W. L. MILLER.

BACK FACING DEVICE FOR LATHES.

APPLICATION FILED JUNE 16, 1911.

1,051,151.

Patented Jan. 21, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

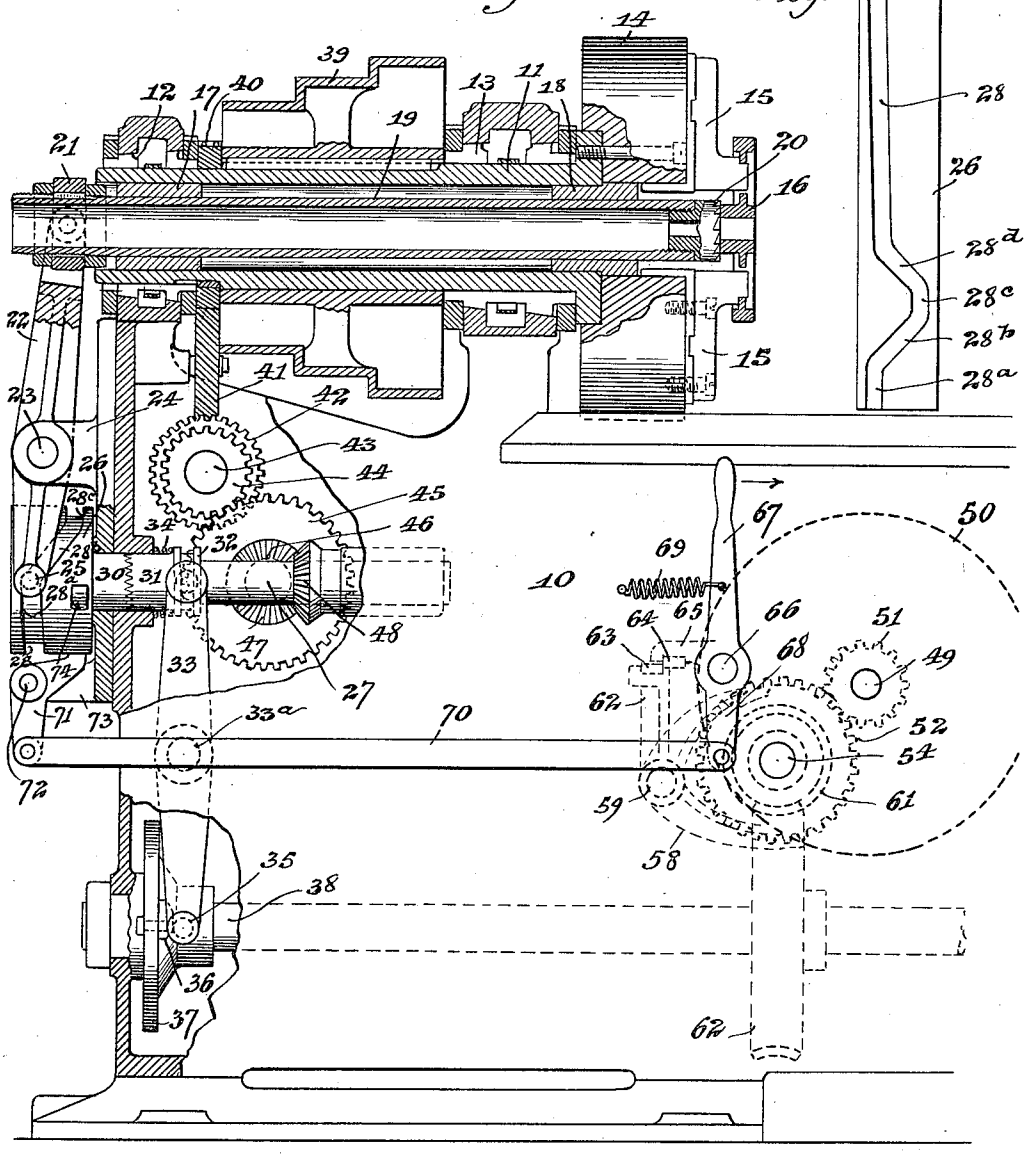

Fig. 5.

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2 SHEETS—SHEET 2.

Fig. 4.

