March 27, 1951 S. A. BRANDENBURG 2,546,687

ENGINE LATHE

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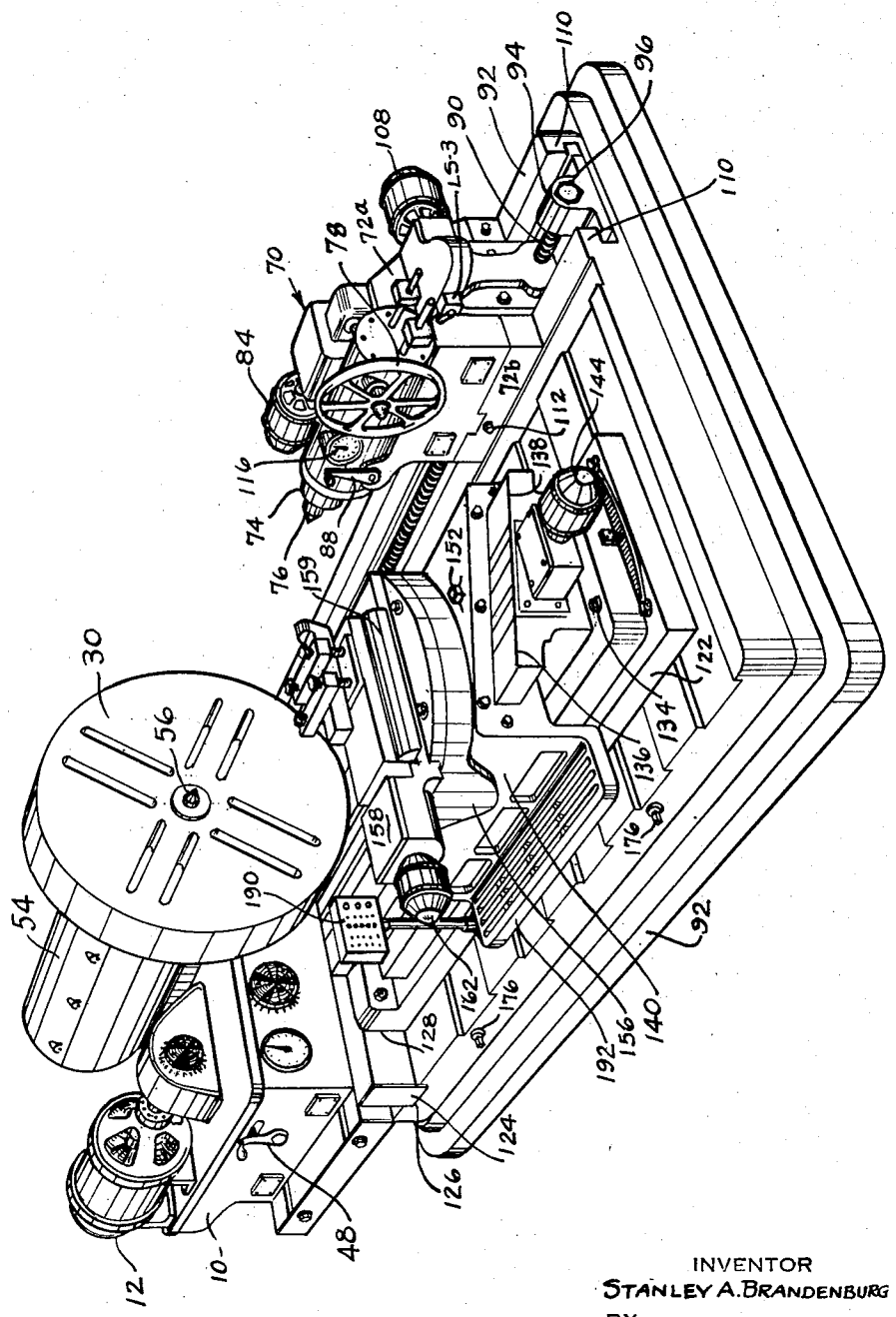


FIG. 1.

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FIG. 5.

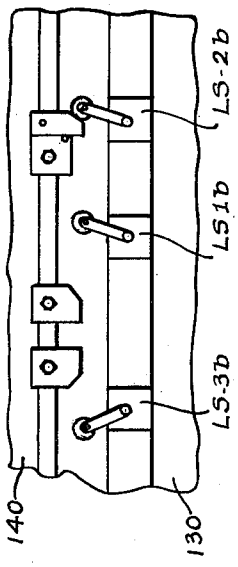
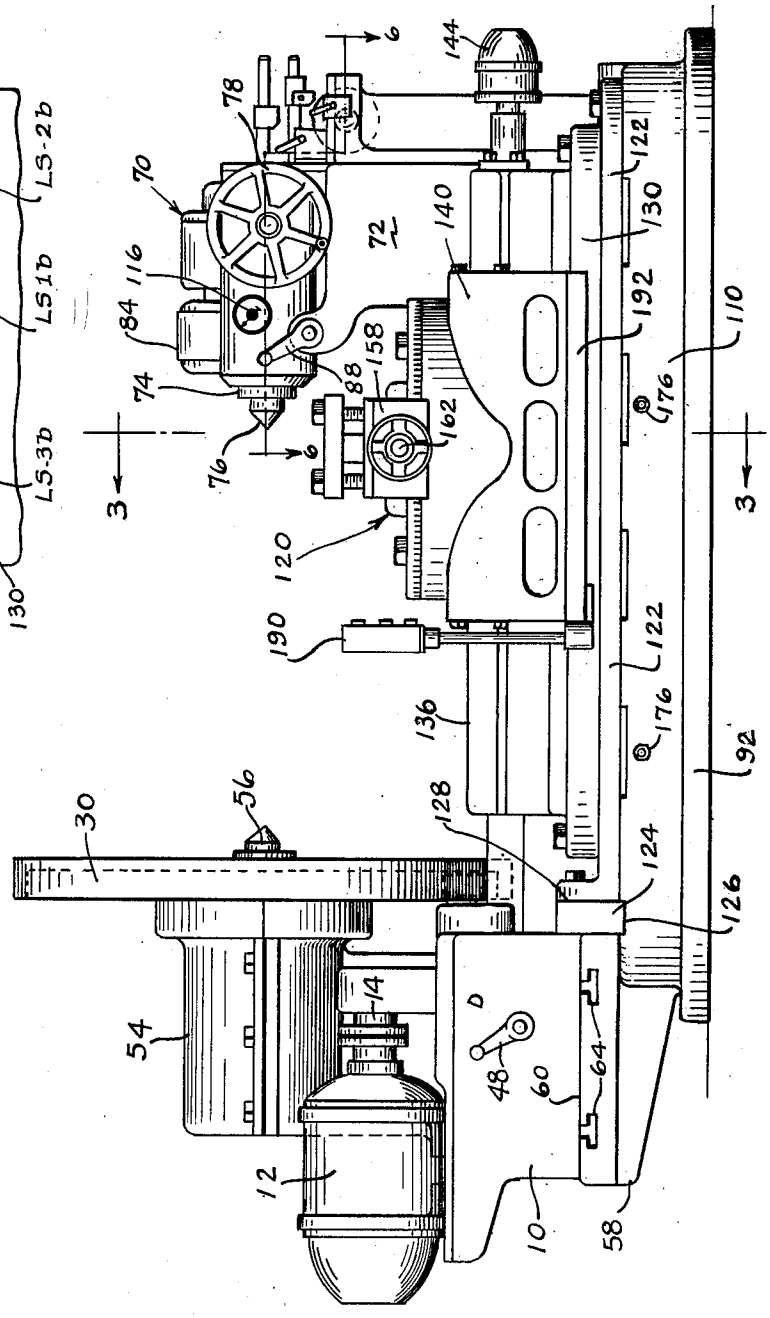


