Sept. 15, 1959 D. E. MACKENZIE 2,903,933

AUTOMATIC THREADING APPARATUS FOR LATHES

Filed Jan. 20, 1955 6 Sheets-Sheet 1

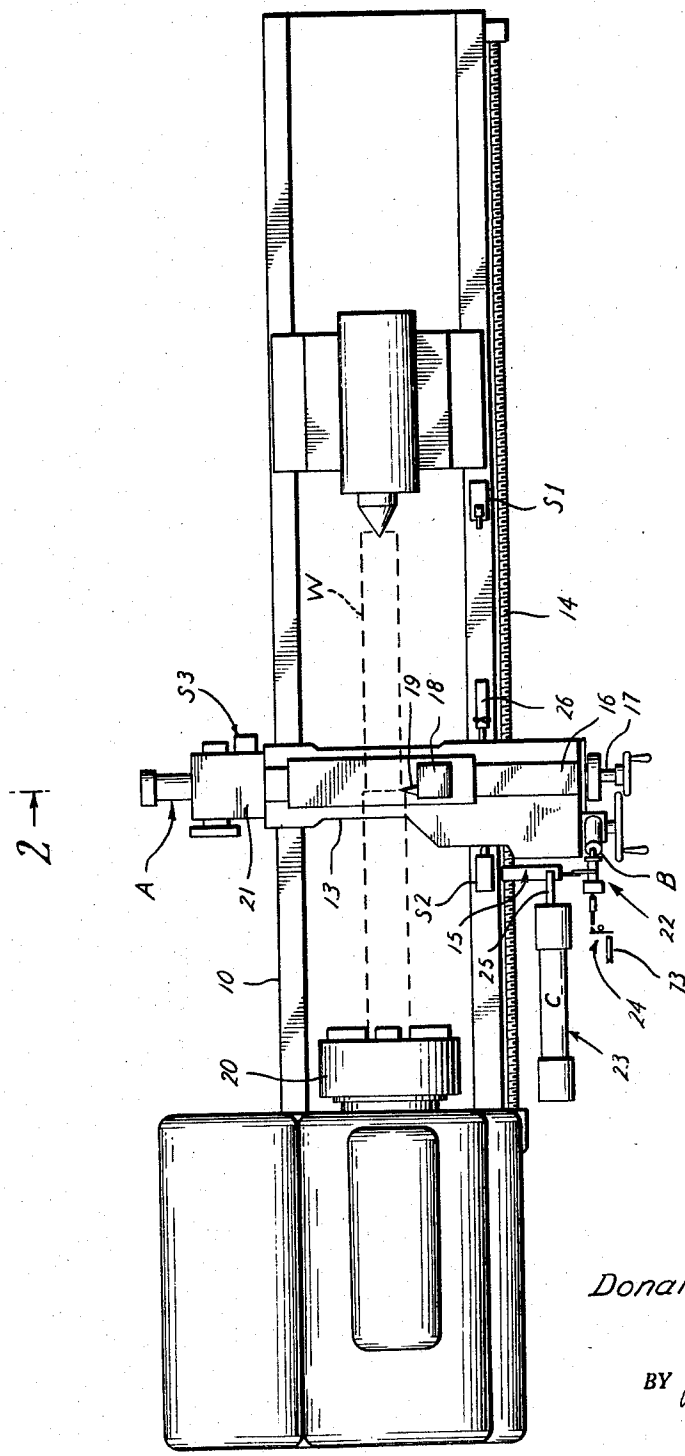


Fig. 1

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AUTOMATIC THREADING APPARATUS FOR LATHES

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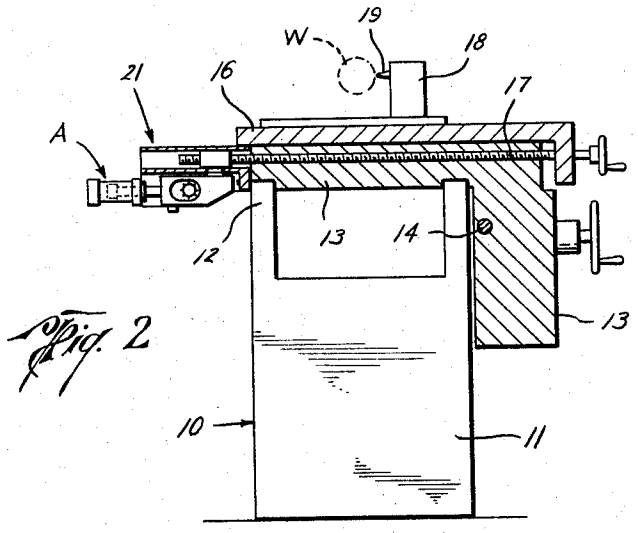