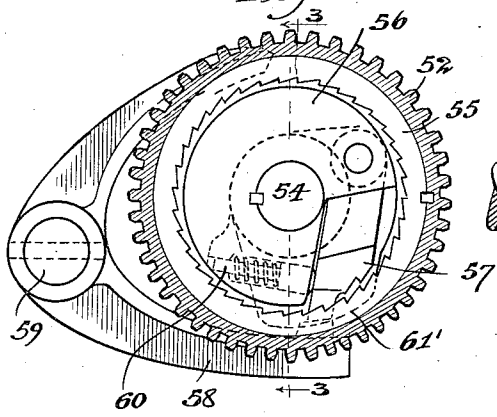


Fig. 3.

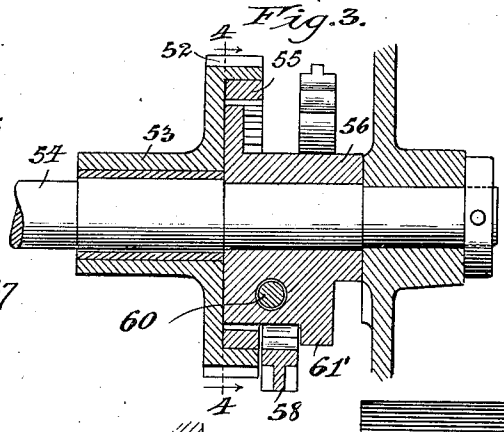
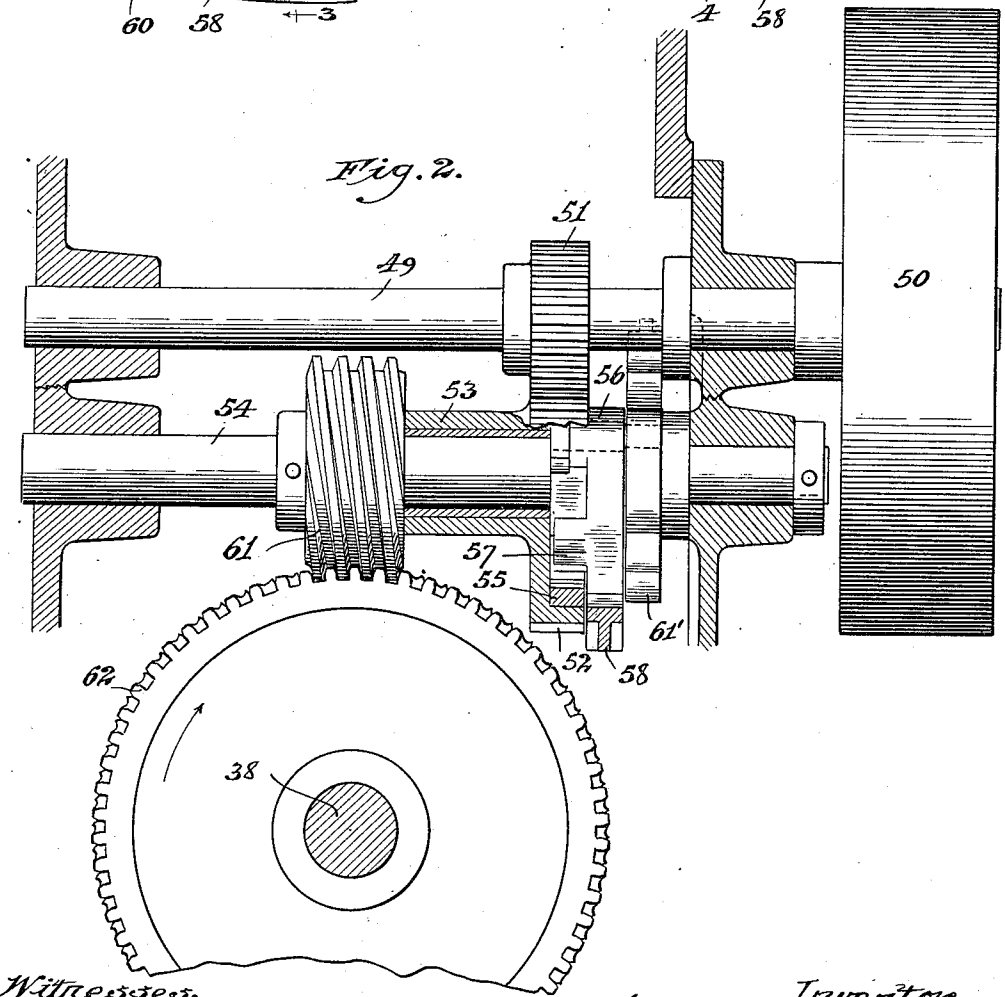


Fig. 2.



