R. S. BROWN.

METAL WORKING MACHINE.

APPLICATION FILED OCT. 25, 1918.

1,311,314.

Patented July 29, 1919.

6 SHEETS—SHEET 1.

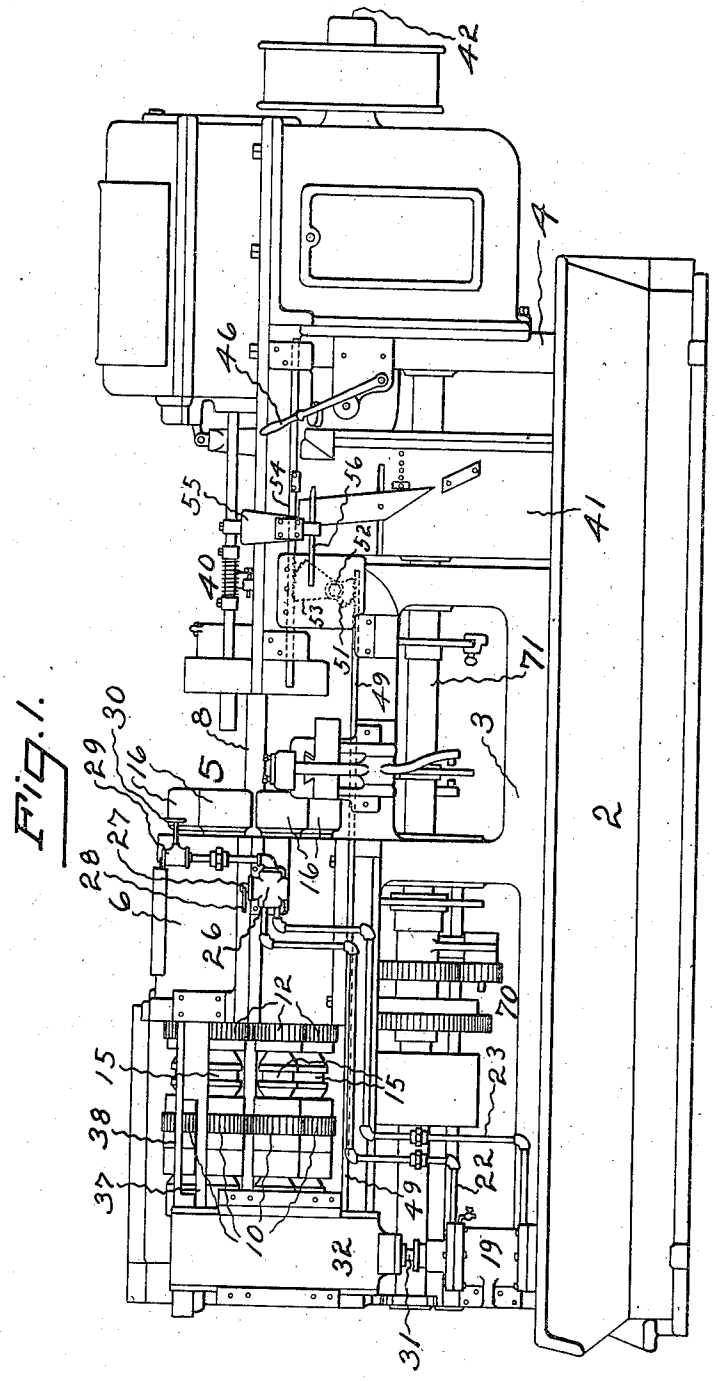


Fig. 1.

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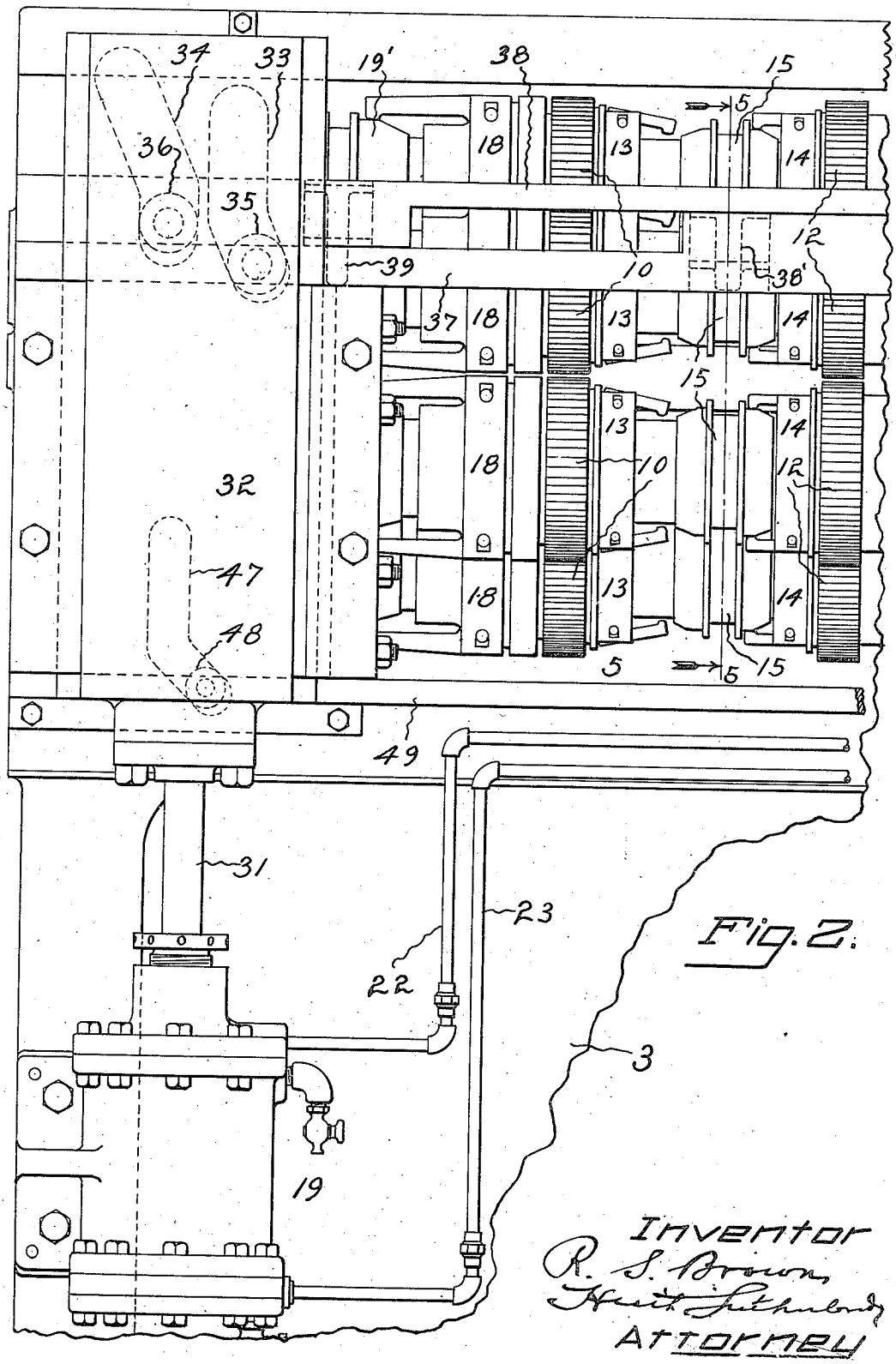


