A. M. POWELL.

METAL PLANING MACHINE.

APPLICATION FILED APR. 23, 1908.

934,837.

Patented Sept. 21, 1909.

4 SHEETS—SHEET 1.

FIG. 2.

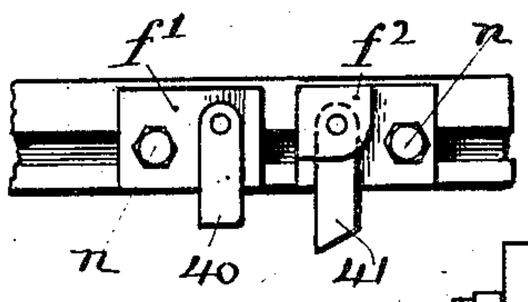

FIG. 1.

Witnesses-

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4 SHEETS—SHEET 2.

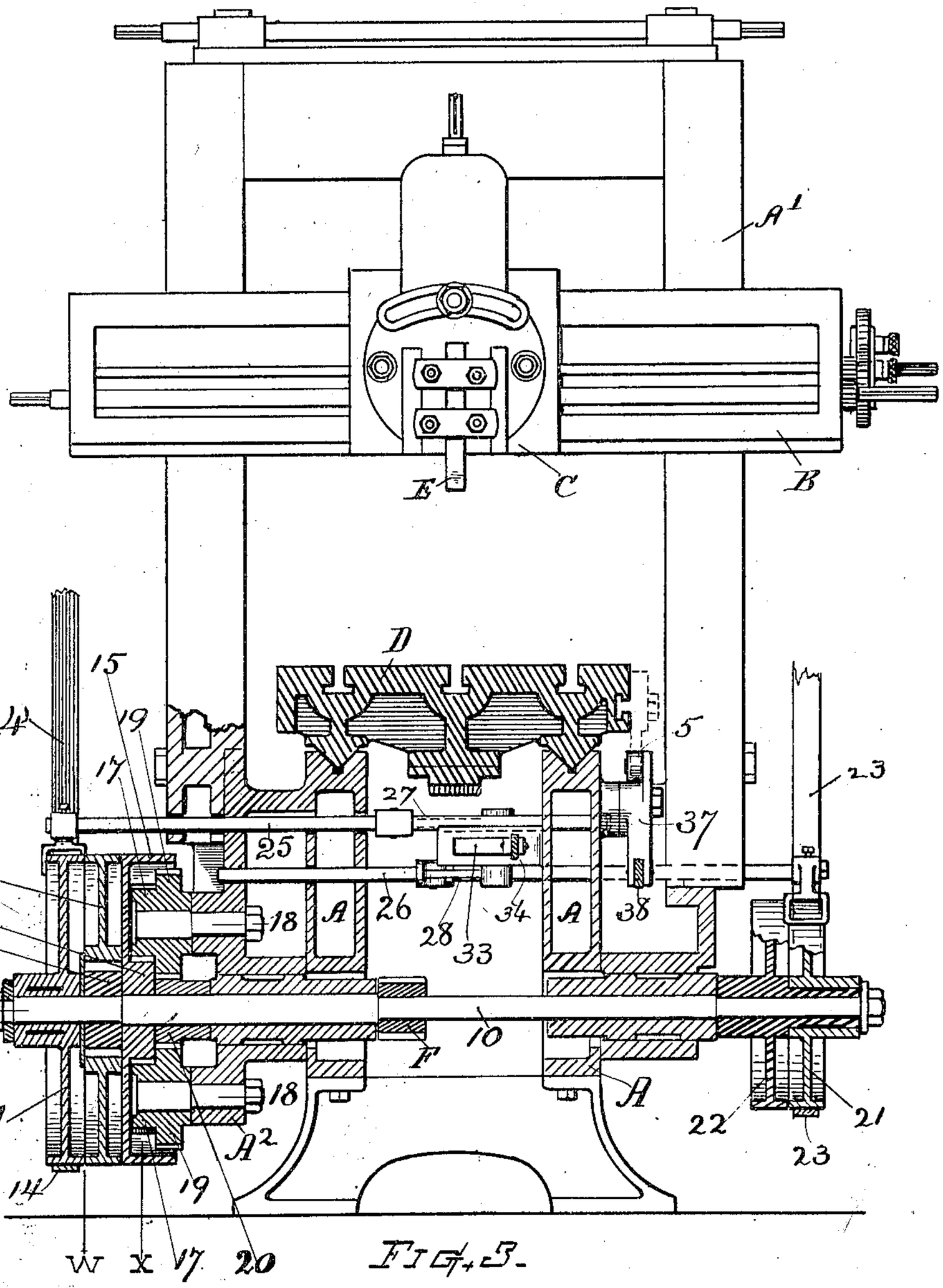

FIG. 3.

