W. SCHELLENBACH.

APRON MECHANISM.

APPLICATION FILED OCT. 28, 1912.

1,067,140.

Patented July 8, 1913.

3 SHEETS—SHEET 1.

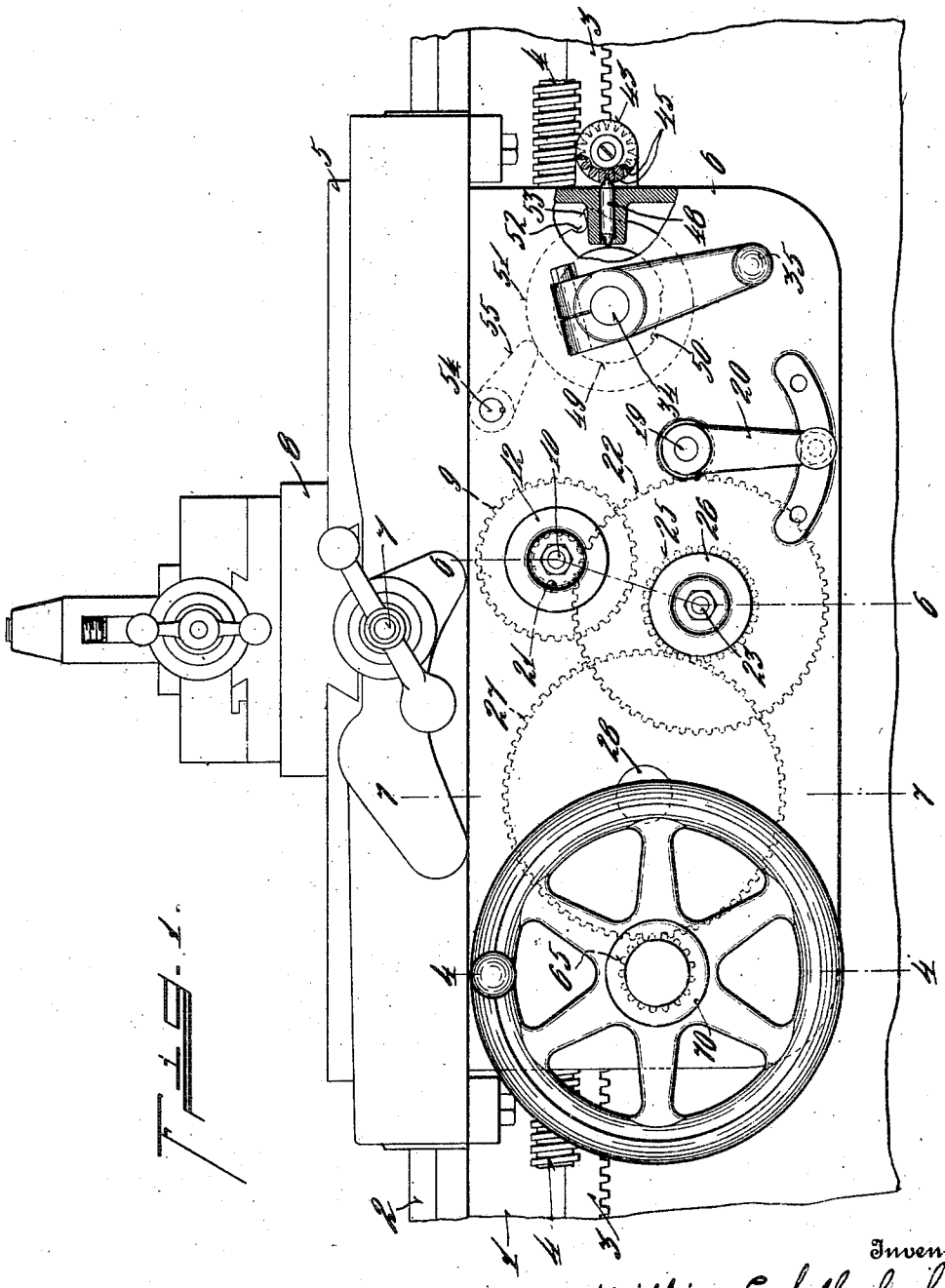


Fig. 1.

