E. RIVETT.

METAL WORKING MACHINE.

APPLICATION FILED JUNE 17, 1914. RENEWED AUG. 23, 1916.

1,198,771.

Patented Sept. 19, 1916.

4 SHEETS—SHEET 1.

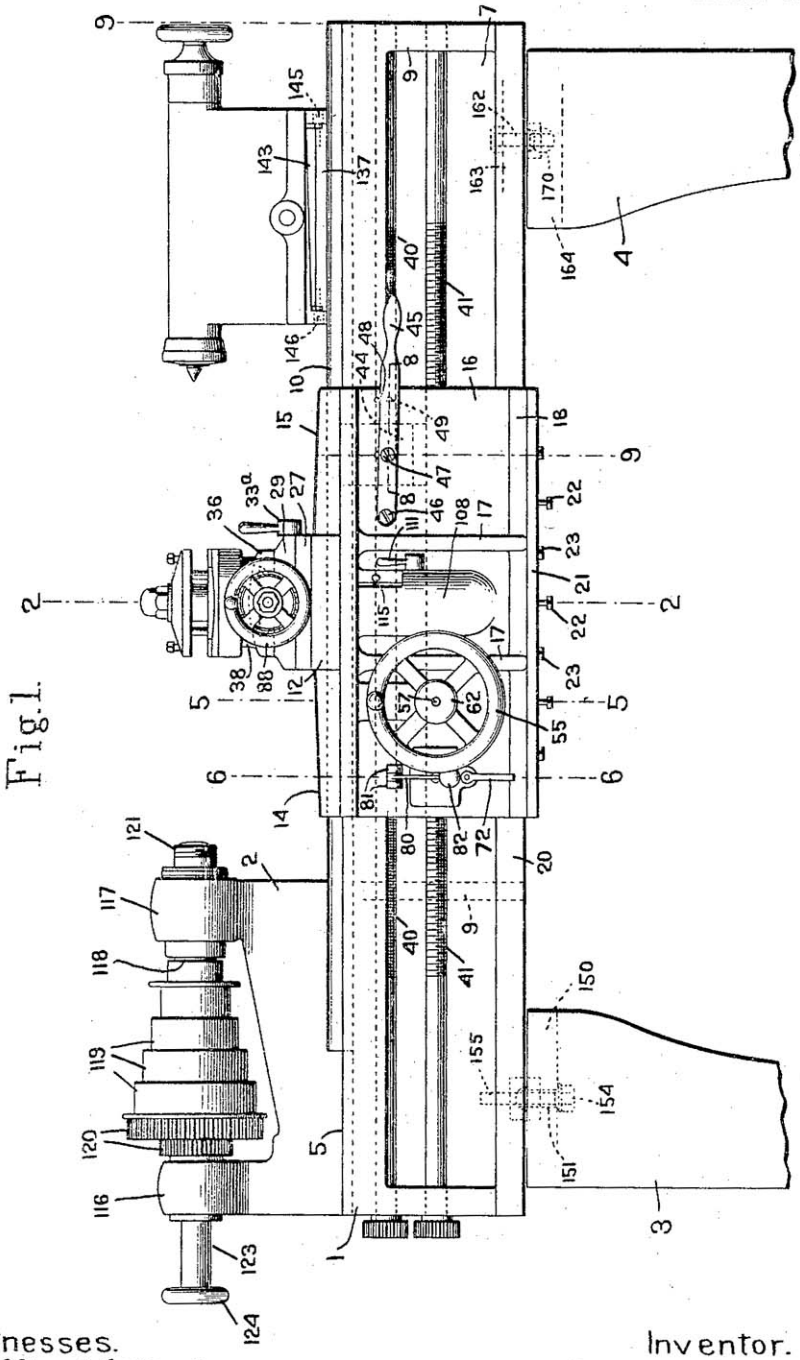


Fig. 1.

Witnesses.
J. Morrill Fuller
William E. Gagen

Inventor.
Edward Rivett,
by Heard Smith & Tennant
Atty's.

E. RIVETT.

METAL WORKING MACHINE.

APPLICATION FILED JUNE 17, 1914. RENEWED AUG. 23, 1916.

1,198,771.

Patented Sept. 19, 1916.

4 SHEETS—SHEET 2.

Fig.2.

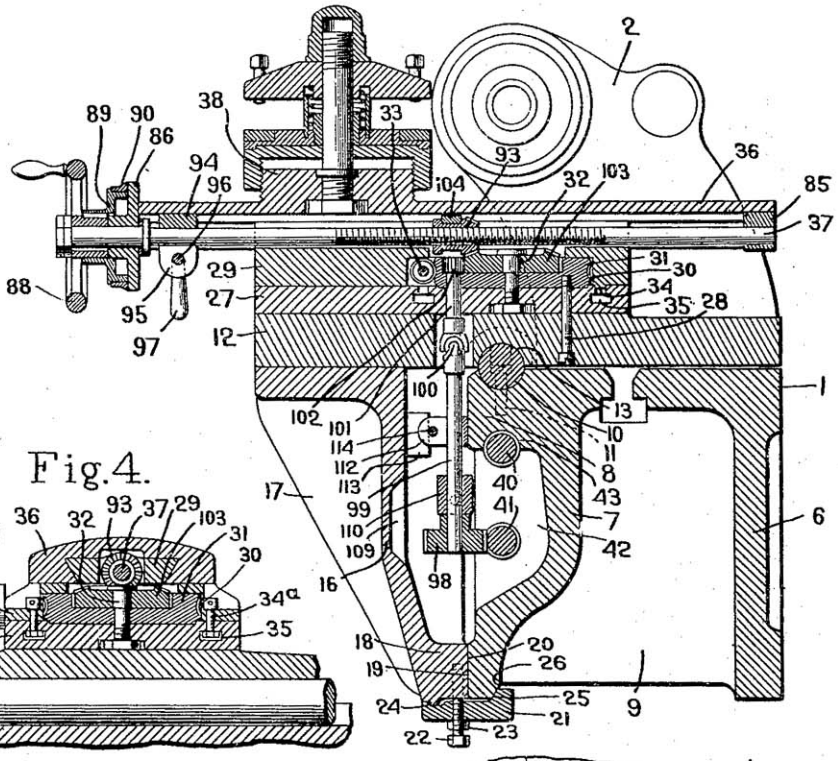


Fig.4.