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4 SHEETS—SHEET 3.

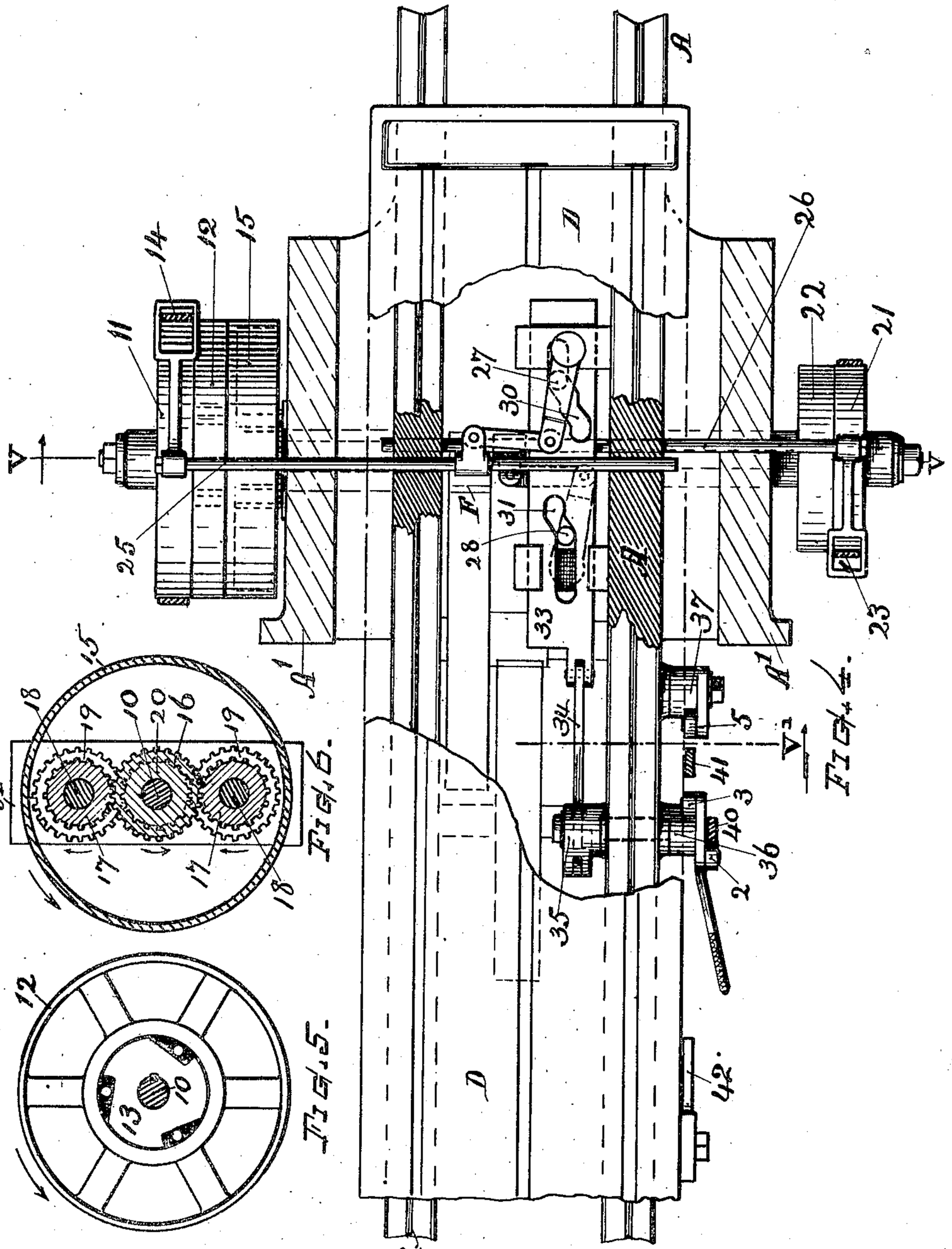

Fig. 4.

Fig. 6.

Fig. 5.

Witnesses.

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4 SHEETS—SHEET 4.

FIG. 7.