Fig. 2

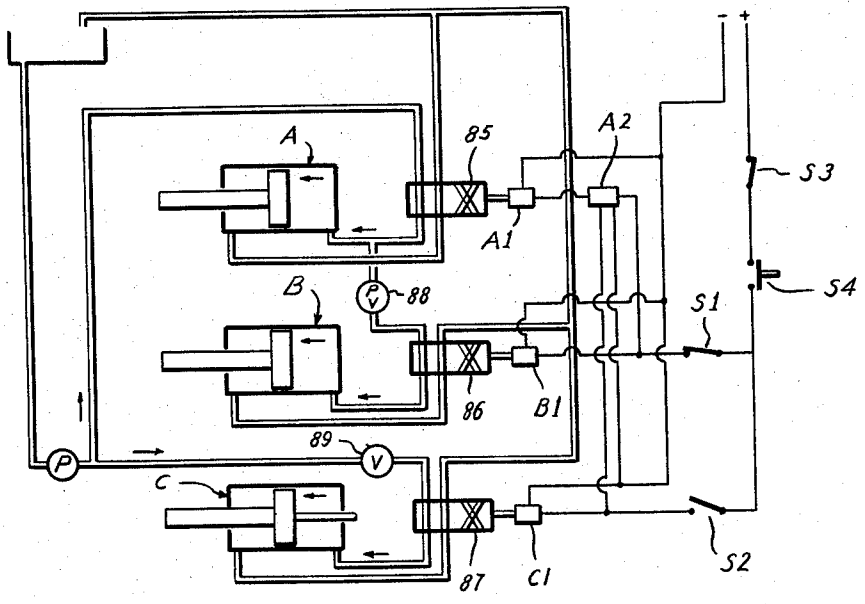


Fig. 13

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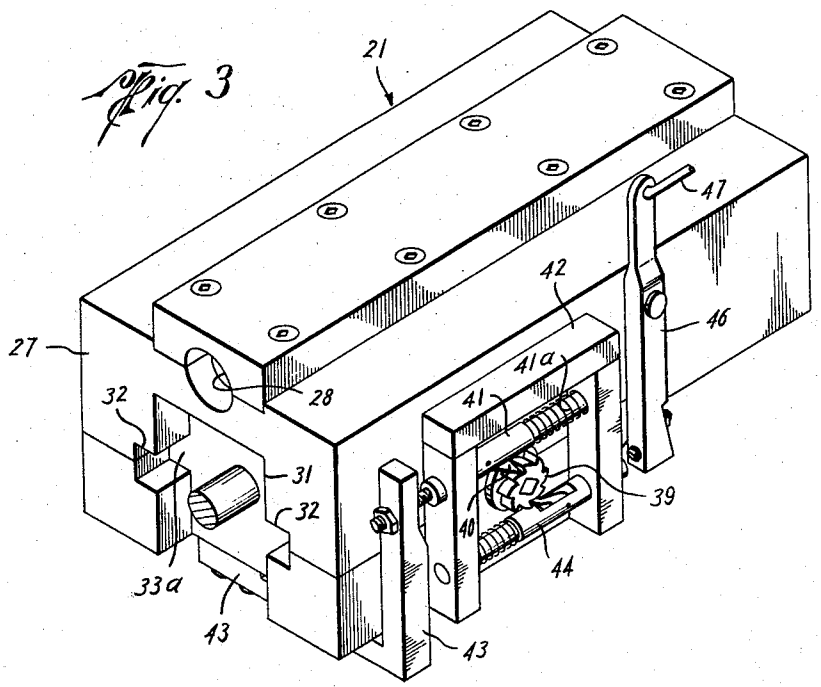
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AUTOMATIC THREADING APPARATUS FOR LATHES