Witnesses

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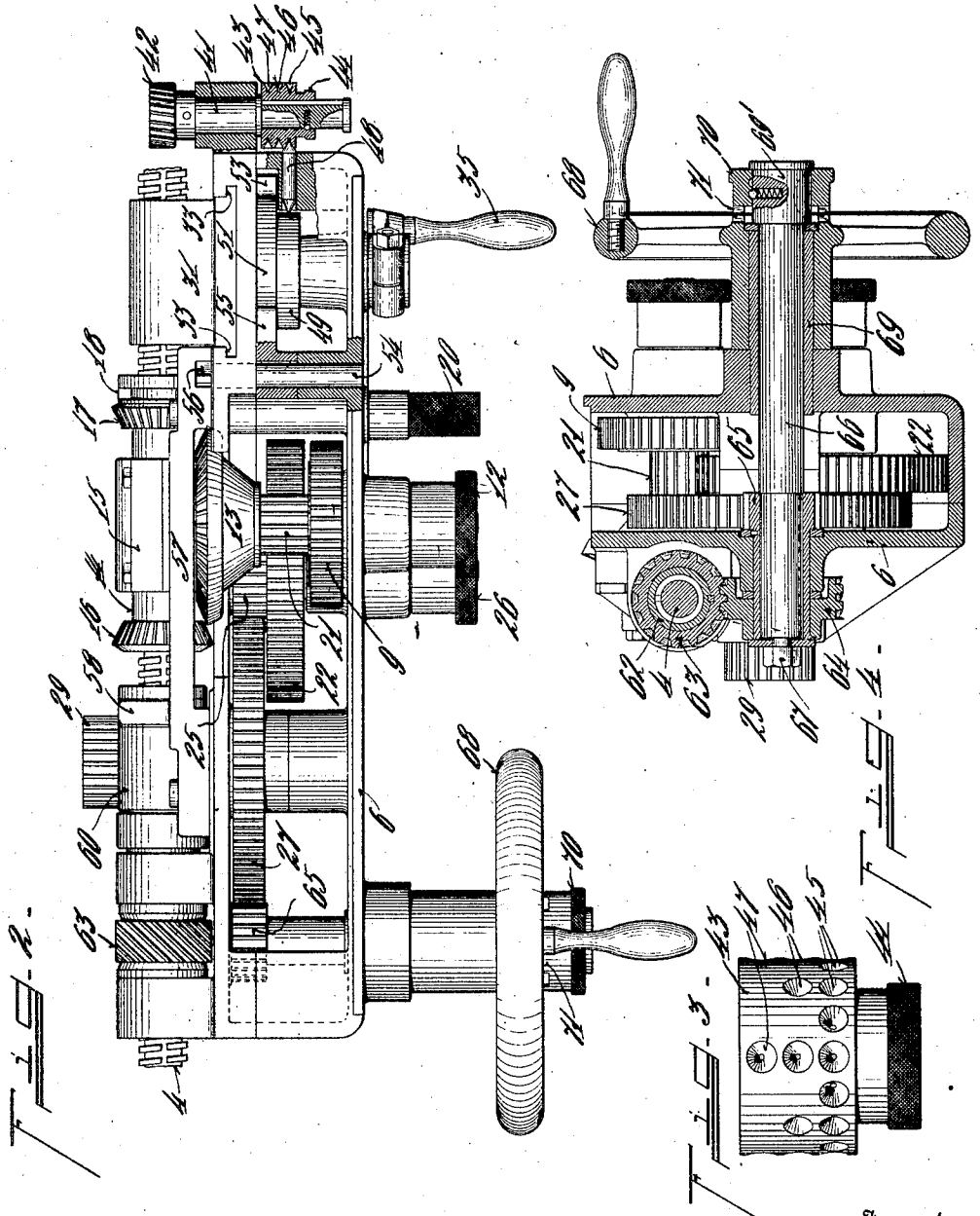


Fig. 2.

Fig. 4.

Fig. 3.

