

No. 761,905.

PATENTED JUNE 7, 1904.

J. C. POTTER, J. JOHNSTON & E. B. SELLEW.

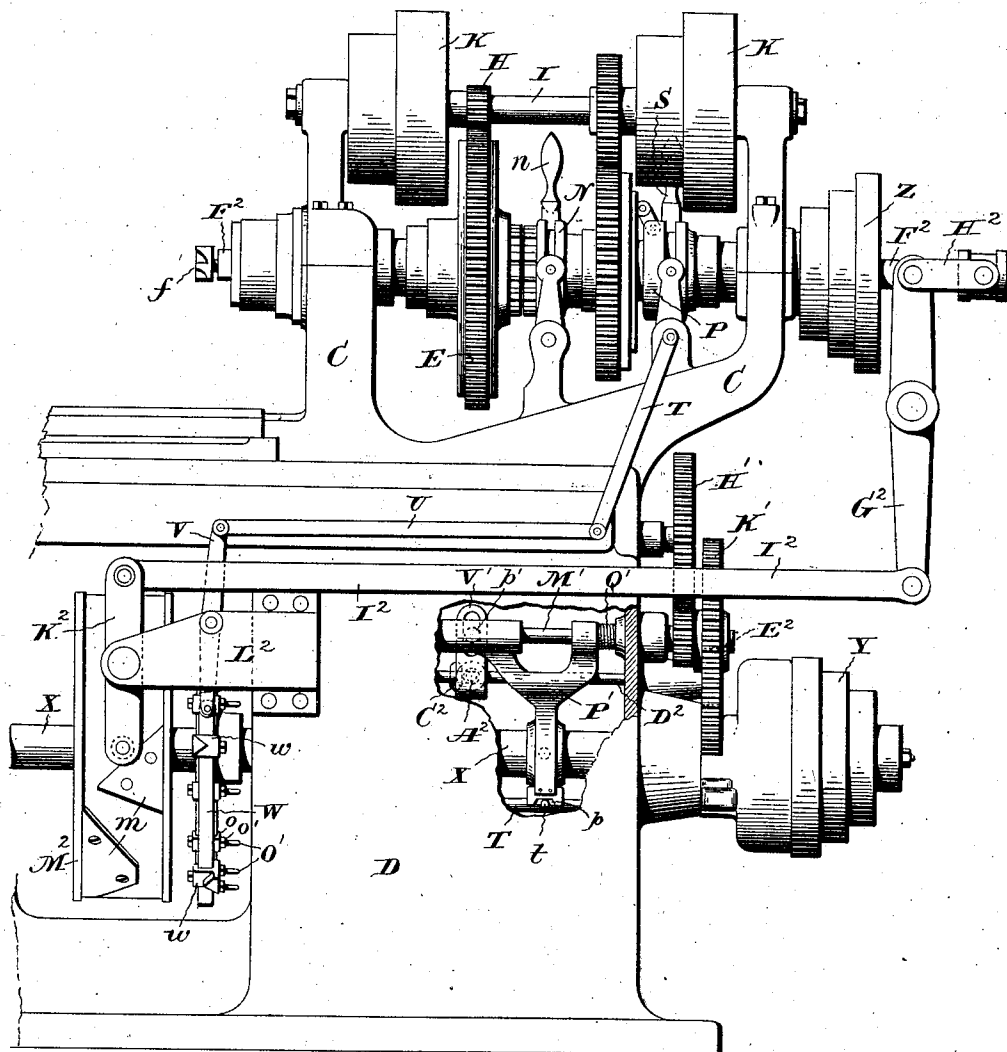
GEARING.

APPLICATION FILED MAY 8, 1902.

NO MODEL.

4 SHEETS—SHEET 2.

Fig. 2.



Witnesses:

Jas. C. Hutchinson
J. L. Lawlor

Inventors.

Jas. C. Potter, Jno. Johnston & E. B. Sellow,
by Edwin J. Prindle, their Atty.

No. 761,905.

PATENTED JUNE 7, 1904.

