J. C. POTTER & J. JOHNSTON.

METAL WORKING MACHINE.

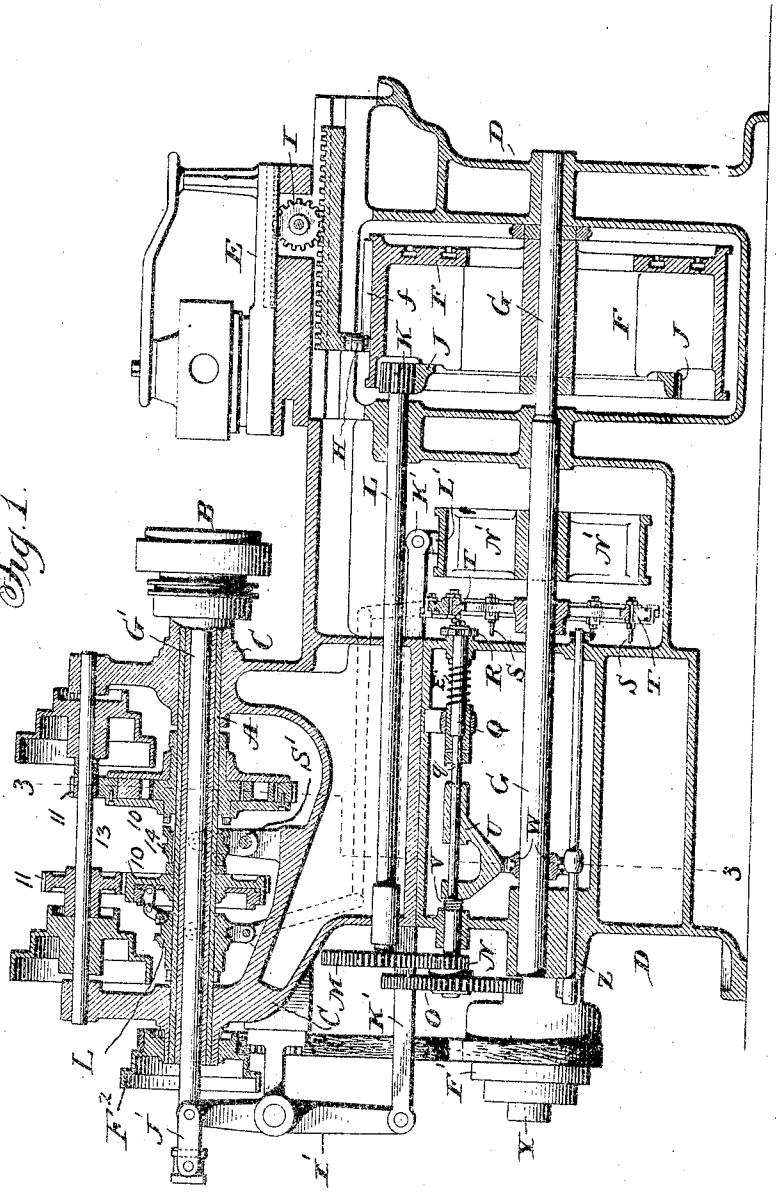
APPLICATION FILED MAR. 19, 1904.

1,038,434.