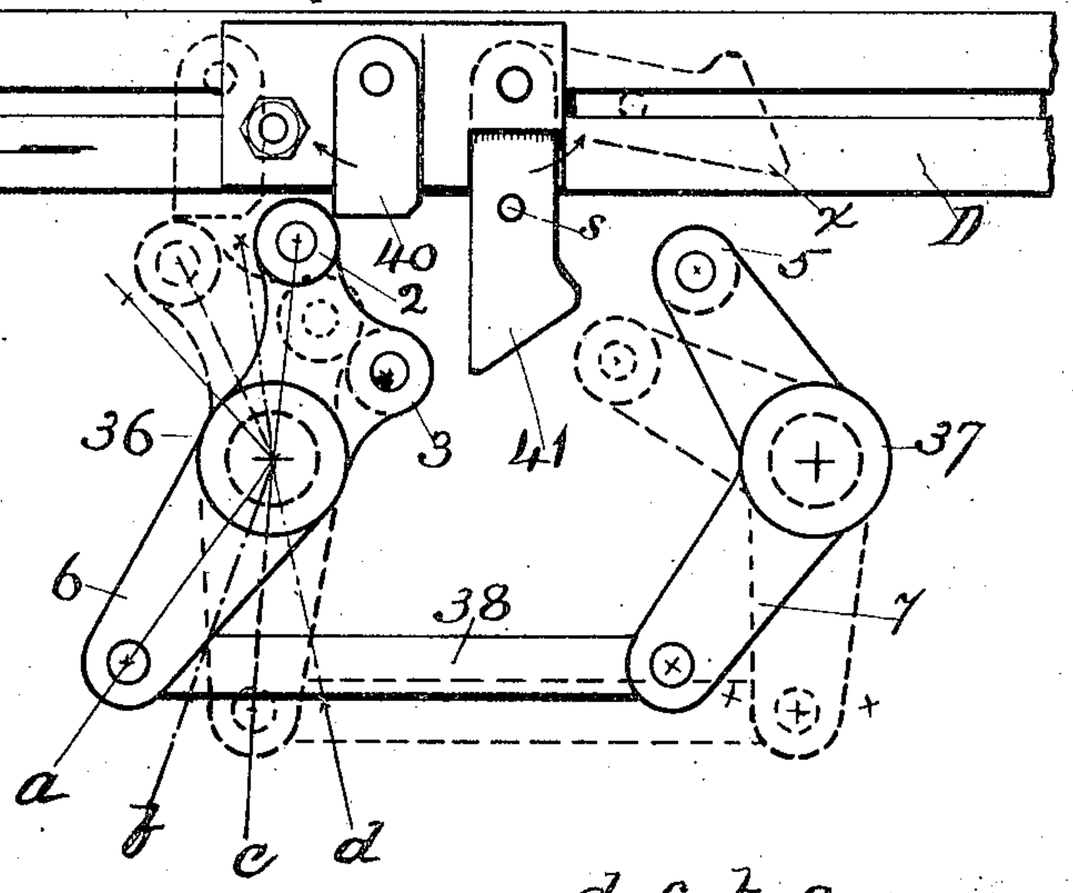


FIG. 9.