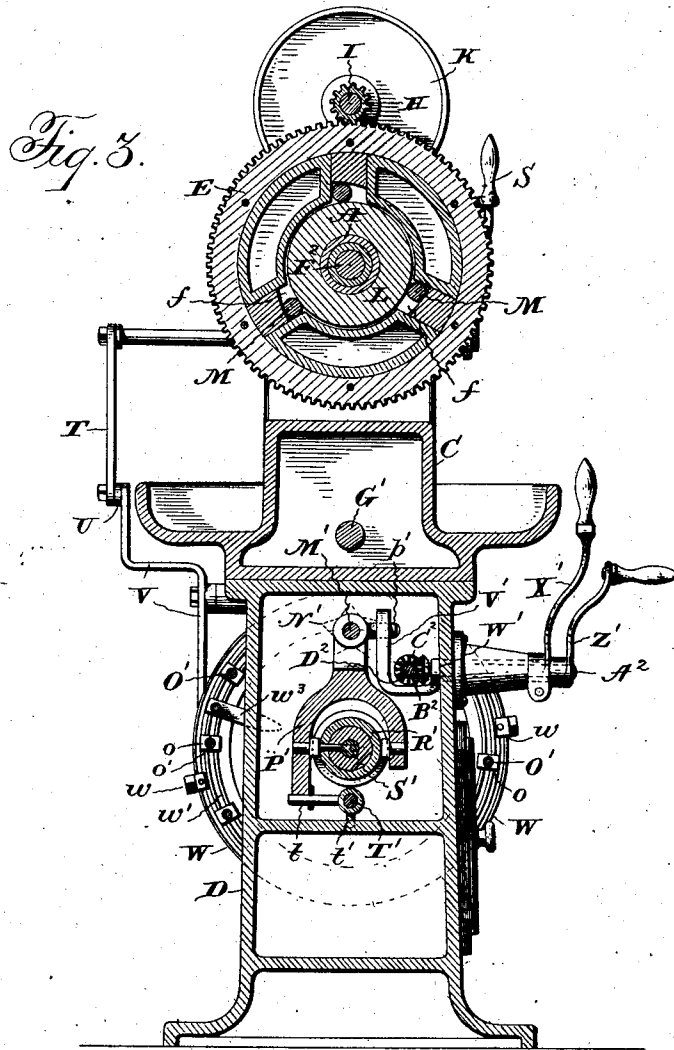
J. C. POTTER, J. JOHNSTON & E. B. SELLEW.

GEARING.

APPLICATION FILED MAY 8, 1902.

NO MODEL.

4 SHEETS—SHEET 3.



Witnesses:

Jas. C. Hutchinson
 J. L. Lawlor.

Inventors.

Jas. C. Potter, Jno. Johnston and Ernest B. Sellew,
 by Edwin J. Prindle, their Attorney

No. 761,905.

PATENTED JUNE 7, 1904.

J. C. POTTER, J. JOHNSTON & E. B. SELLEW.

GEARING.

APPLICATION FILED MAY 8, 1902.

NO MODEL.

4 SHEETS—SHEET 4.

Fig. 4.

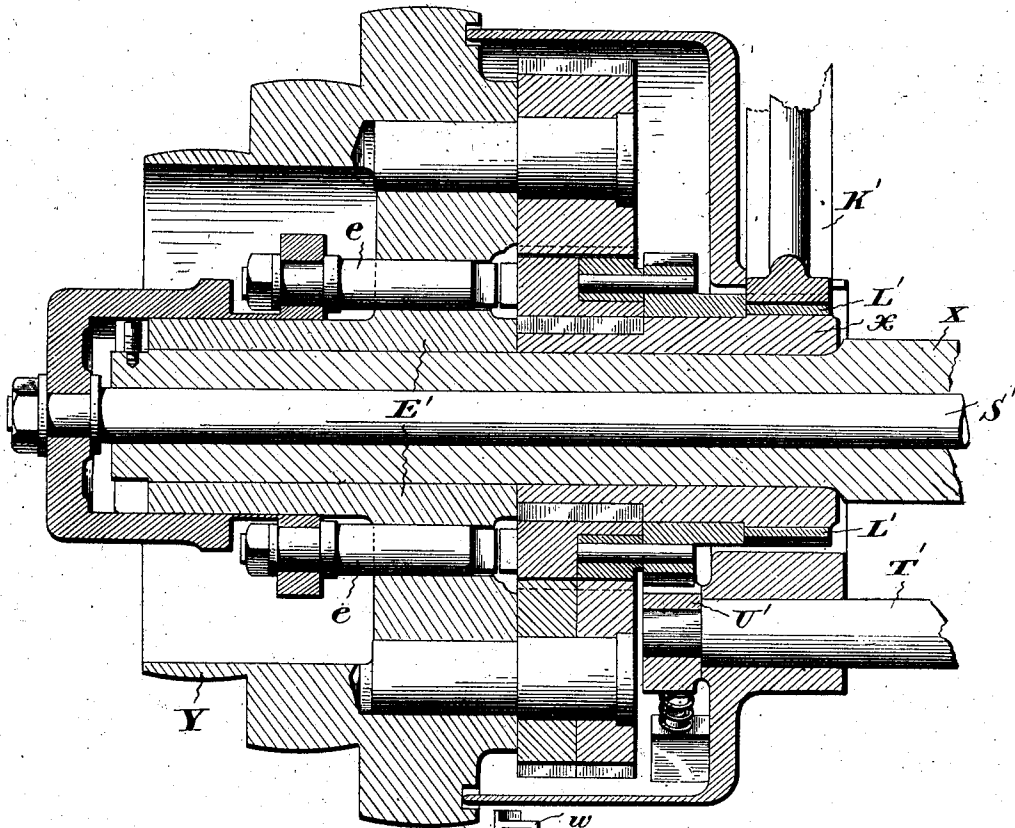
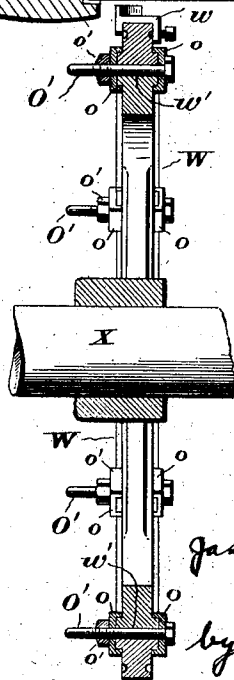