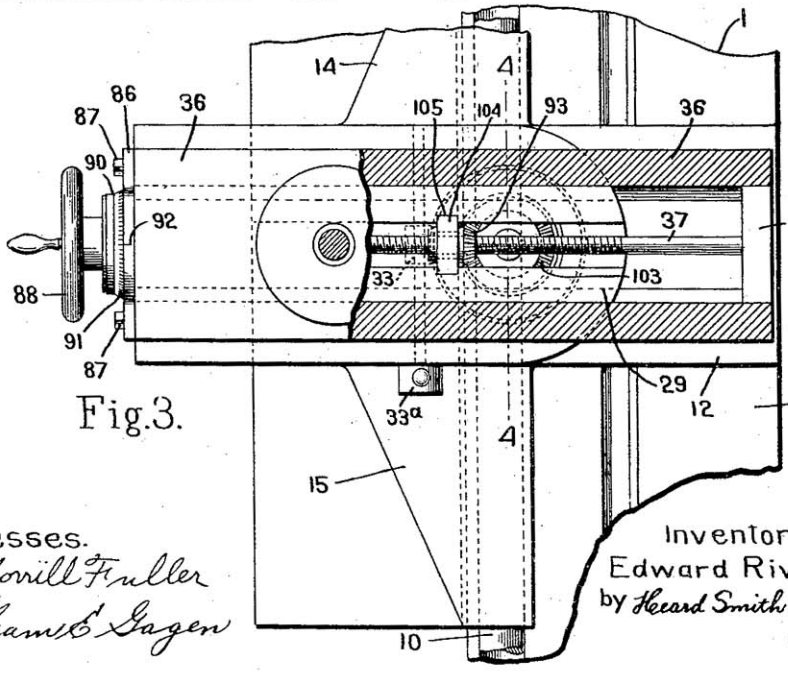


Fig.3.

Witnesses.

J. Morrill Fuller

Williams & Gagen

Inventor.

Edward Rivett,

by Heard Smith & Tennant.

Atty's.

E. RIVETT.

METAL WORKING MACHINE.

APPLICATION FILED JUNE 17, 1914. RENEWED AUG. 23, 1916.

1,198,771.

Patented Sept. 19, 1916.

4 SHEETS—SHEET 3.

Fig. 5.

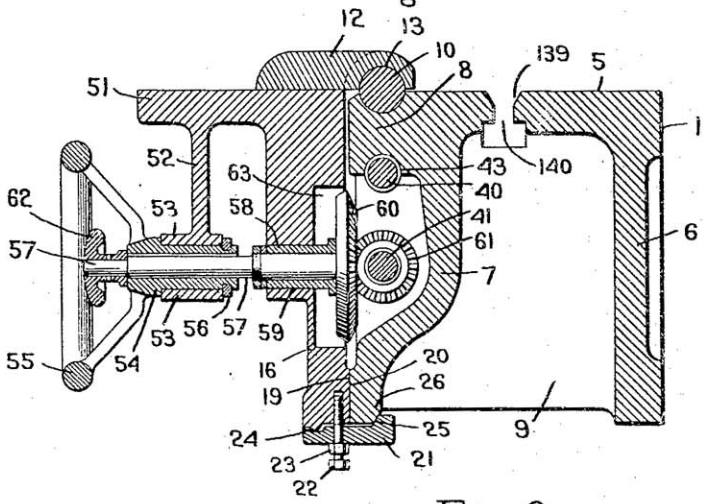


Fig. 6.

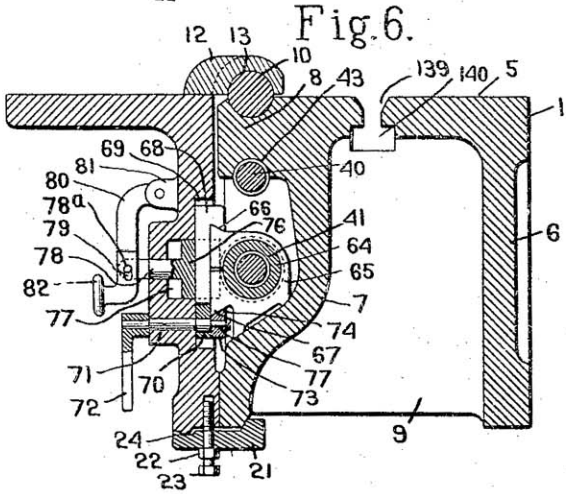


Fig. 7.

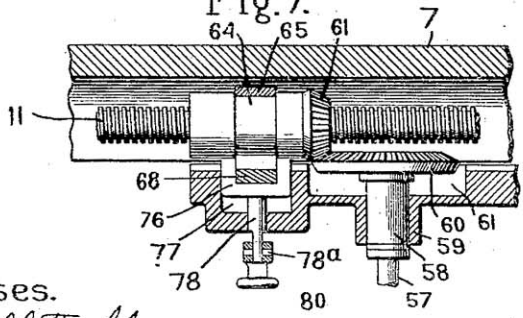
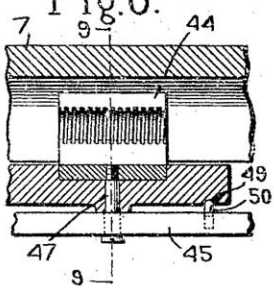


Fig. 8.



Witnesses.

J. Morrill Fuller

William C. Sagen

Inventor.

Edward Rivett,

by Heard Smith & Tennant.

Atty's.

E. RIVETT.

METAL WORKING MACHINE.

APPLICATION FILED JUNE 17, 1914. RENEWED AUG. 23, 1916.

1,198,771.

Patented Sept. 19, 1916.

4 SHEETS—SHEET 4.

Fig.9.

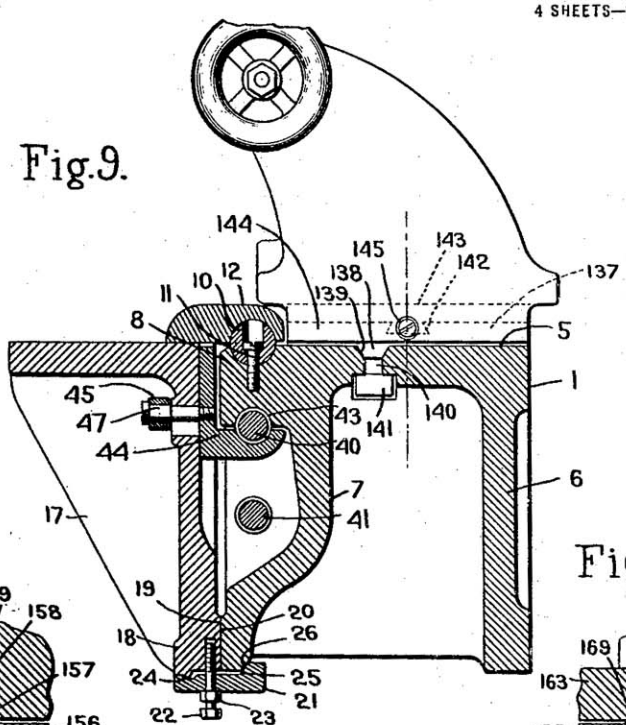


Fig.14.

