

A. MACDONALD.

MACHINE FOR GRINDING, TURNING, AND FINISHING SHAFTS, PISTON RODS, PINS, TOOLS,
AND OTHER MACHINED WORK.

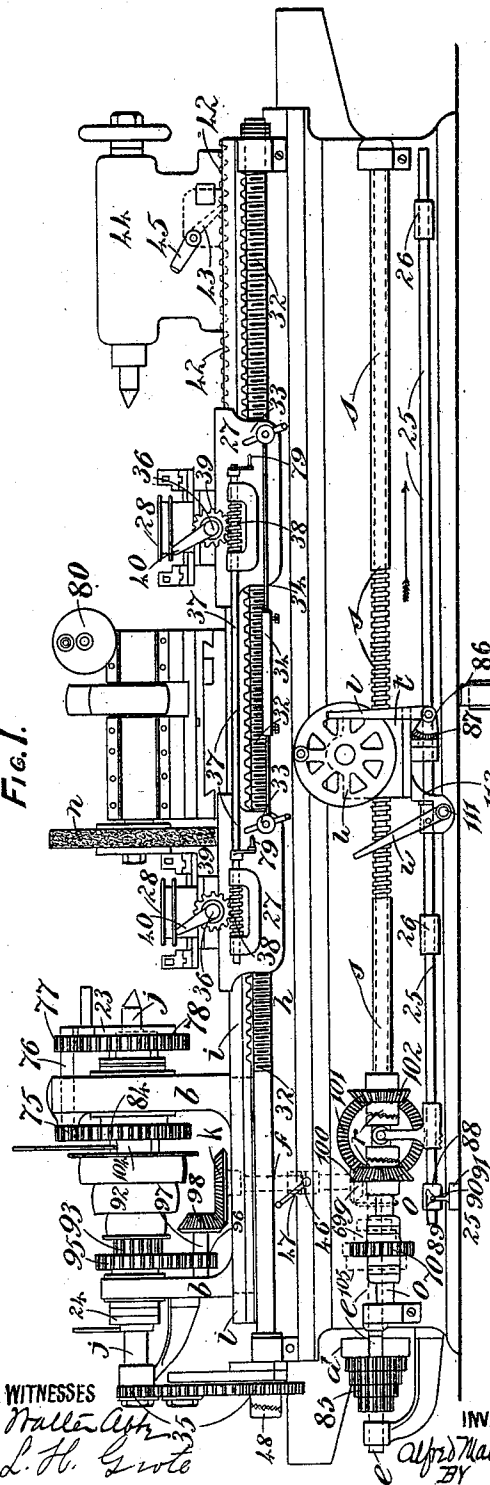
APPLICATION FILED JUNE 4, 1906.

Patented Dec. 27, 1910.

4 SHEETS—SHEET 1.

979,975.

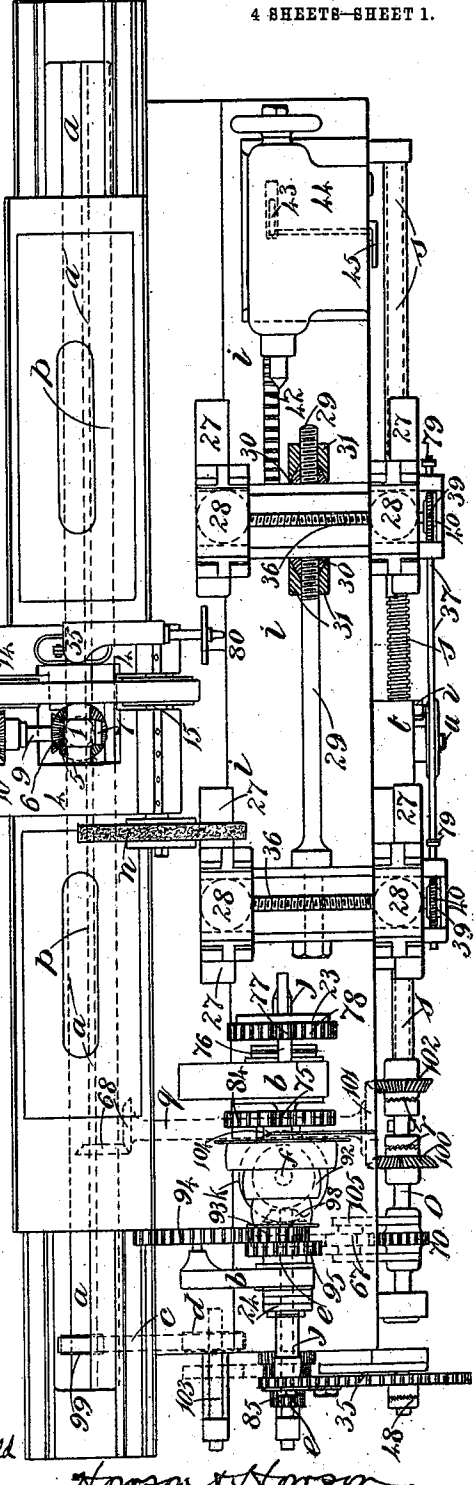
Fig. 1.



