July 15, 1924. 1,501,346

W. E. INGHAM ET AL

LATHE

Filed Nov. 5, 1921 3 Sheets-Sheet 1

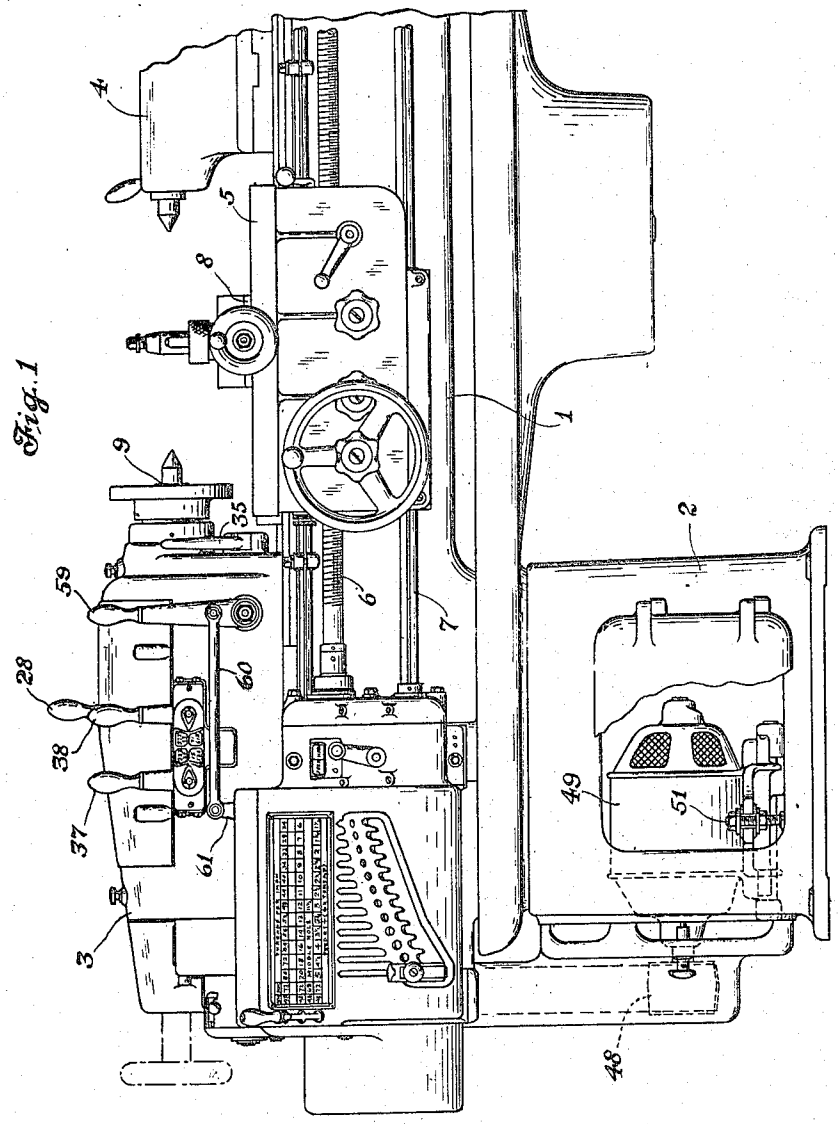


Fig. 1.

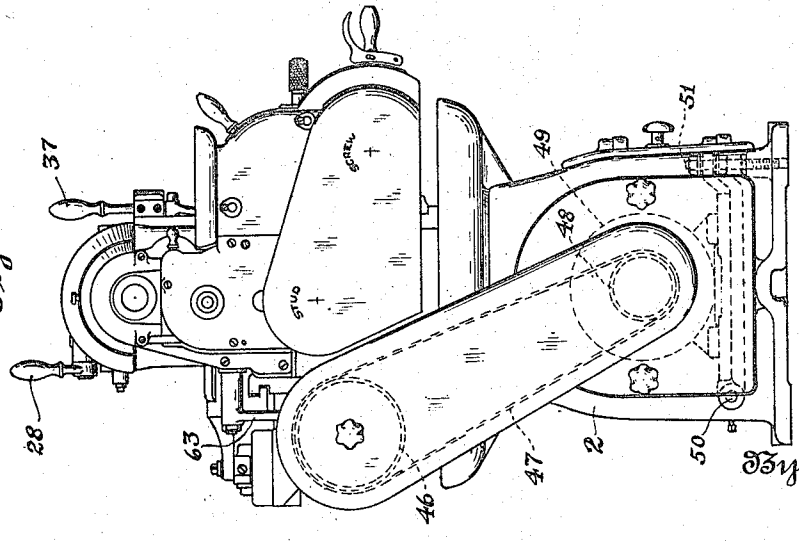


Fig. 2.

Inventor
W. E. Ingham
and
A. G. Whitehead.
By Laurie & Witter
Attorneys.

July 15, 1924. 1,501,346

W. E. INGHAM ET AL

LATHE

Filed Nov. 5, 1921 3 Sheets-Sheet 2.