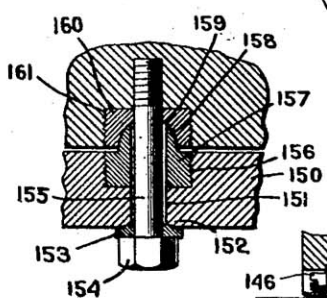


Fig.15.

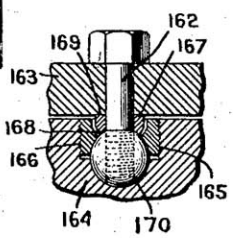


Fig.10.

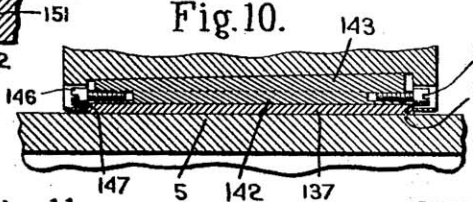


Fig.11.

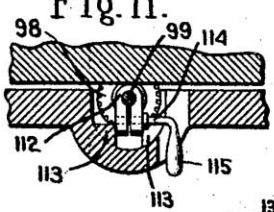


Fig.12.

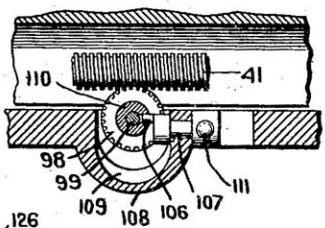
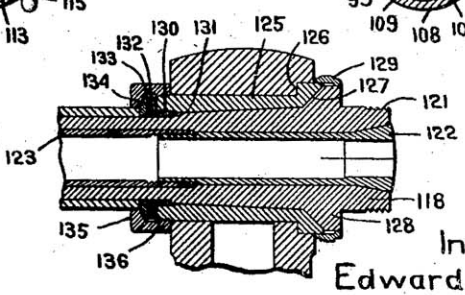


Fig.13.



Witnesses.

J. Morrill Fuller

William E. Gagen

Inventor.

Edward Rivett,

by Heard Smith & Tennant.

Atty's.

UNITED STATES PATENT OFFICE.

EDWARD RIVETT, OF HULL, MASSACHUSETTS.

METAL-WORKING MACHINE.

1,198,771. Specification of Letters Patent. Patented Sept. 19, 1916.

Application filed June 17, 1914, Serial No. 845,733. Renewed August 23, 1916. Serial No. 116,411.

To all whom it may concern:

Be it known that I, EDWARD RIVETT, a citizen of the United States, residing at Hull, county of Plymouth, State of Massachusetts, have invented an Improvement in Metal-Working Machines, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to improvements in metal working machines generally and the specific embodiment and the general features thereof are disclosed as applied to lathes adapted for accurate work.

The general objects of the invention are to provide a machine of rigid structure in which the accurate alinement of the operative parts may be accurately maintained, the wearing away of the relatively movable parts reduced to a minimum and means provided whereby they may be adjusted to compensate for such wear as may take place, to provide means for preventing accident to the relatively movable parts and in the specific embodiment shown herein to provide a machine adapted to perform with increased accuracy a variety of operations such as turning, screw thread cutting, ball turning, taper turning or screw threading, etc.

Another feature of the invention is to provide a three point supporting means for the machine bed which will prevent any twisting strain upon the bed of the machine when it is set up notwithstanding irregularities in the floor upon which the machine rests.

Other objects of the invention and the various novel improvements in detail will more fully appear from the following description and the accompanying drawings and will be fully pointed out in the annexed claims.

In the drawings; Figure 1 is a front elevation of a lathe embodying the preferred forms of my invention, Fig. 2 is a vertical sectional view on lines 2—2 Fig. 1 through the center of the carriage and bed, Fig. 3 is a plan view of the parts shown in Fig. 2 partly broken away to show the feeding mechanism for the cross slide or tool carriage, Fig. 4 is a detail sectional view on lines 4—4 Fig. 3, Fig. 5 is a sectional view on lines 5—5 Fig. 1 showing the hand operating mechanism for the carriage, Fig. 6 is a sectional view on lines 6—6 Fig. 1 showing the automatic carriage feeding mechanism, and the means for throwing the same into operative relation or releasing the same and locking it out of operative relation to permit the manipulation of the carriage by hand, Fig. 7 is a sectional view showing in detail the automatic and manually operated connections to the main feed screw, Fig. 8 is a similar view on lines 8—8 Fig. 1 showing the connection of the carriage driving mechanism to the screw cutting feed, Fig. 9 is a sectional view on lines 9—9 Figs. 1 and 8 showing the tail stock in elevation, Fig. 10 is a detail of the adjusting mechanism for the tail stock, Fig. 11 is a detail sectional view of the clamping means for holding the automatic driving mechanism from rotation when the carriage is being manipulated by hand, Fig. 12 is a detail sectional view showing the means for throwing the automatic driving mechanism for the carriage into and out of operation, Fig. 13 is a sectional view through a portion of the head stock, Fig. 14 is a detail sectional view of one of the three point connections between the body and its support, and Fig. 15 is a detail sectional view of the other two of the three point connections between the body and its support.

In the preferred embodiment of the invention illustrated herein the lathe bed 1 is of a peculiar construction as will hereinafter appear and is provided with a head stock 2 cast integrally therewith to provide a more rigid construction than in the usual form of lathe. In order to provide means for easily setting up the machine upon the floor of the shop which may be more or less irregular a three point support is provided comprising a single leg 3, desirably supporting the head end of the lathe and a pair of legs 4 supporting the tail end of the lathe, these legs being desirably attached to the under side of the bed by universal joints of novel construction as will hereinafter more fully appear.

The lathe bed comprises a horizontal flat portion 5 adapted to carry the tail stock and carriage of the machine there being depending webs 6 and 7, the web 7 being provided at its upper portion with a forwardly extending thickened member 8 adapted to support the mechanism upon which the carriage is mounted and also to provide a backing for the screw which actuates the carriage for screw threading. The lower portion of the

web 7 is desirably extended forwardly so that its upper face lies in the plane of the forward face of an extension 8, the webs 6 and 7 being connected by a series of bracing webs 9 to give strength and rigidity to the frame.