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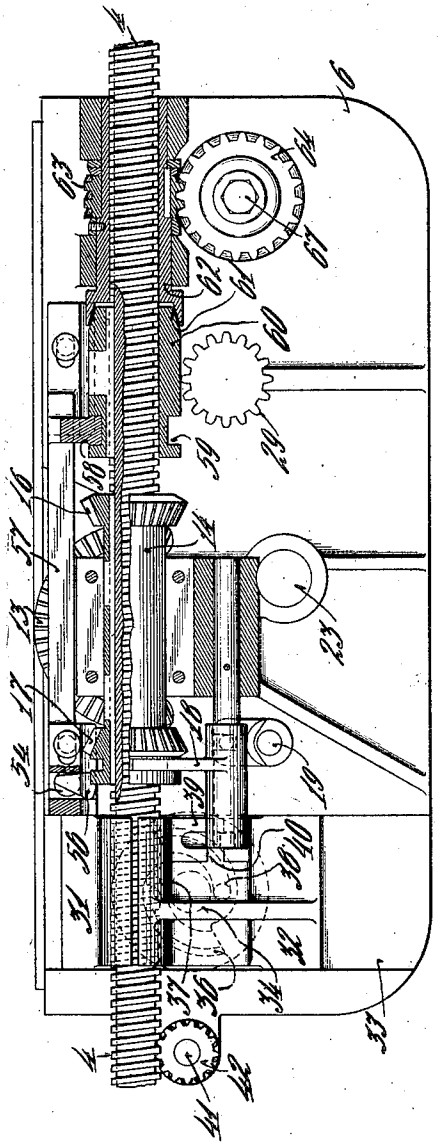
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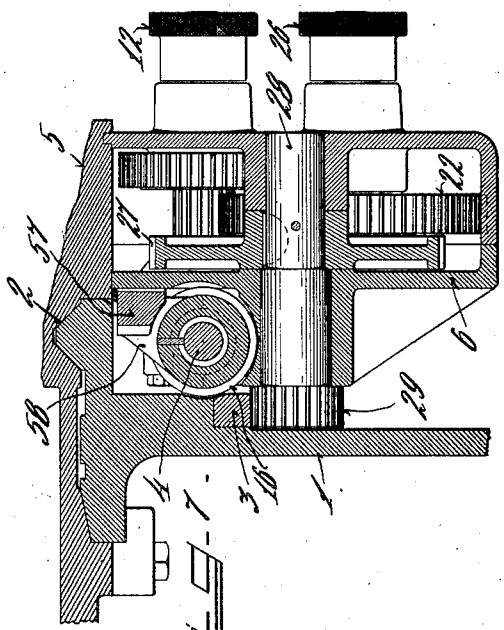
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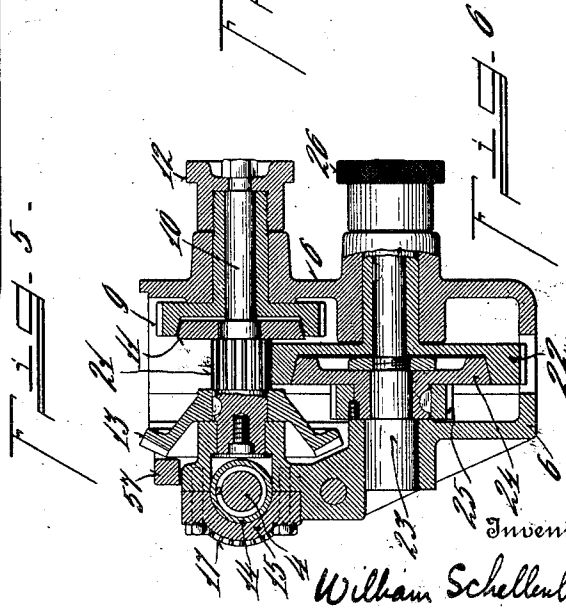
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3 SHEETS—SHEET 3.







Witnesses

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UNITED STATES PATENT OFFICE.

WILLIAM SCHELLENBACH, OF HARTWELL, OHIO.

APRON MECHANISM.

1,067,140. Specification of Letters Patent. Patented July 8, 1913.

Application filed October 28, 1912. Serial No. 728,324.

To all whom it may concern:

Be it known that I, WILLIAM SCHELLENBACH, a citizen of the United States, residing at Hartwell, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Apron Mechanism, of which the following is a specification.

This invention relates to improvements in means for feeding a cutting tool in machine tools and in its more specific aspect it deals with the design and construction of the apron mechanism of an engine lathe.

One object within the contemplation of this invention is to provide an apron mechanism especially adapted for performing repeated operations, such as taking successive cuts in chasing a thread so that these operations may be effected rapidly and conveniently under hand control.

Another object is to devise a simple mechanism whereby the lathe attendant may cause the carriage to travel under automatic feed through a given stroke, and by a simple manipulation cause such carriage thereupon to return at a more rapid rate to the starting point.

Another object is to devise an apron mechanism embodying a single lever, which, when in one extreme position will cause the carriage automatically to be fed through a working stroke, which when moved into an intermediate position will discontinue the movement of the carriage, and which, when moved with some force into its other extreme position will cause the carriage automatically to return at a more rapid rate so long as pressure is maintained on said lever.