Patented Sept. 10, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



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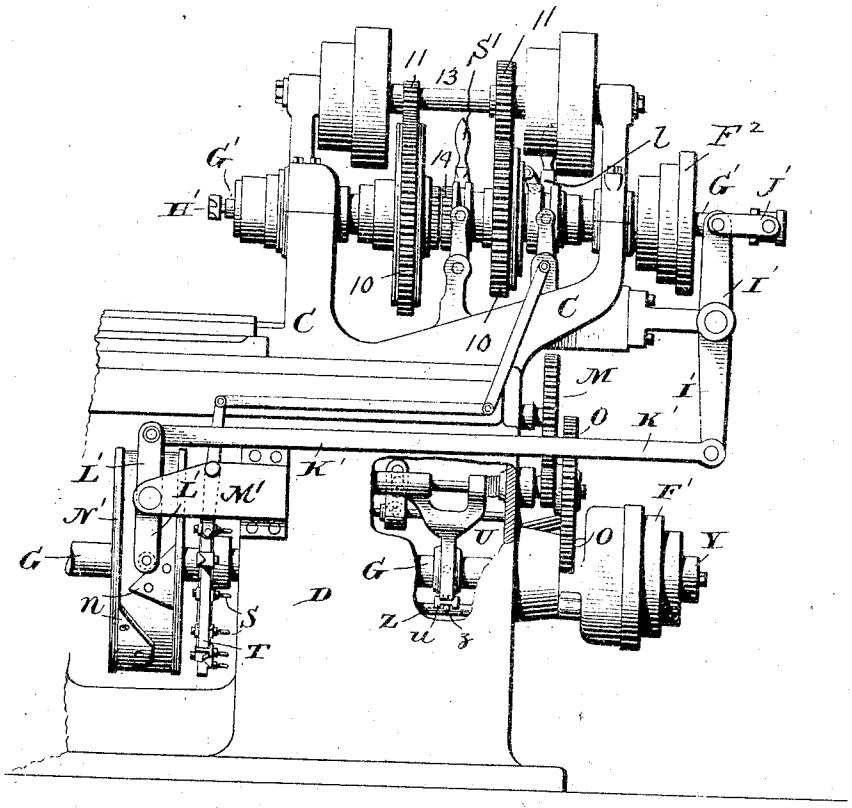
4 SHEETS—SHEET 2.

Fig. 2.



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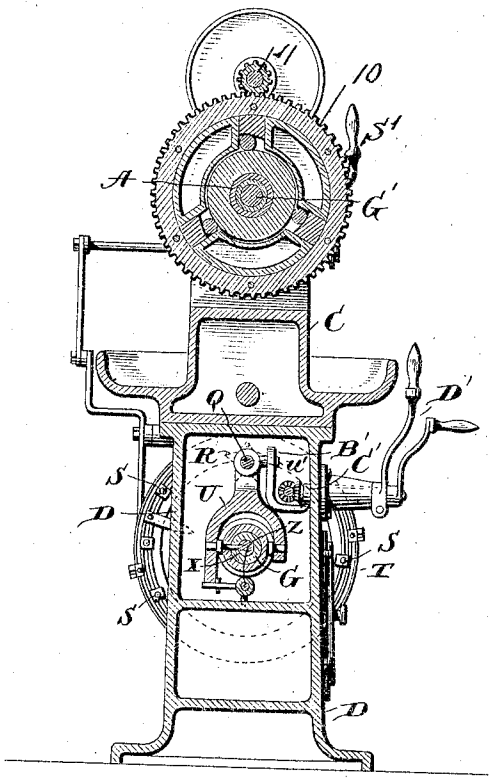
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

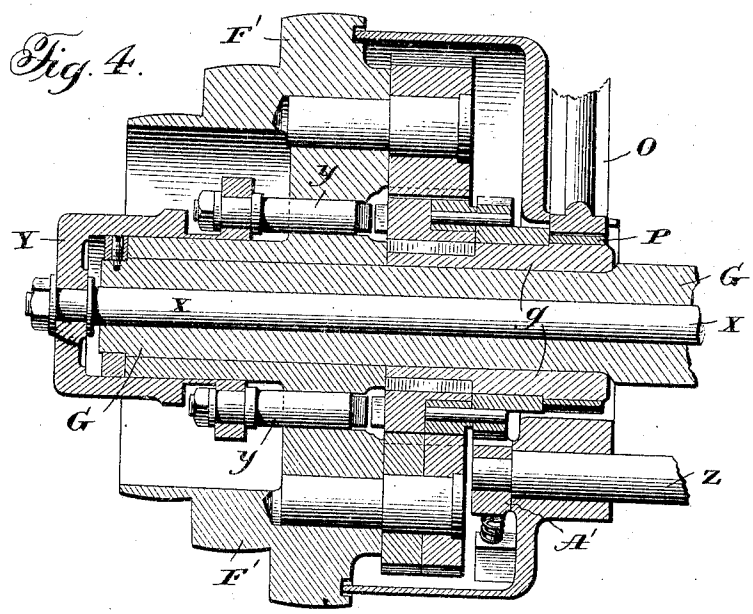
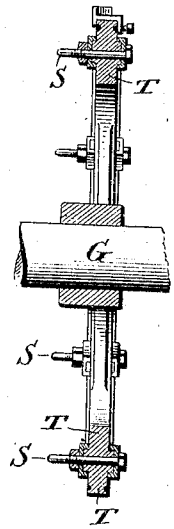


Fig. 5.



