7 of Fig. 1.

Fig. 8, section on line 8—8 of Fig. 1.

Fig. 9, end view of structure shown in Fig. 6 and Fig. 8, showing clutch finger arrangement.

Fig. 10, diagrammatical view showing the driving mechanism of the machine.

Referring to the drawings, the invention comprises a base 15 on which is mounted a bridge 16 provided with a bearing bracket 17, carrying a shaft 18 on one end of which is a work chuck 19 of any desired pattern to hold the work 20. The work 20 here a bevel wheel is rotated by means of the pulley 21, mounted on the shaft 18 and driven from any convenient source of power, not here shown.

A grinding wheel 22 is carried by the bearing bracket 23, mounted on the top cross transverse plate 24, which can slide on the bottom cross transverse plate 25, the motion of which is obtained by means of the hand wheel 26 and the screw 27. The above are mounted on a table 28 and adapted to be reciprocated on ways 29 in a line parallel with the axis of the work chuck spindle. A rack 30 is attached to the underside of the table 28, and is engaged by a pinion 31, best shown in Fig. 6, mounted on a shaft 32, on which is also mounted a bevel gear 33 in mesh with the bevel gear 34 on the shaft 35, on which is also mounted the clutch ring 36. Running loose on the shaft 35 is the hollow sleeve 37 carrying the spiral gear 38 in mesh with the spiral gear 39. A clutch thimble 40 operated by the lever 42 causes the two parts 36^a and 36^b of the piece 36, best shown in Fig. 9, to expand and frictionally hold the spiral gear 38. Thus when a reverse rotating motion is given to the gear 39; a reciprocating motion may be transmitted thereby to the table 28. When the clutch is not engaged this table may be operated by hand through the hand wheel 41.

At the rear of the machine is a pulley 43 mounted on a change speed shaft 44, which here by means of a belt 45 drives the pulley 46 mounted on the shaft 47, on which run loosely the bevel gears 48^a and 48^b, engaged with the bevel gear 49. Mounted on the shaft 47 and rotating with it is a clutch sleeve 50, which is free to slide thereon. On the table 28 is the piece 51, on which are attached the dogs 52^a and 52^b. These engage with the lever 53 pushing it over against the springs 54^a and 54^b moving the piece 55 after releasing the pawl 56, thus moving the clutch sleeve 50 alternately in mesh with the bevel gears 48^a and 48^b, effecting thereby a reverse rotating motion to the bevel gear 49, which is transmitted through the shaft 57 to the spiral gear 58, in mesh with the

spiral gear 59, rigidly mounted on the shaft 60, which thus gets a reversing rotary motion. The above are well known and form no features of this invention.

Another grinding wheel 61 mounted on shaft 61ª is supported by the bearing bracket 62 on the plate 63, to the under side of which is rigidly attached the rack 64 in engagement with the pinion 65, which when given a reversing rotary motion transmits a reciprocating motion to the plate 63 sliding on the ways 66 of the intermediate plate 67. On the bottom of plate 67 are the ways 68, here at right angles to the ways 66, but by making the intermediate plate 67 in two pieces, one to swivel on the other, as indicated in dotted lines in Figs. 4 and 5, these ways could be adjusted to any desired angle. In case the plate 67 be divided in the manner indicated, the two parts thereof should be held together by bolts 67ª passing through the upper section and having their heads seated in annular slots 67ᵇ in the lower section. By this means the two sections can be bound together when properly adjusted.

The intermediate plate 67 slides on the turret base 69, on which is rigidly attached the rack 70, in mesh with the pinion 71. When in operation the turret base 69 is preferably held rigidly to the base 15 by means of the clamps 72 or other suitable means, which when released allows the base 69 and the parts mounted thereon, to be swiveled to any desired angle.

To the intermediate plate 67 is rigidly attached the housing 73, in which is mounted the hollow sleeve 74, on the upper extremity of which are here cut teeth forming the pinion 71, and on the lower extremity is rigidly attached the worm wheel 75 in mesh with the worm 76, connected to the flexible shaft 77.

Within the sleeve 74 is suitably mounted the shaft 78 on the upper extremity of which is the pinion 65, and on the lower extremity the worm wheel 79 in mesh with the worm 80, to which is attached the flexible shaft 77ª. The other ends of the flexible shafts 77 and 77ª are respectively attached to the shafts 81 and 81ª which can be respectively operated by the hand wheels 82 and 82ª. Around the shafts 81 and 81ª are the sleeves 83 and 83ª respectively provided with friction clutches 85 and 85ª as shown in Fig. 8. The gear 84 and 84ª engage spiral gear 86 and 86ª rigidly mounted on the shaft 60. Thus a reversing rotary motion is transmitted through the shaft 60 to the flexible shafts 77 and 77ª, and from thence to the pinions 71 and 65 respectively.

When the base 69 is clamped to the base 15, the rack 70 is absolutely stationary and consequently the intermediate plate 67, and all attached thereto must move when the pinion 71 is rotated. Thus by allowing the housing 73 to move with its attachments, and by having flexible drives thereto, it is possible to swivel the whole auxiliary head in any direction. It will readily be seen that by rotating the pinion 65, only the parts above the intermediate plate 67 are moved.