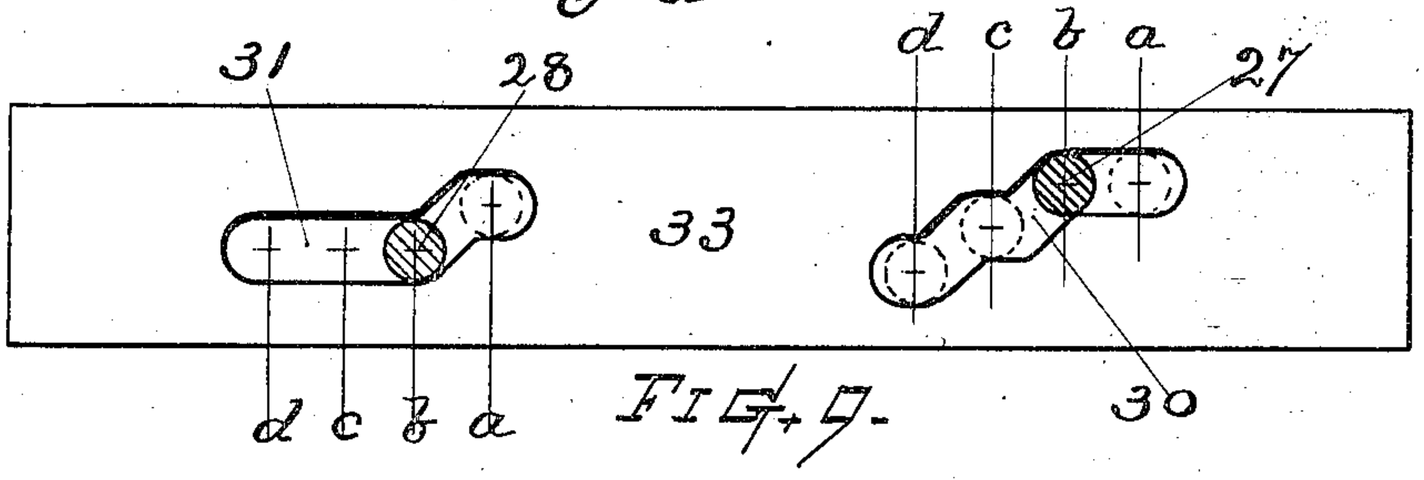
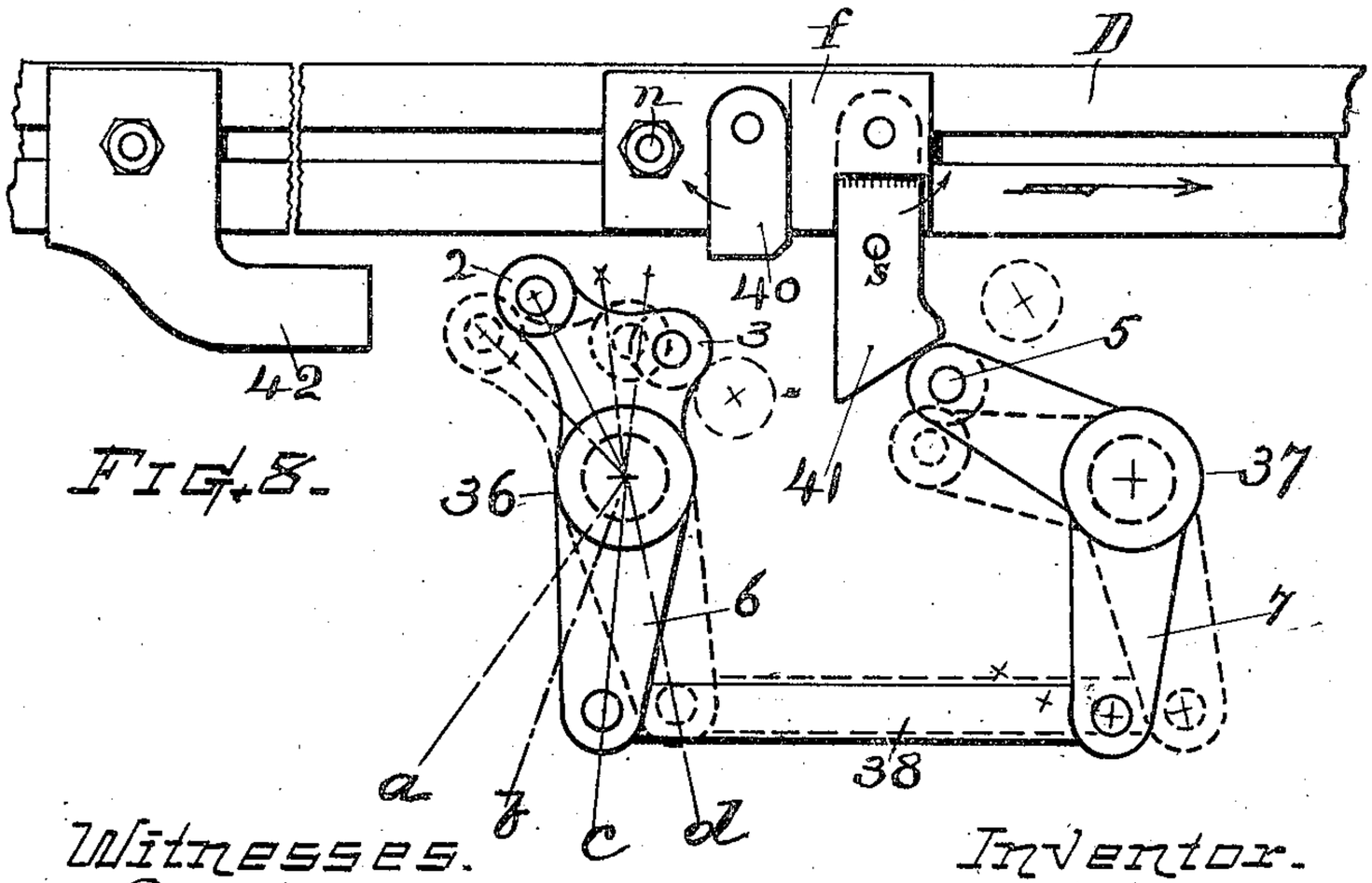


FIG. 8.