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UNITED STATES PATENT OFFICE.

JAMES CHARLES POTTER AND JOHN JOHNSTON, OF PAWTUCKET, RHODE ISLAND, ASSIGNORS TO POTTER AND JOHNSTON MACHINE COMPANY, OF PAWTUCKET, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

METAL-WORKING MACHINE.

1,038,434. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed March 19, 1904. Serial No. 199,018.

To all whom it may concern:

Be it known that we, JAMES C. POTTER and JOHN JOHNSTON, of Pawtucket, in the county of Providence, and in the State of Rhode Island, have invented a certain new and useful Improvement in Metal-Working Machines, and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a machine embodying our invention; Fig. 2 is a view of rear elevation of a portion of the machine; Fig. 3 is a section on the line 3—3 of Fig. 1; Fig. 4 is a detail view in section of the differential gear; and Fig. 5 is a detail view of the speed-changing wheel.

The object of our invention is to improve the construction of machines for turning or performing other operations on metal so as to increase the efficiency of such machines, and by improving their accuracy in the performance of the operations, and to these ends our invention consists in the machine having the features of construction substantially as hereafter specified and claimed.

The machine selected for illustration in which we have embodied our invention is an automatic turret lathe, but it is to be understood that we do not limit ourselves to a turret lathe, nor to an automatic machine in respect to those features of our invention that are applicable to machines other than those of this description. In said machine, the spindle A having a chuck B, whose construction need not be described, is mounted in bearings on the head stock C rising from a base or frame D. As the gearing for driving the spindle forms no part of this invention, it will not be described in detail, its particular construction and operation being fully illustrated and described in Potter & Johnston Machine Company's Patent No. 761,905, dated June 7, 1904, on an application filed May 8, 1902, which embodied the subject matter of the present application, and contained claims which under the requirements of the Patent Office were not permissible in said application filed May 8, 1902, and therefore the present application has been filed. A general description of the spindle driving mechanism herein is however desirable, it comprising two gears 10 of different diameter, with which mesh pinions 11 also of different diameter each driven by a cone pulley on a shaft 13 mounted on the head of stock so that by clutching one gear or the other to the spindle the latter may be revolved at different speeds in the same direction to suit the speed requirements of different kinds of work. The clutch may be shifted either automatically or by hand to cause the spindle to run at the required different speeds for the performance of work.

For reciprocating the turret or tool slide E a drum F on the shaft G is used, having on its periphery cam plates *f* that engage a roller on a bar H, mounted to slide in guides on the frame *d*, and having on its upper side rack teeth that mesh with a pinion I on a shaft mounted on the turret block and meshing with a rack on the under side of the turret slide. The arrangement of the cam plates is a familiar one and need not, therefore, be described. For revolving the drum, there is attached to it on one side a spur gear J with which meshes a pinion K on one end of a shaft L on whose other end is a gear wheel M. Meshing with said wheel is a pinion N, on the same shaft with a gear O in mesh with a pinion P fast to a hollow sleeve or shaft *g* loose on the shaft G, and driven by a differential gear hereinafter described. The advantage of driving the cam drum F, as above described, over the practice which has heretofore prevailed of driving the drum from the shaft, is that the drum is revolved easily and smoothly, without objectionable strains on the parts that are apt to damage them and cause such twisting of the drum as to derange the proper relative position of the cam plates and the roller on the slide-actuating device, and produce inaccurate movements of the slide. Our gearing for driving the drum,

being composed of simple spur gears, is not subject to wear to an extent as to impair the accuracy of the mechanism or be otherwise objectionable. The drum F is keyed to the shaft G and, therefore, the latter is given its motion from the drum.