WITNESSES
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Fig. 2.



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Fig. 3.

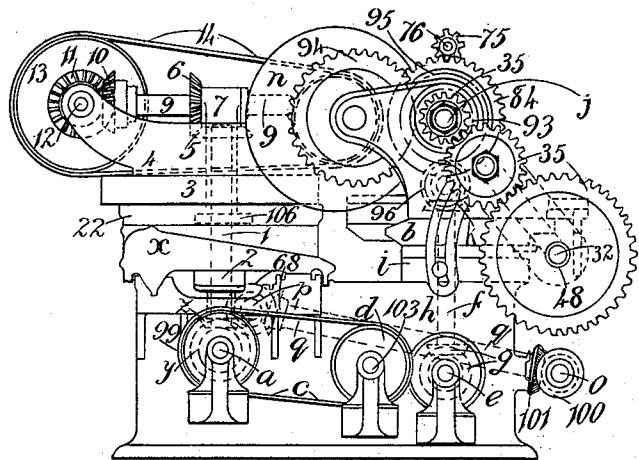


Fig. 4.

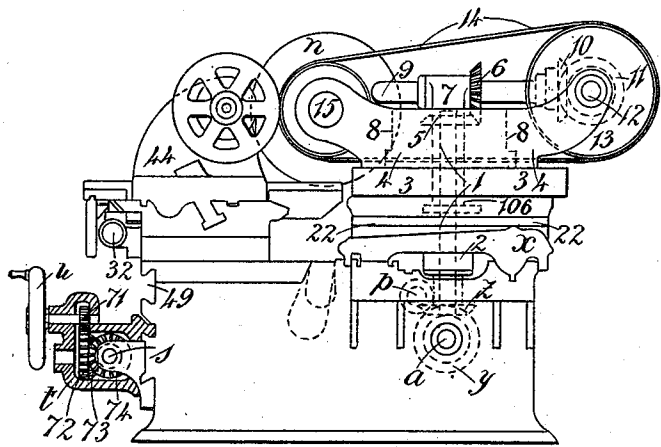
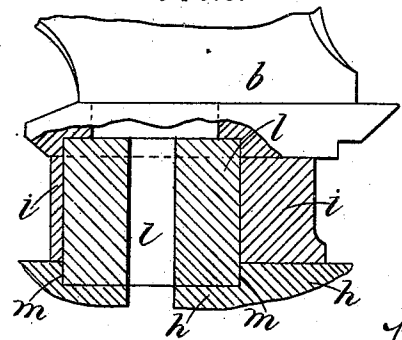


Fig. 5.