Witnesses.

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UNITED STATES PATENT OFFICE.

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METAL-PLANING MACHINE.

934,837. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed April 23, 1908. Serial No. 428,708.

To all whom it may concern:

Be it known that I, ALBERT M. POWELL, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Metal-Planing Machines, of which the following is a specification, reference being made therein to the accompanying drawings.

In the use of "high-speed steel" (so called) for the cutting-tools in metal working machines, such as lathes or drills, wherein the cutting action is continuous and uninterrupted, it is possible to attain very high cutting speeds; in some instances a rate of cutting speed of over two hundred feet per minute has been practicably employed. The great utility and advantages of such rapid execution are readily appreciable to any person conversant with the art. In the case of metal-planing machines, however, it has heretofore been found impracticable to employ a cutting speed of great velocity, owing to the fact that the tool will not withstand the shock or blow that it receives when the work strikes the cutting edge thereof. In planing machines the work is fastened to and carried by a reciprocating table or platen that passes alternately back and forth beneath the cutting tool which latter is secured in the tool-holder mounted upon the bar or cross-rail that is adjustably supported upon the stationary upright housings of the machine. This forward and reverse movement of the platen and work necessarily interrupts the cut at each stroke and the tool receives a severe impact blow when starting in anew; the severity and force of such impact increasing greatly as the speed of the platen is made greater; therefore, while a planer as heretofore constructed has been run at a cutting speed as high as sixty, or perhaps eighty feet per minute, the tools will not stand the continued shocks and blows attending the starting into a new cut, and hence thirty or forty feet speed has been heretofore considered a practical limit.

The prime object of my present invention is to increase the efficiency and speed capacity in machines of this class, and to attain a mode of operation in a metal-planing machine whereby the commencement of the cut is effected at a moderate rate of cutting speed or platen-movement, and then when the tool is fairly in the work effecting an automatic acceleration of the cutting speed or platen-movement so that the completion of the cutting stroke is performed at a higher rate of cutting speed than that at which the cutting tool strikes into or enters the work.

Another object is to provide in a metal-planing machine a platen-driving mechanism, an accelerating mechanism in conjunction therewith, and means for throwing the accelerating mechanism into action during the forward movement of the platen as hereinafter explained.

Another object is to provide a metal-planer having a reciprocating table or platen, with operating means adapted to control the movement of said platen to carry the work against the cutting tool at a comparatively slow speed and after the cutting has commenced to increase the cutting speed and continue the cut at a much higher speed throughout the remainder of the stroke; and then to reverse and return the platen at a quick speed, without increasing the rim velocity of the power pulley.

Minor objects and features of my invention are explained in the following detailed description, the particular subject matter claimed is hereinafter definitely expressed in the summary.

The accompanying four sheets of drawings illustrate a preferred form of embodiment of my invention.

Figure 1 represents a side view of the important parts of a metal planer. Fig. 2 is a side view of the dogs as adapted for separate adjustment. Fig. 3 represents a transverse vertical section, approximately at line V V on Fig. 4, a portion of the section being at line V^1. Fig. 4 represents a sectional plan view, more especially for showing the belt-shifting mechanism. Fig. 5 is a section through the power shaft at line W, and Fig. 6 is a section at line X on Fig. 3. Figs. 7 and 8 are diagrammatic views illustrating the action of the tumblers or rockers, and Fig. 9 is a diagram of the cam-plate indicating the corresponding shift positions.

Referring to the drawings, A denotes the bed-frame; A^1 the upright housings; B the

vertically adjustable rail or cross-head supported thereon; C the tool-holder mechanism mounted upon said rail, E the cutting tool, and D the work-carrier, table or platen. All of said parts may be constructed and arranged in well known manner; the reciprocation of the table or platen being effected by the usual gearing from the pinion F on the power shaft. It will be understood that necessary parts of the planer which are not shown herein may be of the usual or any suitable construction.