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Fig. 3



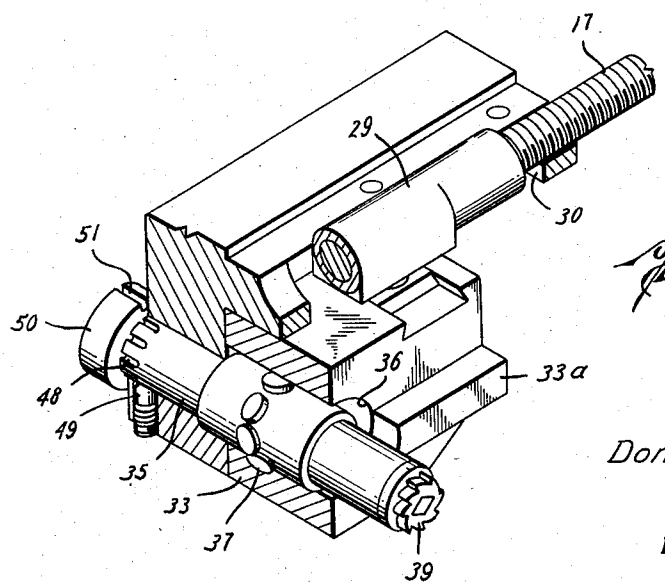


Fig. 7

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AUTOMATIC THREADING APPARATUS FOR LATHES

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Fig. 4

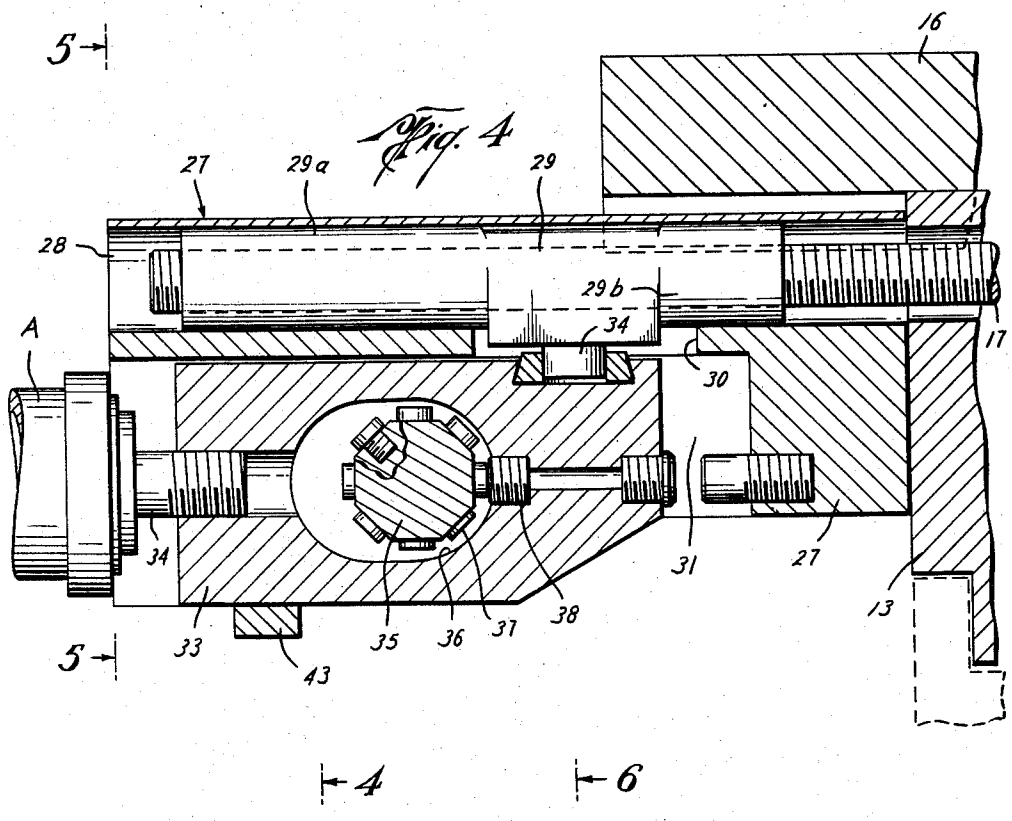
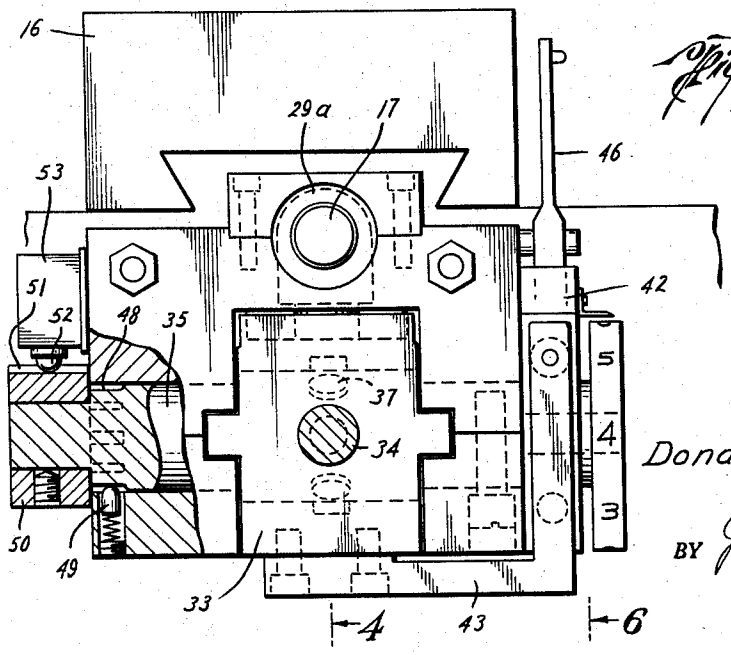


Fig. 5



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AUTOMATIC THREADING APPARATUS FOR LATHES

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Fig. 6

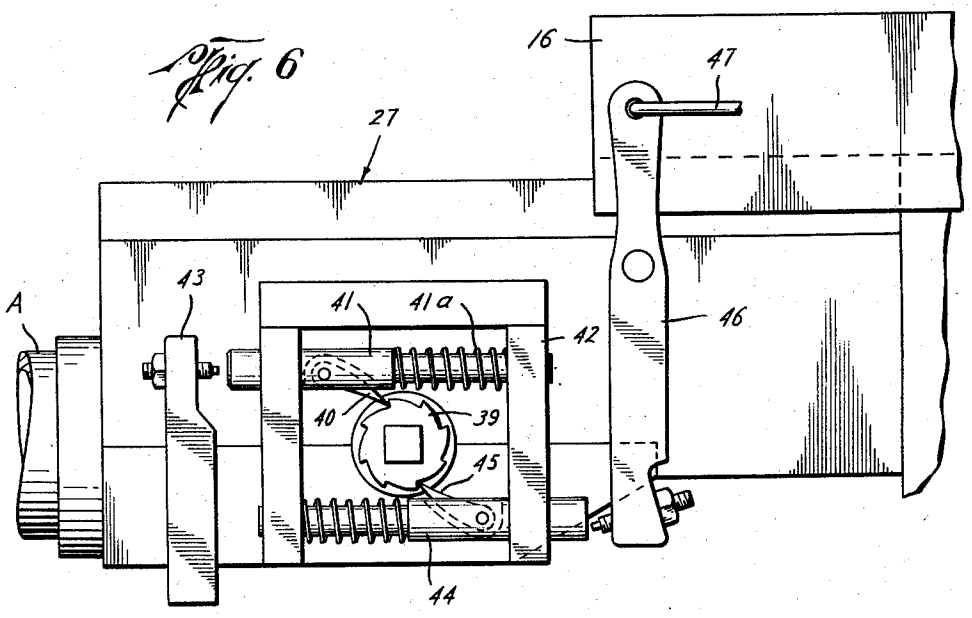


Fig. 11

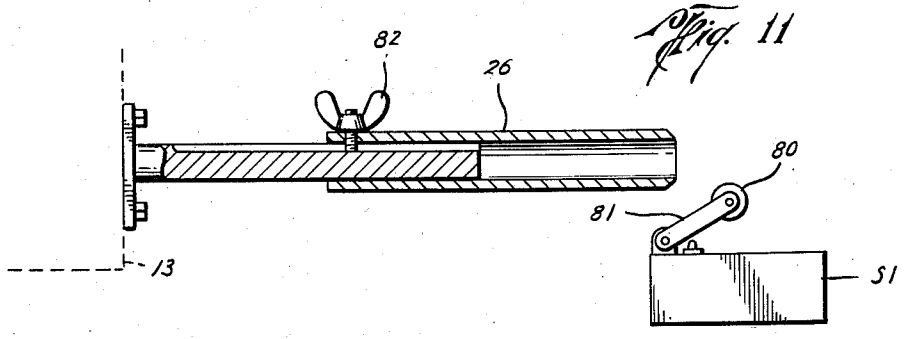
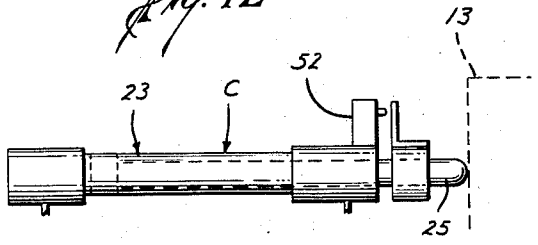