Another object is to provide a mechanism of the above description, which will embody a safety appliance, so that should the operator hold the lever in the rapid return position until the carriage impacted some other element, such as a tail-stock, the drive would not be positive, so that no damage could be done.

Another object of this invention is to provide an attachment operating in connection with the hand controlled mechanism for the carriage, so that when the tool has been withdrawn from the work in cutting threads, and brought to a starting position, it will be impossible for the operator to throw the mechanism into engagement with the lead screw, save at the proper thread, so that the tool will properly enter the thread being chased during the next working stroke.

Other objects will be in part apparent from the annexed drawings and in part pointed out in the following description in connection therewith.

In order that this invention may be so fully disclosed to those skilled in this art that they may be enabled to embody the same in the various forms and modifications to which it is readily subject, drawings exemplifying a preferred form have been appended as a part of this disclosure, and in such drawings like characters of reference denote corresponding parts throughout all of the figures, of which:—

Figure 1 is a front elevation of a carriage and surmounting tool post, having an apron mechanism designed in accordance with this invention. Fig. 2 is a plan view of the apron mechanism with the top plate removed, showing the arrangement of the gears and other elements thereof. Fig. 3 is a detail of one form of a synchronizing device, such as is contemplated hereby. Fig. 4 is a section taken along line 4—4 of Fig. 1, showing the arrangement of the hand wheel for driving the carriage. Fig. 5 is an elevation partly in section, looking forwardly from the rear of the lead screw into the apron mechanism. Fig. 6 is a section taken along line 6—6 of Fig. 1, showing the arrangement of certain other controlling instrumentalities, and Fig. 7 is a section taken along line 7—7 of Fig. 1.

Continuing now by way of a more detailed description, this invention is shown for purposes of illustration in connection with certain conventional elements of an engine lathe, such as the bed 1, having the usual guides 2, and provided with a stationary rack 3, and a rotating lead screw 4. Mounted to slide on the guides 2 is a carriage 5 of suitable design, and on this carriage may be superposed the tool post with any desired number of intervening sliding means for defining or controlling the direction of movement of the tool in the post.

A plate 6 drops from the front of the carriage 5, and forms the apron and constitutes a supporting base for certain of the elements carried thereby, and comprising the apron mechanism.

The friction transverse feed for the tool post operates ultimately on the spindle 7, which has a suitable connection with the part 8, so that when the spindle 7 is rotated the part 8 will be moved transversely on the carriage 5. The spindle 7 is in turn, through suitable conventional gearing, not shown, brought into mesh with the gear 9 shown by Fig. 6. This gear is loosely mounted on a spindle 10, but may be brought into frictional engagement therewith through the clutch member 11, by operating the knurled finger wheel 12. The spindle 10 has a beveled gear 13 keyed thereto and this beveled gear may be driven either right-hand or left-hand from the lead screw by means of a splined sleeve 14 slidably mounted in a bearing 15, and at its ends carrying the beveled gears 16, 17. The position of this element is controlled by a sliding yoke 18 that is operated, as will be seen from Fig. 5, by a pin and yoke connection with the shaft 19 of the hand lever 20. When such hand lever 20 is in the position shown by Fig. 1, the parts are in neutral and inoperative position, but when it is shifted in either direction to its extreme position, one or the other of the beveled gears 16, 17, will be brought into mesh. A means is provided whereby a movement of the part 18 may not be effected, save when other parts are in a non-conflicting position, as presently will be described.

The means feeding the carriage slowly right or left operates from the beveled gear 13, and the parts heretofore described. Such operation may take place when the gear 9 is frictionally clamped to the spindle 10 or when it is free therefrom. On the spindle 10 is a pinion 21 that meshes with a gear 22. This gear is in turn keyed to a spindle 23 and loose on said spindle is a clutch element 24, having keyed thereto a pinion 25. By operating the knurled thumb wheel 26, the clutch member 24 may be engaged with the gear 22, so that gear 25 now receives motion through the pinion 21. This gear 25 in turn meshes with a gear 27 that is keyed to a spindle 28 terminating in a rack pinion 29, that engages the stationary rack 3 on the lathe bed. It will be apparent that when the rack pinion 29 is caused to rotate through the gears aforesaid, it will operate on the rack to feed the carriage slowly either to the right or left, according to which one of the bevels 10 and 17 is in mesh with bevel 13.