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UNITED STATES PATENT OFFICE.

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BACK-FACING DEVICE FOR LATHES.

1,051,151. Specification of Letters Patent. Patented Jan. 21, 1913.

Application filed June 16, 1911. Serial No. 633,480.

To all whom it may concern:

Be it known that I, WILLIAM L. MILLER, a citizen of the United States, residing at Madison, in the county of Dane and State of Wisconsin, have invented certain new and useful Improvements in Back-Facing Devices for Lathes, of which the following is a specification.

This invention relates to an attachment for metal-working lathes designed to effect the facing of a hub or other piece of work on the end or side thereof which is turned toward the chuck while the other end or side of the work is being operated upon by turret or cross-slide tools.

The device of my invention is chiefly characterized by the provision of a back-facing tool-holder slidably mounted in a hollow spindle of the lathe and, in its preferred form, operated by a pivoted cam-actuated yoke-lever, which, in turn, is actuated to effect the in and out movements of the tool-holder by mechanism driven from the spindle, including a normally open or idle clutch, which is closed or rendered active by a cam that is intermittently moved into and out of engagement with a clutch-closing lever either automatically in predetermined timed relation to operations performed on the work by the turret and cross-slide tools, or may be manually controlled so as to throw the back-facing tool into operation at any desired time; the back-facing tool being thrown out of commission automatically in either case as soon as it has performed its work.

The invention and its mode of operation will be readily understood when considered in connection with the accompanying drawings showing a simple embodiment wherein is employed a manual control of the parts which throw into action the back-facer and in which—

Figure 1 is a view partly in side elevation and partly in vertical section of the lathe spindle and head-stock end of the lathe frame and housing. Fig. 2 is an enlarged detail view, partly in section, of the mechanism which rotates or indexes the controlling cam-disk of the back-facer, and which is normally idle, but is automatically tripped into action as soon as the back-facer has completed its work and has been retracted so as to permit the disengagement of the driving clutch of the back-facer, and which, in the form of the invention herein shown, is manually tripped into action when the back-facer is to be used, so as to effect the driving engagement of the back-facer clutch by means of a cam carried by the rotating cam-disk. Fig. 3 is a vertical section on the line 3—3 of Fig. 4. Fig. 4 is a vertical section in a plane at right-angles to that of Fig. 3 on the line 4—4 of Fig. 3. Fig. 5 is a detail of the periphery of the cam drum showing the same as it would appear if projected in a flat plane, to illustrate the form of the cam-groove therein.

Referring to the drawing, 10 designates as an entirety the head-stock end portion of the lathe-bed, and 11 designates a hollow spindle journaled in suitable bearings 12 and 13 of the head.

14 is the usual chuck-head secured to the inner end of the spindle, and 15 the radial chuck-jaws herein shown as engaging a piece of work shown as a fly-wheel 16, the inner or rear end of the hub of which is to be faced by the device of my invention.

Slidably mounted in suitable bearings 17 and 18 within the spindle 11 is a hollow tool shaft 19 that carries at its inner or forward end a hollow milling or facing tool 20. The outer end of the shaft 19 is splined or keyed to a collar 21 which in turn is pivoted in the forked upper end of a yoke-lever 22; this latter being pivoted at 23 between lugs 24 on the frame, and its lower end carrying a stud or roller 25 which engages a spiral cam-groove formed in the periphery of a cam-drum 26 that is loosely mounted on a shaft 27 journaled in the frame. This cam groove, as best shown in Fig. 5, comprises a spiral portion 28 extending through about two-thirds the circumference of the drum, a short portion 28^a that extends parallel with the sides of the drum, a comparatively abrupt oblique portion 28^b extending nearly across the width of the circumference of the drum, another short portion 28^c that is also parallel with the sides of the drum, and another short abrupt oblique portion 28^d extending in the opposite direction to the portion 28^b and connecting the rear end of the portion 28^c with the inner or advance end of the spiral portion 28. The hub of the drum 26 terminates in a clutch-member 30; and keyed or splined on the shaft 27 is a coöperating

clutch member 31 that is formed at its outer end with a grooved collar 32 engaged by the forked upper end of a lever 33. The clutch member 31 is normally urged out of engagement with the coöperating clutch member 30 by a compression-spring 34 confined between the collar 32 and the bearing of the frame in which the shaft 27 and the clutch members 30 and 31 are mounted. The lever 33 is pivoted to the frame at 33ª, and its lower end carries a stud or roller 35 that lies in the path of a cam-block 36 secured at any of a number of spaced positions to the face of a disk 37, this latter, in turn, being fast on a shaft 38 journaled in the lower portion of the machine-bed parallel with the spindle 11 and shaft 27.

