(No Model.) 4 Sheets—Sheet 1.

F. H. RICHARDS.

LATHE HEAD.

No. 354,737. Patented Dec. 21, 1886.

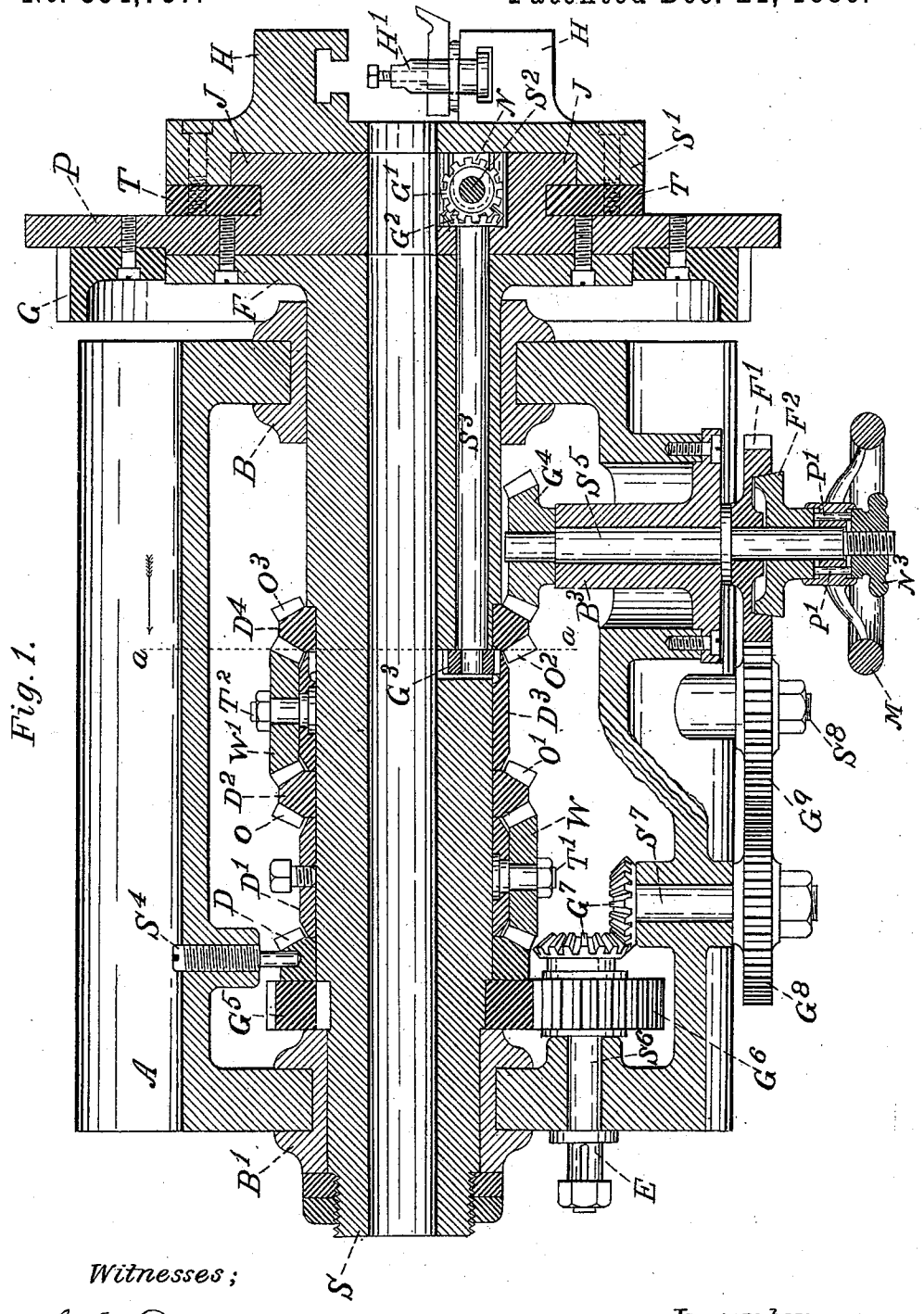

Fig. 1.

Witnesses;

C. O. Palmer.

H. W. Faulkner.

Inventor;

Francis H. Richards

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 2.