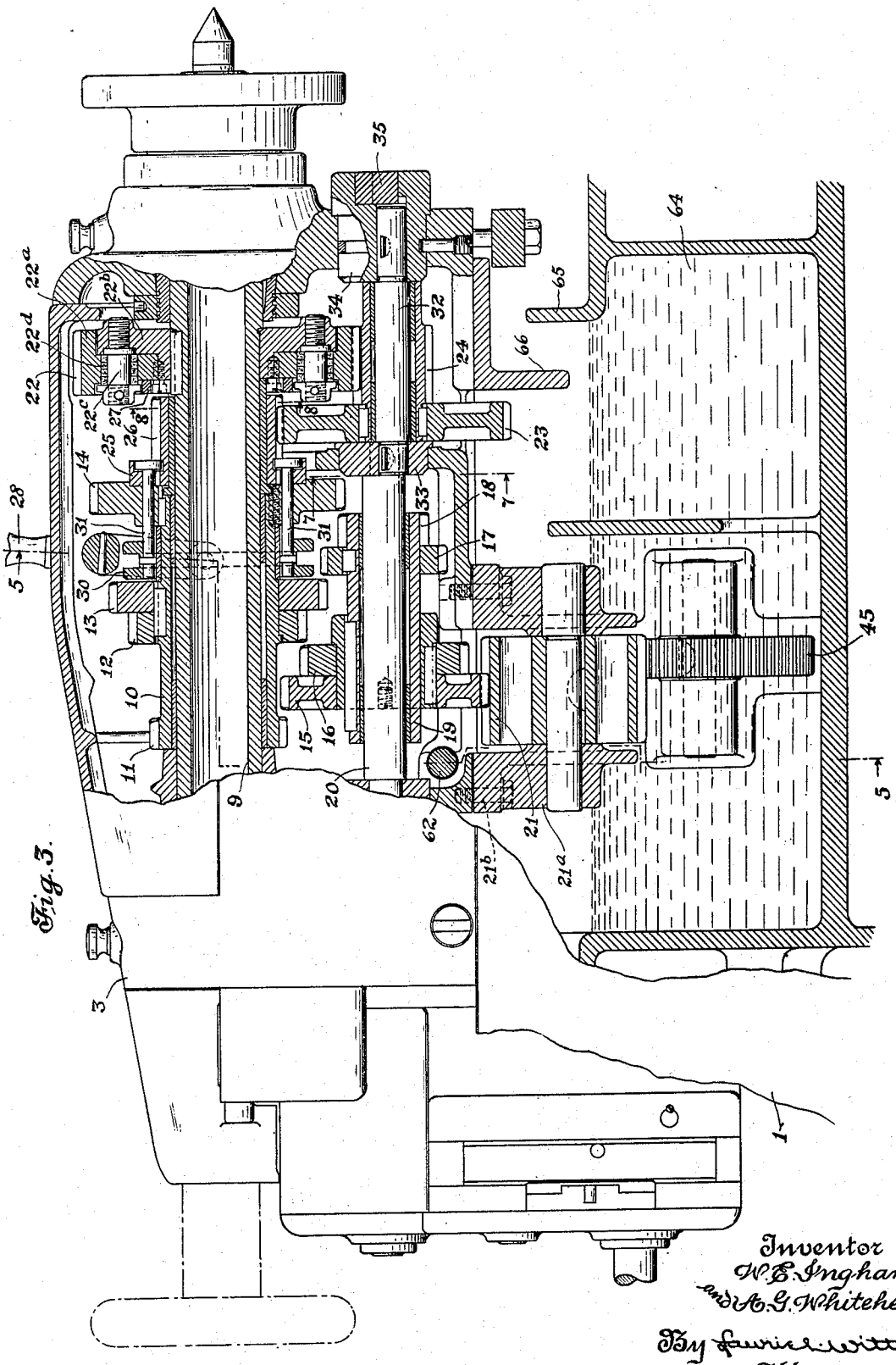


Fig. 3.

Inventor
W. E. Ingham
and A. G. Whitehead
By Laurie & Witter
Attorney.