Fig. 12



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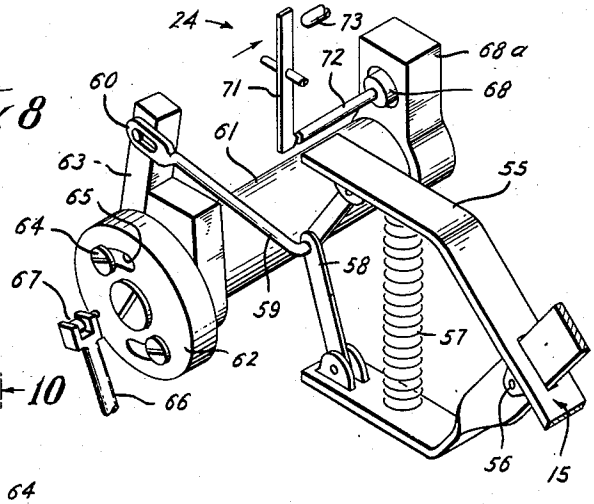
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AUTOMATIC THREADING APPARATUS FOR LATHES

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Fig. 8



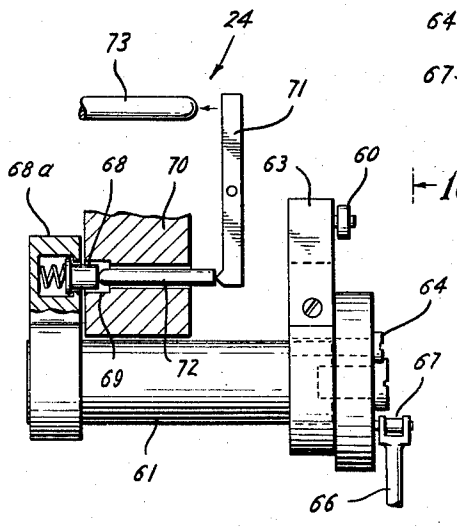
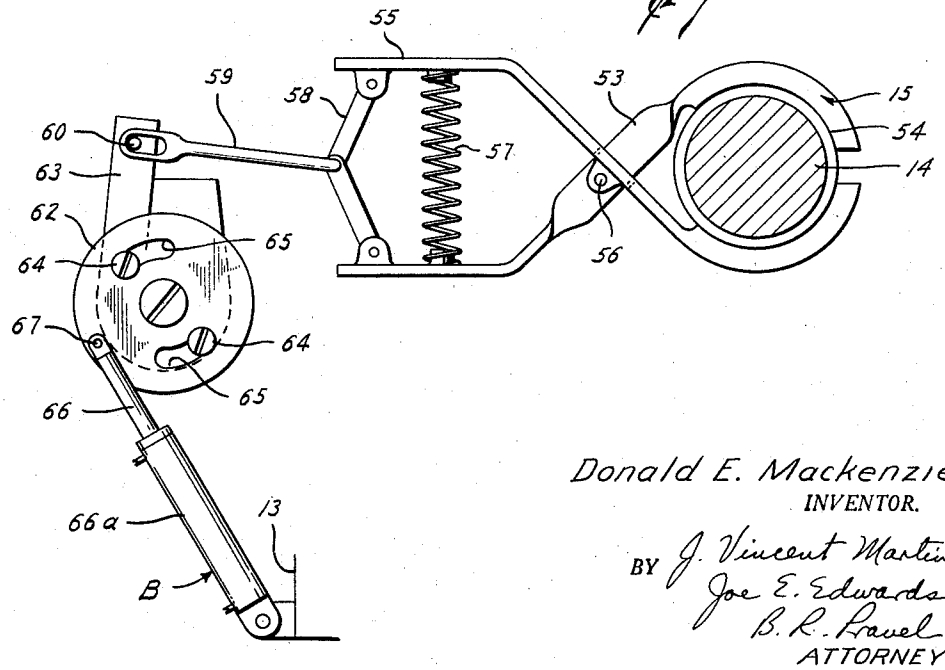


Fig. 9

Fig. 10



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United States Patent Office 2,903,933 Patented Sept. 15, 1959

2,903,933

AUTOMATIC THREADING APPARATUS FOR LATHES

Donald E. Mackenzie, Houston, Tex.

Application January 20, 1955, Serial No. 483,145

3 Claims. (Cl. 82—5)

This invention relates to new and useful improvements in automatic threading apparatus for lathes.

One object of the invention is to provide an improved threading apparatus in the form of an attachment for automatically controlling the threading operation, said apparatus being adaptable for use with any type of turning machine having a cross slide and a lead screw, but being particularly applicable to engine and turret lathes.

An important object of the invention is to provide an improved threading apparatus for lathes which will efficiently and automatically control all of the operations involved in threading a work piece, whereby the apparatus not only relieves the operator but also speeds up the threading operation and in addition assures more accurate threading.

Another object is to provide an apparatus of the character described which will automatically control the threading of a work piece by the single point thread-cutting method, said apparatus controlling the depth of the cut, the length of travel of the cutting tool, the return of the carriage after each pass of the tool and also the number of passes or cuts which may be required to produce a proper thread.

Still another object is to provide an apparatus of the character described which controls all of the operations involved in single point thread cutting and which may be employed for cutting straight threads, either internal or external, or which may be used with the usual taper attachment whereby tapered threads may be cut.

A particular object is to provide an apparatus of the character described wherein the various elements thereof are automatically operated, either hydraulically, pneumatically or electrically, or by a combination of such power sources; the apparatus being arranged so that operation may be commenced by manual control of the operator and thereafter said apparatus will complete the entire threading operation automatically and without any further manual control by the operator.