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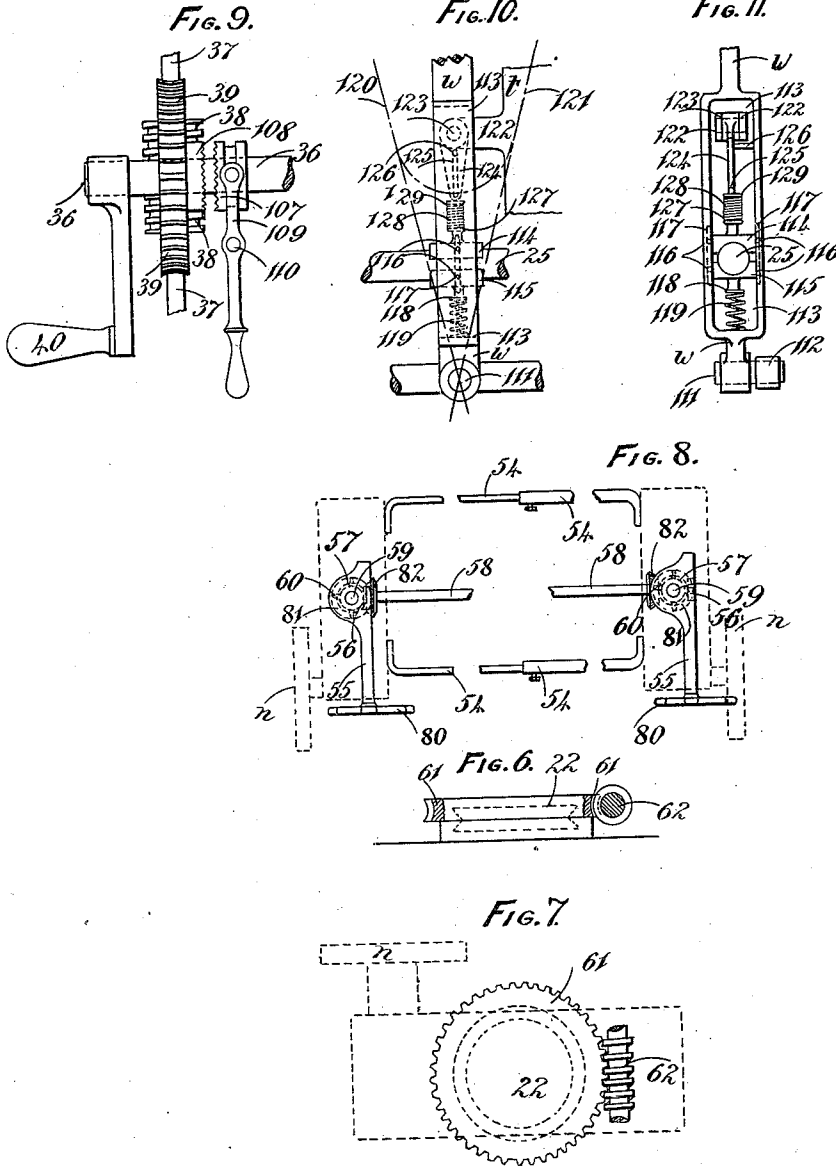
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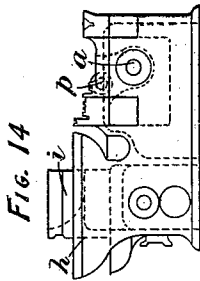


Fig. 16.

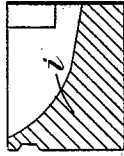


Fig. 17.



Fig. 18.



Fig. 19.

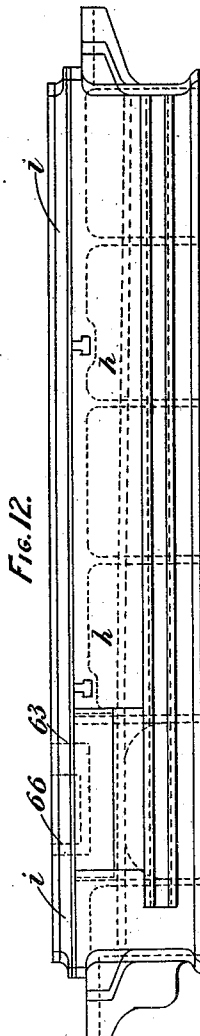


Fig. 13.

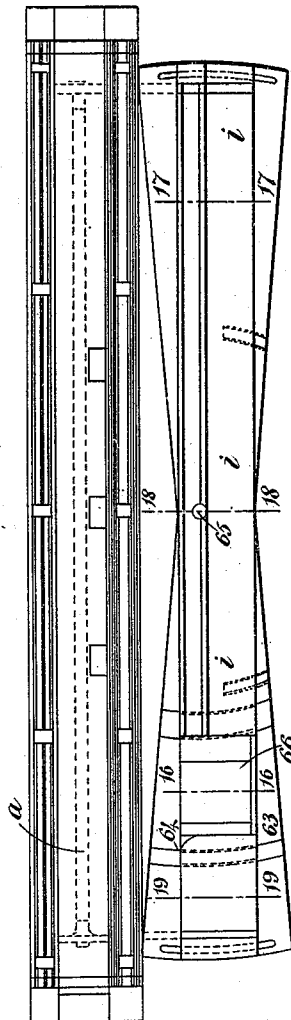
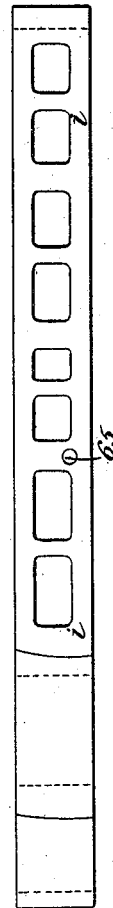


Fig. 15.