Fig. 5.



Witnesses:
Gas. C. Potter, Jr.
J. L. Lawlor.

Inventors:
Gas. C. Potter, Jr., Johnston and
Ernest B. Sellew,
by Edwin J. Prindle, their atty.

UNITED STATES PATENT OFFICE.

JAMES C. POTTER, JOHN JOHNSTON, AND ERNEST B. SELLEW, OF PAW-TUCKET, RHODE ISLAND, ASSIGNORS TO POTTER AND JOHNSTON MACHINE COMPANY, OF PAWTUCKET, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

GEARING.

SPECIFICATION forming part of Letters Patent No. 761,905, dated June 7, 1904.

Application filed May 8, 1902. Serial No. 106,497. (No model.)

To all whom it may concern:

Be it known that we, JAMES C. POTTER, JOHN JOHNSTON, and ERNEST B. SELLEW, of Paw-tucket, in the county of Providence, and in the State of Rhode Island, have invented certain new and useful Improvements in Gearing; and we 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 in 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, the facility of operating the same, and to better the construction by rendering them more durable and less likely to get out of order 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 hereinafter 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. Mounted on the spindle are two gears E and F, respectively, of different diameter. Meshing with the gear E is a pinion G, and meshing with the gear F is a pinion H, both pinions being on a shaft I, mounted on the head-stock at any convenient point.

For rotating each pinion a cone-pulley K, preferably having three steps, is mounted on the shaft I, each pinion being thus revolved by its own pulley and independent of the other, and both; and of course the gears with which they mesh, being in motion at the same time, the speed of the smaller gear obviously being greater than that of the larger one. The larger gear is adapted to be automatically connected to and disconnected from the spindle when the smaller gear is respectively unclutched from and clutched to the spindle, and the means we prefer to use for effecting the automatic engagement and disengagement of the larger gear comprising a collar L on the spindle A and rolls M, placed each in a cavity or recess *f* in the gear F. Each recess or cavity *f* contracts or narrows in one direction, and when the roll is in the narrow end thereof the gear and collar will be locked together and the collar thereby rotated by the gear, while when the roll is in the wider part of the cavity it will be free from the gear, and the collar will not partake of the rotation of the gear. The gear F is journaled on hubs on opposite sides of the collar L, so that it therefore has a good firm bearing and the collar and gripping-rolls are housed by the gear, it having on both sides webs or side pieces, one of which is secured by screws. Normally the collar L is connected to the spindle; but as it is desirable, for reasons hereinafter given, to enable it at will to be disengaged from the spindle a clutch is provided comprising a sleeve N, splined to the spindle, the teeth of which engage clutch-teeth on the collar L. A hand-lever *n* is used for sliding the clutch-sleeve into and out of engagement with the clutch-teeth on the collar L. The collar L being clutched to the spindle, as it is normally, it will be evident that with the gear E also clutched to the spindle the spindle will be revolved by said gear E and the collar L moved faster than the gear F revolves, and the gripping-rolls M, moving to the wider portions of the cavities or recesses in which they are placed will permit the inde-