The spindle 11 may be driven by any known or approved drive, the usual stepped pulley 39 being herein indicated for that purpose; and the shaft 27 carrying the driving clutch member 31 may also be driven from and in suitable speed relation to the spindle by any approved mechanism; the mechanism herein shown for this purpose comprising a spiral gear 40 fast on the spindle 11, an intermediate or idler spiral gear 41 driving a spiral gear 42 fast on a counter-shaft 43, this latter, in turn, carrying a spur-pinion 44 meshing with and driving a spur-gear 45 fast on another counter-shaft 46; said counter-shaft 46 carrying a bevel pinion 47 meshing with and driving a bevel pinion 48 fast on the shaft 27. From this it will be seen that when the clutch 31 is engaged with the clutch 30, the rotation of the shaft 27 will be imparted to cam-drum 26, and through the cam-groove, and the yoke-lever 22, the shank 19 of the back-facer will be reciprocated toward and from the work carried by the chuck-jaws 15. The shaft 38 is intermittently indexed, and is both automatically and manually controlled as to its indexing movements by mechanism which will next be described.

Referring to Figs. 2, 3, and 4, 49 designates a shaft journaled in and transversely of the side wall of the machine-bed and carrying a driving pulley 50 and a pinion 51, which latter meshes with and drives a spur-gear 52 having an elongated hub 53 that is loosely mounted on a counter-shaft 54 journaled in the frame parallel with the shaft 49. The spur-gear 52 is chambered on one face thereof and carries in said chamber a steel-ratchet-ring 55 keyed thereto and formed with internal notches, as shown in Fig. 4; and keyed to the counter-shaft 54 is a dog-holder 56 which carries a pivoted dog 57, the teeth of which are normally held out of engagement with the ratchet-ring 55 by the lower arm of a yoke-lever 58 which engages the nose of the dog sufficiently to keep its teeth out of engagement with the ratchet-ring. The yoke-lever 58 is fast on a cross-shaft 59 mounted parallel with the shafts 49 and 54. When, however, by mechanism hereinafter described, the yoke-lever 58 is tripped so as to allow it to fall, the dog 57 is thrown into engagement with the ratchet-ring by a spring-pin 60 slidably mounted in the dog-holder 56; and when this occurs the shaft 54 is caused to revolve. Keyed or pinned to the shaft 54 is a worm 61 that meshes with and drives a worm-wheel 62 fast on the shaft 38, whereby the cam-disk 37 is rotated. Each turning or indexing movement of the cam-disk 37 is normally limited in extent to that effected by a single revolution of the worm-shaft 54 (except when manually controlled as to the extent of its indexing movement, as hereinafter explained) by a mechanism which automatically raises the yoke-lever 58 during each revolution of the worm-shaft 54 and restores it to a position in which its lower arm engages the dog and disconnects it from the ratchet-ring upon the completion of a single rotation of the latter. This mechanism consists of a cam 61′ carried by the dog-holder 56 that, as the dog-holder rotates, engages and lifts the upper arm of the yoke-lever 58, and thereby throws into action a catch mechanism that normally holds the yoke-lever in raised position against the action of gravity tending to cause the arms of the yoke-lever to fall. This catch mechanism comprises an arm 62 (Fig. 1) fast on and upstanding from the yoke-shaft 59 and carrying at its upper end a hardened steel block 63 that normally abuts against a coöperating block 64 carried by a horizontal arm 65 fast on another cross-shaft 66. Fast on the outer end of shaft 66 is an operating arm 67 designed for the manual release-operation of the catch-block 64; said arm 67 having a depending extension 68 designed for automatic release-operation of the catch-block 64, as hereinafter explained. The arm 67 is normally held vertical, or in a position such that the catch-block 64 engages the catch-block 63 and holds the yoke 58 in raised position (in which the latter holds the dog 57 disengaged from the ratchet-ring 55) by a spring 69. Hence, with the parts in the relative positions shown in Figs. 1 and 4, and the shaft 49 constantly running, the gear 52 is constantly driven, but the ratchet-clutch connection therefrom to the worm-shaft 54 is open, so that the latter is not actuated. When, however, the catch-blocks 64 and 63 are disengaged by either manual or automatic rocking of the shaft 66 through the arms 67 and 68, as hereinafter described, the yoke 58 drops to a position in which its lower arm permits the dog 57 to engage the ratchet-ring 55; while its upper arm lies in the path of the rotating cam 61′, so that, when this occurs, the worm-shaft 54 is ro-