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UNITED STATES PATENT OFFICE.

ALFRED MACDONALD, OF WHITEINCH, SCOTLAND.

MACHINE FOR GRINDING, TURNING, AND FINISHING SHAFTS, PISTON-RODS, PINS, TOOLS, AND OTHER MACHINED WORK.

979,975.

Specification of Letters Patent.

Patented Dec. 27, 1910.

Application filed June 4, 1906. Serial No. 320,143.

To all whom it may concern:

Be it known that I, ALFRED MACDONALD, engineer, a subject of the King of Great Britain and Ireland, and a resident of Whiteinch, Lanarkshire, Scotland, have invented certain new and useful Improvements in Machines for Grinding, Turning, and Finishing Shafts, Piston-Rods, Pins, Tools, and other Machined Work, of which the following is a specification, and for which a patent has been applied for in Great Britain, No. 21,397, dated the 21st of October, 1905.

This invention has reference to improvements in machines for grinding, turning, and finishing shafts, piston rods, pins, tools and other machined work; the principal object being to produce a universal grinding machine, and dispense with the usual overhead gear.

To avoid confusion some of the ordinary appliances and details appertaining to an ordinary lathe have been omitted from the drawings and specification. And in order that my said invention and the manner of carrying same into practice may be properly understood I have hereunto appended explanatory drawings in which—

Figures 1 and 2 are a front elevation and plan view respectively of the general arrangement of a machine as constructed in accordance with my improvements for grinding, turning and finishing articles. Fig. 3 is an end view looking at the headstock end of machine, and Fig. 4 a similar view looking at the tailstock end of machine. Fig. 5 is an end elevation partly in section and broken away, showing one way of giving swinging motion to the headstock. Figs. 6 and 7 are a detached elevation, partly in section, and a plan view respectively showing worm gearing as applied to the swivel joint for grinding purposes. Fig. 8 is a detached diagrammatic plan view showing an arrangement when two emery wheels are used to cooperate with two turning saddles. Fig. 9 is a detached plan view of the end of surface screw and its connections and Fig. 10 is a detached front elevation showing a detail of the mechanism and Fig. 11 is a side elevation corresponding to Fig. 10. Fig. 12 is a front elevation, Fig. 13 a plan view, and Fig. 14 an end view illustrating the bed and swivel plate as being formed with a gap. Fig. 15

is an inverted plan view of the swivel plate, while Figs. 16, 17, 18 and 19 are transverse sections of the swivel plate as taken respectively on lines 16, 17, 18 and 19 on Fig. 13.

Referring to these drawings:—the ordinary driving cones or pulleys 92 are placed in their usual position on a sleeve on the headstock spindle *j* and motion is conveyed from them to the main internal shaft *a* as follows:—On the outer side of the usual gear wheel 93 which conveys motion to the ordinary back gear 94 (only partially shown) of a lathe there is fitted a gear wheel 95 which gears with a pinion 96 mounted on a short shaft 97. On the other end of this shaft 97 a bevel wheel 98 is mounted which engages with the bevel wheel $\frac{1}{2}$ mounted on the upper end of vertical shaft *f*. This vertical shaft *f* passes down through the base of headstock *b*, swivel plate *i* and top of bed *h*. The vertical shaft *f* becomes the pivot or center upon which the headstock *b* is swung around when required at a right or any other angle. On the lower end of this vertical shaft *f* there is a bevel wheel *g* which engages with a bevel wheel mounted on the inner end of the short horizontal shaft *e* which is situated under the headstock *b*. The other end of shaft *e*, projects beyond the end of machine and motion is conveyed across to the main internal shaft *a* by means of gearing 85 from shaft *e* to auxiliary shaft 103. A pulley *d* is mounted on this shaft 103 and motion is conveyed from pulley *d* to pulley 99 on shaft *a* by means of belt *c*. Variable speeds to the emery wheel are obtained by any suitable means such as an ordinary nest of gears 85 fitted on the short shaft *e* at the headstock end of the machine. The emery wheel drive and universal motion to emery wheel is obtained by a bevel wheel *y* mounted on and sliding in a feather way on the main internal shaft *a*. This bevel wheel *y* engages another bevel wheel *z* keyed to the lower end of a vertical shaft 1. These two bevel wheels *y*, *z*, are carried in a bracket 2 bolted to the under side of the main slide *x* thus the bevel wheels are carried with the main slide and receive their motion from main internal shaft *a*. The vertical shaft 1 passes up through the main slide *x*, the cross slide 3 and the emery wheel base 4. On the upper end of the vertical shaft 1 there is a bevel

