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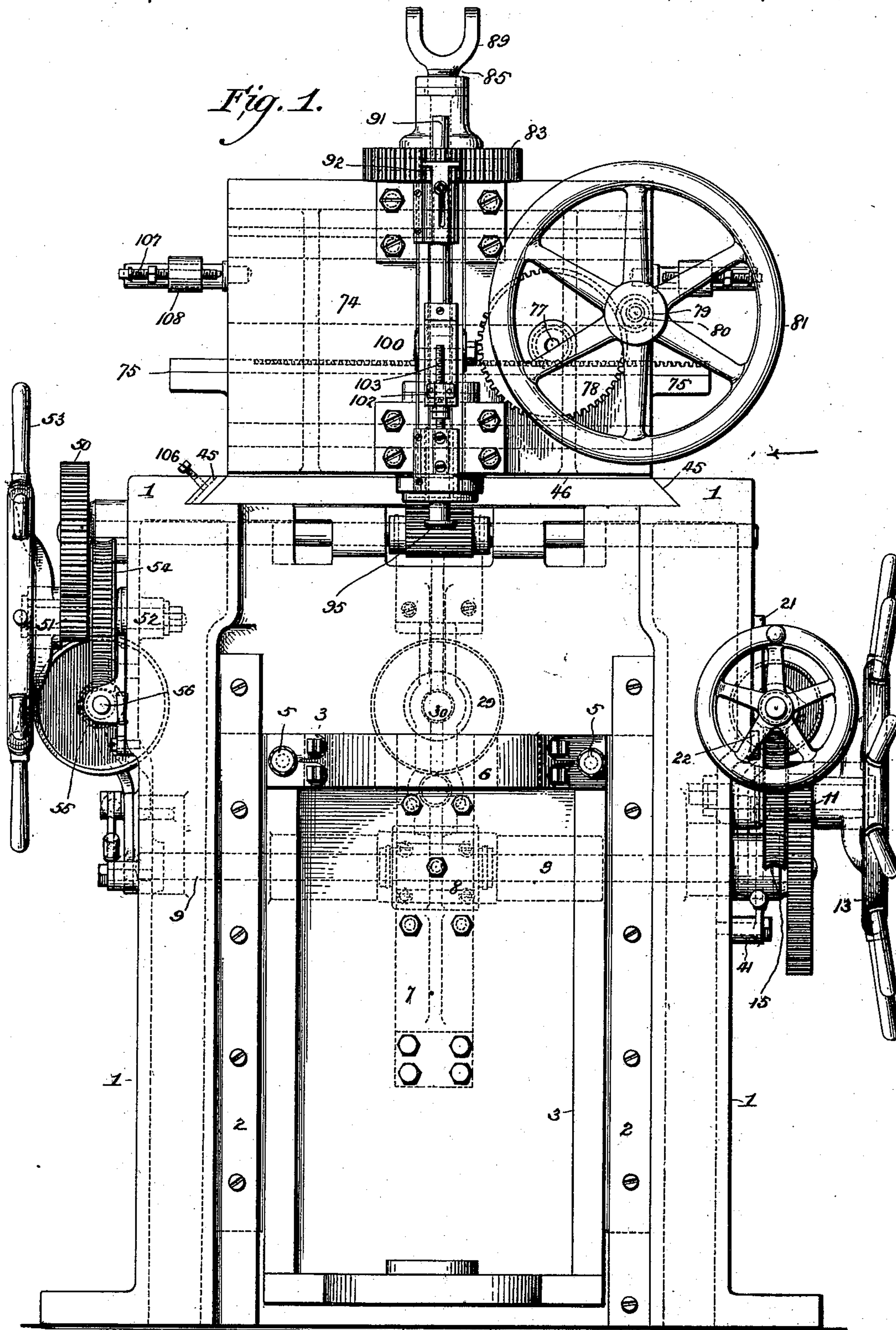
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M. F. SMITH.

METAL CUTTING AND WORKING MACHINE.

No. 506,342.

Patented Oct. 10, 1893.