tated through a single revolution. During this rotation of the dog-holder 56, the cam 61′ carried thereby strikes the upper arm of the yoke 58, raising the latter, and shifting the catch-block 63 back to a position in which it will automatically reëngage with the catch-block 64 (unless the arm 67 is manually held against the pull of spring 69 swung to one side, in which position the catch-block 64 is raised out of engaging relation to the catch-block 63).

Pivoted to the lower end of the arm 68 is a link 70, the opposite end of which is pivoted to the depending arm of a bell-crank lever 71, which latter is pivoted at its elbow at 72 to a lug 73 on the frame just below the cam-drum 26; and the upper arm of said elbow-lever is adapted to be engaged once during each rotation of the cam-drum 26 by a cam projection 74 on the circumference of the latter; said projection 74 being so located on the cam-drum that it will engage and rock the elbow-lever 71 at about the time when the lower end of the yoke-lever 22 has reached the rear end of the abrupt oblique portion 28^b of the cam-groove, in which position the shank 19 of the back-facing tool 20 has been fully retracted by the yoke-lever 22, and is ready to start forward on another operative movement.

In the operation of the back-facer under a controlling mechanism such as that herein shown and described, when a job, such, for instance, as a fly-wheel 16, is to be faced off at the hub, while turret or cross-slide tools may be operating on other parts thereof, the operator seizes the handle 67, swings it in the direction indicated by the arrow in Fig. 1, and disengages the catch-blocks 63 and 64, which allows the yoke 58 to drop, thus throwing the dog 57 into engagement with the constantly running ratchet 55, and, through the connections described, starting the turning or indexing movement of the shaft 38 and cam-disk 37. The operator holds the lever 67 in such position until the cam 36 has engaged or is about to engage the stud 35 on the lower end of the clutch-actuating lever 33, which throws the driving clutch-member 31 into engagement with the driven clutch-member 30, and thus through engagement of the yoke-lever with the oblique portion 28^d of the cam-groove, shifts the back-facer inwardly by a rapid traverse movement into operative engagement with the work. As soon as this operation has been started, the operator releases the handle 67, which effects through spring 69 the restoration of the catch-blocks 63 and 64 to engaging position, and immediately thereafter, the automatic interruption of the indexing movement of cam-disk 37, and the back-facing operation proceeds during the travel of the lower end of the yoke-lever through the portions 28 and 28^a of the cam-groove until finished, and until the back-facer has been retracted by the further travel of the lower end of yoke-lever 22 through the abrupt oblique portion 28^b of the cam-groove; at which point the cam projection 74 engages and rocks the lever 71, and, through the described connections, rocks the shaft 66, thereby again connecting up the driving mechanism of shaft 38, which produces a single revolution of worm-shaft 54 before being automatically interrupted by the return of catch-block 64 to operative position through the action of spring 69, and which effects a sufficient indexing movement of shaft 38 to carry the cam 36 out of engagement with lever 33, allowing the spring 34 to separate the clutch-members 31 and 30, and thus stopping the operation of the back-facer, until the latter is again thrown into operation in the manner described. It will be understood that the purpose of the short portion 28^a of the cam groove that lies in a plane normal to the axis of the cam drum is to permit a short rest of the back-facing tool during at least one revolution of the spindle to remove tool marks from the work; while the similar short portion 28^c provides an easy passage for the stud or roller between the oppositely inclined portions 28^b and 28^d and also provides for the slight continued movement of the cam drum that takes place after the clutch-releasing mechanism has been automatically tripped into action without starting the back-facing tool inwardly on its rapid traverse movement.