July 15, 1924. 1,501,346

W. E. INGHAM ET AL

LATHE

Filed Nov. 5, 1921 3 Sheets-Sheet 3

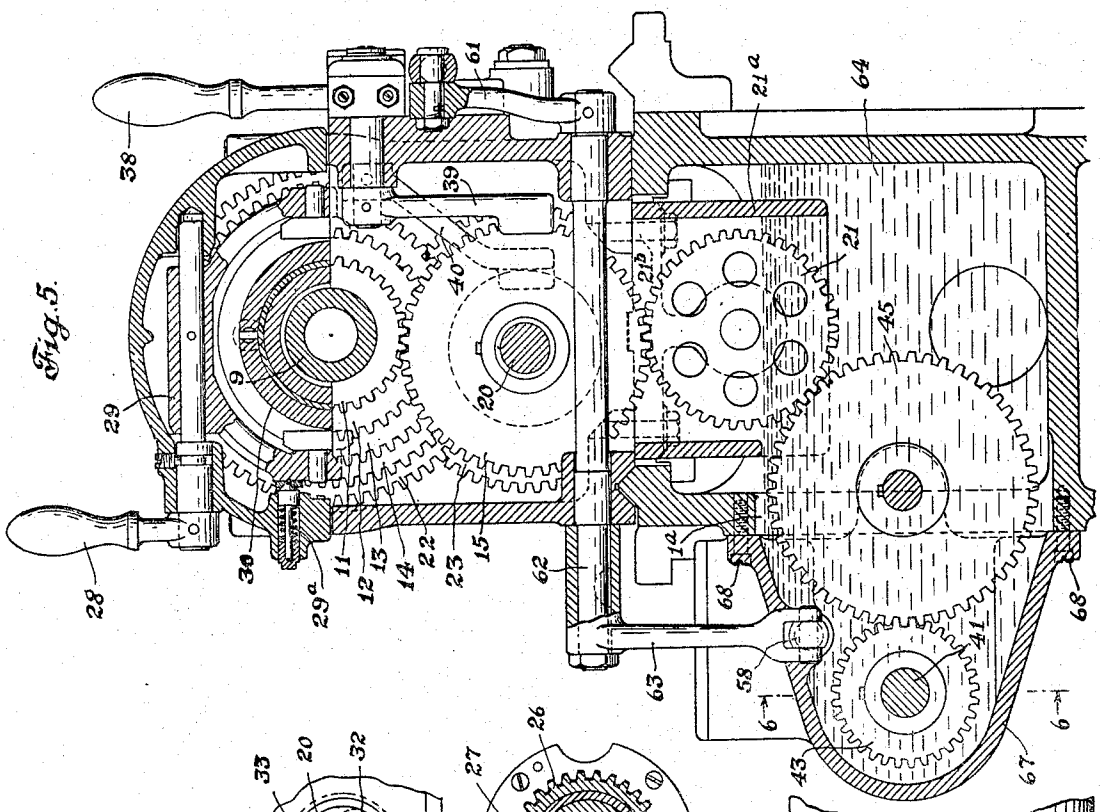


Fig. 5.

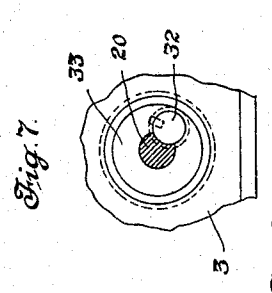


Fig. 7.

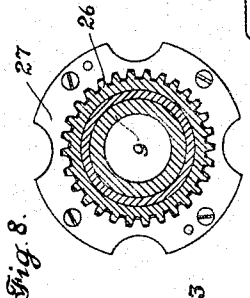


Fig. 8.

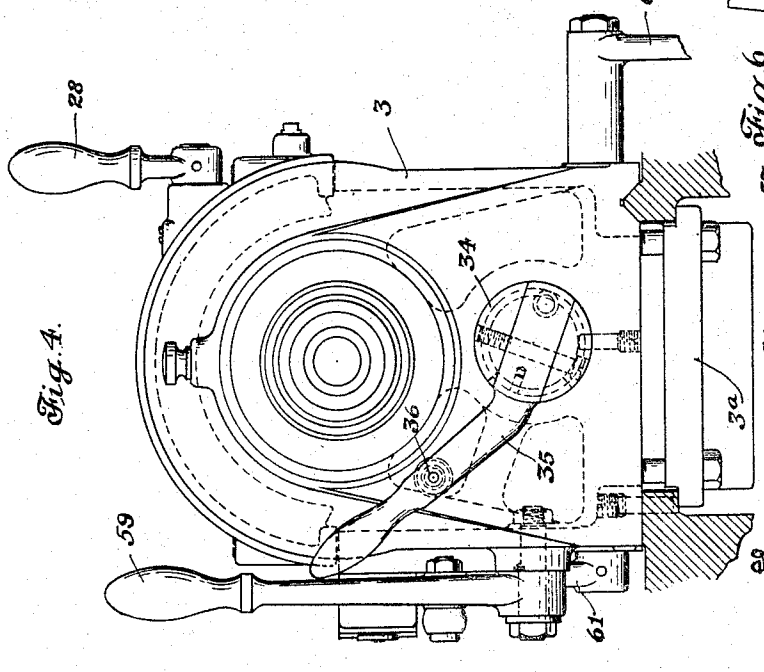


Fig. 4.

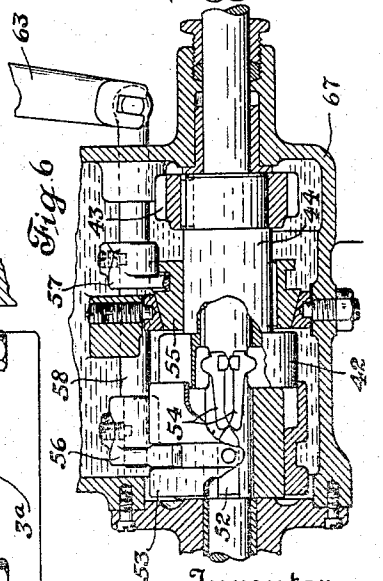


Fig. 6.