WITNESSES: *David Williams*  
*Edwin Cruise.* INVENTOR: *Morris F. Smith*  
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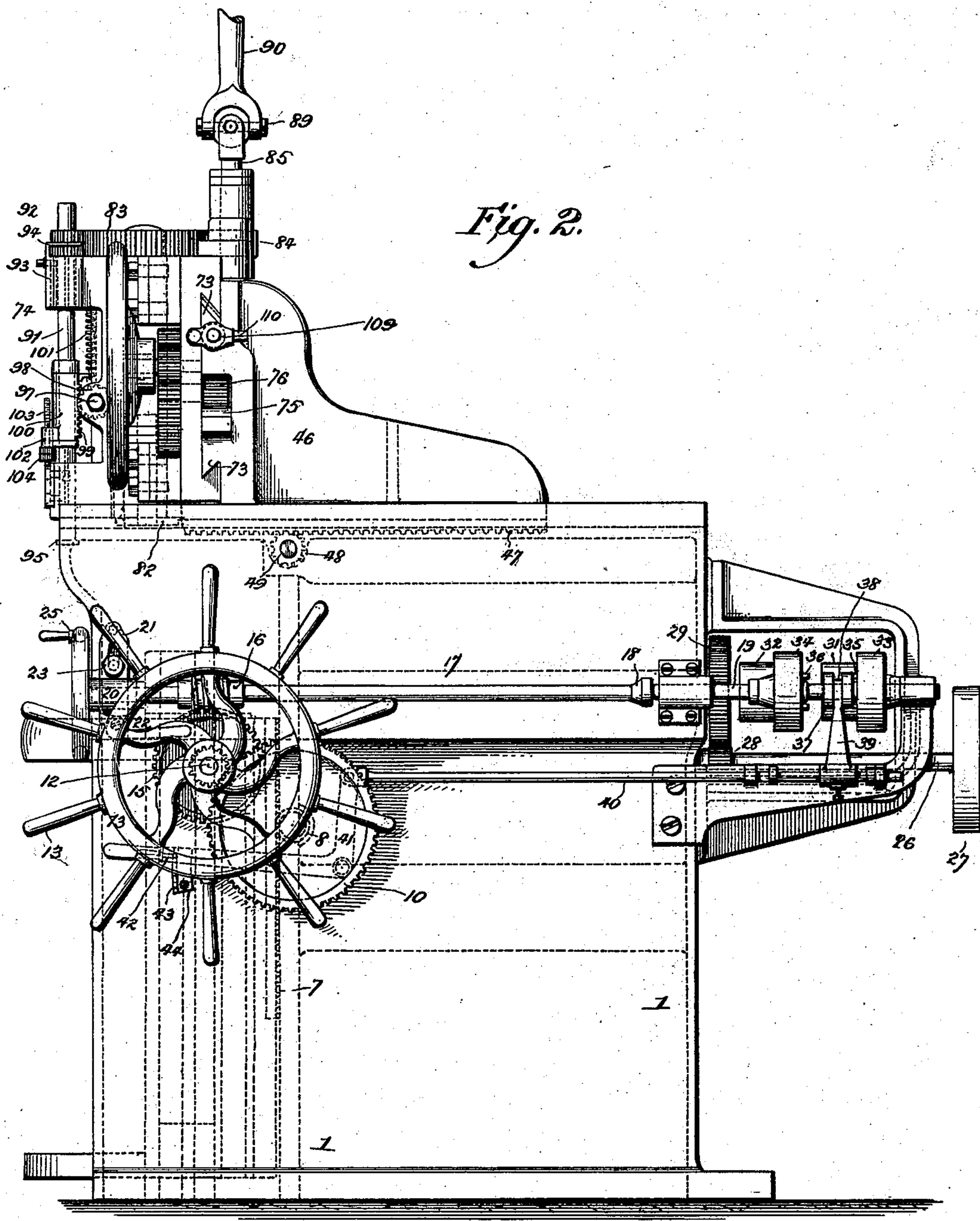
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(No Model.)