Upon the operating shaft 10 there is arranged a loose pulley 11, and two power pulleys 12 and 15 for the driving belt 14. The pulley 12 is connected with the shaft by an interior clutch or ratchet device 13 that transmits motion in one direction of rotation and releases in the opposite direction. In the present instance a roller clutch is employed, (see Figs. 3 and 5) but any other form of ratchet or clutch mechanism affording equivalent action may be employed. Adjacent to the side of the pulley 12 I arrange the third pulley 15, which is loose upon the shaft, and has within its periphery an accelerating mechanism or train of differential sized gears, preferably as shown in Figs. 3 and 6, comprising a gear 16 fixed to the center of the pulley disk, and which meshes with pinions 17 mounted to turn on studs 18 stationarily supported in the frame member A^2. Larger pinions or gears 19 are mounted on said studs and respectively firmly attached to the pinions 17, said gears in turn meshing with a central pinion 20 keyed to the shaft 10. Any convenient number of sets of gears 17 and 19 may be employed within the pulley 15. In the present drawing two sets are shown. Motion transmitted from the pulley 15 through the accelerating gear causes a more rapid rotation of the shaft 10 than is effected when transmitted through the clutch ratchet 13 from pulley 12.

At the opposite end of the operating shaft there is provided a loose pulley 21, and a tight pulley 22 for the reversing belt 23. When the motion of the shaft is reversed the pulley 15 revolves correspondingly slower than the shaft; while the pulley 12 is simply unclutched and then turns with the reverse movement of its ratchet 13. It will thus be seen that a high speed return movement can be employed without increasing the rim velocity of the power pulleys beyond a practicable limit.

The shipper rods 25 and 26 that carry the belt-guiding eyes for the driving belt 14 and reversing belt 23, are respectively disposed in suitable bearings transversely in the frame, and are connected for endwise movement with swinging arms or levers 27 and 28 fulcrumed on stationary parts of the frame, and each having a roll-stud or engaging member that works in the cam slots 30 and 31 of the endwise movable plate or shifting slide 33. Said slide is connected by a link 34 to a crank arm on the inner rocker-head 35 of the tumbler or rocker 36.

The cam slot 30 (see Fig. 9) for controlling the shift of the power belt 14, is formed with three stages and two inclined offsets of suitable extent; while the cam-slot 31 for controlling the shift of the reversing belt 23 is formed with two stages and one inclined offset. In the construction shown I provide two tumblers 36 and 37; the first being provided with two contact lugs or rolls 2 and 3 (see Figs. 7 and 8) disposed approximately in the relation indicated; while the second tumbler 37 has one contact lug or roll 5, and is arranged at a short distance from the first tumbler. The two tumblers are suitably connected for united operation, in the present instance being provided with downwardly projecting arms 6 and 7 that are connected together by a pivotally attached link bar 38. The tumbler 36 is rigidly joined with the inner head 35 by an axle or journal extending through the frame, so that the outer and inner tumbler-heads move in unison.

The trip-dogs, consisting of the starting dog 40, supplemental dog 41 and reversing dog 42, are adjustably secured upon the edge of the platen, as indicated. The dog 40 is brought into contact with the roll 2 of tumbler 36 by the reverse movement of the platen. The supplemental dog 41 is brought into contact with the roll 5 of tumbler 37, by the advance movement of the platen; and the dog 42 is brought into contact with the roll 3 of tumbler 36 at the limit of the advance movement. The dogs 40 and 41 can be both arranged upon the same adjusting block *f*, as shown in Figs. 1 and 7, or they may be provided with separate blocks f^1 and f^2, as in Fig. 2, so as to be independently adjustable along the edge of the platen. The dog-blocks are secured to the grooved edge of the platen in usual manner by a tee bolt and nut *n*. The dog 41 is preferably made with a stop-pin or device at *s*, whereby it can be temporarily retained out of engagement, or swung up to the position indicated by dotted lines *x* in Fig. 7. When so held out of action the machine can operate without acceleration of the platen movement.

In Figs. 7, 8 and 9 lines *a*, *b*, *c*, and *d* are delineated to indicate the several shift positions of the tumbler and the relatively corresponding positions on the cam-plate in respect to the engaging studs of the shipper arms 27 and 28 and movement of the belt-shifting devices. When the parts are at position *a* the drive-belt is on the loose pulley

11, the reverse belt 23 is on the tight pulley 22 and the platen returning. When at position *b* the belts are each on their loose pulleys and the shaft 10 is idle. When at position *c* the drive-belt is on the power pulley 12, the reverse belt on its loose pulley. When at position *d* the drive belt is on the acceleration pulley 15 and the platen advancing at high speed.