A further object is to provide an apparatus of the character described, which is in the form of an attachment and which may be readily and easily applied to any standard type of lathe and without any change in said lathe.

Still another object is to provide an improved apparatus which includes a power operated unit for controlling the movement of the cutting tool in a direction which determines the depth of the cut, said unit including a simplified means for effecting proper inward movement of the cutting tool as the threading operation progresses.

A still further object is to provide an improved control system which combines hydraulic power with electrical control for actuating the apparatus.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof,

wherein an example of the invention is shown, and wherein:

Figure 1 is a plan view of a lathe in schematic illustration, showing an automatic threading attachment, constructed in accordance with the invention, applied thereto;

Figure 2 is a transverse, vertical sectional view taken on the line 2—2 of Figure 1;

Figure 3 is an isometric view of the control unit for controlling the movement of the cross slide;

Figure 4 is a longitudinal sectional view of the operating unit illustrated in Figure 3;

Figure 5 is a transverse sectional view taken on the line 5—5 of Figure 4;

Figure 6 is a side elevation of the control unit shown in Figures 3 to 5;

Figure 7 is a partial isometric view of the unit shown in Figure 3 with portions thereof broken away;

Figure 8 is an isometric view of the control assembly for the half nut or connecting element which is adapted to be connected with the lead screw of the lathe;

Figure 9 is a side elevation of said control assembly and connecting nut;

Figure 10 is a plan view thereof;

Figure 11 is a detailed view showing the adjustable operating rod which actuates one of the limit switches;

Figure 12 is an elevation of the return cylinder assembly which returns the carriage to starting position; and

Figure 13 is a diagrammatic view illustrating the hydraulic system and including a wiring diagram of the electrical control means for controlling the operation of said system.

In the drawings, the numeral 10 designates a lathe which may be of any suitable construction. As shown in Figures 1 and 2 the lathe includes the usual base 11 having a bed provided with longitudinal ways 12 upon which are slidable the usual carriage 13. As is well known, the carriage 13 is adapted to be moved longitudinally along the ways by the usual longitudinal extending lead screw 14. Connection between the carriage and the lead screw is made by means of a connecting element 15, which is generally referred to as a half nut. By selectively engaging or disengaging the half nut 15 with the lead screw 14 the carriage is selectively connected to or disconnected from said lead screw; when connected to the lead screw operation of the screw will move the carriage longitudinally along the bed or ways 12 of the lathe.

Mounted upon the carriage 13 is the usual cross slide 16 which is adapted to be moved transversely of the carriage by means of the usual traverse screw 17 and a tool carrier 18, within which a cutting tool 19 is mounted, is secured to the cross slide 16. The cutting tool 19 is adjusted relative to the work piece W, which is shown in dotted lines in Figure 1, by adjusting the cross slide transversely of the bed of the lathe. By connecting the carriage 13 to the lead screw 14, the cutting tool is caused to travel longitudinally with respect to the work piece which is held in place by the usual chuck 20.

When a threading operation is being carried out, it is normally necessary for the operator to manually adjust the cutting tool 19 to the proper depth which will be required for the first cut or pass and then the operator manually controls the longitudinal movement of the carriage and cutting tool throughout the length of the thread which it is desired to cut. In most instances in single point threading, several passes or cuts are required and thus the attention of the operator is required throughout the threading operation. The purpose of the present invention is to provide in the form of an attachment a means for automatically controlling the various factors which are involved in forming or cutting the complete threads.

In carrying out the present invention, a cross slide control unit **21** which includes a cylinder and piston A is connected with the cross slide **13** and is adapted to control the transverse position of said slide to control the position of the cutting tool **19** with respect to the work piece W. A control assembly generally indicated by the numeral **22** and including a piston and cylinder B is associated with the half nut **15** which is adapted to connect with the lead screw **14** and this assembly, as will be explained, controls the connection of the half nut **15** with said lead screw to effect operation of the carriage by said lead screw. A return cylinder assembly **23** which includes a cylinder and piston C is provided for the purpose of returning the carriage to its initial or starting position with respect to the work piece W. The pistons A, B and C are operated in proper sequence to control the threading operation and may be hydraulically or pneumatically actuated. Operation of the pistons A, B and C is controlled by means of suitable electrical controls which include a limit switch S–1 which is located at the starting position of the carriage; a second switch S–2 which is located at the terminal position of the carriage and which controls the return of said carriage; and a third or shut-off switch S–3 which functions to halt operation of the apparatus after completion of the threading operation.

When the carriage is in a starting position with the tool **19** retracted from the work piece, said carriage will be in a position adjacent to the limit switch S–1 in Figure 1. Upon closing of a master start switch S–4, the apparatus is caused to operate in the desired sequence to carry out threading of the work piece W.

In such sequence, the limit switch S–1 first causes the piston A to operate to move the cutting tool **19** into engagement with the work piece and thereafter, the piston B is operated to engage the half nut or connecting element **15** with the lead screw **14**, whereby the carriage is caused to travel longitudinally of the lathe in a direction to the left in Figure 1. As the cutting tool **19** completes its first pass over the work piece the carriage contacts the limit switch S–2 and simultaneously therewith a mechanical release, which is generally indicated at **24** in Figure 1, is actuated. The mechanical release **24** disengages the half nut or connecting element **15** from the lead screw **14**, whereby further longitudinal movement of the carriage **13** in a direction to the left in Figure 1 is halted. The engagement of the limit switch S–2 functions to first actuate piston A to retract the cutting tool **19** from the work and to thereafter operate the piston C in the return cylinder assembly **23**, whereby the piston rod **25** on the piston C is engaged with the carriage and moves said carriage longitudinally to the right in Figure 1, until said carriage is returned to its initial or starting position. As the carriage moves back to starting position a switch operating member **26** which is secured to the carriage again engages the limit switch S–1 to actuate this switch and effect a repetition of the cycle of operations. Upon this second cycle, the cutting tool **19** is moved inwardly an additional distance, the carriage is caused to traverse the work piece, is then halted and returned to starting position for the subsequent cycle of operation. The apparatus may be adjusted, as will hereinafter appear, to control the depth of each cut or pass of the cutting tool and to control the number of such cuts or passes. When the threading operation is complete, the shut-off switch S–3 is actuated to halt further operation of the apparatus. It is thus obvious that the apparatus automatically controls the various operations involved in the threading of the work piece and after the operator once starts the apparatus by means of the start switch S–4, no further manual control is required. The depth of the cut, the length of each cut or pass and the number of such cuts or passes is automatically controlled until the threading is complete. The results are accomplished by properly actuating the control pistons A, B and C in the proper sequence.