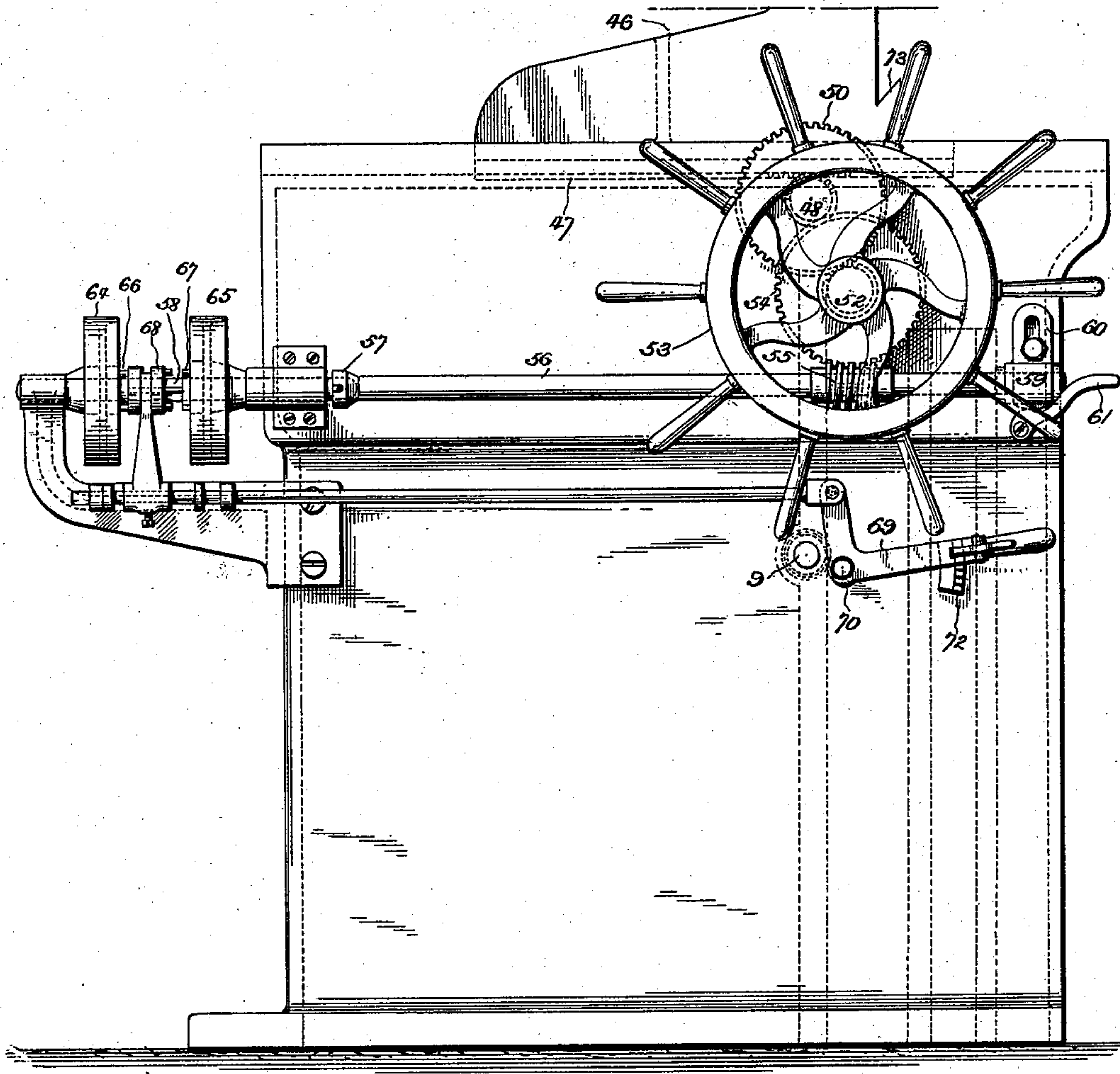
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*Fig. 3.*