pendent faster motion of the collar L. On unclutching the gear E from the spindle the said gear E will of course be idly revolved by its pinion G, and the collar L, accordingly not receiving motion from the gear E through the spindle A, will be clutched to the gear F by the rolls M, the rolls by the action of said gear being moved to the narrow part of their recesses, and thus rotatably connecting the gear and collar. Motion will thus be transmitted to the spindle from the gear F through the collar L, and such motion will be at a lower rate of speed than that given by the gear E.

Any suitable clutch may be employed with the gear-wheel E, the one shown being a friction-clutch having a toggle O, connected to and operated by a sleeve P, slidable on the spindle. The sleeve P is engaged by a yoke Q on a rock-shaft R, and to the latter are connected a hand-lever S, so that the clutch may be operated by hand, and a lever T, connected by a link U to a lever V, that is automatically operated, so as to cause the automatic operation of the clutch. The lever V has a roller in the path of blocks *w*, with inclined sides that are attached to the periphery of a wheel W on a shaft X, mounted in the lower part of the machine-frame D, which has at one end a cone-pulley Y for belting to a cone-pulley Z on the spindle A, from which latter power is thus taken to drive said shaft. Successive blocks *w* engage the lever-roller and alternately move the lever in opposite directions, one block thus acting to cause unclutching of the gear E from the spindle and the other block the clutching of such gear with the spindle. The blocks *w* are adjustable to different positions on the periphery of the wheel to enable the point of time in the operation of the machine for automatically changing the speed of the spindle to be fixed as desired and the period during which the spindle is revolved at a given speed to be fixed.

It will be observed by having for each train of spindle-driving gearing its own driving-cone that the speed at which the spindle may be revolved through each train of gearing may be varied by shifting the belt from one step of the cone to another entirely independent of the other train of spindle-driving gearing. Where a single or common driving-pulley is employed for two trains of spindle-driving gearing, so that one train receives its motion through the other, there can be no independent variation of the speed of the trains of gearing. Inasmuch as the operation of one train of spindle-driving gears is made automatic according to the connection with or disconnection of the other train of gears from the spindle, but a single clutch mechanism is required to effect the change from one train of gears to the other as the spindle-driving means.

In a machine such as the one illustrated, in

which the change from one spindle-driving mechanism to the other is automatically accomplished, the use of a single-clutch mechanism is very advantageous, as compared with a machine employing a double-clutch mechanism, which requires the shifting of the clutch-sleeve out of engagement with the other gear, because double the amount of movement of the clutch-sleeve being necessary with the double-clutch construction the inclined faces of the blocks or cams for automatically moving the clutch-sleeve must be given such angular extent as to materially diminish the speed of the machine in view of the amount of time required to effect the operation of the clutch. Considering the fact that the speed-changing wheel is on a shaft that receives motion from the spindle, our construction, whereby the two trains of gearing are independently driven, is advantageous in that at the time of change from one spindle-driving train to the other said shaft is not deprived of power for driving it, as is the case with a construction employing double-clutch mechanism.

For reciprocating the turret or tool slide A' a drum B' on the shaft X is used, having on its periphery cam-plates *b*, that engage a roller on a bar C', mounted to slide in guides on the frame D and having on its upper side rack-teeth that mesh with a pinion D' 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 B 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 E', with which meshes a pinion F' on one end of a shaft G', on whose other end is a gear-wheel H'. Meshing with said wheel is a pinion I' on the same shaft with a gear K', in mesh with a pinion L', fast to a hollow sleeve or shaft *z*, loose on the shaft X and driven by a differential gear herein-after described. The advantage of driving the cam-drum B', 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 B' is keyed to the shaft X, 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 M' is journaled in bearings in the frame D, on one end of which is a star-wheel N', situated to have its teeth engaged by pins or studs O', attached to the wheel W. 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 M' there are several inclined or cam surfaces *m*, adapted to coact with similar surfaces at one end of a sliding yoke P', mounted on an extension of the shaft M'. The cam-faces on the shaft M' 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 Q', interposed between it and an adjacent portion of the frame D. The yoke P' engages a sliding collar R' on the shaft X, which collar by a transverse pin is connected to a rod S' in an axially-located longitudinal passage in the shaft X and connected with the clutch-sleeve E' 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 *p*, with two inclined sides adapted to act on the end of a radial arm *t* on a rock-shaft T', journaled in bearings in the frame D, to which is attached the pawl U' 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 T' 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 V', attached to a rock-shaft W', engages a pin or stud *p'* on the yoke and is adapted to be operated by a hand-lever X' 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 M' and the star-wheel N' be engaged by the pins or studs O' the shaft M' 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 Y' is provided. Our mechanism for automatically operating the yoke is simple and works very easily and smoothly.