The cross slide control unit **21** is clearly shown in Figures 3 to 7 and includes an outer support or casing **27** which is suitably secured to the carriage **13** of the lathe (Figure 4). The upper portion of the support **27** is formed with a bore **28** which is in alignment with the cross slide traverse screw **17**, which screw controls the position of the cross slide **16**. A nut or colltar **29** is mounted upon the threads of extended end of the screw **17** and has its lower portion extending downwardly through a slot **30** formed in that portion of casing **27** which is below the bore **28**. Guide sleeves **29A** and **29B** may be formed on the nut **29** and said sleeves surround the screw on each side of said nut. A recess **31** is formed in the lower portion of the casing or housing and this recess has longitudinal guide grooves **32** (Figure 3) in its walls which are engaged by ribs **33***a* extending outwardly from a slide block **33**, whereby said block is slidable within the recess **31**. The upper inner end of the block is connected by a suitable pin **34** with the nut **29**, and it is obvious that when the slide block **33** is moved within its recess a similar motion is imparted to the traverse screw **17** of the cross slide to impart transverse movement to said cross slide with respect to the bed of the lathe. Since the cutting tool **19** is carried by the cross slide, it will be evident that an adjustment of said cross slide will result in an adjustment of the tool with respect to the work piece W which is held within the lathe. The slide block **33** is suitably connected to the piston rod **34** of the piston A and when said piston A is moved within its cylinder the slide block will be moved to adjust the cross slide.

For limiting the outward movement of the slide block **33** in order to control the depth of the cut to be made by the tool **19**, a cam shaft **35** extends transversely through an opening **36** in the slide block and also through openings in the side walls of the support or casing **27**. This cam shaft is suitably journaled in the walls of the support and has a plurality of bottom cams **37** which are mounted on the exterior of the shaft, being disposed within the recess **36** of the slide block. The button cams **37** are each of a different thickness or radial projection so that each projects a different distance outwardly from the surface of the cam shaft, as is clearly shown in Figure 4. Each button cam is adapted to coact with a stop **38** which is located within the slide block **33** and it will be evident that when the piston A is operated to move the slide block outwardly or in a direction to the left in Figure 4, the stop **38** of said slide block will engage the particular button cam **37** which is aligned therewith and this will limit the movement of the slide block in such outward direction. Movement of the block in this direction will control the depth of the cut to be made by the cutting tool **19** and by selectively locating the cam buttons of different radial projections in alignment with the stop **38**, the movement of slide block **33** and therefore the movement of the cutting tool will be accurately controlled.

In performing the threading operation, it is desirable to intermittently increase the depth of the cut upon each successive pass of the tool and thus, the movement of the slide block should be gradually increased in successive steps. For this purpose, the button cams are arranged so that at the start of the threading operation the button cam of greatest radial projection will be engaged by the stop **38** and thereafter the button cams of successively smaller radial projection will be moved into alignment with the stop **38** until the threading operation is complete.

For indexing the button cams **37**, one end of the cam shaft **35** is extended and has a ratchet **39** secured thereto. This ratchet is adapted to be engaged by an operating pawl **40** which is carried by a plunger **41** mounted in a suitable supporting frame **42**. When the plunger **41** is moved against the tension of a coiled spring **41***a* the pawl **40** will engage one tooth of the ratchet and will impart a rotation to the shaft. The teeth of the ratchet **39** are of course correlated with the button cams so that each time

that the plunger 41 is actuated the rotation of the shaft will align the next successive cam with the stop 38. The plunger 41 which actuates the indexing ratchet 39 is operated by an angular arm 43 which has its lower end secured to the underside of the slide block 33, as shown in Figure 5. Thus when the slide block is moved inwardly after the completion of each cut or pass of the cutting tool 19, the arm 43 functions to rotate the ratchet 39 and move the next successive button cam into position in alignment with the stop 38; upon return of the slide block to its outermost position, the next cam thus controls the amount of outward movement of the slide block and thereby controls the depth of the cut.

It may be desirable in certain instances to manually actuate the indexing ratchet 39 and for this purpose a second plunger 44 is provided. This plunger has a pawl 45 adapted to engage the ratchet teeth in the same manner as the pawl 40. An operating lever 46 coacts with the plunger 44 and this lever may be connected to a suitable rod 47 with a manual control mounted on the lathe. Under normal operation the indexing ratchet 39 is automatically actuated by the sliding movement of the slide block 33, but when desired may be manually actuated through lever 46.

The cam shaft 35 has its opposite end formed with a plurality of recesses 48 (Figure 5) which coact with a spring-pressed detent 49 whereby the cam shaft is locked in each indexed position by the friction of said detent to prevent an unintentional rotation of said shaft. The outer extended end of the shaft is formed with a collar 50 having a single groove 51 which is so located with respect to the button cams that said groove becomes aligned with an operating member 52 of the control switch S–3 when the threading operation is complete. Thus after the threading of the work piece has been completed, the groove 51 on the collar 50 moves opposite the switch actuating element 52 and operates the shut-off switch S–3 to cut off further operations of the apparatus.