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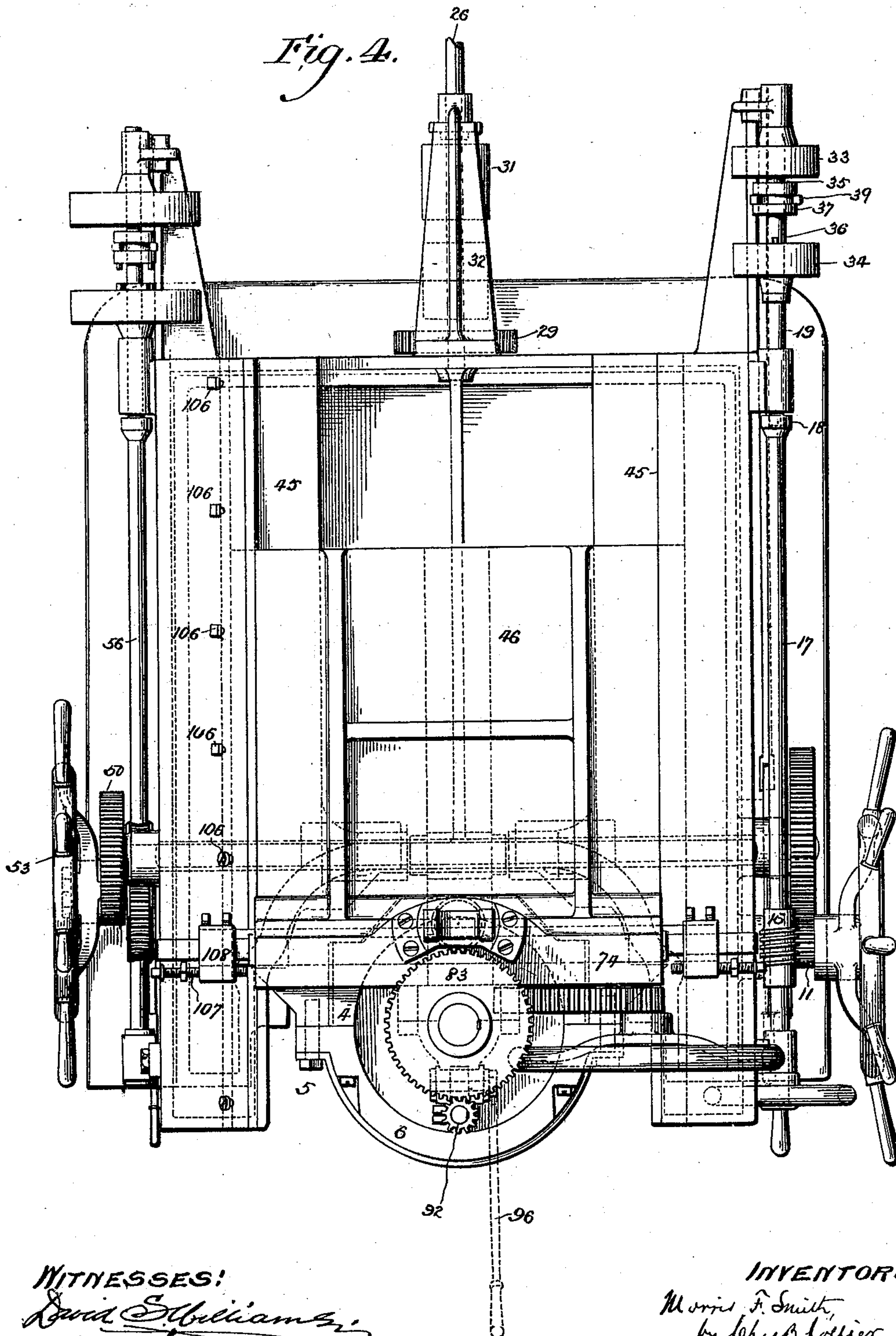
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*Fig. 4.*



WITNESSES:  
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# UNITED STATES PATENT OFFICE.

MORRIS F. SMITH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO THE WILLIAM CRAMP & SONS SHIP AND ENGINE BUILDING COMPANY, OF PENNSYLVANIA.