In the use of lathes, short stock is more often operated upon than long stock and by the short travel of the carriage in operating upon the short stock the relatively moving surfaces between the lathe bed and the carriage become worn so that when long stock is placed in the machine more or less irregularity in the turning or cutting of the stock is caused by the carriage riding from the worn part to the unworn part.

One of the principal objects of this invention is to so mount the carriage that it will have a bearing upon the bed which will prevent the irregular wearing away of a section of the bed and consequently avoid this very serious defect. To accomplish this purpose I have provided a cylindrical support for the carriage of long dimensions which in the preferred form shown herein comprises a cylindrical steel shaft 10 partially embedded in the upper surface of the thickened extension 8 of the bed 5, said shaft being secured therein from movement by means of screws 11 or other suitable fastenings. This shaft 10 is desirably constructed of hardened steel, and is ground absolutely true.

The carriage is desirably a built up construction comprising a main plate 12 having a cylindrical concaved recess 13 adapted to engage the hardened steel shaft 10, there being extensions 14 and 15 from said main portion 12 extending longitudinally of the shaft to give a long bearing upon the same. By thus mounting or pivotally and slidably hinging the carriage upon a single cylindrically curved bearing member the greatest accuracy in alinement may be obtained, since the bearing member may be made with absolute accuracy and so supported in the bed that its axis will lie throughout within or parallel to, the plane of the axis of rotation of the work holding chuck. The shaft 10 extends a suitable distance beyond the inner end of the head stock, the head stock being overhung to permit this arrangement, as illustrated in Fig. 2.

It will be observed that by this construction there will be little tendency for the carriage or shaft to wear, even though short stock is operated upon more frequently than long stock, in order, however, to provide means for taking up any wear which may take place, and also to provide means for supporting the mechanism for actuating the controlling or driving means for the carriage, I have provided a depending member 16 secured to the forward under face of the main portion of the carriage 12, desirably provided with a plurality of strengthening ribs 17 and terminating in a rearward extension 18 which bears against the forward face of the extension of the web 7, the contacting faces of the downwardly extending carriage member and the extension of web 7 being surfaced to provide smooth contact surfaces 19, 20 which will permit the easy and accurate movement of the carriage longitudinally of the lathe bed.

In order to take up any wear which may occur either between the shaft 10 and the under portion of the main carriage member 12, or between the surfaces 19 and 20 a cap plate 21 is provided which is secured to the extension 18 of the depending carriage member by alternately arranged backing and retaining screws 22, 23, said cap plate being recessed at its forward edge to receive a rib 24 extending downwardly from the member 18, the opposite or rearward edge of the cap plate being extended upwardly and having a beveled surface 25 adapted to engage a machined surface 26 upon the downward extension of the web 7.

It will be obvious that the cap plate 21 which is supported upon the depending portion of the carriage will travel with the same and that if any wear occurs a loosening of the backing screws 22 and tightening of the retaining screws 23 will at once readjust the carriage into proper position.

The carriage as has been stated is of a built up construction desirably so made as to provide for the automatic manipulation of the carriage longitudinally of the lathe or the manual operation thereof; to provide for the cross feeding of the tool carriage either automatically or manually and to provide for a circular movement adapted for turning balls, tapers, etc. To provide for these various functions the main portion 12 of the carriage has placed upon it an intermediate plate 27 to which it is secured by bolts 28. Superimposed upon the intermediate member 27 is an upper member 29 which is provided with a recess 30 adapted to receive a worm gear 31 which is secured thereto by a stud 32 in the vertical plane of the center of the lathe, the stud 32 being secured in the intermediate plate 27. The worm gear 31 is prevented from rotation relative to the main member 12 and intermediate member 27 by bolts 28 which extend through both these members into the under portion of said gear.

The upper member 29 of the carriage is rotatable relatively to the intermediate member 27 through the medium of a worm 33 which is journaled in the member 29. The worm 33 engages the teeth of the worm gear 31 and may be actuated either manually by a lever 33ª and suitable ratchet mechanism, or automatically. When the worm 33 is rotated the upper member 29 of the carriage will be caused to rotate about the pivotal stud 32 as a center so that the tool which is

carried upon the cross slide mounted upon the member 29, may be suitably guided for ball turning, taper turning, etc.

The upper member 29 may be guided in its rotation by an annular rib 34 extending from the under surface of the member 29 into a circular undercut slot 35 in the intermediate plate 27 and may be clamped in adjusted position by bolts 34ª having nuts traveling in the undercut recess of the slot 35 and provided with heads having transverse holes to receive a rod or other tool for tightening or loosening said bolts. A cross slide or tool carriage is mounted upon the upper member 29 of the main carriage in such a manner as to provide for the cross feeding of the tool.

In the preferred embodiment illustrated herein the tool carriage comprises a base member 36 curved to embrace the upper part of the member 29 of the main carriage, the tool carriage being provided with downward extensions at each end adapted to receive a screw threaded shaft 37 to propel the tool carriage cross-wise of the lathe, either manually or automatically as will hereinafter be described. The tool carriage is provided with an upward extension 38 preferably cast integrally therewith and screw threaded at its upper portion to receive any suitable holder for the tools such as that illustrated in Figs. 1 and 2 of the drawing, without reference to the manner in which the main carriage may be caused to travel longitudinally of the bed or the tool carriage to travel transversely thereof.

Inasmuch as this lathe is adapted not only for turning but also for screw threading I have deemed it expedient to provide two separate shafts 40 and 41 which are mounted in suitable bearings at the head and tail ends of the machine and which may be rotated through any suitable gearing and at any suitable speed by any usual form of mechanism, (not shown). The shafts 40 and 41 are desirably located within the recess 42 formed by the curved contour of the web 7 and are beneath the forward extension 8 of said web being thereby protected from injury by the dropping of tools or dust and chips from the lathe. The screw threading shaft 40 is desirably mounted in a concaved recess 43 in the under portion of the extension 8 whereby the shaft is afforded a backing which prevents its distortion.

In order to provide for the traverse of the carriage in screw cutting the downwardly extending portion 16 of the main carriage carries a half nut 44 which is slidably mounted in a recess therein and is adapted to be raised and lowered by means of a lever 45 pivotally mounted upon a stud 46 projecting from the forward side of the carriage and secured to said sliding nut by a stud or bolt 47. Means such as holes 48, 49 in the carriage may be provided adapted to receive a spring plunger 50 extending from said lever 45 to support the nut into or out of engagement with the under surface of the feeding shaft 40. It will be obvious that when the lever is raised into position to cause the nut to engage the threads of the shaft 40, as shown in Fig. 9, the carriage will be advanced by the rotation of the screw cutting feeding shaft 40 in the usual manner. At this time of course the mechanism for operating the carriage by the screw 41 is disengaged since it is obvious that both the screw feeding shaft and the shaft which feeds the carriage for turning should not be operatively engaged with the carriage at the same time.