The above parts permit motion through friction clutches, and therefore the above described feeds are not absolutely positive, but may take place with but slight slipping. This is sufficient for certain classes of work, but for other classes of work, as in the cutting of threads, it is essential to have the carriage receive a positive drive from the lead screw. To that end, means are provided whereby this may be accomplished, as will now be described.

The screw threading carriage feed is accomplished by means of a split nut directly connecting the carriage to the lead screw and is best shown by Figs. 2 and 5. This split nut is formed of an upper member 31 and a lower member 32 each of which are retained in a vertical slide-way 33 provided by the apron of the carriage. An actuating shaft 34 is operated by a hand lever 35 and has a bearing through the apron and terminates in a double spiral cam 36 shown by dotted lines by Fig. 5. The upper half nut 31 carries a pin 37 and the lower half nut also carries a pin 38, each of which engage the respective grooves of the double spiral cam so that when the latter is rotated by turning the handle 35 the nuts may be separated or drawn together to engage the threads of the lead screw as the case may be. In this connection it may be noted that the lower half nut 32 is provided with a slotted shift segment 39 having transverse slots adapted to receive a lug projecting from the adjacent portion of the hub of the above mentioned reversing member 18. The purpose of this arrangement is to prevent the reversing member 18 from being shifted either to right or left of its neutral position when the split nut is closed on the lead screw. As will be seen from Fig. 5 when the split nut is opened to disengage the lead screw 4 the reversing member 18 may be shifted in either direction since the lug on its hub will then be able to enter the slot 40.

The automatic control determining proper actuation of the split nut consists of an arrangement whereby the operator will be prevented from engaging the lead screw by the split nut at a different point in its cycle of movement in making repeated runs of the cutting tool over the thread. It will be recalled that the threads cut by a lathe may vary through wide limits so that at one time a fine thread may be cut and at another time the coarse thread may be cut, according to occasion. So also, the thread may originate at one point in the angular revolution of the work and at another time at another point. Now a thread is customarily cut by successive runs at progressively deeper depths of the cutting tool until the ultimate depth of cut for the finished thread is attained. This means that each time the operator withdraws the tool at the end of each run and causes the carriage to travel back to the starting point it is essential to engage the lead screw by the split nut at exactly the same relative point in its rotation with respect to the position of the carriage so that the predetermined ratio of movement between the cutting tool and the

work may invariably be preserved. For example, supposing the carriage was at a given point on the lathe bed, it is evident that the split nut might be made to engage the constantly rotating lead screw and be brought into mesh with its threads at any one of its several revolutions. But if the ratio between the lead screw and the work was such that it made a given number of revolutions for each unit of movement of the work it is evident that if the tool is to traverse the same path on the work that the split nut must be brought into mesh with the lead screw invariably at the same point in each cycle of movement of the lead screw, each cycle consisting of the given number of revolutions thereof. This invention proposes to accomplish this by an arrangement such that the split nut may be engaged only once during each cycle of movement of the lead screw or multiples thereof. This is accomplished in a very simple yet effective manner as follows: A shaft 41 is journaled in an appropriate part of the apron so as to be carried by the same and such shaft in turn terminates in a spur gear 42 that constantly meshes with the lead screw 4. This shaft at its other end has splined thereto an index wheel 43 adapted to be positioned at different points longitudinally of such shaft by means of the knurl finger portion 44. The index wheel 43 is peripherally provided with a series of notches 45 each one of which corresponds to one revolution of the lead screw with respect to a given position of the carriage. Another series of notches 46 is arranged on the periphery of index wheel and these are so spaced that each corresponds with every other *i. e.* every second revolution of the lead screw under the same conditions, and the notches of the third series 47 each corresponds to every fourth revolution of the lead screw. In other words, each series represents a multiple of the revolutions of the lead screw. Now the apron also carries an interponent 48 in the form of a pin tapering at each end. This pin has no attachment either to the index wheel or to hub of the handle 35, so that it is a floating interponent confined to extreme positions which are determined by the relations between the wheel and the handle. The one end of this pin coacts with the index wheel 43 and on the shaft 34 of the hand wheel 35 that actuates the split nut is a cam 49 having a notch 50. Now this interponent pin is of such length that when its right hand end enters a notch in the index wheel its left hand end will clear the ends of the notch 50 so that the handle 35 may assume the position shown on the drawings. On the other hand should the handle 35 be moved so as to bring the notch 50 opposite the end of the interponent pin, then will the index wheel 43 be enabled freely to rotate with respect to the carriage. In this position of the handle 35, the halves of the split nut are separated so that the lead screw now does not positively drive the carriage. The first relative rotary movement of the index wheel 43 will urge the interponent pin to the left and bring its left hand end into the notch 50. Now, irrespective of the longitudinal position of the carriage it will not be possible for the operator to move the handle 35 to engage the lead screw by the split nut until one of the notches on the index wheel are brought into opposition with the right hand end of the interponent pin, whereupon the pressure of the operator will forthwith cause such pin to be urged into the index notch thus clearing the notch 50 and enabling the hand lever 35 to be operated. At this time however the lead screw will be necessarily in proper relationship with the carriage irrespective of the longitudinal position of the latter so that the cutting tool will enter the thread to be cut at the proper point, assuming of course that the operator has correctly set the index wheel. It is to be observed that when the carriage is being thus propelled by the threads of the lead screw for screw cutting that the shaft 1 does not revolve, but when the carriage is stationary or moves at any rate other than that determined by the mesh of the split nut with the lead screw, such shaft 41 together with the index wheel 43 is constantly turning under the action of the lead screw and at a constant lower rate than that of the lead screw if the carriage is stationary. When the carriage is moved by hand the index wheel will rotate faster or slower according to the direction and speed of propulsion of the carriage.