## METAL CUTTING AND WORKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 506,342, dated October 10, 1893.

Application filed December 16, 1892. Serial No. 455,380. (No model.)

*To all whom it may concern:*

Be it known that I, MORRIS F. SMITH, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and Improved Metal Cutting and Working Machine, of which the following is a specification.

My invention relates to certain improvements in metal cutting and working machines and has for its object the construction of a machine which may be adjusted to drill or plane metallic surfaces or be employed as a slotting or milling machine, as more fully set forth hereinafter.

In the accompanying drawings:—Figure 1. is a front elevation of a metal cutting machine constructed in accordance with my invention. Fig. 2. is a side elevation looking in the direction of the arrow, Fig. 1. Fig. 3. is an elevation of the opposite side of the machine, and Fig. 4. is a plan view.

The machine is especially adapted for boring, milling, cutting and otherwise shaping the breeches of rapid firing guns although, of course it may be employed for any other work of similar character.

Referring now to the drawings, 1 represents the frame work in which are supported the various operating parts of the machine.

At the front of the frame are vertical slide-ways 2, in which is guided a vertically adjustable table 3, on which the metal to be operated upon is placed and as this table is in the present instance designed more particularly to hold the gun breech, I preferably construct it in the manner illustrated in the drawings, the main body of the table being open and provided at its upper portion with a semi-circular supporting piece 4, to which is secured by bolts 5, a semi-circular holding clamp 6, the two portions being adapted to surround the body of the breech immediately below the shoulder so as to present the rear portion of the breech to the action of the cutting tools which are situated above this table.

The work table is provided on its rear face, with a rack 7, with which engages a pinion 8, mounted upon a transverse shaft 9, which may be turned to vertically adjust the table,

either by hand or power, by revolving the gear wheel 10, mounted on the outer end of said shaft 9, and meshing with a pinion 11, secured to a shaft 12. Mounted on this shaft 12, is a hand wheel 13, by which the necessary movement may be given to raise or lower the work-table, but I have found it preferable to employ power for the purpose of effecting this adjustment, especially when the work is being drilled and it is found necessary to gradually raise the table and the work up to the drill.

To effect the adjustment by power I secure to the shaft 12, a worm wheel 15, with which is adapted to engage the worm 16, mounted upon a shaft 17, which is coupled at one end by a universal joint 18, to a shaft 19, which may be driven in either direction by suitable mechanism hereinafter described.

The front end of shaft 17, is held in a bearing 20, forming part of, or secured to, a slide 21, against the lower end of which acts an eccentric lever 22, by operating which the slide 21, and the forward end of the shaft 17, may be raised a sufficient distance to disengage the teeth of the worm 16, from the teeth of the worm wheel 15, and permit, when necessary, the operation of the adjusting devices by hand. This slide 21, is slotted and passing through the slots is a locking bolt 23, by which it may be locked in either position to which it may be adjusted by the cam lever 22.

More delicate adjustments of the work table are provided for by securing to the outer end of the shaft 17, a hand wheel 25, which, operating through the worm 16, effects a very gradual vertical adjustment of the table.

On the rear of the machine and held in suitable bearings is a driven shaft 26, carrying at one end a belt wheel 27, over which passes a belt driven from any suitable source of power and on the opposite end of this shaft is a pinion 28, engaging with a gear wheel 29, mounted upon a shaft 30, on which are broad belt wheels 31, and 32.

On the shaft 19, through which motion is transmitted through the shaft 17, to the table adjusting mechanism, are mounted loose belt wheels 33 and 34, from which extend belts to the pulleys 31 and 32 one straight and the



other, crossed, so that the pulleys 33 and 34 are driven in opposite directions; these pulleys are provided with clutch faces 35 and 36 and feathered to the shaft 19, is a clutch 37 having opposite clutching faces adapted to engage with either the clutching face 35 or the clutching face 36 and, for the time being, lock one or other of the pulleys 33, 34, to the shaft 19, and drive such shaft in either direction so that the table may be either raised or lowered as desired.