In order to provide for the feeding of the carriage both automatically and manually a special mechanism is provided whereby the hand operating device may be disengaged during the automatic operation and the mechanism for automatically feeding the carriage disengaged while the same is being driven by hand. This mechanism is further so arranged as to permit the driving of the cross feeding mechanism for the tool carriage from the same shaft 41 which automatically feeds the main carriage.

Referring first to the manual feed the depending portion 16 of the carriage is provided with an extension 51 having a downwardly projecting stand 52 terminating in a journal 53 adapted to receive a sleeve 54 provided with a hand wheel 55, the sleeve 53 of the hand wheel 55 being secured in said journal by a split retaining ring 56. The sleeve 53 is keyed to a central shaft 57 extending through a bushing 58 in a journal 59 in the member 16, said shaft 57 having upon its inner extremity a beveled gear 60 which is adapted to engage a companion beveled gear 61 mounted upon the screw threaded shaft 40. The outer end of the shaft 57 is provided with a knob 62 by means of which the gear 60 may be forced into engagement with the gear 61 or withdrawn from engagement with said gear 91 into a suitable recess 63 in the inner face of the member 16.

It will be obvious that when the hand wheel is forced into engagement with the gear 61 and is rotated the gear 61 will be caused to rotate upon the screw threaded shaft 41 and that if the shaft 41 is maintained stationary the carriage will be moved longitudinally of the machine, at this time the gear being connected to the carriage by mechanism hereinafter to be described. (See Figs. 6 and 7.)

The gear 61 is in the form of a nut having an annular recess 64, the threads of the nut being constantly in engagement with the threads of the shaft 41. In order to provide for the automatic feeding of the

carriage by driving the shaft 41 in the usual manner it is necessary that the gear 61 be locked against rotation. In order to accomplish this purpose I have provided a clamping member comprising a split collar 65 embracing the gear 61 within the recess 64. This split collar is desirably of the form illustrated in Fig. 6 having downward projections which are surfaced off to engage a surfaced way on the lower inclined surface of the web 7, the clamp being adapted to be moved longitudinally of the bed along with the gear, as will be obvious. The clamp 65 is provided at its forward end with diverging surfaces 66 and 67 which are adapted to be engaged by locking members to force the clamp tightly upon the gear 61 and thereby to prevent its rotation.

The preferred form of locking member as disclosed herein comprises a pair of plates having beveled edges adapted to engage the surfaces 66, 67, one of these locking plates 68 being slidably mounted in a recess 69 in the plate 16 and secured at its lower end upon an eccentric 70 carried by a stud 71 journaled in the frame 16, said stud having an operating lever 72. The other portion of the locking member comprises a plate 73 having a beveled edge 74 adapted to engage the surface 67 aforesaid, said plate being mounted upon an extension 75 of the stud, which in turn is mounted eccentrically in the end of the stud 71 in opposite relation to the eccentric 70 so that when the lever 72 is actuated to close the clamp 65 the eccentrics 70 and 75 will act in opposite directions upon their respective members to cause the same to actuate the members of the clamp 65 symmetrically.

The gear 61 is connected to the carriage by means of a yoke or forked piece 76 which embraces the locking member and clamp aforesaid, the yoke being mounted in a recess 77 in the carriage and thereby connecting the gear 61 to the carriage through the parts aforesaid as shown in Figs. 6 and 7.

In order to provide for the driving of the cross feeding mechanism of the tool carriage from the shaft which automatically feeds the main carriage longitudinally of the lathe it is necessary to withdraw the yoke from its engagement with the gear and its clamp so that there will be no feeding of the main carriage during the cross feeding operation; provision is made for thus disengaging the yoke by providing the same with a stem 78 extending through the wall of the carriage 16 and having at its outer end a pin 78^a engaging a slot 79 in a lever 80 which is pivotally mounted between a pair of lugs 81 extended forwardly from the front of the carriage member 16. The lever 80 may be of any desired form but for convenience I have shown the same as having an outwardly turned end provided with a knob 82 which may be readily grasped by the hand.

In the automatic feeding of the machine through the shaft 41 it will be understood that said shaft 41 is driven in any usual manner. The gear 61 is locked to the carriage by yoke 76 and is locked from rotation by the clamp 65 and the locking mechanism aforesaid, thus causing the carriage to be moved longitudinally of the bed plate as the shaft 41 is rotated.

In order to move the carriage manually the clamp 65 is released so that the gear 61 is free to rotate upon the shaft 41. The gear 60 is then thrown into engagement with the gear 61 by pressure upon the knob 62 and the hand wheel 65 rotated to cause the progression of the carriage in either direction, at this time the feeding shaft 41 being at rest.

In the embodiment of the invention shown herein the cross feed of the tool carriage is adapted to be actuated from the same shaft 41 which serves to automatically feed the main carriage longitudinally of the lathe bed. This is accomplished through a substantially vertical shaft which engages a horizontally disposed gear which in turn meshes with a gear in the form of a nut on the screw threaded shaft 37 which is mounted on the tool carriage 36.

Before entering into a description of the automatic driving mechanism the nature of the tool carriage will be more fully explained. As before stated the carriage 36 embraces and engages ways upon the sides of a projecting upper portion of the carriage 29. The rear end of the carriage 35 is provided with a downwardly projecting bearing 85 (Fig. 2). The opposite or forward end of the carriage is likewise provided with a bearing member 86 which desirably may be secured to the end of the carriage by bolts 87. The shaft 37 is mounted in the bearing members 85 and 86 and extends beyond the bearing 86 to receive a hand wheel 88 which may be keyed thereto in the usual manner. The hub of the hand wheel is desirably surrounded by a collar 89 which may be provided with an annular dial 90 which may be provided with graduations 91, see Fig. 3. This dial is desirably in the form of a ring held frictionally upon the collar 89 so that it may be turned to zero at any time. The bearing member 86 is provided with an indicator 92 by which the position of the dial 91 may be set and also by which the amount of rotation thereof may be determined.

The cross feeding of the tool carriage is effected through a gear 93 which is in the form of a nut and is mounted upon the screw threaded shaft 37. This nut is so arranged that it may be prevented from rotation during the manual feeding of the car-

riage by the hand wheel 88, and may be caused to rotate during the automatic actuation of the cross feed from the shaft 41, at which time the screw 37 is locked against rotation by means of a clamp 94 carried in a recess in the underside of the tool carriage 36 and is in the form of a split collar having lips 95 connected by a screw 96 having a handle 97 by which it may be rotated.