Fig. 2.

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6 SHEETS—SHEET 3.

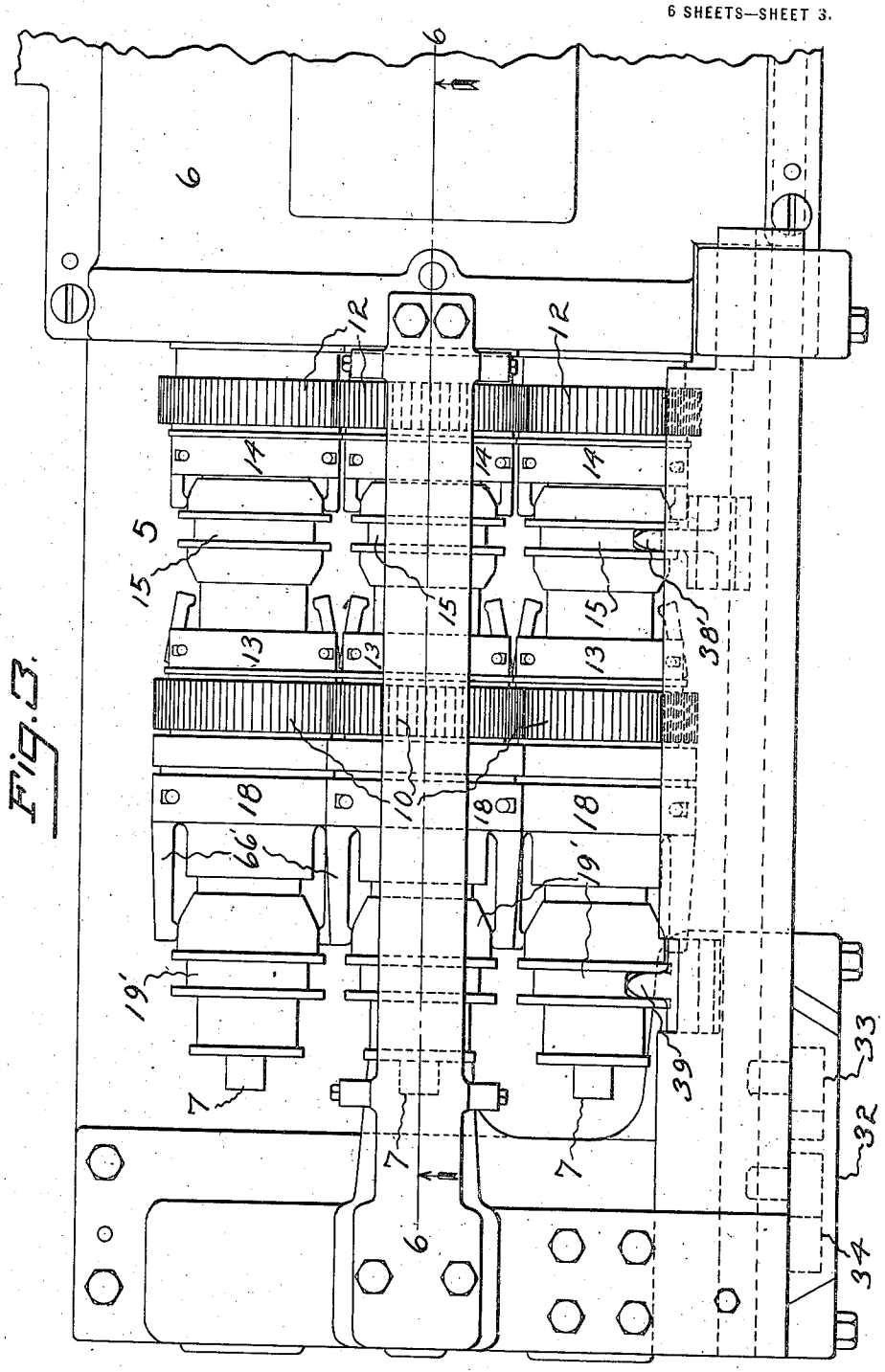


Fig. 3.