FIG. 2.



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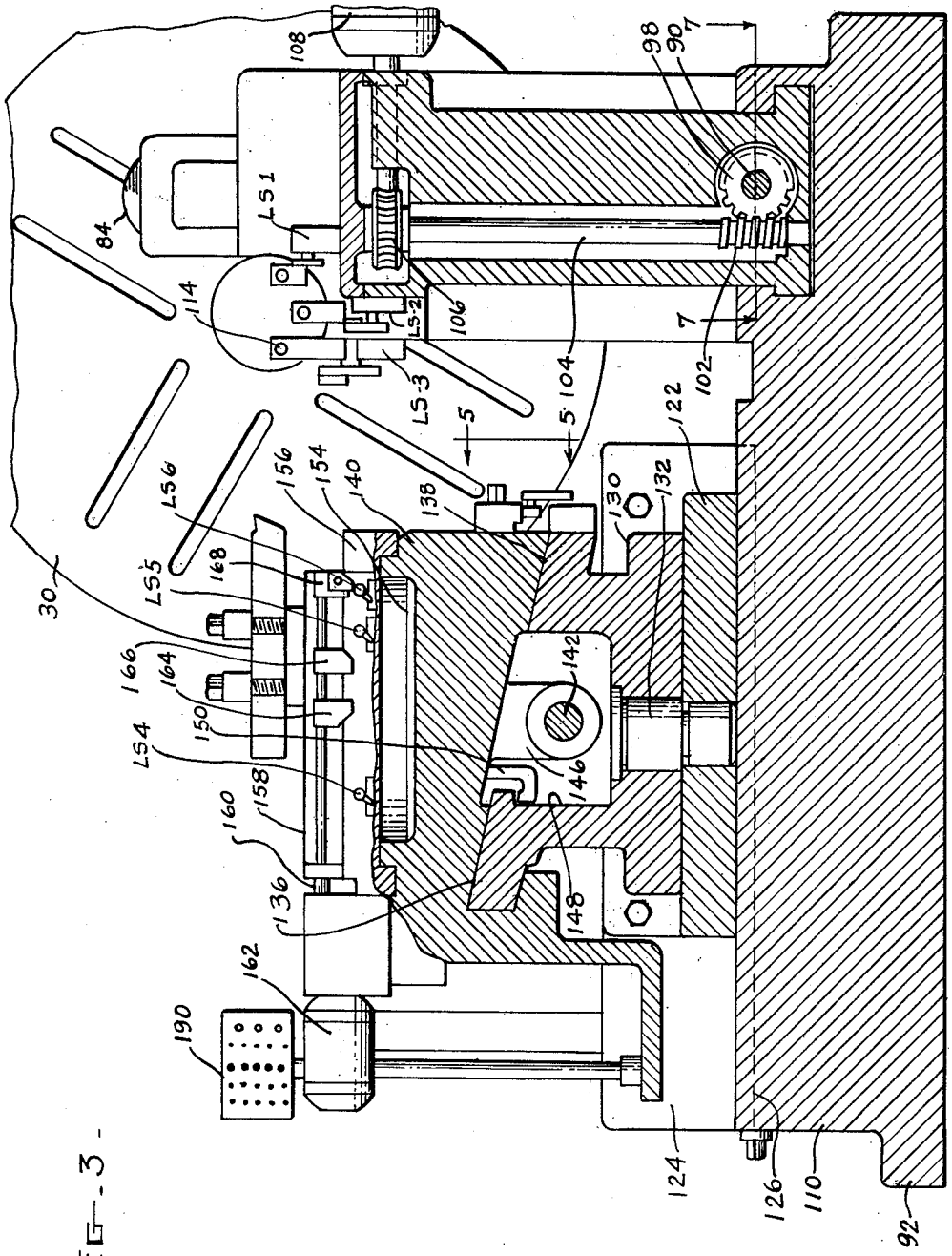


FIG. 3.

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FIG. 4.