The cross feeding of the carriage 36 is effected automatically from the screw 41 through a gear 98 carried by a vertical shaft 99 which is connected by a knuckle joint 100 to a short shaft 101 which is journaled in the intermediate portion of the main carriage and in the worm gear and which carries upon its upper end a pinion 102 which engages teeth on the outer circumference of a gear 103 which is mounted upon the stud 32 within a recess in the worm gear 30. The gear 103 is not only provided with circumferential gear teeth but also with a series of beveled gear teeth upon its upper surface which engage with the beveled gear 93 which, as before stated, is in the form of a nut and mounted upon the shaft 37. It will be obvious that when the gear 98 is in mesh with the threads of the shaft 41 the shaft 99 will be rotated, thus in turn rotating the pinion 102, the beveled gear 103, and the gear 93 upon the shaft 37, which at this time is locked. Such rotation of the gear 93 will of course cause the carriage 36 to travel crosswise of the lathe bed, it being obvious that the gear 93 must be prevented from longitudinal movement upon the shaft 37. This is accomplished by the gear being retained in place by a block 104 (see Fig. 3) held in a recess 105 formed in the member 29.

In order to provide for the cross feeding of the tool carriage manually it is necessary to remove the gear 98 from its engagement with the threads upon the shaft 41, this is accomplished by means of an eccentrically mounted stud 106 projecting from a disk on the short shaft 107 which is mounted in the wall of the main carriage, which may be desirably provided with a swelled portion 108 forming a pocket 109 (Fig. 12) adapted to receive the gear 98 when it is withdrawn from engagement with the shaft 41. The pin 106 engages a sleeve 110 rotatably mounted upon the shaft 99. The shaft 107 is provided with a handle 111 by which it may be rotated in order to cause the disengagement of the gear 98 from the threads of the shaft 41. The handle 111 is given a half turn which causes the upward and lateral movement of the sleeve 110 carrying the end of the shaft 99 with the gear 98 into the pocket 109 aforesaid. This operation is permitted by reason of the fact that the shaft 99 is connected by the knuckle joint 100 with the short shaft 101 which carries the pinion 102 which drives the pinion 103 actuating the nut 93. (See Fig. 12).

In order to prevent the shaft 99 from rotation, and thereby to hold the gear 93 from rotation during the feeding of the tool carriage by the hand wheel 88, a clamp is provided for engaging the shaft 99. This clamp which is shown in detail in Fig. 11, comprises a split collar 112, the lips of which engage lugs 113 cast on the inside of the pocket 109 and prevent the collar from rotation. The lips of the collar are clamped together and the rotation of the shaft thereby prevented by means of a screw 114 which may be provided with a suitable handle 115.

It will be obvious therefore, that when the hand wheel feed is to be used the gear 98 will be removed from its engagement with the shaft 41 and will be locked out of engagement therewith by the clamping collar 112 thus preventing the rotation of the shafts 99 and 101, the gear 103 and the gear 93 which is provided with a nut engaging the shaft 37. In order to manually operate the cross feed the clamp 94 is loosened and the hand wheel 88 rotated to advance or to retract the tool carriage.

One of the features of the invention comprises a novel mechanism within the head stock of the lathe whereby the thrust may be taken up and binding of the rotation of the shaft which carries the chuck or face plate may be prevented.

It has heretofore been mentioned that the head stock is desirably cast integrally with the bed, as illustrated herein the head stock comprises two upwardly and laterally extending bosses 116 and 117 in which is mounted a hollow shaft 118 which is provided with the usual pulleys of various sizes 119 and gearing 120, etc., and at its inner end with a screw 121 adapted to receive the usual face plate. Within the hollow shaft the usual chuck 122 is mounted and is adapted to be extended or retracted by a screw threaded sleeve 123 which may be operated in the usual manner by a hand grip or knob 124.

In order to take up the end thrust a sleeve 125 having a shouldered extension 126 is mounted in the boss 117, said sleeve being provided with a beveled surface, desirably inclined at an angle of 45° to the axis of the shaft and which coöperates with a similar surface upon an enlarged portion 128 of the driving shaft 118. These engaging surfaces may desirably be protected from dust or dirt by a surrounding guard ring or collar 129.

It is desirable to so distribute the thrust that it will not all come upon the surface 127 and I have therefore provided means whereby a portion of the thrust may be otherwise transmitted to the sleeve 125. This is accomplished by providing a flanged

collar 130 upon the shaft 117, said collar 130 being adapted to bear against a shoulder 131 upon said shaft at the rear of the boss 118. The collar 130 engages an anti-friction washer 132, preferably of fiber which in turn engages the face of a collar 133 the outer surface 134 of which is spherical and engages a corresponding spherical surface on the inner side of a nut 135 which is secured to the sleeve 125 by screw threads 136.

It will be obvious from this construction that any heavy thrust upon the chuck or face plate which is attached to the end of the shaft 118 will be transmitted through the sleeve 136, the washer 132, the collar 133 and the nut 134 to the sleeve 125 thereby relieving the pressure upon the surface 127 to a sufficient extent to prevent the binding of the shaft in its bearings.

Another feature of the invention comprises means for vertically adjusting the tailstock of the lathe. In order to accomplish this I have provided a base plate 137 or support for the tail stock having a downwardly extending substantially V-shaped portion 138 adapted to ride in a way 139 in the bed 1, this way being at the upper end of a slot 140 which extends longitudinally of the lathe bed and has undercut walls to receive the heads of fastening bolts 141. The member 137 is provided with a dovetailed groove 142 in which is seated a corresponding tongue projecting downwardly from a wedge shaped member 143 which rests upon the member 137. The ends of the tail stock are provided with downward projections or flanges 144 which are apertured to permit the introduction and manipulation of screws 145 and 146 which are threaded into the opposite ends respectively of the wedge shaped member 143. The heads of the screws are shouldered to engage the ends 147, 148 of the base plate 137.

In order to raise or to lower the tail stock it is merely necessary to adjust the wedge shaped member 143 longitudinally thereof and this is accomplished by advancing one of the screws 145, 146 and retracting the other in the proper manner.