The clutch-sleeve E' of the differential gear has connected to it at diametrically opposite points two bolts *e*, that pass each through a hole in the cone-pulley Y, 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 *e*. The bolts *e* have good long bearings in the cone-pulley holes, and this enables us to make the connection

between said bolts and the clutch-sleeve E' loose, so that should there be any twisting of the parts tending to place the clutch-sleeve out of alinement the bolts will be unaffected thereby. This freedom of the clutch-bolts enables change of speed of the differential gear to be instantaneously accomplished, so that it is possible to advance the tool-slide to the work at a high speed until the tool is very close to the work before changing to a slower working speed. The construction of clutch shown, besides giving the long bearings for the clutch-bolts, permits long bearings to be used for the clutch-sleeve and for the cone-pulley. When the cone-pulley and the fixed gear of the differential gear are clutched together, the sleeve *e*, carrying the pinion L', 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.

To enable the adjustment of the star-wheel engaging pins or studs O' to any point around the wheel W, the latter has a continuous circular slot *w'*, through which the pins or studs pass, their position being fixed by clamps on opposite sides of the wheel, comprising each a block *o*, grooved to engage a rib on the side of the wheel on both sides of the circular slot, and a nut *o'*, engaging thread on the pin or stud. Although a ring or annulus free from the wheel results from the continuous slot, said ring or annulus is securely held in place by the pins or studs and the clamps thereof, the studs with their clamps being thus availed of for holding the ring or annulus in place.

Besides carrying the blocks *w* for operating the mechanism for changing the speed of the spindle A and the pins or studs O' for operating the mechanism for changing the speed of the turret-slide the wheel W has also secured to it a lug or block *w''* to engage an arm *t'* on the pawl-carrying shaft T' to rock the latter to disengage the pawl from the ratchet-wheel of the differential gear, and thus stop the revolution of the shaft X and the travel of the tool-slide, such action occurring on the completion of the work of the tools.

The cam-plates on the drum B' 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 or studs O' on the speed-changing wheel W is fixed in a position where it will engage a tooth of the star-wheel N', so as by the operation of said star-wheel and the parts actuated thereby the differential gear will drive the

shaft X at the slow speed. The drum B' being revolved to carry the slide-operating roller to the end of the cam-plate, the next following pin or stud O' on the speed-changing wheel W is secured in a position on the wheel W to engage a tooth of the star-wheel N' to actuate the latter to effect a changing of the differential gear from the slow to the fast revolution of the shaft X. In adjusting the position of the slide-operating roller relative to the drum-cam this is most conveniently done by revolving the drum by power to carry the roller as nearly as possible to the desired position and then to accurately place the roller in position the drum is moved by hand. To move the drum by hand, a crank Z' is attached to a shaft A², having a bevel-pinion B², that meshes with a like pinion C² on a shaft D², that has a pinion E² in mesh with the gear K' of the train of gears which connects the drum revolving-shaft G' with the shaft X.

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 rechucking 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 F², passing through the spindle A, that carries on its front end the facing-tool f', 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 F² longitudinally any desired mechanism may be employed—such, for example, as that shown, which comprises a lever G², pivoted to a bracket on the head-stock and connected at one end by links H² to the rod and at the other end by the link I² to one end of a lever K², pivoted to a bracket L² on the frame D and having on its other end a roller that is alternately engaged by cam-plates m on a drum M² on the shaft X.

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 S, and if it be desired to stop the revolution of the spindle such can be done by operating the said lever S to unclutch the gear-wheel E and

by operating the clutch-lever n to disconnect the collar L from the spindle. By means of the hand-lever V' the yoke P', 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 shaft X, 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 shaft X 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.

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 spindle, two trains of gears for revolving the same at different speeds, and independent driving means for each train of gears.