The mode of operation is as follows: When the platen starts to advance the work against the cutting tool, it moves at moderate speed until the tool has started in cutting, then the speed of the platen movement is increased by the automatic action of the mechanism and the cut is carried through at a greater velocity or much higher speed than that at which the tool strikes into the work. With reference to Fig. 7, the tumblers 36 and 37 are shown in full lines, as when the platen is on the return; the platen moving in the direction indicated by the arrow. This movement brings the dog 40 into contact with the roll 2 of the tumbler 36 and moves the tumblers to the position *c*, as shown by dotted lines in Fig. 7 and full lines in Fig. 8, effecting a corresponding movement of the cam-plate 33, and the shifting of the driving-belt 14 onto the power pulley 12. (In this shift the momentum of the moving platen carries it past the position *b* where the belts are both on the loose pulleys.)

As the platen D starts on its advance, for a distance sufficient to get the tool fairly into the work, the shaft 10 is operated by the belt 14 upon the power pulley, the ratchet 13 engaging to drive the shaft. The platen is then moving in the direction indicated by arrow in Fig. 8, and brings the inclined end of the dog 41 into contact with and depresses the roll 5 of tumblers 37, thereby swinging the tumblers to the position *d*, or as shown by dotted line in Fig. 8, and effecting a shift of the driving-belt 14 onto the pulley 15, which by reason of the accelerating mechanism increases the velocity of the shaft and cutting speed of the platen proportionally as the predetermined proportions of the accelerating mechanism. When the accelerating mechanism comes into action the speed of the inner member of the ratchet 13 runs away from the outer member or pulley and simply unlocks the ratchet and frees the pulley, so that the shaft and ratchet member can revolve much faster than the revolutions of the pulley rims under the driving belt, without interfering with the action.

At the predetermined limit for the platen movement the dog 42 strikes the roll 3 and throws the tumblers 36 and 37 back to the position *a*, thereby effecting a shift of the driving-belt to the loose pulley 11, and a shift of the reversing belt to the pulley 22, for returning the platen to its primary position, for there again shifting and starting another cut.

When the drive-belt 14 is shifted from the loose pulley onto the moderate speed or initial power pulley 12, the starting of the shaft 10 is gradual, by reason of the slight slipping of the belt. Likewise it may be noted that when the belt is shifted from said power pulley to the accelerating pulley 15, the rim speed of the two pulleys is the same; but as the belt passes onto the latter pulley the shaft commences to accelerate with a gradually increasing instead of an abrupt action, owing to the slipping and elasticity of the belt upon said latter pulley; hence the augmentation of the cutting speed from moderate to high speed while the tool is in the work, is effected by gradual and easy transition and without causing a sudden jump or jerky movement of the tool that might affect the quality of the cut.

It is well known that there have been devices heretofore employed, consisting of extra belts and pulleys for increasing the return movement of the platen in a metal planer. Also various devices, commonly called "variable-speed devices", for changing the general running speed of the machine in full; but all are designed to give a constant speed of cutting from start to finish of the cut. Such mechanisms are essentially different in nature, purpose and result from the invention herein set forth. So far as I have knowledge there has not heretofore been devised or known any means for automatically accelerating or increasing the cutting speed in a metal-planing machine at each reciprocation and during the continuous forward movement of the platen while the tool is in the work and taking off its chip.

I am aware that in practicing my invention some changes may be made in the form of its embodiment, by those skilled in the art, without departure from the nature and scope of the invention as expressed in the claims. I do not wish, therefore, to be limited to the special construction in detail as herein shown.

What I claim and desire to secure by Letters Patent is—

1. In a metal planing machine, the combination with the platen, the operating shaft, drive-pulleys thereon, and means for moving the platen forward to carry the work against the tool; of an accelerating mechanism, operatively disposed intermediate its drive-pulley and the platen-moving devices, and coacting with said operating-shaft, means for starting and reversing the platen movement, and means for automatically putting

said accelerating mechanism into action after the platen has moved a predetermined distance with the tool in cutting action.