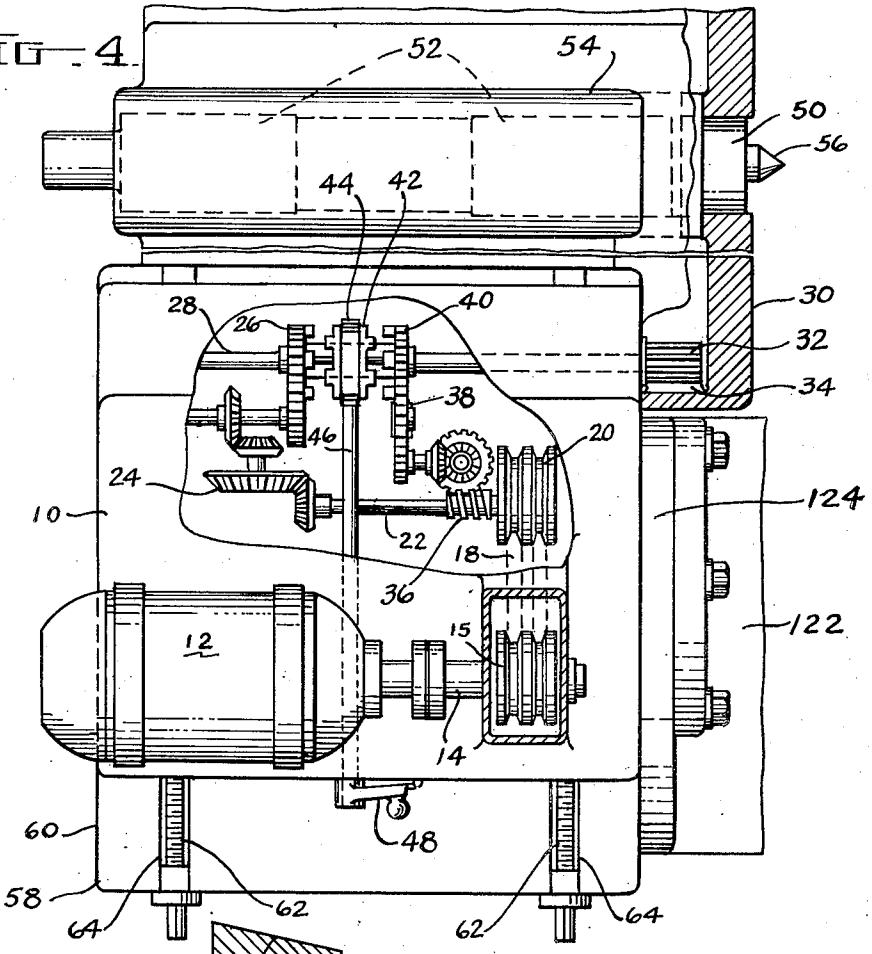
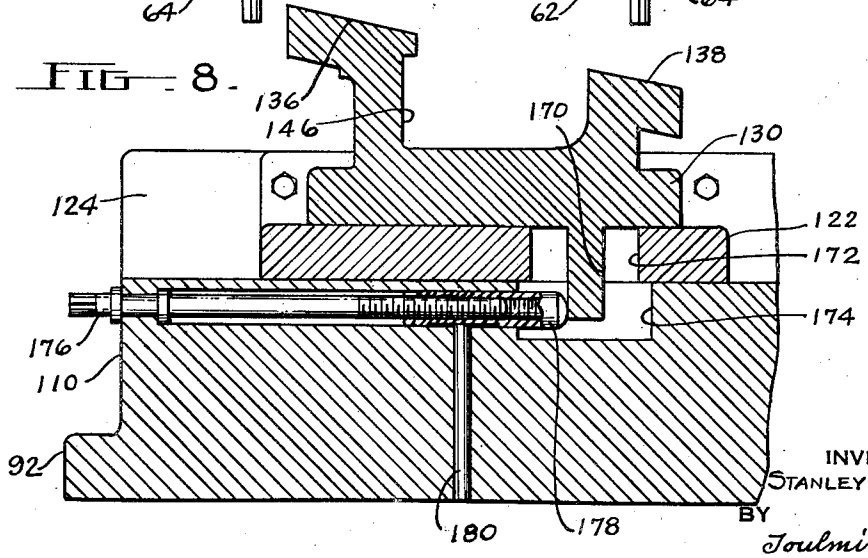


FIG. 8.



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FIG. 6.

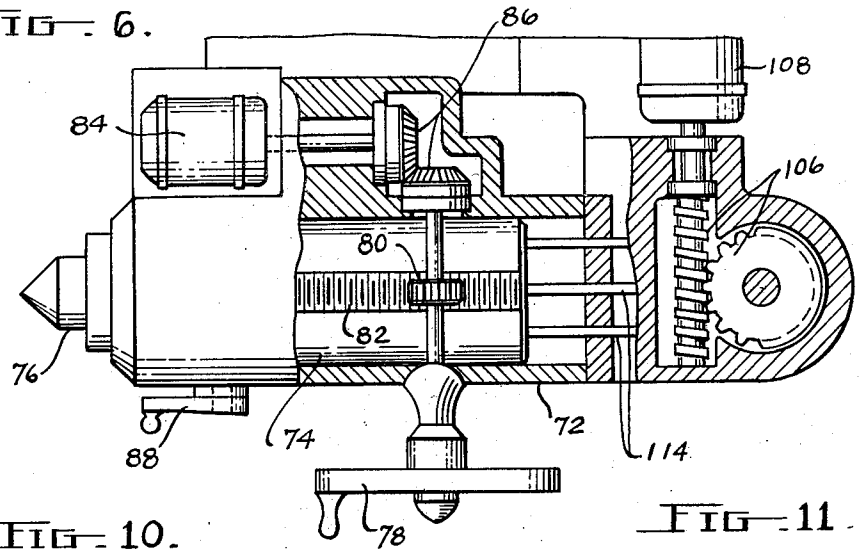


FIG. 10.

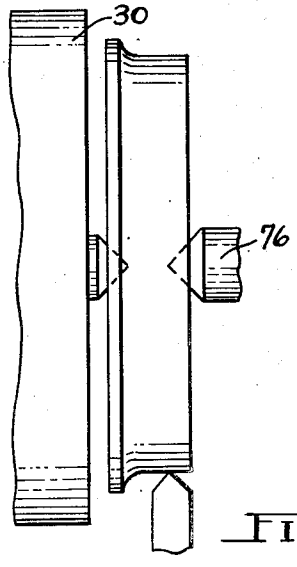


FIG. 11.