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6 SHEETS—SHEET 4.

Fig. 4.

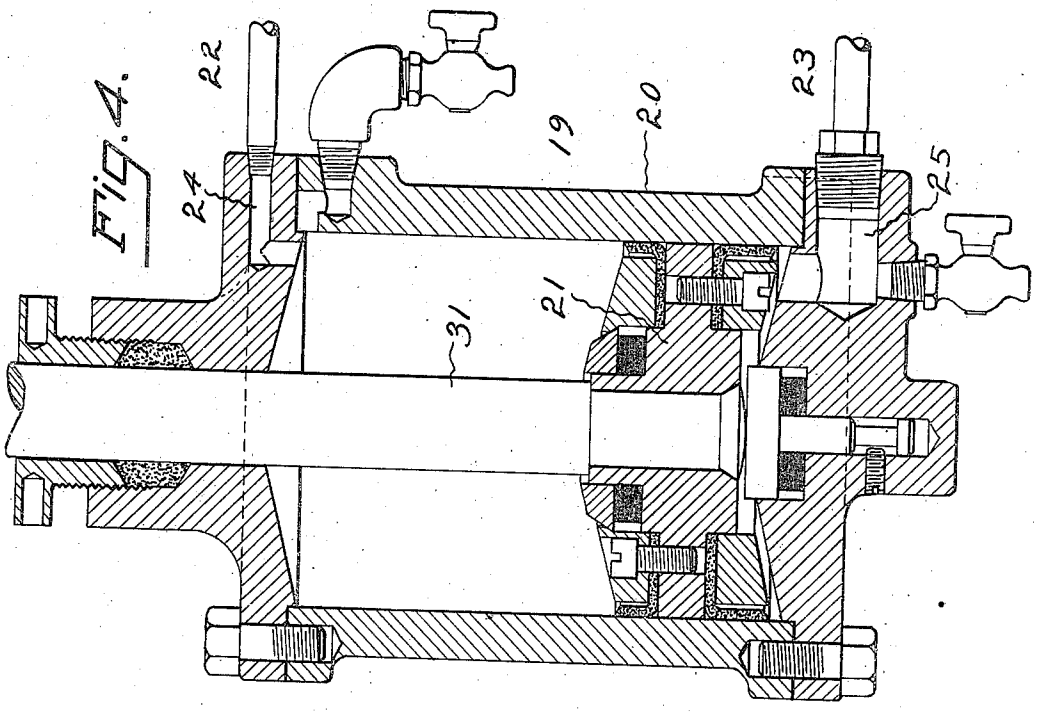
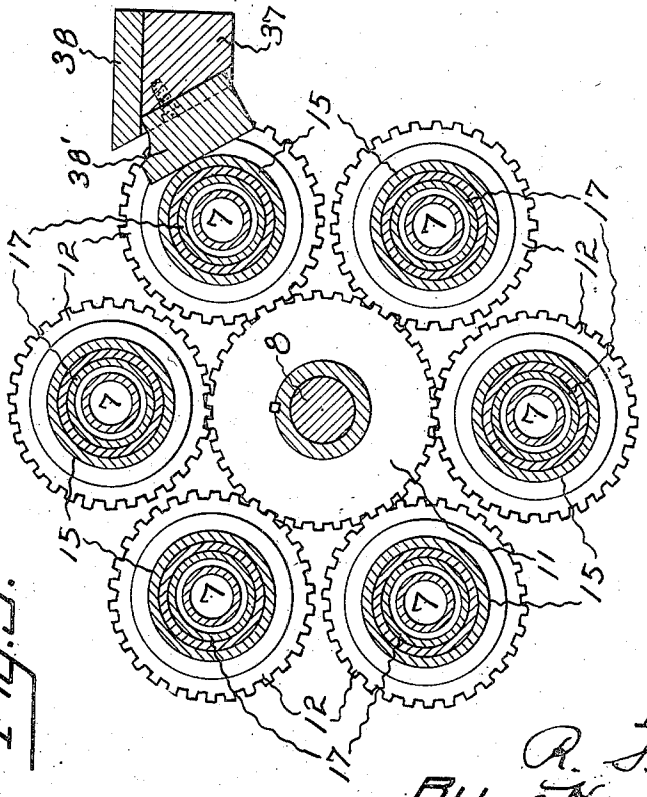


Fig. 5.



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6 SHEETS—SHEET 5.