It will thus be seen that the machine is almost universal in its action. This will be clearly seen in connection with the grinding of the hollow cylinder. By adjusting the grinder 61 in the manner described so that it shall move parallel with the axis of the grinder 22, the exterior surface of the cylinder which is ground by the grinder 61 will be parallel to the interior surface which is ground by the grinder 22. Likewise the exterior surface may be ground parallel to the axis of the clyinder and the interior surface at a taper thereto, both exterior and interior surfaces at a taper to the axis of the cylinder, the interior surface at a taper to the axis of the cylinder, the exterior surface parallel to and the end at right angles thereto, and many other combinations which will be readily evident to any one skilled in the art.

The applicant is aware that a considerable number of changes in the construction and arrangement of parts may be made by any one skilled in the arts without departing from the scope of his invention and therefore he does not care to be limited to the particular embodiments herein shown and described.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a device of the class described, a bed, a work holder mounted on said bed, a grinding element movable relative to said work holder, a turret, a second grinding element mounted on said turret, power driven means for moving said turret relative to said work holder, and power driven means for moving said second grinding element relative to said turret.

2. In a device of the class described, a bed, a work holder, a grinding element movable to and from said work holder, a turret mounted on said bed adjacent to the path of said grinding element but offset therefrom and having a portion thereof movable on said bed substantially parallel to said path, a second grinding element revolubly mounted on the movable portion of said turret, and power driven means for feeding said second grinding element on said movable portion at an angle to the direction of travel thereof.

3. In a device of the class described, a turret comprising a movable base, a plate slidable in guides on said base, a second plate slidable in guides on the first plate, a grinding element mounted on said second plate, means for moving the first plate on

said base including flexible shafting, and means for moving the second plate on said first plate including flexible shafting.

4. In a device of the class described, a turret comprising a revoluble base, a plate slidably mounted on said base, a second plate slidably mounted on the first plate, a grinding element mounted on said second plate, means for moving said first plate on said base at a predetermined rate, and means for moving said second plate on said first plate at a predetermined rate.

5. In a device of the class described, a bed, a work support revolubly mounted thereon, a grinding element movable substantially longitudinally of said bed, and power fed means for grinding the periphery of the work carried by said work support at an angle to the axis of rotation of such support.

6. In a device of the class described, a bed, a work support revolubly mounted thereon, a grinding element movable substantially longitudinally of said bed, means for grinding the periphery of the work carried by said work support at an angle to the axis of rotation of such support, and selective means for feeding such periphery grinding means either by power or manually.

7. In a device of the class described, a turret comprising a base, a plate slidable on said base, a second plate slidable on the first plate, a grinding element mounted on said second plate, driving means for said first plate, and driving means for said second plate concentric with the driving means for said first plate.

8. In a device of the class described, a turret comprising a revoluble base, a plate slidably mounted on said base, a second plate slidably mounted on the first plate, a grinding element mounted on said second plate, means for operating said first plate including a driving shaft carried thereby, and means concentric with said driving shaft for moving said second plate.

9. In a device of the class described, a bed, a revoluble work support mounted on said bed, a grinding head movable to and from said work support, a second grinding head adjacent to said work support, and means for moving said second grinding head relative to said work support at an acute angle to the axis of such support.

10. In a device of the class described, a pair of rotating grinding wheels, a rotating shaft, a second rotating shaft operatively connected with one of said grinding wheels to impart a feeding motion thereto, a geared connection between said first and second shaft, a third rotating shaft operatively connected with the other of said grinding wheels to impart a feeding motion thereto, and a flexible connection between said first and third shaft.

11. In a device of the class described, a pair of rotating grinding wheels, a feeding mechanism for each of said grinding wheels, and a flexible connection between said feeding mechanisms.

12. In a device of the class described, a pair of rotating grinding wheels, a feeding mechanism for each of said grinding wheels, a flexible connection between said feeding mechanisms, and means for reciprocating both of said grinding wheels.

13. In a device of the class described, a pair of rotating grinding wheels, a feeding mechanism for each of said grinding wheels, a flexible connection between said feeding mechanisms, means for reciprocating both of said grinding wheels, and means for regulating the distance traveled by said grinding wheels.

14. In a device of the class described, a turret comprising a movable base, a plate slidable in guides on said base, a second plate pivotally mounted on the first plate, a third plate slidable in guides on said second plate, a grinding element mounted on said third plate, means for moving the first and second plate together on said base including flexible shafting, and means for moving the third plate on the second plate including flexible shafting.

15. In a device of the class described, a turret comprising a base, a plate slidable on said base, a second plate pivotally mounted on the first plate, a third plate, slidable on the second plate, a grinding element mounted on said third plate, and driving means for said third plate, concentric with the driving means for said first and second plate together.

16. In a device of the class described, a bed, a work holder mounted on said bed, a grinding element movable relative to said work holder, a turret, a second grinding element mounted on said turret, power driven means for moving said turret relative to said work holder, power driven means for moving said second grinding element relative to said turret, and means for reciprocating each of said elements.

17. In a device of the class described, a bed, a work holder mounted on said bed, a grinding element movable relatively to said holder, a turret, a second grinding element mounted on said turret, and flexible means for moving said second grinding element relative to said turret.

18. In a device of the class described, a bed, a work holder mounted on said bed, a grinding element movable relatively to said holder, a turret, a second grinding element mounted on said turret, flexible means for moving said second grinding element, and means for reciprocating said second grinding element.

19. In a device of the class described, a bed, a work holder mounted on said bed, a

grinding element movable relatively to said holder, a turret, a second grinding element mounted on said turret, flexible means for moving said second grinding element, means for reciprocating said second grinding element, and means for regulating the travel of said second grinding element.

In testimony whereof I affix my signature in the presence of two witnesses.

WILLIAM ARTER.

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