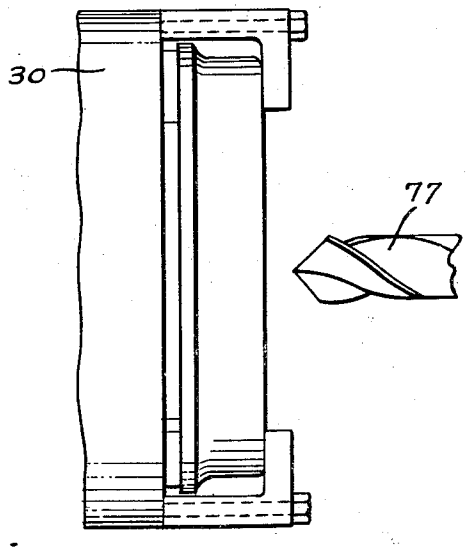
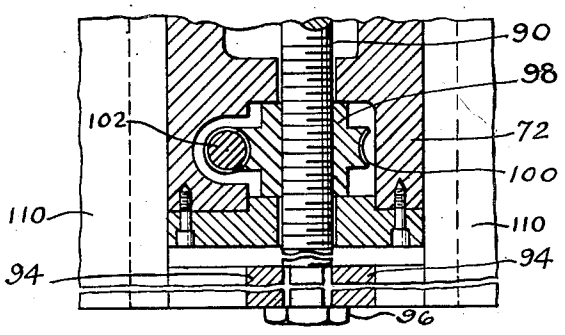


FIG. 7.



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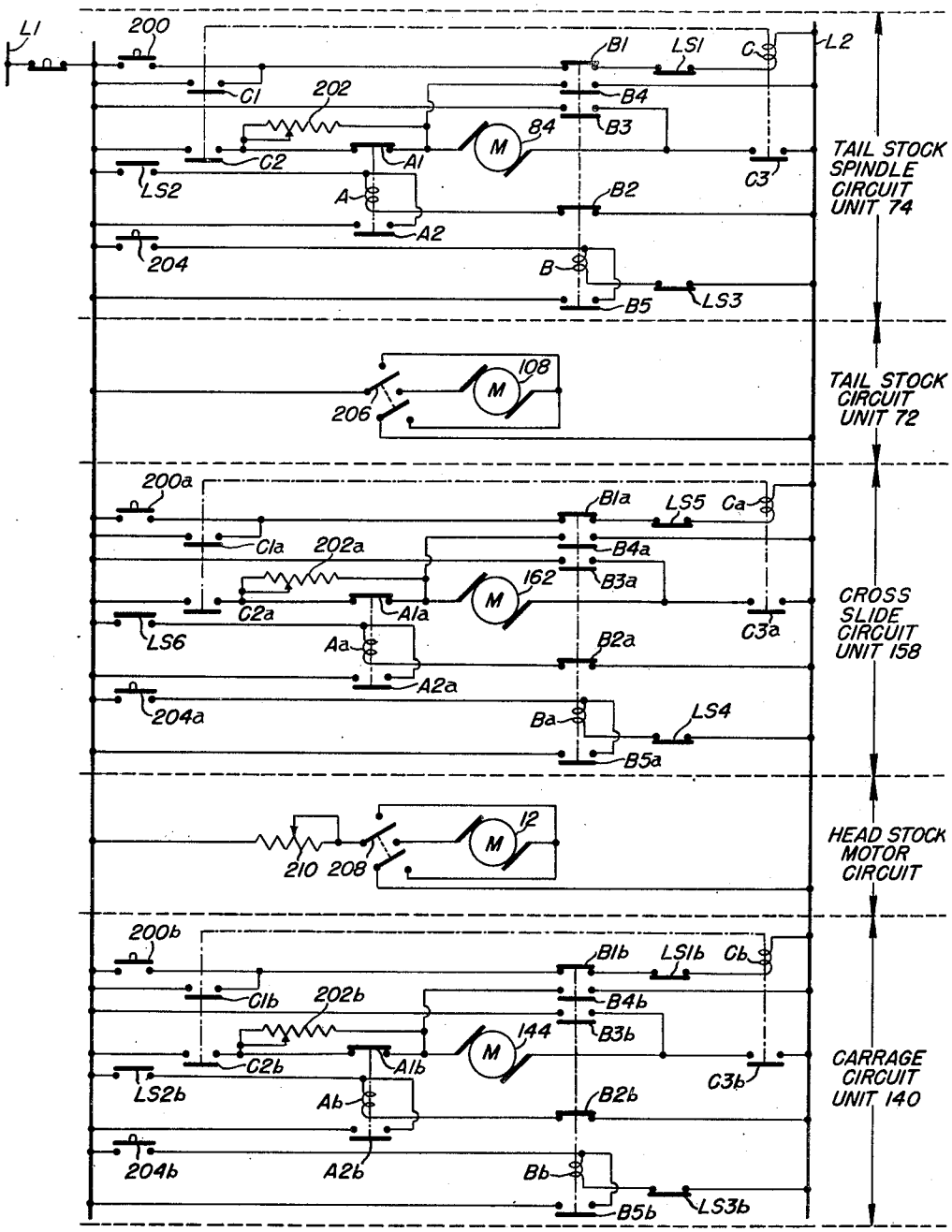


Fig. 9

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FIG. 12.