Inventor
W. E. Ingham
and H. G. Whitehead.
By Fawick & Witter
Attorney.

Patented July 15, 1924. 1,501,346

UNITED STATES PATENT OFFICE.

WALTER E. INGHAM, OF NEWINGTON, AND ALEXANDER G. WHITEHEAD, OF HARTFORD, CONNECTICUT, ASSIGNORS TO PRATT & WHITNEY COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

LATHE.

Application filed November 5, 1921. Serial No. 513,139.

To all whom it may concern:

Be it known that we, WALTER E. INGHAM and ALEXANDER G. WHITEHEAD, citizens of the United States, and residents of Newington and Hartford, respectively, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Lathes, of which the following is a specification.

This invention relates to lathes and particularly to the spindle driving mechanism therefor. The primary object of the invention is to provide an improved arrangement of spindle driving mechanism comprising change speed gearing, such mechanism being so constructed and arranged as to render the machine more compact and stable and to improve the general appearance and operation thereof.

In lathes and other machines comprising a rotary spindle, the driving means for such spindle, including the back gears, has usually been located laterally of the spindle or in such a relatively spaced position as to render the machine unsightly and ofter unstable. The entire mechanism for driving the spindle in the present invention is so compactly arranged beneath the spindle as to improve the stability, operation and general appearance of the machine. It is accordingly an object of the invention to provide a change speed spindle driving mechanism and spindle driving back gears, both located beneath the spindle, and to drive such mechanism preferably from a motor in the base of the machine, the arrangement being such as to generally improve the operation of the mechanism and to provide a symmetrical and well balanced machine.

Another object of the invention is to provide a machine of the type stated wherein the spindle and change gears and driving gears therefor are mounted in a headstock on the bed of the machine and extend downwardly therein, such gears being adapted to be driven by a driving means preferably comprising gearing projecting through the side of the bed and extending upwardly into driving engagement with the said spindle driving gears, the headstock and its gearing and the driving means and its gearing each being removable from the bed as a unit.

A further object of the invention is to provide an oil reservoir within the bed of the machine directly beneath the headstock, such reservoir also preferably comprising a casing secured to the exterior of the bed and housing a driving unit for the spindle driving gears, the oil in the reservoir being adapted to properly lubricate the spindle and its operating mechanism and to receive the drainage oil from such mechanism.

With these and other objects in view our invention consists in the features of construction and operation set forth in the following specification and illustrated in the accompanying drawings. In such drawings annexed hereto and forming a part of this specification, we have shown certain embodiments of our invention but it will be understood that the invention can be otherwise embodied and that the drawings are not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

Referring to the figures of the drawings:

Figure 1 is a partial front elevation of a lathe comprising the present invention.

Fig. 2 is an end view thereof.

Fig. 3 is an elevation of the headstock, a portion thereof being shown in longitudinal vertical section.

Fig. 4 is a front end elevation of the headstock.

Fig. 5 is a vertical cross sectional view of the machine taken on line 5—5 of Fig. 3.

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 5.

Fig. 7 is a fragmentary cross sectional view taken on line 7—7 of Fig. 3.

Fig. 8 is a fragmentary cross sectional view taken on line 8—8 of Fig. 3.

Referring more specifically to the drawings by reference characters, 1 indicates the bed of a lathe supported on a base or pedestal 2. A headstock 3 and a tailstock 4 are mounted on the bed and a tool carriage 5 is slidably mounted on the ways of the bed. The tool carriage 5 may be operated from a screw 6 or from a feed shaft 7, the latter also being adapted to operate a tool slide 8. The improved feed mechanism for operating the screw and feed shaft is fully disclosed in a copending application to W. E. Ingham,

Serial No. 513,167 filed on even date herewith.

A rotary spindle 9 is mounted in the headstock 3. As illustrated in the drawings, the driving mechanism for the spindle, including change speed gearing therefor, is arranged beneath the spindle. A portion of the driving means for the change speed gearing is located to the rear of the machine directly opposite the feed mechanism located at the front of the machine. The power means preferably comprises a motor in the base operatively connected to the driving means through a flexible connection, shown as a belt drive. Such connection and arrangement, as illustrated particularly in Fig. 2, provides a symmetrical and well balanced machine of a design particularly pleasing in appearance.

A spindle driving sleeve 10 is loosely mounted on the spindle 9 and is provided with four driving gears 11, 12, 13 and 14 thereon adapted to be operatively engaged respectively by four gears 15, 16, 17 and 18 keyed to a tubular shaft or sleeve 19 loose on a fixed shaft 20. The shaft 19 is adapted to be driven from a wide gear 21 meshing with gear 15. The gear 21 is mounted in a bracket 21^a secured to the bottom of the headstock by means of bolts 21^b. By shifting the gears 15 to 18, as hereinafter explained, the sleeve 10 may be driven at any one of four different speeds.