The control assembly for controlling the engagement and disengagement of the half nut or connecting element 15 is clearly shown in Figures 8 to 10. As illustrated the half nut or connecting element comprises a pair of pivoted elements 53 having internally threaded jaws 54 which are adapted to close about and engage the lead screw 14 of the lathe. The handles 55 of the elements extend outwardly beyond the pivot point 56 and a coiled spring 57 normally urges the handles to a position which disengages the clutch jaws 54 from the lead screw 14. For engaging the jaws of the element 15 with the lead screw, a pair of toggle links 58 are pivoted to the handles 55 and to each other. An operating rod 59 extends from the center connection between the toggle links and has its opposite end connected to an actuating arm 60 which is mounted upon a shaft 61. The shaft 61 is adapted to be rotated by means of a ring 62 which abuts a flange 63 mounted on the shaft 61 and connection between the flange and ring is made through screws 64 which project outwardly from said flange and engage within arcuate slots 65 in said ring. The piston B which has its cylinder 66*a* connected to the carriage 13 of the lathe has its piston rod 66 connected at 67 with the ring 62 and when the piston B is actuated, the ring 62 rotates whereby one end of each slot 65 engages the pin 64 within said slot to impart a rotation to the shaft 61; such rotation is in a direction which will break the toggle links 58 and cause the threaded jaws 54 of element 15 to be engaged with the lead screw 14 of the lathe. Engagement of the jaws with the lead screw is maintained by means of a spring-pressed locking detent 68 which is carried by an arm 68*a* mounted on the shaft 61. The locking detent engages a recess 69 in a bracket 70 which is carried by the carriage 13. Thus when the piston B has rotated the shaft to engage the element 15 with the lead screw, such element is locked against disengagement from the lead screw until the locking detent 68 has been depressed. Therefore, the piston B may return to its initial position, such movements being permitted by the arcuate slots 65, without disengaging the jaws 54 of the half nut from connection with the lead screw.

The half nut or connecting element 15 remains engaged with the lead screw until a release lever 71 which coacts with a plunger 72 is actuated by a rod 73. The rod 73 is carried by the lathe and is positioned at a point adjacent the end of the travel of the carriage, the mechanical release assembly being generally indicated at 24 in Figure 1. As the carriage reaches the end of its travel, the lever 71 is engaged by the rod 73 which depresses the plunger 72 and disengages the detent 68 from its recess 69; when this occurs the spring 57 which is constantly urging the half nut or connecting element toward disengaged position functions to release the jaws 54 from the lead screw. It is thus evident that with the arrangement shown the half nut or connecting element 15 is engaged with the lead screw by operation of the piston B and is disengaged from said lead screw after the travel of the carriage has been completed by the mechanical release assembly 24 which comprises the detent, plunger-rod 72 and associated parts.

As has been mentioned, the carriage 13 is returned to its starting position by the return cylinder assembly 23. This assembly (Figure 12) is a simple cylinder having the piston C therein and said piston has a rod 25 which extends outwardly for engagement with the carriage 13. The limit switch S–2 is adapted to be engaged by the carriage 13 when said carriage reaches the limits of its travel and upon operation of limit switch S–2 the piston C is actuated to move its piston rod in a direction to the right in Figure 1. The piston rod engages the carriage and moves said carriage back to its initial or starting position. As the carriage returns to starting position the switch actuating element 26, which is more clearly illustrated in Figure 11, engages a roller 80 to depress an arm 81 and thereby actuate the limit switch S–1. It is noted that the element 26 may be constructed of telescoping members which may be moved to various relative positions and locked therein by a set screw 82 to vary the over-all length of said element.

Any suitable system of control may be employed for controlling the operation of the pistons A, B and C in a desired sequence, but in Figure 13 a preferred form of control means is schematically illustrated. As shown in this figure the piston A has a cross-over valve 85 associated therewith, which valve is actuated by an electrical solenoid A–1. Piston B has a similar cross-over valve 86, which is actuated by a solenoid B–1, while cylinder C has associated therewith a cross-over valve 87 controlled by a solenoid C–1. A sequence valve 88 is disposed in the hydraulic system between the piston A and the piston B, and as is well known, this type of valve permits operation of piston A and prevents operation of piston B until a predetermined pressure has built up in the cylinder of piston; said valve thus functions to cause operation of piston A first after which piston B may be actuated. A sequence valve 89 is also connected in the circuit in association with piston C and is arranged so that piston A will operate prior to the time that piston C operates.

A relay A–2 is associated with the operating solenoid A–1 of piston A and is provided for the purpose of holding the solenoid A–1 in closed position after the same has been initially energized, as will be hereinafter explained. The limit switch S–1 is connected to the solenoids A–1 and B–1 so that when the switch is actuated the solenoids A–1 and B–1 are operated to cause an operation of pistons A and B. Since switch S–1 is the switch at the beginning of the operation, piston A is operated to adjust the cutting tool after which piston B is operated to engage the half nut or connecting element 15 with the lead screw 14. At this time the other limit switch S–2 is open and piston C which is the return piston is inactive.

After pistons A and B have been actuated the carriage begins to move to the left and this opens limit switch S–1. However, because of the relay A–2, piston A maintains the cutting tool **19** in contact with the work but piston B may return to its initial position because solenoid B–1, being de-energized, will actuate valve **86** to reverse the direction of pressure upon this piston. As noted in connection with Figure 8, piston B can return to its original position without disengaging the half nut **15**.

As the carriage **13** completes its movement, the half nut is released by reason of the release assembly **24**, the release lever **71** being engaged by rod **73** (Figure 8), and thus further movement of the carriage is halted. Simultaneously with the disengagement of the half nut from the lead screw, the carriage strikes the limit switch S–2 to close said switch. When this occurs the relay A–2 is released and the solenoid C–1 is energized. Because of the sequence valve **89**, piston A first returns to its initial position to withdraw the tool **19** from the work, after which piston C is actuated to return the carriage **13** to starting position. When the carriage returns to starting position the switch S–1 is again actuated to repeat the operation. It is noted that at the time that piston A is moved to move slide block **33** and thereby retract the tool **19** from the work, the indexing ratchet **39** is operated to move the next button cam **37** on the cam shaft **35** into position to control the limit of movement of the cutting tool relative to the work upon the next operation of slide block **33**. The foregoing cycle of operations is continued successively until the threading operation is complete.