In an annular groove 38 in the clutch are the bifurcated ends of a standard 39, secured to a guided rod 40, the forward end of which is connected to one arm of a bell-crank lever 41 fulcrumed to the frame of the machine, the opposite arm of said lever being provided with a handle and a locking bolt 42 which may engage with any one of three locking notches 43, in a rack 44, secured to the frame work, and by means of which the clutch 37 may be made locked in engagement with either of the clutching faces 35, 36, or be locked midway between the two pulleys, as desired.

The upper frame of the machine is provided with dove-tailed guide ways 45, 45, in which is adapted to travel a frame 46, provided on its under surface with a rack 47, with which is adapted to engage a pinion 48, held upon a shaft 49, and on the opposite end of said shaft is a gear wheel 50, with which engages a pinion 51, mounted upon a shaft 52, which also carries a hand wheel 53, by which the necessary movement may be imparted to the pinion 48, to move the frame 46, longitudinally on the machine.

On the shaft 52, is mounted a worm wheel 54, with which engages the worm 55, mounted upon a shaft 56, and connected at its rear end by a universal joint 57, to a shaft 58, and the forward end of this shaft 56, is held in a bearing 59, mounted upon a slide 60 and under the control of a cam lever 61, fulcrumed to the frame of the machine so that by operating the cam lever the forward end of the shaft 56, may be raised or lowered to effect the engagement or disengagement of the worm 55, with the worm wheel 54, and the machine be rendered capable of adjustment either by hand or power.

On the shaft 58, are two pulleys 64, and 65, from which extend driving belts to the broad pulleys 31, and 32, mounted upon the driven shaft 30, and these pulleys 64, 65, are provided with clutching faces 66, 67, with which may engage clutching faces on a clutch 68, feathered to a shaft and under the control of a bell crank lever 69, fulcrumed at 70, to the frame of the machine and provided at its forward end with a locking pin adapted to engage with any one of a series of locking notches in a rack 72, so that the clutch 68, may be locked when in contact with either the clutching face 66, or the clutching face 67, or in a position mid-way between the two.

The front face of the frame 46, is provided with dove-tailed guides 73, for the reception

of a transversely adjustable tool carriage 74, and on this frame, 46, is secured a rack 75, the teeth of which mesh with the teeth of a pinion 76, mounted upon one end of a stub shaft 77, secured in the carriage 74, and upon the opposite end of this shaft 77, is a gear wheel 78, with which engages a pinion 79, mounted upon a shaft or stud 80, which also carries a hand wheel 81, by turning which the pinion 76, is caused to traverse the rack 75, and so move the tool carrying frame 74, transversely across the machine.

The main tool mandrel 82, is held in suitable bearings in the carriage 74, and is provided at its upper end, with a gear wheel 83, with which engages a pinion 84, mounted upon one end of a stub shaft 85, the upper end of which is connected by a universal joint 89, to a driven shaft 90, so that the necessary rotative movement may be imparted to the shaft 85, without regard to the position to which the tool mandrel may be adjusted, this form of connection being preferable, although, of course, any form of flexible extension shafting may be employed to transmit the power. Any form of tool may be secured in this mandrel 82, either a milling, shaping or other cutting tool or a drill or reamer and the machine may be advantageously employed for cutting or milling irregular forms, as it is only necessary to employ a former of the proper shape and after starting the tool to continuously adjust the frame 46, and the tool carriage 74, to keep the tool well up to the former.

At the front of the tool carriage 74, is a vertical shaft 91, on the upper end of which is feathered a pinion 92, which may be vertically adjusted by means of a slide 93, having a bifurcated end 94, extending at right angles to the main portion of the slide and adapted to an annular groove in the pinion 92, so that, when necessary, the said pinion may be moved up out of engagement with the gear wheel 83, and the shaft 91, be prevented from rotating. On the lower end of this shaft 91, is a tool mandrel 95, in which may be secured a tool of any desired character and which, owing to its more rapid rotation, may be employed to do the smaller work in a much quicker manner than if the tool mandrel 82, be used. This tool mandrel may also be used to hold a slotting tool to which a vertical reciprocating motion is given by hand through the medium of a lever 96, secured to a shaft 97, on which is a pinion 98, meshing with a rack 99, on a sleeve 100, held between two collars secured to the shaft 91, the return movement after the depression of the shaft being aided by a spring 101, extending between the upper end of the sleeve 91, and a fixed point on the frame 74.