It has heretofore been mentioned that the lathe is desirably supported upon a three point bearing, this is accomplished in the preferred form of the invention by providing a single leg beneath the head of the lathe, which is desirably secured thereto by means of a spherical bearing. The leg 3 as shown in Fig. 1 is provided with a web 150 which is provided with an aperture 151 desirably enlarged at its lower end to form a spherical seat 152 for a washer 153 which rests upon the head 154 of a bolt 155 which bolt extends loosely through the aperture 151 and engages the bed 1. The upper surface of the web 150 is provided with a circular screw threaded recess 156 in which is seated a screw threaded bearing plug 157 having an upwardly extending spherical portion 158 which engages the concaved face 159 of a companion bearing plug 160 which is likewise screw threaded in an aperture 161 in the under face of the bed.

It will be observed by reference to Figs. 1 and 14 that the bed of the lathe is supported by the spherical bearing surfaces slightly above and free from the leg 3 so that the latter is permitted a slight adjustment in any direction. The illustrations above referred to show the separation between these parts in exaggerated form and it is to be understood that only a slight adjustment is provided but which is sufficient in connection with the adjustment of the other leg to permit the proper positioning of the lathe bed even though the floor upon which the lathe is seated is somewhat uneven.

The leg 4 which supports the tail end of the lathe is likewise provided with two universally adjustable bearings which may desirably be of the form illustrated in Figs. 1 and 15 in which bolts 162 pass through the flanges 163 on the bottom of the lathe bed and are screw threaded into spherical balls 170 which are seated in corresponding recesses in the web 164 of the pair of legs 4.

The connections between the balls and the leg are desirably effected by bearing plugs 165 circular in form, screw threaded into a corresponding recess 166 in the web 164, the interior of the screw-plug being spherical in form to engage the upper surface of the ball to retain the same in position. The stem of the bolt 160 is also desirably provided with a collar 167 having a spherical surface 168 adapted to engage the ball adjacent to the stem of the bolt, the opposite face 169 of the collar being flat and engaging the surface of the bed of the machine. This collar is sufficiently small in diameter to permit a slight adjustment of the leg. These collars serve to keep the leg slightly separated from the under surface of the bed and to permit a slight universal adjustment of the pair of legs 4. If when the lathe is being set up, the floor presents an irregular surface which would have a tendency to twist the bed if the connections with the legs were rigid, a slight adjustment of the legs will automatically take place which will avoid the objection.

It is to be understood that the embodiment of the invention disclosed herein is illustrative merely and is not in any way restrictive of the scope of my invention. While many hand operating mechanisms have been described it is to be understood that such mechanisms may be operated automatically, and also that means may be provided to so interlock the various operating mechanisms as to make them foolproof; and that other

forms of specific embodiments of the invention may be utilized within the spirit of this invention and within the scope thereof as set forth in the following claims.

Having described my invention, what I desire to secure by Letters Patent is:

1. In a machine of the class described, a bed, a single bearing member having a cylindrically curved bearing surface mounted on said bed, a carriage pivotally and slidably hung upon said bearing member and means for guiding the carriage in its sliding movement.

2. In a machine of the class described, a bed, a single cylindrical hardened bearing member adjustably mounted on said bed, a carriage pivotally and slidably hung upon said bearing member and means for guiding said carriage in its sliding movement.

3. In a machine of the class described, a bed, a single cylindrical hardened bearing member partially embedded throughout its length in said bed, a carriage pivotally and slidably hung upon said bearing member and means for guiding said carriage in its sliding movement.

4. In a machine of the class described, a bed having a horizontal portion and a substantially vertical portion provided with a guideway, a single cylindrical longitudinally disposed bearing member mounted upon the horizontal portion of said bed, and a carriage pivotally hung upon said bearing member and having a depending member engaging said guideway.

5. In a lathe comprising a bed, a head stock and a relatively movable carriage, a single hardened cylindrical bearing member supported by said bed and extending beyond the inner end of said head stock, a cylindrically concaved and laterally extending bearing member on said carriage hung upon and covering said cylindrical hardened member and adapted to travel beyond the inner end of said head stock, whereby a longer bearing surface is provided, the bearing protected and localized wear prevented.

6. A lathe comprising a bed with a hardened cylindrical bearing member extending longitudinally thereof, a head stock integral with said bed and overhanging said bearing member, a driving shaft journaled in said head stock in substantially the vertical axial plane of said bearing member, a carriage having an extended bearing surface engaging said hardened member adapted to engage and cover said hardened bearing member and travel beyond the inner end of the head stock.

7. A lathe comprising a bed provided with a single longitudinally disposed hardened bearing member and having a depending guide-way, a carriage pivotally mounted on said bearing member having a depending member engaging said guideway, and means for adjusting said depending member relative to said guideway to compensate the wear.

8. A lathe comprising a bed provided with a longitudinally disposed hardened bearing member and having a depending guideway, a carriage mounted on said bearing member having a depending member and engaging said guideway, and means for relatively adjusting said depending member to compensate the wear comprising a cap plate supported by said carriage having a beveled surface engaging a coöperating surface on the depending member of the bed, and means for adjusting said cap plate.

9. A lathe comprising a bed, a carriage mounted thereon adapted to be moved longitudinally of said bed, a curved bearing member or a web depending from said bed providing a chamber, a recess in the wall of said chamber, an operating shaft mounted in bearings in said bed and lying in said recess, whereby a backing for said shaft is provided to prevent distortion thereof.

10. A lathe comprising a bed, a carriage mounted thereon adapted to be moved longitudinally of said bed, a curved bearing member or web depending from said bed providing a chamber, a recess in the wall of said chamber, a feeding shaft for said carriage mounted in bearings in said bed and lying in said recess whereby a backing for said shaft is provided to prevent distortion thereof, and means upon said carriage adapted to be thrown into or out of engagement with said feeding shaft.

11. A lathe comprising a bed, a carriage mounted thereon adapted to be moved longitudinally of said bed, a curved bearing member or web depending from said bed providing a chamber, a feeding shaft for said carriage for screw cutting mounted within said recess and backed by the wall thereof against distortion, a main feeding shaft in said chamber, means upon said carriage adapted to engage said screw cutting feeding shaft, alternative means upon said carriage adapted to engage said main feeding shaft whereby said carriage may be reciprocated, both shafts being inclosed within said chamber and protected from injury.

12. In a lathe having a bed and a carriage movably mounted thereon, means for feeding said carriage comprising a threaded feed shaft, a nut mounted thereon, means for preventing said nut from rotation comprising a split collar mounted in a way in the bed, means for clamping said collar upon said nut to prevent rotation of the latter, and means upon said carriage adapted to be connected to or disengaged from said collar.