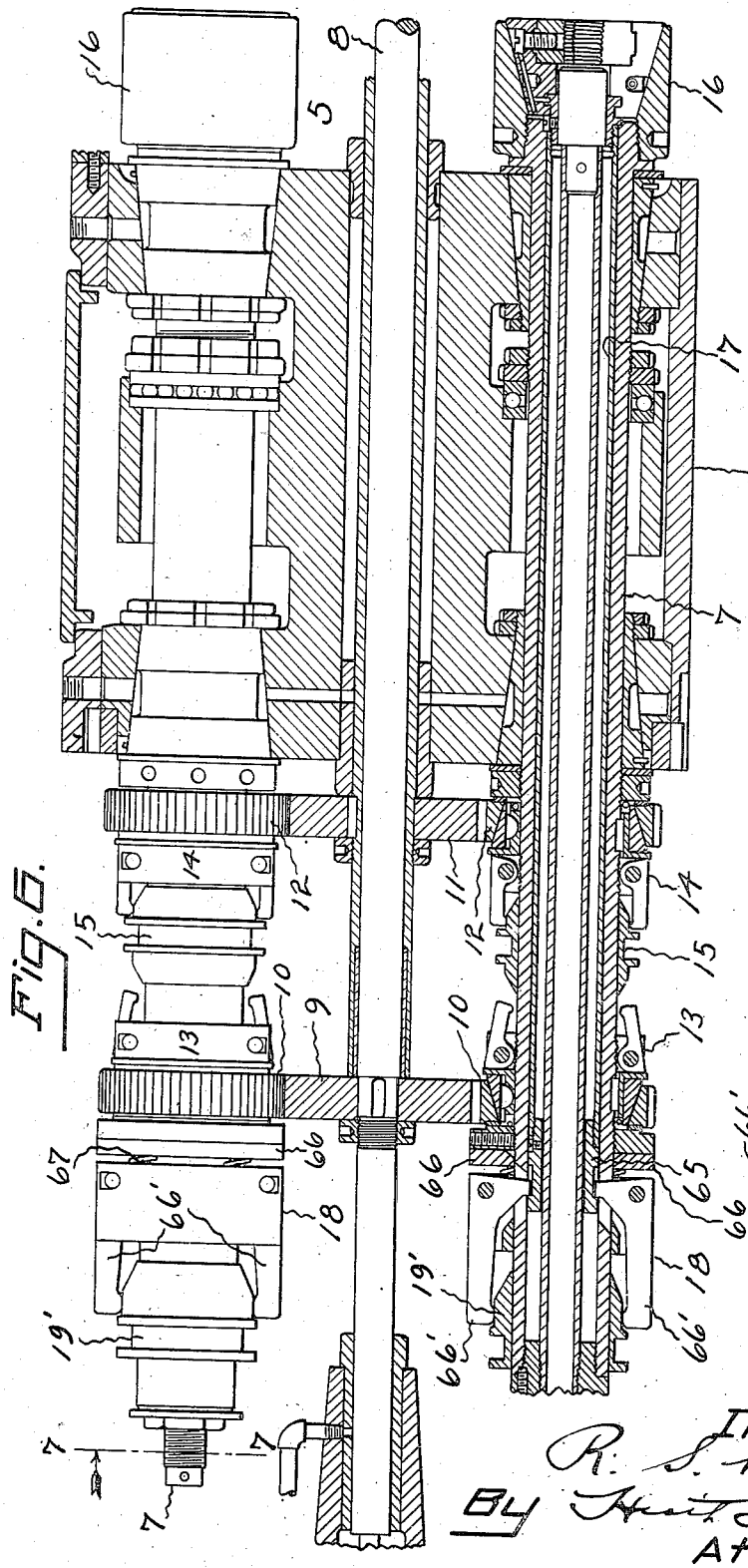


Fig. 6.

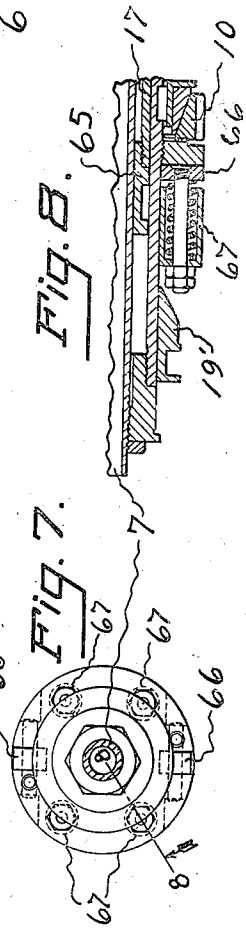


Fig. 8.

Fig. 7.

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6 SHEETS—SHEET 6.