The drive of the spindle is either directly from the sleeve 10 through a two-part cushion gear 22 keyed to the spindle or indirectly therefrom through the back gears 23 and 24 located beneath the spindle, such drive always being through the cushion gear 22. The gear 22 comprises two parts 22^a and 22^b secured together by studs 22^c, flexible washers 22^d being interposed to serve as a cushioning or shock absorbing means. The gear 14 is provided with an internally toothed gear 25 seated rigidly in one face thereof. A gear 26 is loosely and slidably mounted on the spindle between the gears 22 and 25, such gear being always in mesh with gear 25 and being adapted to be engaged with an internally toothed portion 27 of gear 22. The gear 26 is adapted to be shifted axially on the spindle by a handle 28 operatively connected to a yoke 29 engaged within an annular groove in a ring 30, a spring detent 29^a being adapted to hold the yoke in its shifted position. The ring is connected to the gear 26 through a pair of pins 31 extending through the gears 14 and 25 and having heads thereon engaging the gear 26.

The back gears 23 and 24 are keyed together and are mounted for rotation on a shaft 32 eccentrically mounted in rotary bearings 33 and 34 at its ends, the said bearings and shaft 20 being coaxial. By referring to Fig. 7 it will be seen that one end of shaft 20 is supported centrally in the bearing 33, which shaft 20 is intersected by a portion of shaft 32 supported eccentrically in such bearing. The coaxial construction of shaft 20 and bearings 33 and 34 provides for easy boring of the openings in the headstock wherein such shaft and bearings are mounted. The front bearing 34 is provided with a handle 35 whereby the bearings may be rotated to throw the back gears into or out of operation. A latch 36 on the handle is adapted to hold the handle and back gears in the operative position with gears 26 and 23 and gears 22 and 24 in mesh as illustrated in Fig. 3.

The gears 15 and 16 are splined for longitudinal movement on the tubular shaft 19 and gears 17 and 18 may be shifted longitudinally with such shaft 19 on the shaft 20. Shifting handles 37 and 38 are provided with arms 39 and 40 engaging gears 15 and 17 whereby such gears may be shifted to engage any one of gears 15 to 18 respectively with gears 11 to 14 of the spindle.

In operation, the sleeve 10 may be driven at any one of four speeds through gearing 11 to 18, as has been described. If it is desired to drive the spindle direct at such speed, the gear 26 is shifted forwardly into engagement with gear teeth 27 of gear 22, the back gears 23 and 24 at such time being dropped from engagement with gears 26 and 22. If it is desired to operate the spindle at a reduced speed through the back gears, the gear 26 is drawn backwardly from engagement with gear 22 and the back gears are brought upwardly into mesh with gears 26 and 22, such driving position of the gearing being illustrated in Fig. 3 wherein the drive to the spindle is through gears 26, 23, 24 and 22.

It will be noted that the headstock with the spindle and its cooperating mechanism, as thus far described, is removable from the bed 1 as a unit. The headstock may be secured to the bed by a clamping means 3^a. The spindle is adapted to be driven by driving gearing extending upwardly in the bed into driving engagement with the spindle gearing. Such mechanism is hereinafter more specifically described.

The gear 21, heretofore defined as driving the change speed gearing, is driven from a power shaft 41 through a friction clutch 42, gear 43 on a sleeve 44, and meshing with a gear 45 in mesh with gear 21. The shaft 41 is provided with a belt pulley 46 so located to the rear of the machine that the same may be driven either from a motor in the base of the machine or from an overhead countershaft. In the drawings we have illustrated this shaft 41 as driven by a belt 47 from a pulley 48 on a motor 49. The motor 49 is housed within the base 2 substantially vertically beneath the spindle

9. Preferably, the motor is pivoted at 50 and adjustable about such pivot by means of a screw 51 whereby to place the proper tension on belt 47.

The friction clutch 42, illustrated in Fig. 6, is of the type known as the Johnson clutch. The inner driving portion of the clutch is mounted on the power shaft 41. Such clutch portion is adapted to be expanded by means of a plurality of pins 52 mounted on an annular member 53 and adapted to engage expanding levers 54. A brake element 55 is keyed to the sleeve 44. Collars 56 and 57 on a longitudinally slidable rod 58 engage the clutch member 53 and brake 55 respectively. A handle 59 at the front of the machine is operatively connected to the rod 58 through a connecting rod 60 engaging a lever 61 on one end of a rock shaft 62, a lever 63 on the opposite end of such shaft engaging the rod 58. Movement of the rod 58 in one direction is adapted to release the brake and engage the clutch and movement thereof in the opposite direction is adapted to disengage the clutch and apply the brake.

As shown particularly in Figs. 3 and 5, we provide an oil reservoir 64 in the bed of the machine directly beneath the headstock. The spindle and its operating mechanism may be lubricated from this reservoir in any manner desired. It will be noted that the spindle driving gearing extends downwardly into this reservoir and such gearing and spindle are preferably lubricated from the splash of the gears therein, the oil being carried upwardly by the rotating gears to the spindle and its several operating elements. The reservoir is also adapted to receive the oil dripping from the spindle and gearing. The bed and headstock are provided with overhanging flanges 65 and 66 thereon whereby to prevent dripping of the lubricant exteriorly of the reservoir.