13. In a lathe having a bed and a carriage movably mounted thereon, means for feeding said carriage comprising a thread-

ed feed shaft, a nut mounted thereon, means for preventing said nut from rotation comprising a split collar having angular extensions, a slide mounted in ways in said carriage engaging one of said extensions, an eccentric mounted in said carriage for actuating said slide, a member eccentrically mounted in respect to the shaft of said eccentric engaging the other extension whereby the rotation of the shaft of said eccentric will contract said extensions symmetrically to clamp said nut, and means upon said carriage adapted to be connected to or disengaged from said collar extensions.

14. In a lathe having a bed and a carriage movably mounted thereon, means for feeding said carriage comprising a threaded feed shaft, a nut mounted thereon, means for preventing said nut from rotation comprising a split collar having angular extensions, a slide mounted in ways in said carriage engaging one of said extensions, an eccentric mounted in said carriage for actuating said slide, a member eccentrically mounted in respect to the shaft of said eccentric engaging the other extension whereby the rotation of the shaft of said eccentric will contract said extensions symmetrically to clamp said nut, and means upon said carriage adapted to be connected to or disengaged from said collar extensions comprising a yoke embracing said sliding clamping member and engaging said extensions, and means for moving said yoke into and out of engagement therewith.

15. In a lathe having a bed and a carriage movably mounted thereon, means for feeding said carriage comprising a threaded feed shaft, a nut mounted thereon having an external gear, means for connecting said gear carrying nut to said carriage to cause the movement of the latter relative to the bed, and means supported by the carriage to cause the rotation of said gear carrying nut comprising a hand wheel mounted in journals in the carriage, a shaft slidably keyed in said hand wheel carrying a gear adapted to be engaged with or disengaged from the gear of the nut and means upon said shaft for sliding the same longitudinally of the axis of the hand wheel to cause said engagement or disengagement.

16. A lathe comprising a bed, a longitudinally movable carriage mounted thereon, a threaded main feeding shaft mounted in said bed and means for rotating the same, a transversely movable tool carriage or cross slide, a screw-threaded shaft rotatably mounted in said tool carriage for actuating the same, a counter shaft in two parts connected by a knuckle joint mounted in the main carriage having a pinion engaging said main feeding shaft and means for throwing said pinion into or out of engagement with said main feeding shaft.

17. A lathe comprising a bed, a longitudinally movable carriage mounted thereon, a threaded main feeding shaft mounted in said bed and means for rotating the same, a transversely movable tool carriage or cross slide, a screw-threaded shaft rotatably mounted in said tool carriage for actuating the same, a counter shaft in two parts connected by a knuckle joint mounted in the main carriage having a pinion engaging said main feeding shaft and means for throwing said pinion into or out of engagement with said main feeding shaft comprising a sleeve on said counter shaft and a crank journaled in said carriage having a member engaging said sleeve and means for rotating said crank.

18. A lathe comprising a bed, a longitudinally movable carriage mounted thereon, a threaded main feeding shaft mounted in said bed and means for rotating the same, a transversely movable tool carriage or cross slide, a screw-threaded shaft rotatably mounted in said tool carriage for actuating the same, a counter shaft in two parts connected by a knuckle joint mounted in the main carriage having a pinion engaging said main feeding shaft and means for throwing said pinion into or out of engagement with said main feeding shaft a pocket in said carriage inclosing said pinion and said controlling means whereby the same are protected from chips, dirt and other substances.

19. A lathe comprising a bed, a longitudinally movable carriage mounted thereon, a threaded main feeding shaft mounted in said bed and means for rotating the same, a transversely movable tool carriage or cross slide, a screw threaded shaft rotatably mounted in said cross slide for actuating the same, a counter shaft mounted in the main carriage having a pinion engaging said main feeding shaft but adapted to be removed from such engagement, means operable from said counter shaft to feed the tool carriage, means lor locking the tool carriage feeding shaft from rotation during the automatic cross feeding of the tool carriage, means for disengaging the countershaft from operative relation with the feeding shaft and means for locking the same against rotation during the manual operation of cross slide.

20. A lathe having a bed, a movable carriage mounted thereon comprising a base member, an upper superimposed member pivotally mounted upon said base member in the vertical plane of the axis of the lathe and carrying a tool holder, and means for rotating said superimposed member about said pivot comprising a non-rotatable worm gear secured to said base member and a worm mounted in said superimposed mem-

ber in engagement with said gear, means to rotate said worm to adjust the position of the tool holder, means to clamp said superimposed member in adjusted position, and means located within the circumferential plane of the worm gear to actuate said tool holder when in any adjusted position.

21. A lathe having a bed, a movable carriage mounted thereon comprising a base member, an intermediate member secured thereto, a pivotal stud carried by said intermediate member in the vertical plane of the axis of the lathe, a superimposed member rotatably mounted upon said intermediate member recessed to receive a gear mounted upon said pivotal stud but secured from rotation thereon, a worm in said superimposed member engaging said gear and means to actuate the same to cause rotation of said superimposed member, a recess in said gear, a combined spur and bevel gear rotatably mounted in said recess and means for rotating the same, a cross slide and means engaging said beveled gear for actuating said cross slide.

22. A lathe having a bed, a movable carriage mounted thereon comprising a base member, an intermediate member secured thereto, a pivotal stud carried by said intermediate member in the vertical plane of the axis of the lathe, a superimposed member rotatably mounted upon said intermediate member recessed to receive a gear mounted upon said pivotal stud but secured from rotation thereon, a worm in said superimposed member engaging said gear and means to actuate the same to cause rotation of said superimposed member, a recess in said gear, a combined spur and bevel gear rotatably mounted in said recess and means for rotating the same actuated from the main feed shaft for said carriage.

23. In a machine of the class described a bed, a plurality of supporting legs connected to said bed by three universal joints, whereby said legs may be positioned to avoid undue strain upon the bed notwithstanding irregularities in the supporting floor.

24. In a machine of the class described, a bed, a pair of united legs supporting one end of said bed connected thereto by two universal joints, a single leg supporting the opposite end of said bed connected thereto by a universal joint substantially as described.

25. In a machine of the class described, a universally adjustable supporting joint for connecting adjacent members comprising a bearing plug having a spherical extension carried by one of said members, a complementary bearing plug having a spherically concave surface to engage said spherical extension, and to maintain said members slightly spaced apart, a bolt passing freely through one of said members and said bearing plugs and firmly secured in the other of said members.

26. In a machine of the class described a universally adjustable supporting joint for connecting adjacent members comprising a ball socket in one of said members, a ball seated therein, a retaining plug for said ball, a collar having a concave spherical surface engaging said ball and of sufficient thickness to maintain said members slightly separated, and a bolt extending through one member into the other member and having screw threaded engagement with said ball.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

EDWARD RIVETT.

Witnesses:

FREDERICK A. TENNANT,

THOMAS J. DRUMMOND.