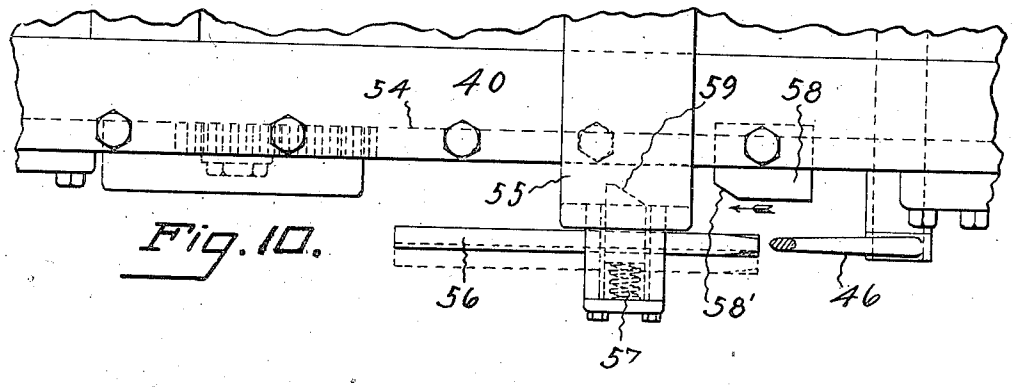
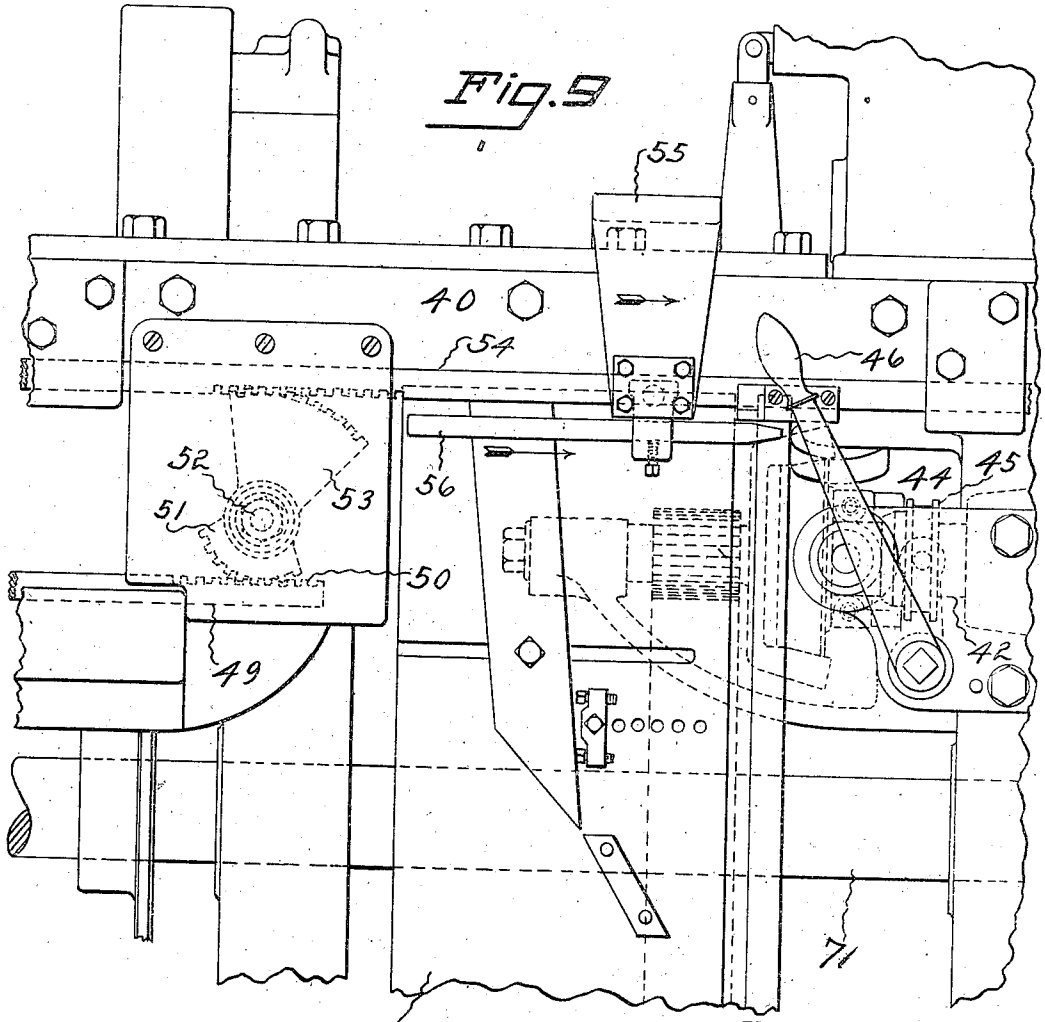


Fig. 10.

Fig. 9



Inventor

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UNITED STATES PATENT OFFICE.

ROBERT S. BROWN, OF NEW BRITAIN, CONNECTICUT, ASSIGNOR TO THE NEW BRITAIN MACHINE COMPANY, OF NEW BRITAIN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

METAL-WORKING MACHINE.

1,311,314. Specification of Letters Patent. Patented July 29, 1919.

Application filed October 25, 1918. Serial No. 259,636.

To all whom it may concern:

Be it known that I, ROBERT S. BROWN, a citizen of the United States, residing at New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Metal-Working Machines, of which the following is a specification.

This invention relates to metal-working machines. Some of the features of the invention, however, can with advantage be employed in connection with machines of other kinds in view of which circumstance it is clear that I have selected the title given merely as a matter of convenience. In that form of embodiment of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification the invention is shown as incorporated in what is known as a "screw machine." This form of structure I will set forth sufficiently in the following description to enable those skilled in the art to practice the invention. I am in nowise restricted to this particular disclosure; I may depart therefrom in several respects within the scope of the invention defined by the claims succeeding said description. I might state that one of the fundamental purposes I have in view is the provision of effective, easily operable and readily accessible means by which the action of one or more parts can be precisely controlled by the use of proper fluid, such as compressed air. This is merely one of several agents any of which are satisfactory but I have obtained proper results by the use of compressed air.

Referring to said drawings:

Figure 1 is a side elevation of a machine involving the invention.

Fig. 2 is a similar view of one end of the same, the head or left end as shown in Fig. 1.

Fig. 3 is a top plan view of the parts appearing in said Fig. 2.

Fig. 4 is a vertical, central section of a motor.

Fig. 5 is a cross section of the work-carrying spindles, as looking toward the foot end of the machine.

Fig. 6 is a horizontal sectional top plan view of the work-carrier and spindles.

Fig. 7 is a cross section on the line 7—7 of Fig. 6.

Fig. 8 is a horizontal sectional detail view of the parts appearing in said Fig. 7.

Fig. 9 is a side elevation of the parts appearing at the foot end of the machine.

Fig. 10 is a top plan view of the structure shown in said Fig. 9.

Like characters refer to like parts throughout the several views which are on different scales.