wheel 5 carried on a bracket 106, and this engages another bevel wheel 6 carried in a bracket 7 bolted on the upper side of the emery wheel base 4 which bridges a large slot 8; and thus when the emery wheel base 4 is swung around on the swivel joint 22 the bevel wheels y , z , and 5 remain in the same position in relation to the main slide x , while bevel wheel 6 rotates around bevel wheel 5 with the center of the vertical shaft 1 as its pivot, so as to obtain complete circular motion. The motion of the above bevel gear is conveyed by a sliding and revolving shaft 9 which slides through one of the bevels, 6. On the rear end of this shaft 9 is another bevel wheel 10 engaging a bevel wheel 11 on a shaft 12 on the rear end of the emery wheel base 4. On this shaft 12 is a pulley 13 and its motion is transmitted by means of a belt 14 to the emery wheel spindle 15. This enables the emery wheel n to be drawn toward or pushed from the work while in motion and the belt at a uniform tension. Ordinary means are used for feeding the emery wheel n toward or from the work (not shown).

To obtain the traverse of the emery wheel n a shaft o in front of and lying parallel to the horizontal shaft e is geared to the latter by means of a gear wheel 67. This parallel horizontal shaft o is connected to the main emery wheel slide screw p in rear part of machine, by means of an inclined shaft q which lies at right angles to shaft o and the main emery wheel slide screw p the connection between these two shafts and screws being made by bevel gears 68 and 100, 101 and 102. Difference or variation in the speed of traverse is obtained in any suitable manner as by mounting a nest of gears 69 on shaft e , and using in connection therewith sliding gear 67 carried by a bracket 105 on shaft o and sliding gear 70 on shaft o .

Any ordinary means is used for traveling the main emery wheel slide x along the main emery wheel slide screw p such as a half nut connected with the under side of main slide x and engaging with the slide screw p (not shown). The reverse motion to the emery wheel main slide x is secured by three bevel wheels 101, 102, 100, and clutch r arranged at end of horizontal shaft o and the inclined shaft q . Gear wheel 100 is fast on the independent shaft o , gear 102 is loose on shaft s and the clutch r is splined to both shafts o and s .

The emery wheel main slide x is controlled by means of a screw s along front of machine, on the end of which is one of the aforementioned three bevel wheels 102. When shaft e revolves shaft o by means of sliding gears 70 and 67 and nest of gears 69 the bevels 100, 101 and 102, will revolve screw s and the carriage t which is provided with a nut gearing with the latter will travel along

screw s by means of bevel wheels 73 and 74, one of which 74 is connected to screw s by means of a feather and groove. When the clutch r is moved into gear with opposite bevel wheel 102 by mechanism described below the screw s will revolve in opposite direction and therefore the carriage t will travel along screw s in opposite direction. Working on this front screw s is the small carriage t , already referred to, to which is attached a hand wheel u and two handles v and w . When the hand wheel u is turned then by means of gear wheels 71, 72, bevel wheels 73 and 74, the screw s will revolve and by means of clutch r and bevel wheels 101, and 102 inclined shaft q , and bevel wheels 68 the main emery wheel slide screw p will revolve and bring the main emery wheel slide x to any desired point along the bed of machine. One of the above handles w reverses the traverse motion of the main slide x by means of clutch r and bevel wheels 100, 101 and 102, and the other handle v locks the clutch in the inoperative position, thus permitting the main slide x to be fully controlled by the hand wheel u . On shaft 25 is mounted a sleeve 88 formed with a slot 89, and a pin 90 is mounted on a bracket 91 secured to front of machine, and this pin 90 engages with slot 89 in sleeve 88. When the handle v is moved then by means of quadrant 86 and bevel wheel 87, the shaft 25 will revolve for a part of a revolution and move the pin 90 into the bottom of slot 89, where it locks the clutch r in its mid position. The pin 90 must be moved to top of slot 89 before the shaft 25 can travel by means of handle w or collars 26 to shift the clutch r into gear with either bevel wheel 100 or 102.