The device of the present invention has been designed more especially as an attachment for an automatic turret-lathe such as is shown in my co-pending application Serial No. 611,037, filed February 27, 1911, in which lathe a shaft, corresponding in function to the shaft 38 herein, carries one or more cam-drums, the cams of which automatically control the spindle speeds and stop, start and control the feed and traverse movements of the turret and cross-slide tools all in predetermined properly timed order and relation, according to the particular job in hand; the drum-shaft being intermittently and automatically indexed through successive spaces as the work proceeds; and, in the application of the present invention to such a machine, the hand-lever 67 herein shown can be dispensed with since the indexing of the shaft 38 to bring the cam 36 into engagement with the lever 33, as well as to carry it out of engagement with the latter, will be automatically effected by the several clutch-tripping mechanisms pertaining to other operating parts of the machine, or by devices which automatically effect a continuous rotation of the drum-shaft to any predetermined extent desired or re-

quired. The device of my present invention is, however, of course, applicable advantageously to lathes other than those such as are controlled by an automatically actuated intermittently rotating member carrying cams which effect the automatic starting and stopping of the various tool-carrying members of the lathe.

I claim—

1. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of actuating means, including a clutch, for moving said back-facing tool-holder toward and from the work, and a controlling mechanism, including a clutch-shifting device and an intermittently revolving cam-carrier coöperating with said clutch-shifting device, for effecting the advance movement of the back-facing tool-holder, substantially as described.

2. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of actuating means, including a clutch, for moving said back-facing tool-holder toward and from the work, a spring normally holding said clutch open, and a controlling mechanism, including a clutch-closing device and an intermittently revolving cam-carrier coöperating with said clutch-closing device, for effecting the advance movement of the back-facing tool-holder, substantially as described.

3. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of actuating means, including a clutch, for moving said back-facing tool-holder toward and from the work, a spring normally holding said clutch open, a clutch-closing lever, a rotary member carrying a cam adapted to engage and disengage said lever to effect the closing and permit the opening of said clutch, respectively, normally idle means for effecting an intermittent rotation of said cam-carrying member, and means for throwing into operation said normally idle means and for controlling the time and extent of the intermittent movements of said cam-carrying member, substantially as described.

4. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of actuating means, including a clutch, for moving said back-facing tool-holder toward and from the work, a spring normally holding said clutch open, a clutch-closing lever, a rotary member carrying a cam adapted to engage and disengage said lever to effect the closing and permit the opening of said clutch, respectively, normally idle means for effecting an intermittent rotation of said cam-carrying member, and automatic mechanism for throwing said normally idle means into operation upon the completion of each back-facing operation and the retraction of the back-facing tool-holder, substantially as described.

5. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of actuating means including a clutch, for moving said back-facing tool-holder toward and from the work, a spring normally holding said clutch open, a clutch-closing lever, a rotary member carrying a cam adapted to engage and disengage said lever to effect the closing and permit the opening of said clutch, respectively, normally idle means for effecting an intermittent rotation of said cam-carrying member, means for throwing said normally idle means into operation and maintaining the same in operation until said cam engages said lever, whereby to set in operation the actuating means of the back-facing tool-holder, and automatic mechanism for again throwing said normally idle means into operation upon the completion of each back-facing operation and the retraction of the back-facing tool-holder, whereby to throw out of operation the actuating means of the back-facing tool-holder, substantially as described.

6. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of a yoke-lever pivoted between its ends to the frame of the machine and at its upper end connected to said back-facing tool-holder, a rotary drum having a cam-groove engaging the lower end of said yoke-lever, said cam-groove being so formed as to effect a slow feed movement and a rapid back traverse movement of said back-facing tool-holder, and means for rotating said cam-drum at a speed proportional to the spindle speed, substantially as described.

7. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of a yoke-lever pivoted between its ends to the frame of the machine and at its upper end connected to said back-facing tool-holder, a rotary drum having a cam-groove engaging the lower end of said yoke-lever, said cam-groove being so formed as to effect a slow feed movement and a rapid back traverse movement of said back-facing tool-holder, and driving connections, including a clutch, between said spindle and said drum, substantially as described.

8. In a lathe, the combination with a hollow spindle, and a back-facing tool-holder slidably mounted therein, of a yoke-lever pivoted between its ends to the frame of the machine and at its upper end connected to said back-facing tool-holder, a rotary drum having a cam-groove engaging the lower end of said yoke-lever, said cam-groove be-

ing so formed as to effect a slow feed movement and a rapid back traverse movement of said back-facing tool-holder, driving connections, including a clutch, between said spindle and said drum, means for throwing said clutch into action when the back-facing tool is to be operated, and means for automatically throwing said clutch out of action when the back-facing tool has completed its operation, substantially as described.

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