The different parts of the machine may be supported in any convenient manner. For this purpose (Fig. 1 for instance) I have shown the base or bed 2 and the frame members as 3 and 4 rising from and suitably fastened to said base member; usually these frame members are bolted to the base or bed 2. As a matter of fact I have shown the invention as incorporated in a machine of the same general type as that disclosed in Letters Patent No. 1,177,827 of April 4, 1916, and to which reference may be had for a more definite and full understanding of certain parts not herein described in detail as they form in themselves no part of the invention. I will, however, set forth certain features which are not in themselves new with me merely to indicate the many advantages of the invention.

As will be clear the machine shown is of the "multiple-spindle" type and involves in its make up two carriers, one for the work and the other for a tool or tools. In the present instance one of these carriers is rotary and the other is reciprocatory. As shown the work-carrier is rotary while the tool-carrier is reciprocatory.

A work-carrier such as meets my conditions is that denoted in a general way by 5 (Figs. 1, 2, 3 and 6) mounted in a suitable casing as 6. These may be as fully set forth in the Letters Patent already identified. This work-carrier 5 is given an intermittent or step by step rotary or indexing movement. There extend entirely through said carrier 5 the spindles 7 of which there may be any convenient number. As a matter of fact there may be instances where there is but a single spindle and its work or other holder. Extending through the work-carrier or cylinder 5 is a rotary shaft 8 which as in said Letters Patent extends practically the length of the machine, the shaft being continuously rotative at least during the action of the machine. Fastened to the head end of said shaft 8 is the pinion

9 the teeth of which are in mesh with the annular series of pinions 10 loosely associated with the respective work-carrying spindles 7, the pinions 10 being arranged in annular order around the operating pinion 9. The shaft 8 also has rigidly fastened to it the pinion 11 in mesh with an annular series of pinions 12 loosely associated with the respective spindles 7 all this being shown fully in Fig. 6. The pinions 10 and 12 may be connected to their spindles for rotation therewith through the intervention of clutch members as 13 and 14 respectively which are actuated by operating members as 15 (Fig. 3 for instance). In Figs. 3 and 6 all the clutch members 14 are disposed so as to couple the forward sets of pinions 12 to the work-carrying spindles 7 and thus cause the rotation of said spindles. It will be clear that if an operating member as 15 be moved to a neutral position it will cause the unclutching of the corresponding pinion 12 and thus the stopping in motion of the spindle 7 with which said pinion 12 is directly associated. In the patented machine these "operating members" 15 as I have termed them herein are automatically actuated but this particular point does not concern the present invention for which reason it is not necessary to further describe it.

Each of the spindles 7 is provided at its inner end with a work-holder, such as a chuck 16 which when closed securely holds the work while being operated upon, and when opened permits the removal of the work. Through the spindles 7 extend the draw tubes 17 provided substantially as shown in said patent with means for causing the opening and closing of the respective chucks 16. The spindles 7 loosely carry the operating devices 18 by which said draw tubes 17 are moved endwise to cause the opening and closing of the respective chucks, each operating device as will be understood including a spool 19'.

It will be understood that during the normal action of the machine, the work-carrier or cylinder 5 rotates and that the work-carrying spindles 7 also rotate. I may, however, at the will of the attendant of the machine stop the rotation of a spindle at a predetermined point and at practically the same time or a little later may open a chuck to free a piece of work or accomplish some other like function. As I have already observed these actions are secured through the intervention of fluid and although it may be of any desired character I prefer that it be compressed air.

The base 2 sustains what might be considered as a motor which as will be inferred is pneumatically-operated although this is not always necessary. Such a motor as 19 (Figs. 1, 2, and 4) includes in its structure a cylinder as 20 in which is slidable the piston 21 circumferentially packed. There are tapped into the upper and lower ends of said cylinder 20 of the supply pipes 22 and 23 for compressed air, the delivery ends of said pipes being fitted as by threading into ports or passages as 24 and 25 by which air is admitted in alternation to the end portions of the cylinder. As shown the two pipes or ducts 22 and 23 lead from the box or casing 26 sustained rigidly by the frame member 3 (Fig. 1) so that the valve in said box or casing is within easy access of the attendant of the machine. The valve 27 is of some familiar three-way type so that when operated as by the handle 28 the compressed air can be delivered into the desired one of the two supply pipes 22 and 23. The compressed air to the valve casing or box may be furnished from a suitable source of supply which I have not deemed it necessary to illustrate although the pipe or duct 29 leads from this source of supply and will be provided preferably near the casing or box with a valve 30 which is open during the action of the machine to supply when necessary the proper supply of compressed air or equivalent fluid.

The stem 31 of the piston 21 extends upwardly through a gland in the upper head of the cylinder and has preferably a rigid connection with a cam member or plate as 32 supported as shown for vertical sliding movement upon the frame member 3 above the cylinder as represented best in Fig. 2. It will of course be clear that upon manipulation of the valve 27 to cause air to enter the upper end of the cylinder 20 by way of the pipe 22 the piston 21 and hence the stem or rod 21 and hence the cam member 32 are lowered, the cam member functioning as I will hereinafter set forth. When the piston is in its lowered position as are the parts connected therewith, and on the admission of air into the cylinder by way of the pipe 23, the piston and associated parts will be caused to raise or ascend to reverse the other action.