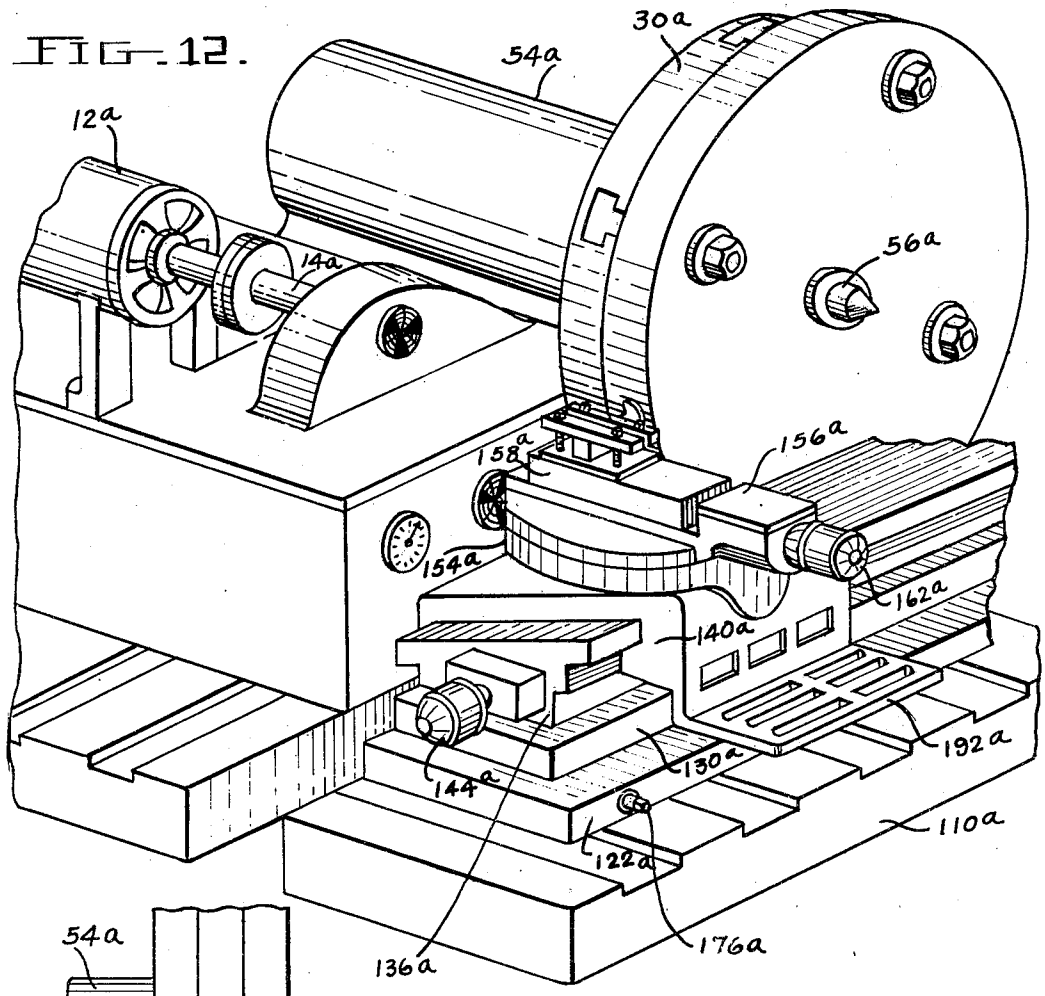
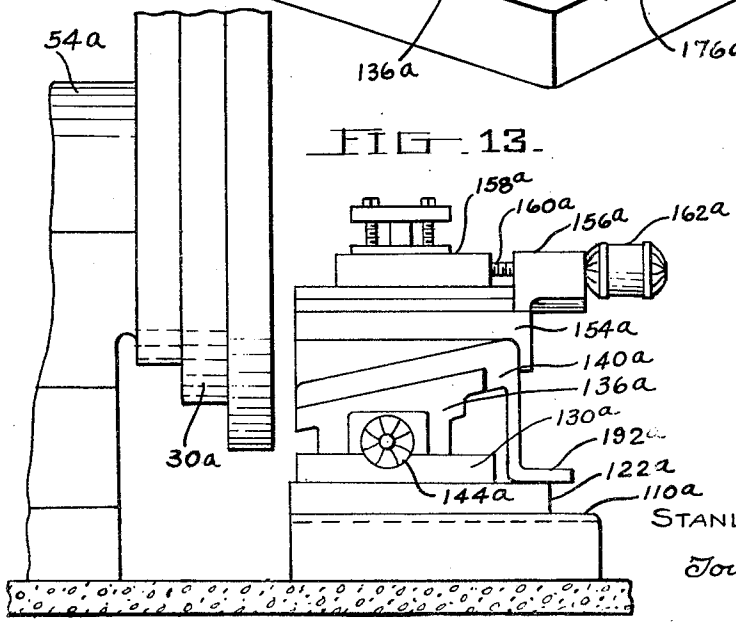


FIG. 13.



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Patented Mar. 27, 1951 2,546,687

UNITED STATES PATENT OFFICE

2,546,687

ENGINE LATHE

Stanley A. Brandenburg, Sidney, Ohio, assignor to The Monarch Machine Tool Co., Sidney, Ohio, a corporation of Ohio

Application August 24, 1945, Serial No. 612,463

3 Claims. (Cl. 82—21)

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This invention relates to lathes and, particularly to large engine lathes.

It is a particular object of this invention to provide a large capacity lathe which is economical to manufacture and assemble.

It is still another object of this invention to provide a large capacity lathe in which the various portions thereof are manufactured as separate units and subsequently assembled into the finished machine.

It is still another object to provide a large capacity lathe according to the foregoing objects in which the various components are separately powered.

It is still another object to provide a centralized control system for a lathe in which the various components thereof are separately powered.

It is another object to provide a lathe having a large swing and a relatively short length in which the various components are separately manufactured and powered, which are assembled on a bed which aligns the various components with each other, and which is provided with a centralized control system located to be conveniently operated by the lathe operator.

It is still another object to provide an improved method and apparatus for turning tapers in a lathe according to the foregoing objects.

These and other objects will become more apparent upon reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a perspective view of a typical lathe construction embodying the features of this invention;

Figure 2 is a view of the lathe from the operator's side thereof;

Figure 3 is a transverse section indicated by the line 3—3 on Figure 2 and illustrates the construction and arrangement of the carriage and cross slide;

Figure 4 is a plan view over the headstock end of the machine showing the drive from the headstock motor to the spindle and illustrating the adjustability of the power unit to accommodate for different sizes of face plates;

Figure 5 is an elevational view looking in the direction of the arrows 5—5 of Figure 3 showing the cams and limit switches which control the movements of the carriage;

Figure 6 is a plan view of the tailstock unit showing various actuating means therefor;

Figure 7 is a plan view taken on the line 7—7 of Figure 3 and shows the arrangement for connecting the tailstock unit with its driving screw;

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Figure 8 is a fragmentary sectional view illustrating the mechanism employed for adjusting the angularity of the carriage relative to the line of centers on the machine for turning tapers;

Figure 9 is a wiring diagram illustrating one type of electrical circuit adapted for the control of the various components of the lathe;

Figures 10 and 11 illustrate typical setups of work pieces in the lathe; and

Figures 12 and 13 illustrate a modified arrangement wherein there is a pit between the headstock unit and the tool supporting unit.

General arrangement

A lathe constructed according to this invention comprises the usual components consisting of a headstock, a tailstock, and a carriage and cross slide assembly.