As is usual, provision is made for moving the tool-carrying slide at different speeds, a differential gear, as is common, being employed for this purpose. For shifting the clutch and pawl of the differential gear automatically, a shaft Q is journaled in bearings in the frame D, on one end of which is a star wheel R situated to have its teeth engaged by pins or studs S attached to a wheel T on the shaft G. Each pin or stud moves the wheel and its shaft through the distance of one tooth. A friction device, such as a fiber washer, is applied to the star wheel to prevent its going beyond the point at which a pin leaves it. On the other end of the shaft Q there are several inclined or cam surfaces *q* adapted to coact with similar surfaces at one end of a sliding yoke U mounted on an extension of the shaft Q. The cam faces on the shaft Q engaging those on the yoke will, by the rotation of the shaft, slide the yoke in one direction. The movement of the yoke in the opposite direction is produced by a coiled spring V interposed between it and an adjacent portion of the frame D. The yoke U engages a sliding collar W on the shaft G which collar, by a transverse pin, is connected to a rod X in an axially located longitudinal passage in the shaft G and connected with the clutch sleeve Y of the differential gear. In the lower end of one of the branches of the yoke, and preferably in a hardened plate attached thereto, is a notch *u* with two inclined sides adapted to act on the end of a radial arm *z* on a rock shaft Z journaled in bearings in the frame D to which is attached the pawl A′ of the differential gear. The yoke, it will be observed, operates both the clutch and the pawl of the differential gear. When the yoke is moved in either direction a sufficient distance, one or the other inclines will engage the arm, and the shaft Z being thereby rocked, the pawl of the differential gear will be disengaged from its ratchet.

To enable the yoke to be moved by hand so that the change of speed of the tool slide can be made at will, a lever B′ attached to a rock shaft C′ engages a pin or stud *u′* on the yoke and is adapted to be operated by a hand lever D′ on the rock shaft. In view of the fact that the yoke may be held by the hand lever with its cam surfaces engaging those of the shaft Q and the star wheel R be engaged by the pins or studs S, the shaft Q is movable longitudinally, so that it may revolve under these circumstances, and breakage of the parts is prevented. For returning the shaft to its normal position, from which it may be moved by the action of the cam surfaces on each other, a coiled spring E′ is provided.

Our mechanism for automatically operating the yoke is simple, and works very easily and smoothly. The clutch sleeve Y of the differential gear has connected to it at diametrically opposite points two bolts *y* that pass each through a hole in a cone pulley F′ so that they may engage clutch teeth on the side of the gear wheel of the differential gear, which is fixed or keyed to the sleeve *g*. When the cone pulley and the fixed gear of the differential gear are clutched together, the sleeve *g* carrying the pinion P is directly driven from the cone pulley, while when said pulley and gear are unclutched, said sleeve and pinion are driven through the sun and planet gearing.

As in the case of the machine of Patent No. 761,905, issued June 7, 1904, the turret slide moving drum is geared to the spindle A which has on it a cone pulley F^2 which is connected by a belt with the cone pulley F′ of the cam drum revolving mechanism, so that power to rotate the cam drum to actuate the turret slide is taken from the work spindle. By gearing the turret slide moving means and the work spindle together, it will be seen that the relation of spindle speed and tool-feeding speed is maintained at a constant or fixed ratio, so that any liability to improper relation of speed of rotation of work and feed of tool is avoided, which is not the case where the cam drum and the spindle are not geared together.

The cam plates on the drum F which move the tool-slide to the work have such length as to move the slide through the greatest extent of travel it is desired it shall have. For adjusting the parts so that the tool-slide will move at the fast speed until the tool engages the work, when the length of travel of the slide during the operation of the tool on the work is less than the entire length of travel of the slide, the slide-operating roll is moved to the point on the cam where the slower working feed is to begin, and then one of the pins of studs S on the speed-changing wheel T is fixed in a position where it will engage a tooth of the star-wheel R, so as by the operation of said star-wheel and the parts actuated thereby the differential gear will drive the drum at the slow speed. The drum F being revolved to carry the slide-operating roller to the end of the cam-plate, the next following pin or stud S on the speed-changing wheel T is secured in a position on the wheel to engage a tooth of the star-wheel to actuate the latter to effect a

change of the differential gear from the slow to the fast speed.