By reference to Fig. 5, it will be noted that the side of the bed 1 is provided with an opening 1^a through which projects the gear 45. The driving means comprising shaft 41, gear 45 and the mechanism cooperating therewith is supported in a casing 67 secured to the exterior of the bed about the said opening 1^a by means of bolts 68. As has been heretofore described, the headstroke and its cooperating mechanism including the driving gear 21, are removable from the bed as a unit. It will be noted also that the driving means, including the shaft 41 and gear 45, is also removable from the bed as a unit merely by removing bolts 68. Such construction renders the machine extremely compact and simple and easy to disassemble for inspection or other purposes when such action is desired. It will furthermore be noted that when these two units, viz, the driving unit in casing 67 and the driven unit on the headstock, are properly assembled on the bed, their respective gears 45 and 21 intermesh as illustrated in Fig. 5. It will furthermore be noted that the casing 67 forms an extension of the oil reservoir 64, the oil being adapted to flow freely through the opening 1^a. Both these driving units and the spindle are therefore at all times properly lubricated from this reservoir.

By reference to Figs. 1 and 2, it will be noted that the general construction and arrangement of the several parts of the machine are such as to provide a lathe having the several advantages and improvements heretofore outlined. The several controls, including the back gear shifting handle 35, spindle change speed gearing handles 37 and 38, and clutch shifting handle 59 are directly in front of the operator's position at the lathe. The spindle driving gearing, illustrated in Fig. 3, is so compactly arranged as to provide a rigid construction closely adjacent the front end of the spindle. The back gearing is free from the usual long driving shaft, is arranged within the headstock beneath the spindle and may be conveniently operated from the handle 35 placed beneath the spindle at the front end of the headstock. Such arrangement of the entire spindle driving mechanism beneath the spindle leaves the headstock free from any objectionable laterally projecting driving mechanism. The arrangement of the power shaft 41 and the cooperating driving means for the change speed gears to the rear of the machine, directly opposite the feeding mechanism therefor at the front of the machine, provides a symmetrical and well balanced machine, as illustrated particularly in Fig. 2. Also the arrangement and location of the driving pulley 46 readily adapts the machine to be operated as well from an overhead countershaft as from the motor 49 illustrated in the drawings. It will furthermore be noted that since the change speed gearing is directly adjacent the spindle, the speed of the belt 47 is constant, a change of spindle speed only effecting the speed of the spindle and the gears thereon. Such arrangement avoids the tendency of the belt to slip with a consequent loss of power which ordinarily attends a drive of this type wherein the belt operates at variable speeds.

What we claim is:

1. In a machine of the class described, the combination of a rotary spindle, a plurality of gears thereon, a shaft adjacent the spindle, gearing including certain of the spindle gears for operatively connecting the shaft with the spindle, a plurality of back gears adapted to be engaged with other of the spindle gears, the said gearing and back gears being lo-

cated substantially in the vertical plane of the spindle, and means operatively connected with the shaft for driving the same.

2. In a machine of the class described, the combination of a rotary spindle, a plurality of gears thereon, a shaft adjacent the spindle, gearing operatively connecting the shaft with certain of the spindle gears, a plurality of back gears beneath the spindle adapted to be engaged with other of the spindle gears, the said gearing and back gears being located beneath the spindle, and means operatively connected with the shaft for driving the same.

3. In a machine of the class described, the combination of a rotary spindle, a plurality of gears thereon, a shaft extending along one portion of the spindle, gearing operatively connecting the shaft with certain of the spindle gears, a back gear shaft extending along another portion of the spindle, back gearing on the back gear shaft adapted to be engaged with other of the spindle gears, the said two shafts being located beneath the spindle, and means operatively connected with the first named shaft for driving the same.

4. In a machine of the class described, the combination of a rotary spindle, a plurality of gears thereon, a shaft parallel with and adjacent the spindle, gearing operatively connected to certain of the spindle gears, and including change speed mechanism, for operatively connecting the shaft with the spindle, back gears for the spindle, means for engaging and disengaging the back gears from certain of the spindle gears, the said gearing and back gears being located beneath the spindle, and means operatively connected with the shaft for driving the same.

5. In a machine of the class described, the combination of a rotary spindle, a plurality of gears thereon, a shaft extending along one portion of the spindle, gearing operatively connecting the shaft with certain of the spindle gears, a back gear shaft extending along another portion of the spindle, a plurality of bearings coaxial of the first shaft and supporting the back gear shaft, back gearing on the back gear shaft adapted to be engaged with other of the spindle gears, the said two shafts being located beneath the spindle, and means operatively connected with the first named shaft for driving the same.