Each of these components is separately powered with its own motor and, where necessary, its own feed and traversing screws. The operation of the electric drive motors for the components is integrated in a control panel which is carried by the carriage.

The carriage also comprises a platform for carrying the operator during the traversal of the carriage from end to end of the machine. The ways upon which the carriage slides are a portion of a bed which is pivotally mounted on a sub-bed so that the carriage may be reciprocated along a path which is inclined to the line of centers of the machine thereby to turn tapers.

The various components of the machine may be mounted on a sub-bed or bed plate which includes means for positively aligning the various elements in order to insure the production of precision work pieces.

Headstock

The headstock of the lathe of this invention comprises, as shown principally in Figures 1, 2 and 4, a gear box at 10 which mounts an electric drive motor 12, preferably of the variable speed direct current type. The motor drives through its shaft 14 into a pulley 15 which is connected by the belts 18 with a second pulley 20 on a shaft 22. The shaft 22 drives through a first gear train generally indicated at 24 into a gear 26 which is rotatably mounted on a shaft 28 which extends through the gear box 10 and emerges adjacent the lathe face plate 30. The end of the shaft 28 carries a pinion or small gear 32 adapted for meshing with teeth on a ring gear at 34 carried by the face plate 30. The face plate 30 is thus driven in rotation.

The shaft 22 also carries a worm gear 36 which drives through a second gear train generally indicated at 38 into a gear 40 rotatably mounted on the shaft 28. The gears 26 and 40 comprise inwardly extending clutch members which are adapted for being engaged selectively by a clutch member 42 which is splined or feather keyed to the shaft 28 and shifted in opposite directions by a yoke 44 which is connected by a shaft 46 with a selector lever 48 on the outside of the gear box 10. The gear trains 24 and 38 are such that the gears 26 and 40 are driven in the same direction but at different speeds so that the selector lever 48 is operable to select a higher or a lower speed in one direction of rotation of the face plate 30. Other speeds may be had, and the opposite direction of rotation may be had, by adjusting the speed of the motor 12 or by reversing its rotation.

The face plate 30 is centrally apertured to receive the flanged end 50 of the spindle which is journaled in the bearings 52 in the spindle housing 54. By extending the spindle substantially through the face plate 30, a rigid and accurate support thereof is obtained. The end 50 is also adapted for receiving a center 56 so that work may be bolted to the face plate for support or may be mounted on the center 56.

The spindle housing 54 forms a portion of an assembly which provides a bed 58 for supporting the gear box 10. In order to accommodate different sized face plates, the gear box 10 is slidably mounted on the upper surface 60 of the bed 58. In order to adjust the gear box 10 laterally on the surface 60, there are provided the screws 62 which engage the gear box 10 in any well known manner and which are supported in T slots 64 of the said bed.

Tailstock

The tailstock, Figures 1, 2 and 6, which is generally indicated at 70, comprises a frame 72 which has slidably mounted therein the tailstock spindle 74 carrying the center 76. The spindle 74 is adapted for manual reciprocation through a hand wheel 78, pinion 80, and rack 82 as shown in Figure 6 and is further adapted for reciprocation by power means by the motor 84 which drives through the bevel gear arrangement at 86 into the gear 80. The spindle may be clamped in any position of adjustment by the clamping device at 88.

The entire tailstock frame 72 is adapted for reciprocation toward and away from the face plate 30 by a long lead screw 90, Figures 1 and 7, carried in the bed 92 and rigidly attached at opposite ends thereof as by the block 94 and nut 96. The screw 90 is retained against rotation within the block by splines or keys as desired. Reciprocation is had along the screw 90 by means of a nut 98 carried in the frame 72 and in engagement with the said screw. The nut 98 comprises the worm wheel portion 100 which is engaged by the worm gear 102 of the shaft 104 that extends vertically upward through the frame 72 and is driven through a worm and wheel arrangement at 106 from a motor 108. The motor 108 is preferably of a direct current type so that the speed and direction of rotation thereof may be changed at will.

In order to provide for the exact aligning of the centers 56 and 76 the tailstock frame 72 may be formed into the portions 72*a* and 72*b*, the latter of which is guided on the ways 110 of the bed 92 and the former of which is transversely adjustable by means of a screw 112.

Thus, the tailstock unit may be positioned along the bed at any desired point, the spindle may be separately advanced and retracted at will, and the center may be exactly aligned with the headstock center.

Spindle 74 is adapted to receive a variety of tools such as drills, reamers, etc., as shown at 77, Figure 11, thus arranging the tailstock spindle as a tool holder.

In order to provide for automatic control means for controlling the reciprocation of the tailstock spindle, there may be provided the limit switches LS1, LS2 and LS3, Figure 3, arranged to be actuated by suitable cam members carried by the tailstock spindle. These cam members may be supported on the rods at 114 or may be otherwise suitably associated in order to be moved by the spindle during its reciprocation. The switches LS3, LS2 and LS1 provide, respectively, a back stop to limit the retracting movement of the spindle, a shift over from rapid advance to feed rate, and an in stop for halting the advancing movement of the spindle. These switches, as will be explained in connection with the wiring diagram, are suitably interlocked with manual switches carried by the control panel so that the operator has control of the tailstock spindle at all times. To facilitate the operation of the machine by the operator, the tailstock spindle frame 72 may carry an indicator 116 which reads directly the travel of the tailstock spindle.

Carriage and cross slide assembly

The carriage and cross slide assembly, Figures 1, 2, 3, 5 and 8, is generally indicated at 120 and comprises a sub-bed member 122 which is secured to the main bed 92 by bolts or other suitable devices and is aligned therewith by means of a cross aligning bar or key 124 which fits within a keyway 126 in the main bed 92 and has an accurately machined surface 128 thereon which is engaged by a correspondingly shaped surface on the sub-bed 122.

The sub-bed 122 carries the carriage bed 130 which is pivotally mounted on the said sub-bed by a pivot pin 132 extending through the said bed. The carriage bed 130 is secured in any position of adjustment by bolts such as are indicated at 134 and comprises the inclined ways 136 and 138 adapted for slidably supporting the carriage 140. The ways 136 and 138 are inclined so that the pressure of the workpiece on the tool is transmitted squarely to the carriage bed and therethrough to the sub-bed and main bed of the machine. This gives great rigidity and insures better workpieces with less wear and misalignment of the machine occurring from heavy machining operations.