The sleeve 100 is provided with an extension 102, through which passes a threaded stem 103, the lower end of which is secured to the carriage 74, and on this threaded stem are one or more adjustable nuts 104, which may be vertically adjusted to any desired dis-



tance and so limit the extent of downward movement of the shaft 91, and the tool which it carries.

In some classes of work it is desirable that the tool mandrel be held in one position while the work is being performed and I therefore provide for the locking of the frame 46, and carriage 74, the frame 46, being held by one or more set screws 106, extending through the frame of the machine and engaging with the slide 46, while the carriage 74, is held in position by means of set nuts 107, extending through collars 108, adjustably secured to studs 109, on the frame 46, by set screws 110, so that by moving the collars 108, to the extreme end of the studs 109, the carriage 74, may be used a considerable distance without coming into contact with the screws 107.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the frame and the longitudinally and transversely adjustable tool carriage of the work table, a rack thereon, a pinion engaging therewith, a shaft carrying said pinion, a worm gear mounted on said shaft, a worm engaging with said worm wheel, a shaft carrying said worm, a driven shaft from which said worm shaft is driven, a universal joint between the worm shaft and the driven shaft, a bearing in which said worm shaft is mounted, and devices for effecting the raising and lowering of said bearing, substantially as specified.

2. The combination with the frame and the longitudinally and transversely adjustable tool carriage, of the work table, a rack thereon, a pinion engaging with said rack, a shaft carrying said pinion, the worm wheel mounted on said shaft, a worm engaging with said worm wheel, a shaft carrying said worm, a driven shaft, a universal joint between the worm shaft and the driven shaft, a bearing in which said worm shaft is mounted, a slide carrying said bearing, and a cam lever for effecting the vertical adjustment of said slide with devices for locking said slide in position, substantially as specified.

3. The combination with the frame and the longitudinally and transversely adjustable tool carriage, of the work table, a rack thereon, a pinion engaging with said rack, a shaft carrying said pinion, a driven shaft connecting gear by which the rotation of the driven shaft is imparted to the pinion carrying

shaft, loose pulleys 31 and 32, mounted on said driven shaft and driven in opposite directions, clutch faces on said pulleys, a clutch feathered to the shaft between said clutching faces, and an operating lever connected to said clutch, substantially as specified.

4. The combination with the frame, and the longitudinally and transversely adjustable tool carriage, of a tool mandrel, mechanism for driving the same, a supplementary tool mandrel, gearing connecting the same to the main tool mandrel, devices for effecting the engagement and disengagement of said gearing, and a suitable device to impart a vertical reciprocating movement to the supplementary tool handle, substantially as specified.

5. The combination with the frame, and the longitudinally and transversely adjustable tool carriage, of a tool mandrel, mechanism for driving the same, a supplementary tool mandrel, gears connecting the same to the main tool mandrel, an adjustable slide carrying one of said gears and devices for locking said slide in its adjustable position, substantially as specified.

6. The combination with the tool carriage, the main tool mandrel, and mechanism for driving said mandrel, of a supplementary tool mandrel, gearing to transmit rotary movement from the main to the supplementary mandrel, devices for effecting the engagement and disengagement of said gearing, a lever to impart vertical reciprocating movement to the supplementary mandrel, and a spring to aid the lever in its return movement, substantially as described.

7. The combination with the tool carriage, the main tool mandrel, and mechanism for driving said mandrel, of a supplementary tool mandrel, gearing to transmit rotary movement from the main to the supplementary mandrel, devices for effecting the engagement and disengagement of said gearing, a lever to impart vertical reciprocating movement to the supplementary mandrel, and an adjustable device to limit the downward movement of said mandrel, substantially as described.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

MORRIS F. SMITH.

Witnesses:

GEO. W. REED,  
E. CRUSE.