6. In a machine of the class described, the combination of a headstock, a rotary spindle mounted therein, a plurality of gears mounted on the spindle, a shaft extending along one portion of the spindle, gearing operatively connecting the shaft with certain of the spindle gears, a back gear shaft extending along another portion of the spindle, the headstock having a plurality of circular openings therein coaxial of the first shaft, a bearing block rotatably mounted in each of such openings and supporting the back gear shaft eccentrically therein, back gearing on the back gear shaft, means for rotating the bearing blocks to engage the back gears with other of the spindle gears, and means operatively connected with the first named shaft for driving the same.

7. In a machine of the class described, the combination of a bed, a headstock thereon, a rotary spindle mounted in the headstock, a set of gears on the spindle, a shaft in the headstock beneath and parallel with the spindle, a set of gears on the shaft adapted to cooperate with the spindle gears, certain of the gears of one set being relatively slidable longitudinally to selectively engage the gears thereof with the corresponding gears of the other set, and power operated means beneath the spindle and shaft for driving the shaft.

8. In a machine of the class described, the combination of a bed, a headstock thereon, a rotary spindle mounted in the headstock, a set of gears on the spindle, a shaft in the headstock beneath and parallel with the spindle, a set of gears on the shaft adapted to cooperate with the spindle gears, certain of the gears of one set being relatively slidable longitudinally to selectively engage the gears thereof with the corresponding gears of the other set, spindle driving back gears beneath the spindle, and means operatively connected with the shaft for driving the same.

9. In a lathe, the combination of a spindle, a driving gear loose thereon, a gear fixed to the spindle, means for sliding the loose gear into and out of driving engagement with the fixed gear, two back gears beneath the spindle, means for raising and lowering the back gears into and out of mesh with the loose and fixed gears, and means for driving the said loose gear.

10. In a lathe, the combination of a spindle, a driving gear loose thereon, a gear fixed to the spindle, the fixed gear having an internally toothed portion corresponding in contour to the driving teeth of the loose gear and adapted to be engaged and driven thereby, means for sliding the loose gear axially on the spindle into and out of driving engagement with the said toothed portion of the fixed gear, two back gears beneath the spindle, means for raising and lowering the back gears into and out of mesh with the loose and fixed gears, and means for driving the said loose gear.

11. In a lathe, the combination of a spindle, a driving gear loose thereon, a gear fixed to the spindle, means for optionally operatively connecting the two gears, two back gears supported on a shaft eccentrically mounted in bearings at its ends beneath the spindle, a handle secured to the front end

of the shaft beneath the spindle and adapted to rotate the shaft and bearings to raise the back gears into mesh with the said spindle gears, and means for holding the shaft and gears in the raised position.

12. In a lathe, the combination of a spindle, a driving gear loose thereon, a gear fixed to the spindle, means for optionally operatively connecting the two gears, two back gears beneath the spindle, means for raising and lowering the back gears into and out of mesh with loose and fixed gears, and means including change speed gearing beneath the spindle for driving the said loose gear.

13. In a machine of the class described, the combination of a headstock, a rotary spindle mounted therein, spindle driving gearing, including change speed gearing, beneath and adjacent the spindle, a power shaft to the rear of and operatively connected to the said gearing, and a driving pulley on the power shaft, the location of the pulley being such that the same may be belt-driven either from a motor in the base of the machine or from an overhead countershaft.

14. In a machine of the class described, the combination of a headstock, a rotary spindle mounted therein, a shaft parallel with, adjacent and beneath the spindle, change speed gearing between the shaft and spindle, a power shaft below and to the rear of the spindle, an operative connection between the power shaft and gearing, and a driving pulley on the power shaft, the location of the pulley being such that the same may be belt-driven either from a motor in the base of the machine or from an overhead countershaft.

15. In a machine of the class described, the combination of a rotary spindle, a shaft parallel with and adjacent the spindle, gearing including change speed mechanism beneath the spindle for operatively connecting the shaft with the spindle, a power shaft to the rear of the first named shaft, means comprising a friction clutch for operatively connecting the two shafts, and a hand lever at the front of the machine for operating the clutch.

16. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, a power shaft to the rear of the bed, an operative connection between the power shaft and gearing, and a driving pulley on the power shaft, the location of the pulley being such that the same may be belt-driven either from a motor in the base of the machine or from an overhead countershaft.

17. In a machine of the class described, the combination of a base, a bed supported thereon, a headstock on the bed, a rotary spindle mounted in the headstock, a motor mounted in the base, change speed gearing beneath and adjacent the spindle for driving the same, and a flexible driving connection between the motor and the change speed gearing.

18. In a machine of the class described, the combination of a base, a bed supported thereon, a headstock on the bed, a rotary spindle mounted in the headstock, a motor mounted in the base, change speed spindle driving mechanism beneath and adjacent the spindle and comprising a shaft parallel with the spindle, an operative connection comprising a plurality of gears on the shaft adapted to mesh with certain gears on the spindle, and an operative driving connection between the motor and the change speed gearing.

19. In a machine of the class described, the combination of a base, a bed supported thereon, a headstock on the bed, a rotary spindle mounted in the headstock, a motor mounted in the base substantially in the vertical plane of the spindle, spindle driving change speed gearing beneath the spindle, and a belt driving connection between the motor and the change speed gearing.