The carriage 140 is reciprocated on the carriage bed 130 by means of a screw 142 which is adapted for being driven by a motor 144 which is preferably of the D. C. type whereby speed and direction of rotation may be controlled. The screw 142 engages a nut 146, carried by the carriage, which extends into a suitably shaped recess 148 in the carriage bed. The motor 144 is adapted for rapidly reciprocating the carriage in either direction or for feeding the carriage at reduced rates in either direction. The control of the motor 144 is accomplished by manual means associated with the control panel and is also accomplished automatically by limit switches LS—1*b*, LS—2*b* and

LS—3b adapted for actuation vy cams carried by the carriage in a manner similar to that set forth in connection with the automatic control of the tailstock spindle.

When it is desired rigidly to clamp the carriage to its bed, a pair of clamps, one of which is indicated at 150 in Figure 3 are clamped against the carriage bed by the nuts 152, of Figure 1, so that the carriage and bed become a substantially rigid unit.

Swivelly mounted on the carriage 140 as by the pivot 154 is the cross slide bed 156 adapted for reciprocably mounting the cross slide 158. The cross slide assembly comprises the usual cross slide screw 160 which is connected to be driven by a reversible variable speed motor 162. As in the case of the carriage drive and the tailstock spindle drive, the speed of the motor 162, and the travel of the cross slide 158, are controlled by the limit switches LS4, LS5 and LS6 which are adapted for selective actuation by the cams 164, 166 and 168 which are carried by the cross slide and which provide, respectively, for an out feed stop, an in feed stop, and for the initiation of the feed stroke of the cross slide. These cams and switches are shown exposed in Figure 3 and concealed by cover 159 in Figure 1. Cover 159 is provided as a safety measure.

The cross slide itself is of heavy construction and provides adequate means for clamping large tools in position for taking heavy cuts on workpieces.

Referring to Figure 8, the arrangement for accomplishing taper turning according to this invention is illustrated. The carriage bed 130 comprises depending lugs 170 which extend through apertures 172 in the sub-base 122 and are received in pockets 174 in the main bed 92. The bed 92 has a pair of elongated screws 176 journaled therein which threadedly engage a pair of sleeves 178 which are keyed against rotation by the pins or keys 180 and which abut the lugs 170. By loosening the clamp bolts 134 and adjusting the screws 176 it will be apparent that the carriage bed 130 can be adjusted to any predetermined angle, within limits, relative to the line of centers of the headstock and tailstock and thereafter be clamped into position. Then, when the carriage is reciprocated on its bed, the cutting tool carried by the cross slide will describe a tapered path relative to a workpiece. The adjustment of the carriage and carriage bed into taper turning position is accomplished without diminishing the rigidity and strength of the tool supporting structure which comprises the carriage and carriage bed.

Electrical control circuits

The electrical control of the motors of the various components of the lathe of this invention is integrated in a control panel 190 which is carried on the platform 192 supported by the carriage. The platform forms a support for the operator so that he is carried back and forth with the carriage and control panel. The location of the control panel provides the operator with complete control of the machine operation at all times.

The electrical connections are indicated in Figure 9 wherein it will be seen that there are provided the power lines L1 and L2 between which the various motors and operating relays are connected.

The circuit of Figure 9 is divided by dash lines into sub-circuits which are identified by legends at the right side with their associated components. The first circuit is the one for the tailstock spindle reciprocating motor 84 and will be seen to comprise a contactor coil C which is connected through the normally closed limit switch LS1 and the normally closed contactor blade B1 and the normally open start button 200. The start button 200 is bypassed by the normally open contact blade C1 which provides a holding circuit for the contactor coil C. Closure of the start switch 200 energizes the contactor coil C which is held by the blade C1. Energization of the contactor coil C also closes the blade C2 to close a circuit through the normally closed blade A1 and the motor 84 for driving the tailstock spindle 74 rapidly in the advancing direction. When the spindle has advanced to the point where it engages and closes the limit switch LS2, the contactor coil A is energized through the normally closed blade B2 and is held through the contactor blade A2. Energization of the contactor coil A opens the blade A1 and inserts the speed controlling resistor 202 in circuit with the motor 84 to reduce its speed to that required for the feeding movement of the tailstock spindle. To this end, the resistor 202 is adjustable.

After the tailstock spindle has advanced a predetermined distance in its feeding movement, it engages and opens the limit switch LS1 thereby de-energizing the contactor coil C and permitting the blades C3 to open to de-energize the motor 84 and to bring the tailstock spindle to a halt.

Then, when it is desired to retract the tailstock spindle, the reverse switch 204 is depressed to energize the contactor coil B which is held through the blade B5. Energization of coil B closes the normally open blades B3 and B4 thereof and connects the motor 84 between the lines L1 and L2 in a direction opposite to which it was connected before thereby driving it in reverse direction to retract the tailstock spindle. The motor 84 runs at high speed since the blade B2 is open, which de-energizes coil A, hence normally closed blade A1 bypasses resistor 202. When the tailstock spindle is fully retracted it engages and opens the limit switch LS3 in series with the coil B and de-energizes the latter, thereby de-energizing the motor 84 and bringing the tailstock spindle to a halt.

The traversal bodily of the tailstock structure is accomplished by closing one of the contacts of the reversing switch 206 to energize the motor 108 to drive the nut 98 on the screw 90. This operation is manually controlled from the control panel 190 and is for the purpose approximately of positioning the tailstock unit relative to the work.

The electrical control circuit associated with the cross slide and the circuit associated with the carriage are identical with that associated with the tailstock spindle and their corresponding parts bear corresponding numbers with the addition, respectively, of a subscript *a* and *b* except where the similar element has been previously indicated by another reference numeral.

The circuit for energizing the headstock motor 12 includes a reversing switch 208 similar to the reversing switch 206 adapted for driving the motor 12 in opposite directions, and also includes the adjustable speed controlling resistor 210 for selecting speeds in both directions of operation of the said motor 12.