Although our machine is so constructed that the changes of speed of revolution of the spindle and speed of the tool-slide are effected automatically, yet the revolution of the spindle and the movements of the tool-slide are controllable at the will of the operator. Hence, if by the action of the automatic mechanism the spindle be revolving at the slower speed, yet if it be desired to run it at the faster speed—for example, when it is desired to see whether the work is truly chucked—this can be accomplished by operating the hand lever 1, and if it be desired to stop the revolution of the spindle such can be done by operating the said levers 1 and S′ to unclutch the gear wheels 10 from the spindle. By means of the hand lever D′ the yoke V which actuates the pawl and clutch of the differential gear, may be moved to a position to disengage both the clutch and the pawl, thus stopping the revolution of the drum F, and consequently the movement of the tool-slide. It may be moved to a position to engage the pawl and ratchet of the differential gear, but not the clutch, so as to run the drum F at a speed to cause the slow travel of the tool-slide, and it may be moved to a position to disengage said pawl and ratchet and to engage the clutch of the differential gear, and thereby cause the tool-slide to move at a high speed.

In working on some objects, such, for example, as a pulley, which requires facing of both ends of its hub, rechucking is necessary for facing the end of the hub within the chuck. To avoid the necessity for re-chucking, and automatically to face the end of the hub within the chuck, we provide our machine with a back facing attachment. This comprises a longitudinally movable rod G′ passing through the spindle A that carries on its front end the facing tool H′ which, by the movement of the rod at the proper time, is brought to, and removed from, position for work. The operation of the back facing tool is preferably so timed that said tool will do its work while similar work is being done on the outer end of the hub, as thus any tendency of the back facing tool to push the work out of the chuck will be opposed. For moving the rod G′ longitudinally, any desired mechanism may be employed, such for example, as that shown, which comprises a lever I′ pivoted to a bracket on the head stock and connected at one end by links J′ to the rod, and at the other end by the link K′ to one end of a lever L′ pivoted to a bracket M′ on the frame D, and having on its other end a roller that is alternately engaged by cam plates *n* on a drum N′ on the shaft G.

It is to be understood that though, in this specification, we have described, with particularity, details of construction, and though in the embodiment of our invention shown and described we prefer these details of construction, we nevertheless do not limit ourselves to any special construction or organization of the members of the machine.

Having thus described our invention, what we claim is—

1. The combination of a work spindle, different sets of gears for driving it at different work-performing speeds in the same direction, automatic means to change the gear connection with the spindle, a tool slide movable at different speeds at different times and in the same direction for the performance of work, and while the spindle is revolving in the same direction, means for moving said slide, and gearing between the slide moving means and the work spindle that preserves the ratio of working spindle speed and working feed of tool.

2. The combination with the work spindle and the tool slide, of a driving member, a gear connection from said driving member to said work spindle, including a plurality of trains of gears, said trains, respectively, driving the spindle at different working speeds, automatically operated clutch mechanism for said trains of gears, and means for gearing the spindle and the tool slide together that preserves the ratio of working spindle speed and working feed of tool.

3. The combination with the work spindle and the tool slide, of a driving shaft, gearing between said shaft and the work spindle to drive the same at different working speeds, comprising a pair of gears of different diameter on the shaft, and a pair of gears on the spindle of different diameters respectively meshing with those on the drive shaft, a clutch for controlling the gear connection between the drive shaft and the spindle, means automatically operating the clutch, and means for gearing the spindle and the tool slide together that preserves the ratio of working spindle speed and working feed of tool.

4. The combination with the work spindle, rotatable at different working speeds, and the turret slide, of a driving member, a connection from said driving member to said work spindle, a driving connection from the spindle to said turret slide that preserves the ratio of working spindle speed and working feed of tool, and automatic speed changing means located in advance of said driving connection.

5. The combination of a work holding means and a driving shaft operatively connected therewith, different sets of gears for driving said shaft in the same direction for

different work performing speeds of the work holding means, automatic means to change the gear connections with said shaft, a tool slide movable at different speeds and in the same direction for the performance of work and while the work holding means is revolving in the same direction, means for moving said slide, and gearing between the slide moving means and said shaft that preserves the ratio of speed of the work and the working feed of the tool.

In testimony that we claim the foregoing we have hereunto set our hands.

JAMES CHARLES POTTER.
JOHN JOHNSTON.

Witnesses:
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JAMES HEYWOOD.