2. The combination of a spindle, two trains of gears for revolving the same at different speeds, independent, simultaneously-operated driving means for each train of gears, means for clutching one train to and unclutching it from the spindle, and means for automatically connecting and disconnecting the other train and the spindle when the first-mentioned train is, respectively, unclutched from and clutched to the spindle.

3. The combination of a spindle, two trains of gears for revolving the same at different speeds, independent, simultaneously-operated driving means for each train of gears, means for clutching the faster train to and unclutching it from the spindle, and means for automatically connecting and disconnecting the slower train and the spindle when the faster train is, respectively, unclutched from and clutched to the spindle.

4. The combination of a spindle, two trains of gears for revolving the same at different speeds, independent, simultaneously-operated driving means for each train of gears, automatic means for clutching the faster train to and unclutching it from the spindle, and means for automatically connecting and disconnecting the slower train and the spindle when the faster train is, respectively, unclutched from and clutched to the spindle.

5. The combination of a spindle, two trains of gears for revolving the same at different speeds, independent, simultaneously-operated driving means for each train of gears, a clutch for the faster train of gears, means for auto-

70

75

80

85

90

95

100

105

110

115

120

125

130

5 matically connecting and disconnecting the slower train and the spindle when the faster train is, respectively, unclutched from and clutched to the spindle, a clutch-operating lever, and a wheel carrying cams for operating the said lever.

10 6. The combination of a spindle, two trains of gears for revolving the same at different speeds in the same direction, automatic means for changing the speed, and hand-operated means for changing the speed.

15 7. The combination of a shaft or part to be revolved, gearing for revolving the same at different speeds, and speed-changing means comprising an intermittently-revolving shaft carrying a cam, a part movable by the cam, and means to automatically revolve the shaft.

20 8. The combination of a shaft or part to be revolved, gearing for revolving the same at different speeds, and speed-changing means comprising a shaft carrying a cam, a part movable by the cam, a star-wheel on the shaft, and a wheel carrying parts to engage said star-wheel.

25 9. The combination of a shaft or part to be revolved, gearing to revolve the same at different speeds, speed-changing means, a slidable part for actuating the speed-changing means, a shaft carrying a cam to slide said part, a star-wheel on said shaft, and a wheel carrying parts to engage said star-wheel.

30 10. The combination of a shaft or part to be revolved, differential gearing including a clutch and pawl for revolving the same at different speeds, a rock-shaft carrying the pawl, a sliding part connected with the clutch, an arm on the rock-shaft adapted to be actuated by said sliding part, and means to move said sliding part.

35 40 11. The combination of a shaft or part to be revolved, differential gearing including a clutch and pawl for revolving the same at different speeds, a rock-shaft carrying the pawl, a sliding part connected with the clutch, an arm on the rock-shaft adapted to be actuated by said sliding part, automatic means for moving the sliding part, and hand-operated means to move said part.

12. The combination of a shaft or part to be revolved, differential gearing including a clutch and pawl for revolving the same at different speeds, a rock-shaft carrying the pawl, a sliding part connected with the clutch, an arm on the rock-shaft, said sliding part having surfaces to engage the arm when the part is moved in either direction, and means to move said sliding part.

13. The combination of a shaft or part to be revolved, gearing for revolving the same at different speeds, means to change the speed, a sliding part for operating the speed-changing means, a shaft carrying a cam that acts on said sliding part, automatic means to rotate the shaft, yielding means to hold the shaft in position for the cam carried thereby to act on the sliding part, and hand-operated means for moving said sliding part.

14. In a speed-changing mechanism, a wheel carrying operating pins or studs, said wheel having a continuous, circular slot in which the pins or studs are adjustably fixed.

15. In a speed-changing mechanism, a wheel having a continuous circular slot, pins or studs passing through the slot, and clamping means on the pins engaging the wheel on both sides.

16. The combination of a pulley, a clutch-sleeve having bolts loosely attached thereto which pass through openings in the pulley, and a member of a differential gear having teeth for engagement by the bolts.

17. The combination of a spindle, two trains of gearing for revolving the same at different speeds, a reciprocating part gearing for moving said part at different speeds, and a single wheel carrying means to change the speed of the spindle and the speed of the reciprocating part.

In testimony that we claim the foregoing we have hereunto set our hands this 3d day of April, 1902.

JAMES C. POTTER.
JOHN JOHNSTON.
ERNEST B. SELLEW.

Witnesses:

ELLA A. BISHOP,
GEO. I. PARKER.