The friction clutch power driven quick return for the carriage will now be described. It will be understood that heretofore it has been customary to return the carriage by hand power and to that end a hand wheel has been arranged on the carriage. This has also been done in this arrangement so that such an operation may be accomplished should it be desired but further than this provision has been made whereby a power actuated means is combined with the hand operative means so that either may be used at will. It will be understood that the return movement of the carriage in chasing a thread represents an amount of time lost depending upon the speed with which it may be accomplished and it also represents a considerable amount of manual labor to be performed by the operator if it is hand actuated. As the carriage together with the numerous parts thereon is usually quite massive and heavy in an engine lathe it will be apparent that the work consumed in returning it is not a negligible factor. This in-

vention proposes an arrangement such that with the utmost ease and convenience the operator will be able to cause the carriage to return at the end of each run of the cutting tool in chasing a thread and to do so at a rapid speed that in this instance is four times the positive thread cutting speed, and to so arrange this mechanism that it will be safe for use in connection with the hand control means.

In the drawings, the parts are shown in the position assumed when the carriage is being positively propelled in chasing a thread. Now when the end of the thread is reached the movement is discontinued by the attendant who turns the hand lever 35 sufficiently to open the split nut 31 free of the lead screw as has been explained in the foregoing. When this is done the carriage will forthwith come to a stop and must be propelled in the opposite direction preparatory for the next run. To do this the operator continues the movement of the lever 35 to the end of its swing and by maintaining pressure on such lever a friction clutch will be held in effective condition so as to transmit propelling power to the carriage. The mechanism for doing this includes a disk 51 keyed to the shaft 34 and having a smooth periphery including a notch 52 and an abutment 53. A rock shaft 54 is mounted in the apron and carries a pawl 55 terminating in a riding contact with the periphery of the disk 51 and normally positioned thereon as shown by Fig. 1. When the hand lever 35 is rotated anti-clock-wise the end of the pawl 55 contacts the abutment 53 and enters the notch 52 thus causing the pawl 55 to swing clock-wise and impart a corresponding rotation to the rock shaft 54. This rock shaft in turn terminates in a dog 56 that is arranged in a corresponding recess in the end of a bar 57 mounted to reciprocate within the limits of movement imparted by the dog 56 on the apron. This reciprocating rod moves to the left when the handle 35 is swung as aforesaid and, as shown by Fig. 5 it has a yoke 58 entering a groove 59 in a sleeve 60 that is splined to the lead screw 4. Thus, the bar 57 is effective to translate the sleeve 60. The latter terminates in a conical face 61 adapted to interfit with a corresponding face provided by a sleeve 62 through which the lead screw freely passes. It is apparent that if sufficient pressure be maintained on the hand lever 35 the aforesaid counterpart conical faces will come together with sufficient friction to clutch the sleeve 60 and 62 together whereby the latter will be frictionally driven by the former but permit of slipping in case the carriage meets with undue resistance at any point in its travel. The sleeve 62 now becomes a driving element for the carriage through certain parts that will be described. Keyed to the sleeve 62 is a worm 63 that meshes with a similar worm wheel 64 secured on the hub of a gear 65 mounted on a shaft 66. A nut 67 suffices to maintain a sufficient driving connection between these parts. This gear 65 in turn meshes with the gear 27 already described that transmits motion to the pinion 29 that engages the rack 30. It will thus be seen that if the friction between the clutch surfaces 61 is kept adequate by maintaining sufficient pressure on the hand wheel 35, the carriage will be returned in a reverse direction by power derived from the spline on the lead screw. It should be stated that the gearing ratio of the above described parts is such that the carriage in this instance has a return speed four times greater than its screw cutting speed. Should the pressure on the hand lever 35 be maintained until the carriage meets an undue resistance at any point in its return travel, as by abutting the tailstock, no damage will ensue because slipping will take place at the clutch surfaces 61; the parts being so proportioned that even under considerable pressure on the hand lever 35 the clutching effect is relatively feeble although sufficient for the return of the carriage.