2. A metal planer including within its structure, in combination with the work-supporting platen, mechanism for reciprocating said platen, and the shaft therein whereby said platen-reciprocating mechanism is operated; a constant-speed drive-means for applying operative force, means coactively connected with said shaft for initiating the forward cutting stroke of the platen at a predetermined normal low velocity, means coactively connected with said shaft for advancing the forward cutting stroke of the platen at a predetermined greater or high velocity without change in the speed of the operating force, mechanism adapted for automatically shifting the drive or operative force from said lower-velocity means to said higher-velocity means, and a shift-controlling device carried by the platen and positioned for mechanically effecting action of said shifting mechanism after the cutting-tool has entered the work and while in cutting action.

3. A metal planer including a reciprocating platen, a platen actuating mechanism provided with an operating shaft journaled in bearings in the bed-frame and having thereon means for rotating said shaft for the forward movement of the platen at normal cutting speed, and means for rotating said shaft for forward movement of the platen at higher cutting speed, said means severally operable by a uniformly speeded drive-belt, an automatic belt-shifting mechanism for shifting the drive power belt from the normal to the higher speed means, a controlling dog carried by the platen for effecting said change of speed during the normal cutting action in the forward movement of the platen, and a reverse-drive pulley arranged for reversely rotating said operating-shaft to return the platen at a higher speed than its normal cutting-speed.

4. In a metal planer, the combination, with the reciprocating platen, platen-actuating gearing, and its operating shaft; of two drive-pulleys and a loose pulley, of equal diameters, arranged adjacent to each other on said shaft in the order specified, the loose pulley at the outer side, a forwardly-engaging backward-releasing means operatively connecting the first of said drive-pulleys with said shaft for its forward rotation in unison with the pulley, means comprising an accelerating train operatively connecting the second of said drive-pulleys with said shaft for its rotation at greater velocity than said pulley, a driving-belt shiftable to either pulley, said pulleys adapted for passing the driving-belt immediately from the first to the second adjacent drive-pulleys while both said pulleys are running at a uniform rim-velocity, a belt-shifting mechanism, and means carried by the platen for controlling said belt-shifting mechanism, for the purpose set forth.

5. In a metal-planing machine, the combination with the reciprocating platen and platen-actuating mechanism, of the operating-shaft provided with a loose pulley, a power pulley connected with said shaft by a ratchet or clutch device operative in one direction and releasable in the other direction of rotation, an accelerator pulley connected with said shaft by an accelerating mechanism, means for shifting the driving-belt to the several pulleys, and means actuated by a member attached to the platen for changing the drive from said power pulley to the accelerator pulley at a predetermined position in the advance movement of the platen.

6. In a metal-planer, in combination with the reciprocating platen, its actuating gears and operating shaft, and a single drive-belt; means for rotating said shaft at different velocities, including adjacent pulleys of similar diameter for said belt, a belt-shifting means for guiding said drive-belt onto either of said pulleys, a pair of rocking tumblers having connections for moving the belt-shifting means, said tumblers provided with dual and single contact lugs respectively, means connecting said tumblers for conjoined action, trip-dogs for starting and reversing the platen movement, and a supplemental dog carried by said platen and adapted for imparting a secondary movement of the tumblers for intermediately controlling a shift of the drive-belt onto the high velocity pulley.

7. In a metal-planing machine, the combination with the platen and platen-actuating mechanism, of the operating shaft, pulleys for the driving-belt arranged on said shaft, and comprising a loose pulley, an initial power pulley connected to the shaft by a ratchet-clutch, a power pulley mounted loose upon the shaft and having a central gear, a system of speed-increasing gearing connecting the same with the shaft; pulleys for the reversing belt adapted for giving high speed reverse action, belt-shipping devices including the cam-plate having its shipper-actuating slots formed approximately as shown, a pair of tumblers actuating said cam-plate, means connecting said tumblers for simultaneous movement, the starting and reversing dogs, and a supplemental dog that effects action of the belt-shifting devices to shift the drive-belt onto said speed-increasing pulley at a predetermined position in the advance movement of the platen.

8. In a metal planer of the character de-

scribed, the combination, of a reciprocating platen, platen-operating gearing, an operating shaft having therefor a speed-accelerating mechanism for said shaft, pulleys for the forward-driving belt and pulleys for the reversing belt, belt-shipping devices for driving-belt and reversing-belt, means for moving the respective belt-shipping devices, tumblers connected therewith, and platen-carried controlling devices for initiating the starting, reversing and intermediate acceleration of the platen movement, and means for releasing the controller for the accelerating mechanism and maintaining it idle, to permit operating the planer with a non-accelerated forward movement of the platen.

Witness my hand this 21st day of April, 1908.

ALBERT M. POWELL.

Witnesses:
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CHARLES S. POWELL.