In Figures 12 and 13 there is illustrated a modified arrangement wherein the carriage bed 136*a*

is mounted transversely of the axis of the headstock spindle housing 54*a* and there is a pit between the headstock unit and the carriage bed. This permits workpieces of greater than ordinary size to be mounted on the face plate and turned by a tool supported in the cross slide. The portions of the Figures 12 and 13 which are similar to the portions of Figures 1 through 11 are similarly numbered with the addition of a subscript *a*.

From the foregoing it will be seen that the lathe of this invention comprises a plurality of separate components or units, each having their own source of power, and that the operation of the various units integrate in a central control panel adjacent the operator's position. Also, this invention provides means for aligning the separate and individual components on a sub-bed so that accurately machined workpieces are produced. This invention further provides, in a machine consisting of various, separately powered components aligned on a sub-bed, the feature of taper turning by shifting the carriage bed about a pivot so that none of the rigidity of the tool supporting structure is lost.

It will be understood that various modifications and arrangements in structure could be made without departing from the spirit of my invention and, accordingly, I desire to comprehend such modifications and substitutions of equivalents as may be considered to come within the scope of the appended claims.

I claim:

1. In combination with a machine tool adapted to rotate a workpiece about an axis of rotation, the provision of an improved tool support, comprising a carriage sub-bed secured in a fixed position relative to said axis of rotation, a carriage bed mounted on said sub-bed, pivotal connecting means to pivotally interconnect said carriage bed and said sub-bed, said carriage bed having inclined carriage support surfaces, carriage means having inclined base surfaces corresponding to said inclined support surfaces of the carriage bed, said base surfaces being other than perpendicular to said pivotal connecting means and cooperating with the carriage support surfaces to support said carriage on said carriage bed for reciprocable movement in a plurality of preselected paths, a cross-slide bed carried by said carriage means, pivot substantially parallel with said pivotal connecting means for interconnecting said carriage means and said cross-slide bed, a cross slide carried by said cross-slide bed for reciprocable movement substantially perpendicular to said pivot means, and means to mount a tool on said cross slide, said tool being adapted to perform work operations on said workpiece, the performance of work operations on said workpiece producing a work thrust on said tool, said cooperating surfaces of the carriage means and carriage bed being inclined substantially normal to the line of work thrust against the tool.

2. In combination with a machine tool adapted to rotate a workpiece about an axis of rotation, the provision of an improved tool support, comprising a carriage sub-bed having an upper horizontal plane surface and secured in a fixed position relative to said axis of rotation, a carriage bed having a lower horizontal plane surface and mounted on the horizontal plane surface of said sub-bed, vertical pivotal connecting means to pivotally interconnect said carriage bed and said sub-bed, said carriage bed having inclined carriage support surfaces, carriage means having inclined base surfaces corresponding to said inclined support surfaces of the carriage bed, said base surfaces being other than perpendicular to said pivotal connecting means and cooperating with the carriage support surfaces to support said carriage means on said carriage bed for reciprocable movement in a plurality of preselected paths including a path in the direction of said axis of rotation when said base and support surfaces define a plane having a line perpendicular thereto which is also perpendicular to said axis of rotation, an upper horizontal plane surface on said carriage means, a cross-slide bed having a lower horizontal plane surface and carried by said upper horizontal plane surface of said carriage means, vertical pivot means interconnecting said carriage means and said cross-slide bed, a cross slide carried by said cross-slide bed for reciprocable movement, and means to mount a tool on said cross slide, said tool being adapted to perform work operations on said workpiece, the performance of work operations on said workpiece producing a work thrust on said tool, said cooperating surfaces of the carriage means and carriage bed being inclined substantially normal to the line of work thrust against the tool, said carriage bed being pivotal on said sub-bed about said pivotal connecting means and said cross slide thereby being adjustable for reciprocation in a direction at an angle to said axis of rotation when said base and support surfaces define a plane having a line perpendicular thereto which is not perpendicular to said axis of rotation.

3. In combination with a machine tool adapted to rotate a workpiece about an axis of rotation, the provision of an improved tool support, comprising a carriage sub-bed having an upper horizontal plane surface and secured in a fixed position relative to said axis of rotation, a carriage bed having a lower horizontal plane surface and mounted on the horizontal plane surface of said sub-bed, vertical pivotal connecting means to pivotally interconnect said carriage bed and said sub-bed, said carriage bed having inclined carriage support surfaces, carriage means having inclined base surfaces corresponding to said inclined support surfaces of the carriage bed, said base surfaces being other than perpendicular to said pivotal connecting means and cooperating with the carriage support surfaces to support said carriage means on said carriage bed for reciprocable movement in a plurality of preselected paths including a path in a direction perpendicular to said axis of rotation when a vertical plane normal to said base surfaces includes said axis of rotation, an upper horizontal plane surface on said carriage means, a cross-slide bed having a lower horizontal plane surface and carried by said upper horizontal plane surface of said carriage means, vertical pivot means interconnecting said carriage means and said cross-slide bed, a cross slide carried by said cross-slide bed for reciprocable movement, and means to mount a tool on said cross slide, said tool being adapted to perform work operations on said workpiece, the performance of work operations on said workpiece producing a work thrust on said tool, said cooperating surfaces of the carriage means and carriage bed being inclined substantially normal to the line of work thrust against the tool.

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(References on following page)

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
48,283	Jillson	June 20, 1865
334,832	Williams	Jan. 26, 1886
855,234	Detrick	May 28, 1907
1,031,284	Newton	July 2, 1912
1,322,352	Schellenbach	Nov. 18, 1919
1,326,597	Ingle	Dec. 30, 1919
1,477,186	Randolph	Dec. 11, 1923
1,521,269	Blood	Dec. 30, 1924
1,598,120	Cole	Aug. 31, 1926
1,909,110	Krug	May 16, 1933
1,999,778	Peaslee	Apr. 30, 1935
2,033,406	Vancil	Mar. 10, 1936
2,079,791	Cook	May 11, 1937
2,132,924	Belden	Oct. 11, 1938
2,272,088	Hultgren	Feb. 3, 1942
2,368,408	Brooking	Jan. 20, 1945
2,426,932	Hornbostel	Sept. 2, 1947

FOREIGN PATENTS

Number	Country	Date
924	Great Britain	A. D. 1909
219,164	Great Britain	July 24, 1924
414,496	Great Britain	Aug. 9, 1934