The overall operation of the apparatus is believed to be obvious. Initially the carriage **13** is in starting position adjacent the switch S–1 in Figure 1. The operator actuates the master switch S–4, and upon such operation piston A moves the tool into position with the work piece. The half nut or connecting element **15** is then engaged with the lead screw and the carriage and tool traverse the work piece for the desired length. Upon reaching the end of its travel the mechanical release mechanism **24** disengages the half nut while the switch S–2 functions to retract the piston A and move the cutting tool away from the work and to thereafter operate cylinder C to return carriage to starting position. Upon return to starting position the carriage actuates the switch S–1 through the rod **26**, and this causes piston A to again move the tool into contact with the work. Since the button cams have indexed during the retraction of piston A, the tool will now move into engagement with the work to a deeper depth so that the next cut will be made. Thereafter the cycle of operation is repeated until the desired number of cuts to complete the threading operation have been made.

The apparatus is relatively simple in construction and may be mounted on the lathe without any material change in the lathe structure itself. It is thus in the form of an attachment and is applicable to any type of turning machine having a carriage and a lead screw; actually it has been found to be adaptable to both engine and turret lathes. Not only does the apparatus relieve the operator of the manual control of the depth of cut and the length of travel, but it also provides for a faster operation and more accurate threading. It is of course evident that the button cams **37**, which are mounted on the cam shaft **35** may be varied in thickness and in number in order to meet the particular needs of the work being done; also, any suitable cam projections could be employed upon the shaft. Although control of the pistons A, B and C has been described as being a combination of hydraulic power and electrical control, it is evident that the pistons may be actuated pneumatically and other methods of automatic control may be employed. So long as the various operations which are performed in the threading of a piece of material are automatically controlled, the purposes of the invention will be accomplished.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim is:

1. A turning machine for cutting threads comprising, a base having ways thereon, a carriage slidable along the ways, a rotatable chuck on the base for supporting a work piece, a lead screw mounted on the base, a half nut mounted on the carriage and connectable with the lead screw to move the carriage along the ways with rotation of the lead screw, a first closed cylinder and piston therein mounted on the carriage, a lost motion connection between the half nut and one of said cylinder and piston including a pin and shoulder which are engaged by pressurizing the cylinder and move the half nut into engagement with the lead screw, a detent holding the half nut in engaged position during each cut, said lost motion connection permitting retraction of said first piston and cylinder after the detent is engaged without releasing the half nut, a detent release carried by the base and engaging and releasing the detent at the end of each cut, a spring urging the half nut toward disengaged position and effective upon release of the detent to return the half nut to disengaged position, a cross slide mounted on the carriage for movement transverse to said movement of the carriage and carrying a cutting tool, a transverse screw mounted on the carriage and controlling movement of the cross slide, a nut slidably carried by the carriage and threaded on the transverse screw, a stop carried by the nut, a cam mounted on the carriage and engaged by said stop as the cutting tool is moved into cutting position to determine the depth of each cut, means for indexing said cam in response to each reciprocation of said nut, a second closed cylinder and piston therein mounted on the carriage and connected to the nut for reciprocating the nut and for holding the stop against the cam during each cut, a third closed cylinder and piston therein mounted on the base for engaging and returning the carriage to starting position at the end of each cut, and a hydraulic control system including a source of liquid under pressure connected to each of said first, second and third cylinders through first, second and third control valves, respectively, said first and second valves operable in response to movement of the carriage to a position to begin a cut to pressurize one side of said first and second pistons and move the half nut into engagement with the lead screw and the stop into engagement with the cam to position the cutting tool in cutting position, said first valve reversing flow of pressure fluid to said first cylinder to pressurize the other side of said first piston to withdraw the pin from the shoulder of said lost motion connection in response to movement of the carriage by said lead screw, said second valve reversing in response to the carriage reaching the end of a cut to reverse flow of pressure fluid to said second cylinder to pressurize the other side of said second piston and withdraw the cutting tool, said third valve operable in response to the carriage reaching the end of a cut to pressurize the third cylinder and return the carriage to beginning position.

2. As a subcombination a cross-slide control adapted to be secured to a turning machine carriage and to reciprocate the transverse screw of the cross-slide comprising, a support adapted to be mounted on a turning machine carriage, a cam mounted on the support, a nut slidably carried by the support and adapted to be threadedly connected to the transverse screw of the cross-slide, means for indexing the cam with each reciprocation of the nut relative to the support, a stop carried by said nut and engaging the cam upon reciprocation of the nut in one direction, and means including hydraulic operator for selectively reciprocating and holding the stop in engage-

ment and in disengagement with the cam, respectively.

3. As a subcombination, means for releasably securing a carriage to the lead screw of a turning machine comprising, a half nut having both halves pivoted on a carriage at a common point, handles on each half of the nut, a spring between said handles urging the two halves of the half nut toward closed position, an operating rod attached to each handle and movable to a first position to close the half nut and to a second position to permit the spring to open the half nut, a closed cylinder having a piston therein mounted on the carriage, a lost motion connection between the rod and one of the piston and cylinder including a shoulder and pin engageable upon pressurizing the cylinder and moving the operating rod to nut-closing position, said lost motion connection permitting reverse relative movement of said piston and cylinder to disengage the shoulder and pin without opening

the half nut, a detent releasably holding the half nut in closed position upon movement of the rod to nut-closing position, and means for selectively reciprocating said piston and cylinder relative to each other.

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