A handle w is fulcrumed on a pin 111 secured in a bracket 112 which is fixed to the carriage t and this handle w is formed with a loop 113. Mounted on shaft 25 there are two half collars 114 and 115 which are formed with pins 116 which work in slots 117 in loop 113 of handle w . The lower half collar 115 has a disk 118 attached to it and a spring 119 is mounted between disk 118 and bottom of loop 113. When the handle w is in the vertical position the spring 119 is compressed and forces the half collar 115 against the shaft 25, and when the handle w is in either of the positions 120 or 121 the spring 119 is expanded and the lower half collar 115 is not forced on to shaft 25. A bracket or lug 122 is secured on the carriage t and this bracket is fitted with a pin 123 on which is mounted a cam 124 formed with a slot 125, a pin 126 is fitted in handle w and works in this slot 125. A disk 127 is secured to the upper half collar 114 and a spring 128 is mounted between this disk 127 and another disk 129 and this disk 129 bears on the lower end of cam 124

and the spring 128 is compressed and forces the half collar 114 downward on to shaft 125, when the handle is in the vertical position. The pin 126 is in the top of slot 125 when the handle is in this position. When the handle is in the positions 120 or 121 the cam 124 has swung around on the pin 123 by means of the pin 126 secured in handle *w* and the spring 128 is not compressed and the half collar 114 is not forced on to the shaft 25. When both half collars 114 and 115 commence to press on shaft 25 the latter is moved and moves the clutch *r* into gear with either bevel wheel 100 or 102. When handle *w* is in position 120 or 121 the half collars 114 or 115 will travel along shaft 25 without shifting it. When the clutch *r* is in gear with bevel wheel 100 the carriage *t* travels in the direction of arrow and when said clutch is in gear with bevel wheel 102 the carriage *t* travels in the opposite direction of arrow.

A shaft 25 is placed beneath and parallel to the screw *s* on front of machine and on this shaft 25 there are two adjustable collars 26 arranged so that this shaft becomes the tappet rod and being connected with the two handles *v*, *w*, already described, and the front carriage *t*, full control of the emery wheel slide *x* is secured either by hand or power in either direction and for any distance along the bed within the capacity of the machine, and this mechanism also gives automatic reversal to the emery wheel slide *x* already described.

Above the main slide *x* and below the cross slide 3 there is a swivel joint 22 which permits the emery wheel base 4 and the cross slide 3 to swing around to any angle. This swivel joint 22 is concentric with the vertical shaft 1 carrying the bevel wheels and passing up through the cross slide 3 and the emery wheel base 4.

In regard to the dead center for grinding between centers, motion is brought over the top of the front bearing of the headstock *b* from the gearing on the spindle *j* to the driving plate 23 by means of a gear wheel 84 mounted on a sleeve on spindle *j*, thus enabling the gear wheels and cones to run free on spindle *j*. The gear wheel 84 gears with a wheel 75 mounted on spindle 76. On other end of this spindle 76 is mounted a gear wheel 77 which drives a gear wheel 78, which drives driving plate 23 which revolves freely on the headstock spindle *j* and a clutch 24 on spindle at the rear end of headstock *b* secures the spindle *j* from revolving; and the gear wheel 84, usually a fixture on the headstock spindle, is disengaged by a clutch on 104 on same, so that when grinding on live centers the plate 78 and its operating gearing remain stationary. The means whereby the dead center is obtained has already been herein described as in use in

the ordinary universal machine, and in addition to this all the grinding mechanism can be thrown out of gear when turning by pulling a clutch from its gearing. This clutch 46 is placed on the vertical shaft *f* situated under the headstock *b* and is controlled by a handle 47 in front of the machine. The shaft *f* is formed in two parts. On the lower end of the top part of shaft *f* is secured a clutch and the top end of the lower part of shaft *f* has a bearing inside clutch concentric with the upper part of shaft *f*. On the upper end of lower part of shaft *f* there is a sliding clutch which is engaged and disengaged with upper clutch by means of handle 47 in front of machine.