The cam member or plate 32 as illustrated has through it the cam slots 33 and 34 which respectively receive studs or antifriction rollers as 35 and 36 connected to the rods 37 and 38 supported as shown for horizontal endwise reciprocation by the upper portion of the frame member 3 as shown in Figs. 2 and 3. The rod 37 is the agent for effecting through coöperating means the stoppage of a spindle 7 on the front or attendant's side of the machine while the rod 38 is the agent for accomplishing through intervening means the opening of the chuck 16 associated with the spindle thus stopped, these actions preferably occurring in sequence. That is to say the predetermined spindle is first stopped in its rotation and then the chuck carried thereby is opened in view of which circumstance the work or equivalent carried by said chuck

can be readily and easily removed. The slot 33 it will be seen has a steep lower or effective portion which merges into an ineffective upper portion, the latter being parallel with axis of the cam member or plate while the former is oblique to said axis. The upper or longer branch portion of the slot 34 is the effective part thereof being oblique to said axis while its lower and shorter branch is parallel to said axis, the two oblique portions, however, extending oppositely to each other.

It will be assumed that the cam member or plate 32 is in its advanced position which of course is up at which time the piston 21 is against the upper head of its cylinder 20, and that it is desired to stop the rotation of a spindle 7 and then to open the chuck 16 carried thereby. In this case the attendant of the machine will operate the valve 27 in the manner set forth, to cause compressed air to enter the upper end of the cylinder, by way of the pipe 22 and thus lower the piston and as a result the cam member or plate 32, the latter on such action causing as I will later explain the successive thrust of the rods 37 and 38 to the left which is their retractive movement, both of them having been shown in their advanced positions in Fig. 2. The rod 37 is provided between its ends with a finger 38′ adapted to enter the peripheral grooves of the operating members 15 as the latter revolve. Thus when the rod 37 is retracted its finger 38′ will move the operating member 15 with which it is for the time being coöperative, into position to arrest the rotation of the spindle 7 carrying said operating member. Subsequently, the finger 39 having in the meantime entered the peripheral groove of the operating device 18, effects on the corresponding movement of the rod 38 the longitudinal movement of the draw tube 17 coactive with said operating device and the resultant opening of the chuck carried by said spindle 7.

The frame member 4 supports on its upper side a tool carrier as 40 which as in said Letters Patent is in the form of a slide reciprocatory by the cam drum 41. The stoppage in motion of this cam drum 41 will of course cause the stoppage in movement of the tool carrier or slide 40. The main shaft 42 is adapted to be connected operatively with the cam drum 41 by a clutch such as that denoted in a general way by 44 (Fig. 9), said clutch in said view being shown as being in its effective or operative relation to secure the transfer of power from the main shaft 42 to the cam drum 41 thus to bring about the reciprocation of the tool carrier or slide 40. If the movable member 45 of said clutch be shifted by the lever 46 to its neutral or cam-drum-stopping position, the stoppage of motion of the cam drum 41 will be the result accompanied of course by the non movement of the slide 40. I might note at this point that it is possible for the attendant of the machine when he desires to move the shiftable member 45 of the clutch to said neutral position by bringing the lever 46 to an upright or practically upright position. I provide, however, automatic means for accomplishing this particular result when the desired spindle of the group already described, is stopped and its chuck opened, to remove the work so that as a consequence it will not be possible at such time to operate the tool carrier or slide 40.

It will be understood that indexing mechanism denoted in a general way by 70 is carried by the shaft 71 driven by the cam drum 41 so that when the cam-drum is stopped in the manner noted, said shaft 71 is also stopped, the consequence being that at such time, the work-carrier 5 cannot be indexed.

The cam member or plate 32 has in addition to the two described cam portions or slots, a third cam portion, also shown as a slot 47 having a lower effective and an upper ineffective portion, to receive the stud or or anti-friction roller 48 on the horizontally-reciprocative rod 49 supported and guided by the frame member 3 as best illustrated in Fig. 2. This rod is shown provided with rack teeth 50 in mesh with the teeth of the sector 51 fixed to the shaft 52 on the frame of the machine. Said shaft also rigidly carries a second segment 53 the teeth of which mesh with those of the bar 54 reciprocative on the framing.

The slide 40 has fixed thereto a bracket as 55 (Figs. 9 and 10) the overhanging portion of which supports for lateral movement, the rod 56 shown as occupying its operative and inoperative positions in Fig. 10 by full and dotted lines. Said rod is yieldingly held in its operative position as by the coiled spring 57 supported by said bracket. The bar 54 is shown provided with a rigid laterally extending actuator or plate 58 coöperative with the nose piece 59 extending inwardly from the rod 56. It will be clear that on each backward movement normally of the slide 40 the nose piece 59 engages the beveled portion or face 58′ of said actuator which results in the lateral or outward movement of the rod 56 as shown by dotted lines in Fig. 10 so that said rod cannot encounter the clutch lever 46 when in said dotted line or ineffective relation.

The cam slot 47 to which I have referred, has a lower effective portion which is oblique to the longitudinal axis of the cam member or plate 32 and an upper ineffective portion which is as will be clear, parallel to said axis. It will be assumed that the cam member 32 has been retracted or moved downward to effect the removal of work in the manner already described. On the initial movement of said cam member the lower

walled portion of the slot 47 engaging the stud 48, will shift the rod or bar 49 to the left in Fig. 2 thus through the agency of the two sector gears 51 and 53 moving the bar 54 to the right in Figs. 9 and 10 and as a consequence moving the actuator 58 out of the range of movement of the rod 56 so that the latter during the backward movement of the slide 40, can remain in its operative position. In view of this circumstance the free end of the rod or bar on such backward movement will strike the lever 43 and bring the same to an upright or vertical position, the lever in turn moving the clutch member 45 to neutral and stopping thereby further movement of the slide 40.