20. In a machine of the class described, the combination of a base, a bed supported thereon, a headstock on the bed, a rotary spindle mounted in the headstock, a shaft parallel with and adjacent the spindle, gearing including change speed mechanism beneath the spindle for operatively connecting the shaft with the spindle, a shaft to the rear of the first named shaft, means comprising a friction clutch for operatively connecting the two shafts, a motor in the base, and a belt driving connection between the motor and the second named shaft.

21. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, and drive gearing in the bed engaging the said gearing extending into the bed, the headstock and its gearing being removable from the bed as a unit.

22. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, and a driving gear in the bed engaging the said gearing extending into the bed, the rotary axis of the said gearing being parallel to the

spindle axis and the headstock and its gearing being removable from the bed as a unit.

23. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, a set of gears on the spindle, a shaft in the headstock beneath and parallel with the spindle, a set of gears on the shaft adapted to cooperate with the spindle gears, certain of the gears of one set being relatively slidable longitudinally to selectively engage the gears thereof with the corresponding gears of the other set, and means in the bed operatively connected to the shaft for driving the same, the headstock and the shaft with the gears thereon being removable from the bed as a unit.

24. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, a set of gears on the spindle, a shaft in the headstock beneath and parallel with the spindle, a set of gears on the shaft adapted to cooperate with the spindle gears, certain of the gears of one set being relatively slidable longitudinally to selectively engage the gears thereof with the corresponding gears of the other set, a gear supported in the headstock beneath the shaft, operatively connected to the shaft and extending downwardly into the bed, and other gearing in the bed operatively connected to the said gear for driving the same, the headstock, change gears and the said gear supported in the headstock being removable from the bed as a unit.

25. In a lathe, the combination of a base, a bed supported thereon, a removable headstock mounted on the bed, a spindle rotatably mounted in the headstock, gearing operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, and driving means extending through the said opening and engaging the said gearing for driving the spindle.

26. In a lathe, the combination of a base, a bed supported thereon, a removable headstock mounted on the bed, a spindle rotatably mounted in the headstock, gearing including change speed gearing operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, and driving means extending through the said opening and engaging the said gearing for driving the spindle.

27. In a lathe, the combination of a base, a bed supported thereon, a removable headstock mounted on the bed, a spindle rotatably mounted in the headstock, gearing including change speed gearing operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, and gearing extending through the said opening and engaging the first said gearing for driving the spindle.

28. In a lathe, the combination of a base, a bed supported thereon, a removable headstock mounted on the bed, a spindle rotatably mounted in the headstock, gearing including change speed gearing operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, gearing extending through the said opening and engaging the first said gearing for driving the spindle, and driving means for the second mentioned gearing supported on a bracket secured to the exterior of the bed adjacent the said opening.

29. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, and driving means extending through the said opening and engaging the said gearing for driving the spindle, the headstock and gearing being removable from the bed as a unit independently of the said driving means.

30. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, and gearing extending through the said opening and engaging the first said gearing for driving the spindle, the headstock and gearing being removable from the bed as a unit independently of the second mentioned gearing.

31. In a lathe, the combination of a bed, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the bed, the bed having an opening through the side thereof, gearing extending through the said opening and engaging the first said gearing for driving the spindle, and driving means for the second mentioned gearing supported on a bracket secured to the exterior of the bed adjacent the said opening, the headstock and gearing being removable from the bed as a unit and the said bracket with its driving means and gearing being removable from the side of the bed as a unit.

32. In a machine of the class described, the combination of a bed, an oil reservoir

formed therein, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the reservoir, the oil in the reservoir being adapted to lubricate the gearing and spindle, and means for driving the gearing.

33. In a machine of the class described, the combination of a bed, an oil reservoir formed therein, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the reservoir, the oil in the reservoir being adapted to lubricate the gearing and spindle, and means engaging the gearing in the reservoir for driving the spindle.

34. In a machine of the class described, the combination of a bed, an oil reservoir formed therein, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing, including change speed gearing, supported in the headstock beneath the spindle, operatively connected to the spindle and extending downwardly into the reservoir, the oil in the reservoir being adapted to lubricate the gearing and spindle and the reservoir being adapted to catch the oil draining from the said gearing and spindle, flanges on the bed and headstock for preventing the dripping of oil outside the reservoir, and means for driving the gearing.

35. In a machine of the class described, the combination of a bed, an oil reservoir formed therein, a headstock mounted thereon, a spindle rotatably mounted in the headstock, gearing operatively connected to the spindle and extending downwardly into the reservoir, the bed having an opening through the side thereof into the reservoir, a casing supported on the exterior of the bed about the said opening, and a driving unit within the casing operatively connected to the said gearing through the opening, the reservoir being adapted to catch the oil draining from the gearing and spindle and the oil in the reservoir being adapted to lubricate the gearing, spindle and driving unit.

In testimony whereof, we hereto affix our signatures.

WALTER E. INGHAM.
ALEXANDER G. WHITEHEAD.