For turning operations I fit *V* or other shaped bearings on the swivel table *i* to which are fitted saddles 27 intended for use as turning saddles. On these saddles 27 I mount boxes 28 for rapid manipulation of work. These saddles 27 are connected by means of a rod 29 fastened to one, and partly screwed along the body and fitted with adjustable nuts at each side of the other saddle. One of these nuts is turned cone shaped on the outside and split in two halves 30. The other nut 31 is partly screwed in the inside and the other part bored out cone shaped to fit the cone part of the two halves 30, thus giving quick adjustment to the saddles 27 when setting them to cut two different parts of a piece at one time. The leading screw nut handles 33 are connected by means of a rod 34 which is also adjustable with regard to length and by this means the saddles 27 can be wrought independent or together. The leading screw 32 receives its motion in the ordinary way by being geared by pinions 35 on the outer end of the headstock spindle *j* and the ordinary reverse feeding is also obtainable. The surface screws 36 in both saddles 27 may be connected by rod 37, worms 38 and worm wheels 39, and thus the tools on both saddles 27 may be moved simultaneously to the work by one handle 79. When front and back tool boxes 28 are fitted to the saddles 27, these tool boxes may be connected by surface screws 36 on which are formed right and left hand threads thus permitting all four tool boxes to be drawn to and from the center of the machine by turning the handle 79.

As shown in Fig. 9 a clutch 107 is secured by means of a feather to the surface screw 36 and this clutch 107 is put into and out of gear with another clutch 108 by means of handle 109 fulcrumed on a pin 110 which is fitted into the saddle 27. The clutch 108 is mounted on the back of worm wheel 39 which is free to rotate on surface screw 36. The surface screws 36 in each saddle 27 can be connected or disconnected from each other by shifting the clutch 107 into or out of gear with clutch 108, and the tool boxes 28

in one saddle 27 can be brought together or farther apart at will by turning the surface screw 36 by means of handle 40.

The turning mechanism may be thrown out of gear when grinding by means of a clutch 48 placed on the end of the leading screw 32.

A number of teeth 42 are cast along the upper side of the swivel plate *i* but below the surface, and a lever 43 hanging loosely in the tail stock 44 drops into the recesses between the teeth 42, thus relieving the tail stock holding down bolts of excessive strain when under heavy cutting. When the tail stock 44 is required to be shifted along the bed of the machine, the lever 43 referred to can be quickly lifted from the notch by a handle 45 in front of the tail stock 44.

Instead of placing the pulleys 92 in their usual position on headstock spindle *j* they may be placed on the end of main internal shaft *a* and motion be conveyed to the work by the same process and gears as when they are placed in their usual position, the only difference being that instead of driving from headstock spindle *j* down to main internal shaft *a*, the drive shall be from shaft *a* to headstock spindle *j*. By another modification the aforesaid pulleys 92 may be placed on the end of the horizontal shaft *e* under the headstock *b* and motion be conveyed from this part to the work by the same process and same gears as already described under the first arrangement, and the belt *c* be carried across the end of machine to drive the main internal shaft *a* which is the medium through which motion is conveyed to the emery wheel *n*. By a further modification the pulleys may be arranged on auxiliary shaft 103 midway between the short horizontal shaft *e* and the main internal shaft *a*, then motion be conveyed to the short horizontal and main internal shafts *e* and *a* by means of belts; and motion from the short horizontal shaft *e* to headstock *b* obtained as already stated. In the last three modifications described when the drive is from the shaft *a* to the headstock spindle *j*, the use of the clutch 46 is unnecessary.

By a modified arrangement as shown in Fig. 5, the swinging motion to the headstock *b* other than making the vertical shaft *f* the pivot is obtained by having a large circular strip *l* concentric with the center of the vertical shaft *f*, this strip *l* being part of or attached to the headstock base and passing through the swivel table *i* enters a recess *m* in the top of the bed *h*.

When two emery wheels *n* are required to cooperate with the two turning saddles 27, as shown in Fig. 8, the saddles are clamped together by means of two rods 54 that can be adjustable, thus placing the emery wheels *n* at any required distance

from each other, and both can be controlled by the one hand.