It will be clear that the operative movement or retraction of the cam member or plate 32 is in a downward direction and during this motion one of the spindles 7 is stopped and its work-holder is opened. At the proper point in the movement of the tool-carrier or slide it is stopped. It will be evident that on the upward movement of the cam member the actions set forth are reversed in view of which circumstance the parts are thus restored to their initial conditions and the machine started by the operation of the hand lever 46. Both the retractive and advancing movements of the cam member 32 are accomplished through the intervention of the attendant of the machine. When said cam member is in its normal position as shown in Fig. 2, the normal action of the machine is the consequence.

I provide means by which the work is yieldingly held in the chucks 16 as I will now explain. It will be remembered that the opening of these chucks 16 is secured through the action of the draw tubes 17. The draw tubes 17 loosely carry operating devices 18 the action of which in turn is obtained by the spools 19′ loose on the respective spindles. Each draw tube 17 has fixed to it the sleeve 65 (Figs. 6, 7 and 8). Each spindle in turn is surrounded by the plate or disk 66 rigid therewith. The bodies of the operating devices 18 pivotally support levers as 66′ of angular form, the longer branches of the levers being operable by the spools 19′. Between the bodies of the operating devices 18 and the relatively stationary plates or disks 66 are interposed coiled springs as 67 in view of which it will be clear that the chucks when closed through the action of the spools will yieldingly grip the work.

What I claim is:

1. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each furnished with a holder, and fluid governed means to be actuated at will and supported independently of the spindles, for effecting the stoppage in rotation of a desired spindle and for also causing the action of the holder carried by said spindle while it is thus stopped, to free the part carried by the spindle.

2. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a holder, and fluid governed means to be actuated at will and supported independently of the spindles, for effecting the stoppage in rotation of a desired spindle and subsequently for causing the action of the holder carried by the spindle while it is thus stopped, to free the part held thereby.

3. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a work holder, a reciprocatory carrier provided with means to act on the work carried by the respective holders as the rotary carrier turns, and fluid-governed means to be actuated at will and supported independently of the spindles, for effecting the stoppage of a spindle and also the movement of the reciprocatory carrier.

4. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a work-holder, a reciprocatory carrier provided with means to act on the work carried by the respective holders on the rotary carrier, and fluid-governed means to be actuated at will and supported independently of the spindles, for effecting the stoppage of a spindle and subsequently the operation of its holder to free the part carried thereby, and for also arresting the movement of the reciprocatory carrier.

5. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a holder, and fluid-governed means to be actuated at will for effecting the stoppage of a predetermined spindle of the group and while the spindle is thus stopped performing an independent action on a part carried thereby.

6. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a holder, and fluid governed means to be actuated at will, for effecting the stoppage of a predetermined spindle of the group and for subsequently causing the operation of the holder associated with said spindle while said spindle is thus stopped to free the part held in said holder.

7. In a machine of the class described, the combination of a rotary spindle provided with a holder, a cam, fluid-governed means supported independently of the spindle and to be actuated at will, to effect the movement of said cam, and means actuated by said

cam on its said movement for stopping the rotation of the spindle and for subsequently causing the holder to free the part held thereby.

8. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each having a holder, a cam, fluid-governed means, supported independently of the carrier and the spindles and to be actuated at will, to effect the movement of said cam, and means actuated by said cam on its said movement for stopping the rotation of a predetermined spindle and for subsequently causing the holder to free the part held thereby.

9. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each having a work-holder, a reciprocatory carrier provided with means to hold a tool to operate on the work as the rotary carrier turns, a cam, fluid-governed means, supported independently of the rotary carrier and its spindles and to be actuated at will, for effecting the movement of said cam, and means actuated by said cam on its said movement, for stopping the rotation of a predetermined spindle, for subsequently causing the holder thereof to free the part held thereby and for also stopping the movement of the reciprocatory carrier.

10. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each having a work-holder, a reciprocatory carrier provided with means for holding a tool to operate on the work supported by said holders, a cam supported by the framework of the machine, fluid-governed means actuated at will for causing opposite movement of the cam, and a plurality of rods reciprocatory by the cam, one of the rods having means associated therewith for stopping a predetermined spindle and another of said rods having means for subsequently opening the holder of the spindle which is thus stopped.

11. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each having a work-holder, a reciprocatory carrier provided with means for holding a tool to operate on the work supported by said holders, a cam supported by the framework of the machine, fluid-governed means actuated at will, for causing opposite movements of the cam, and three rods reciprocatory by the cam, one of the rods having means associated therewith, for stopping a predetermined spindle, another having means for subsequently opening the holder of the spindle thus stopped, and the third having means for effecting the stoppage in movement of the reciprocatory carrier.

12. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each provided with a chuck, means for yieldingly closing the chucks and fluid-operated means for opening a chuck at will when the carrier is in a predetermined position.

13. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each furnished with a holder, and fluid operated means supported independently of the spindles and their holders, for closing the holder of a spindle and then starting the rotation of the spindle provided with the holder thus started, at a predetermined point.

14. In a machine of the class described, the combination of a rotary carrier provided with a series of rotary spindles each furnished with a holder, and fluid governed means to be actuated at will, for closing each holder of a spindle and then starting the rotation of the spindle provided with the holder thus started, at a predetermined point in the rotation of the carrier.

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

ROBERT S. BROWN.

Witnesses:

OTTO HILTON,

HEATH SUTHERLAND.