The hand power carriage propelling means consists of a hand wheel 68 mounted on a stationary bearing sleeve 69 projecting from the apron. The shaft 66 terminates in a portion 69′ on which is splined a finger clutch 70 having teeth 71 adapted to be brought into mesh with corresponding teeth on the hand wheel 68 thereby connecting the latter positively with the shaft 66. When this is done a movement manually imparted to the hand wheel 68 will result in a rotation of the pinion 65 and a propulsion of the carriage through the gears 27 and 29 as already described.

It will thus be seen that the organization above stated is well adapted to achieve the purposes of this invention by means of a structure quite simple compared with the multiplicities of results obtainable. The apron mechanism herein disclosed may in fact be termed universal from the standpoint of its capacities and it will be found in practice to be durable, effective and reliable.

I therefore claim as new and desire to secure by Letters Patent:—

1. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, and shift mechanism adapted in one position to effect a positive driving connection between the threads of said screw and said carriage, and adapted in another position to effect a connection with said screw causing a reverse travel of said carriage at a higher speed.

2. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable

thereon, a feed screw, and shift mechanism adapted in one position to effect a positive operative connection between said carriage and screw and in another position to effect a frictional drive connection between said parts.

3. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, and shifting mechanism adapted in one position to effect a positive driving connection between said screw and carriage, and in another position to effect an impositive reverse direction driving connection at a higher speed ratio between said parts.

4. A mechanism of the nature disclosed combining a rotatable bevel-pinion having a limited axial shift, a shift lever therefor, a bevel-gear adapted to be meshed with said bevel-pinion, a cross feed pinion adapted to be brought into clutched or unclutched relation with said bevel-gear, a pinion fixed to said bevel-gear, a gear meshing with said pinion, a second pinion, a friction-clutch between said gear and second pinion, a third pinion geared to said second pinion, a traveling carriage on which said parts are mounted, a rotating shaft splined to said bevel-pinion positively to rotate the same, a stationary rack meshing said third pinion enabling it to propel said carriage, and a lathe-bed mounting said carriage, rack and splined-shaft.

5. A mechanism of the nature disclosed combining a bevel-gear, a reversible-drive unit therefor consisting of a sleeve terminating at each end in a bevel-pinion and having a limited axial shift, a shift-lever therefor for enabling either one or neither of said bevel-pinions to be meshed with said bevel-gear, a rack-pinion, gearing including a hand-operated friction-clutch extending from said rack-pinion to said bevel-gear, a traveling carriage on which said parts are mounted, a pinion concentric with said bevel-gear for transmitting motion to a cross feed, a friction clutch between said pinion and bevel-gear, a rotating shaft splined to said sleeve positively to rotate the same, a stationary rack meshing with said rack-pinion enabling it to propel the carriage by motion impositively derived from said bevel-gear, and a lathe-bed mounting said rack, shaft and carriage.

6. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, means for establishing a driving connection between the threads of the screw and the carriage, a hand-operated device for actuating said means, a member journaled on said carriage transversely with said screw meshing with the threads thereof to be rotated thereby, and an interponent reciprocating only between said device and said member, and having its position positively determined by the said device and said member, whereby said interponent may be caused to be positioned in the path of said hand-operated device during definite intervals to control the actuation of said device and have its position positively determined by the relation of said member to said carriage.

7. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, hand-actuated means for establishing a driving connection between the threads of the screw and the carriage, a device rotatably mounted on said carriage and so connected with the screw that its rotary position relative to the carriage will be a function both of the rotary position of the screw and the controlled position of the carriage, and an interponent mounted independently of said means and positively movable by said rotatable device into a position positively obstructing the actuation of said means, whereby the operation of the latter may be positively controlled by said device when it is in a selected rotary position or any multiple thereof relative to the carriage.

8. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, means for establishing a driving connection between the threads of the screw and the carriage, a device rotatably mounted on said carriage and so connected with the screw that its rotary position relative to the carriage will be a function both of the rotary position of the screw, and the translated position of the carriage, said device being provided with a plurality of circular series of stops, the stops in each series being differently spaced, and a connection adapted to be brought into coöperation with either of said series of stops whereby the actuation of said means may be accomplished only at intervals corresponding with the timing of said stops.

9. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, means for establishing a driving connection between the threads of the screw and the carriage, a hand actuated member adapted at one extreme position to render said means operative and at an intermediate position to render said means inoperative, and mechanism for impositively propelling said carriage in a reverse direction and rendered operative by said member when the latter is maintained by pressure in its other extreme position.

10. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw, means for establishing a driving connection between the threads of the screw and the carriage, a hand actuated member adapted at one extreme position to render said means operative and at an inter-

mediate position to render said means inoperative, and mechanism for impositively propelling said carriage in a reverse direction at a more rapid rate and rendered operative by said member when the latter is maintained by pressure in its other extreme position.

11. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a member movably mounted on said carriage adapted to engage the threads of said screw for positively propelling said carriage, a hand operated element for actuating said member, a friction clutch, means operable through said clutch impositively to propel said carriage, and a clutch operating connection actuated by said element when the latter has been moved a predetermined distance in the direction required for its releasing of said member from said feed screw.

12. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw having a spline, a half nut movably mounted on said carriage to engage the threads of said feed screw, a hand lever for operating said half nut, a sleeve slidably telescoping said feed screw and keyed to the spline thereof, mechanism operative from said sleeve to propel said carriage, and means adapted to clutch said mechanism to said sleeve when said hand operated element has been moved a predetermined distance in the direction required for effecting a disengagement of said half nut from said screw.

13. A mechanism of the nature disclosed combining a lathe bed, a carriage slidable thereon, a feed screw having a spline, a reversible carriage propelling mechanism operable from the spline of said screw, means for rendering said mechanism operative or inoperative, a device adapted to be engaged with the threads of said screw only when said mechanism is rendered inoperative, a hand actuated element for actuating said device, and means rendered operative when said hand element has disengaged said device adapted impositively to propel said carriage from the spline of said screw in an opposite direction and at a rate exceeding that given it through said device.

14. A mechanism of the nature disclosed combining a lathe bed having a rack, a carriage slidable thereon, a feed screw having a spline, a sleeve freely telescoping said feed screw, means for rotating said sleeve with said feed screw from the spline thereof, a worm gear fixed to rotate with said sleeve, a second worm gear meshing with said first worm gear and having its shaft journaled on said carriage transversely to said screw, a gear meshing with said rack, and a driving connection between said gear and said second worm gear.

15. A mechanism of the nature disclosed combining a lathe-bed, a stationary rack and a rotating screw-shaft having a spline, a traveling carriage, a gear splined permanently to said shaft whereby the same is positively rotated thereby, gearing including a hand-operated friction-clutch extending from said rack into proximity with said gear adapted impositively to propel said carriage, shift-mechanism adapted to effect a meshing between said gear and said gearing to enable the latter impositively to propel said carriage from said rack, a member secured to the carriage adapted non-rotatably to engage the threads of said shaft, and means enabling said member to be so engaged positively to propel the carriage only when said shift-mechanism is in neutral position.

16. A mechanism of the nature disclosed combining a lathe-bed, a stationary rack, a rotatable screw threaded shaft having a spline, a traveling carriage, a gear splined permanently to said shaft whereby it is positively rotated and having a limited axial shift on said carriage, gearing extending from adjacent said bevel-pinion into mesh with said rack, shift mechanism for shifting said gear axially to effect an engagement with said gearing to enable said carriage to be propelled through said rack, and a member movably mounted on said carriage adapted to be non-rotatably engaged with the threads of said screw positively to propel said carriage and enabled when so engaged to obstruct movement of said shift mechanism.

In testimony whereof, I have hereunto set my hand.

WILLIAM SCHELLENBACH.

Witnesses:
OLIVER B. KAISER,
CLARENCE B. FOSTER.