Each emery wheel hand feed 55 is controlled by worm 56 and worm wheel 57, the worms 56 being carried in the hand feed brackets 80 while the worm wheels 57 are carried on vertical shafts 59 and gives the cross motion to the emery wheel *n* by rack and pinion which is situated in emery wheel base 4. On each vertical shaft 59 are mounted bevel gears 81, 82, which are clamped to said shaft 59 by star handle clamping device 60 that can be connected or disconnected at the will of the operator and these bevel gears 81, 82, being connected by an extension rod 58 the hand feeds can be used conjointly or independently as required. Both wheels *n* will thus be fitted with automatic feeds so that independent or united action may be obtained.

A worm wheel 61 as shown in Figs. 6 and 7 may be cast around the upper part of the swivel joint 22 and a worm 62 may engage it, thus enabling a concave surface to be ground to a perfect radius.

As shown in Figs. 1 and 2 the swivel plate *i* is mounted on the top of bed *h* and is made to swivel with the shaft *f* as pivot. The headstock, tailstock, and the saddles are mounted on the swivel plate *i*. In the modified form of swivel plate *i*, shown in Figs. 12 to 19, a large gap 63 is cast in the bed of machine the ends of which are circular arcs 64 which have their centers concentric with the pivot 65 of the swivel plate *i* or table which is preferably at the center. The swivel plate *i* is offset at 66 and bears at this point in a depression 63 in the bed. Thus the swivel plate *i* bears on the top of bed and on the top of the part forming the gap 63 in the bed. When the pivot 65 for swivel plate *i* is placed in the center of same, shaft *f* under the headstock *b* is fitted with a universal joint and an extension joint, so that motion may be transmitted by said shaft *f* while the swivel plate is swung to one side. To permit this, a slot is cut transversely across the top of machine bed under the swivel plate *i*. The outside ends of the gap piece 66 in swivel plate *i* are circular arcs and fit loosely the corresponding arcs in the bed, thus giving a solid bearing and a substantial gap swivel plate. This swivel plate *i* moves on a pivot 65 similar to the ordinary universal grinder. When swung to an angle to the front or rear of machine for taper work even in extreme positions it has a solid support having its bearing ledges extending along the front and back of the bed of machine which increase in breadth as the taper of the work increases in distance from the pivot 65 of swivel plate *i*. The gap part 66 of the swivel plate *i* also swings out or in on a similar but shorter ledge. The gap 63 in bed and the gap 66 in swivel plate *i* may

be placed at headstock end or in the middle of the bed, or one at each end, or one at tailstock end only, and thus it is proposed to give one or more gaps at any point between the centers of the machine.

What I claim is:—

1. The combination of a frame; a headstock; driving mechanism therefor; a driving shaft; means including a gear spindle for connecting the headstock driving mechanism and said driving shaft; the headstock being free to swivel around said spindle; a movable structure a tool carried thereon; and means including a shaft extending transversely of the frame for operating said structure from said driving shaft to move it longitudinally of the machine.

2. The combination of a headstock; driving mechanism thereon; a driving shaft; mechanism including a gear spindle connecting the headstock driving mechanism and said driving shaft; a tool actuated from said shaft; with a swivel ring for the headstock surrounding said spindle and entering a recess in the bed so as to permit said headstock to turn around the spindle.

3. The combination of a tool slide; a slide screw therefor; and means for driving the same; with a mechanism for controlling said means; said mechanism comprising interposed gearing and a clutch for disconnecting one part of the gearing from the other; a

screw driven by said gearing; a carriage traveling on said screw; and means in connection with said carriage for controlling said clutch.

4. The combination of a tool slide; a slide screw therefor; and means for driving the same; with a mechanism for controlling said means; said mechanism comprising interposed gearing and a clutch capable of operatively connecting one part of said gearing with the other; a screw driven by the gearing; a controlling carriage traveling on said screw; and mechanism including means on the carriage for manually actuating said gearing at will.

5. The combination of a supporting frame; a driving shaft; a tool supporting structure swiveled on said frame and also longitudinally movable; a tool; means connecting said tool and said driving shaft including a substantially vertical spindle mounted axially of the tool supporting structure, gears carried thereby and other gears intermeshing therewith whereby the tool is actuated from the driving shaft.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

ALFRED MACDONALD.

Witnesses:

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WM. RUTHERFORD.