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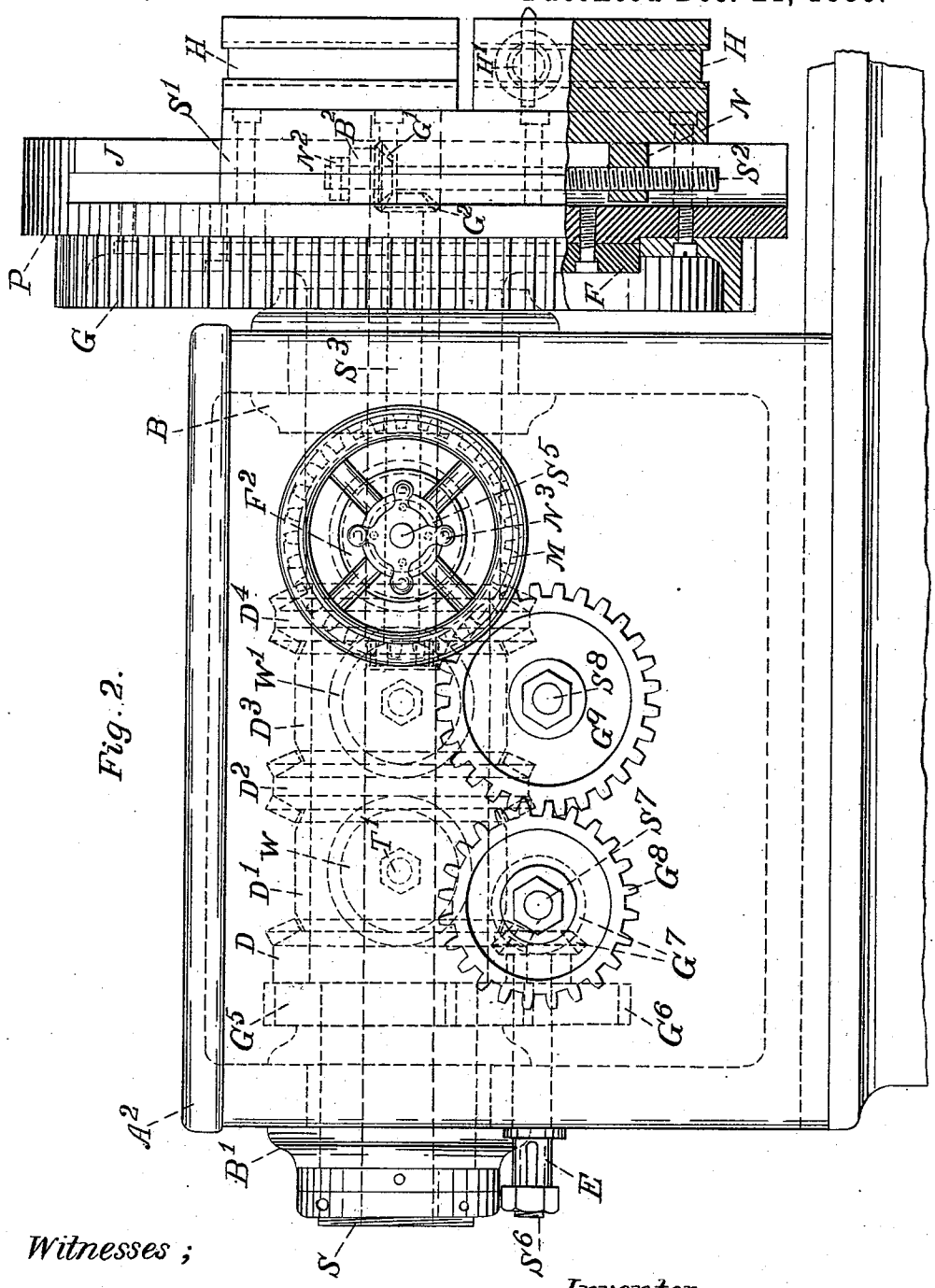

Fig. 2.

Witnesses;

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(No Model.) 4 Sheets—Sheet 3.

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Fig. 5.

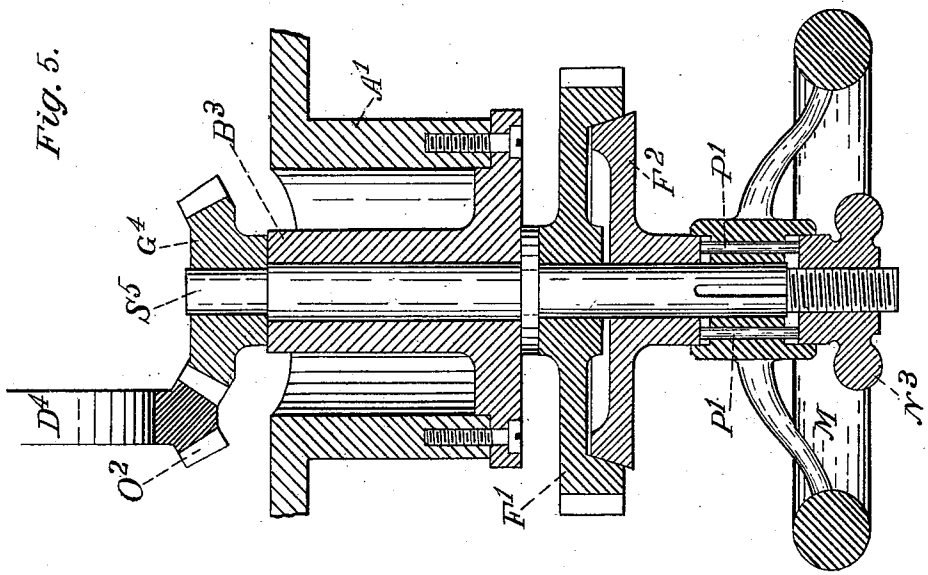
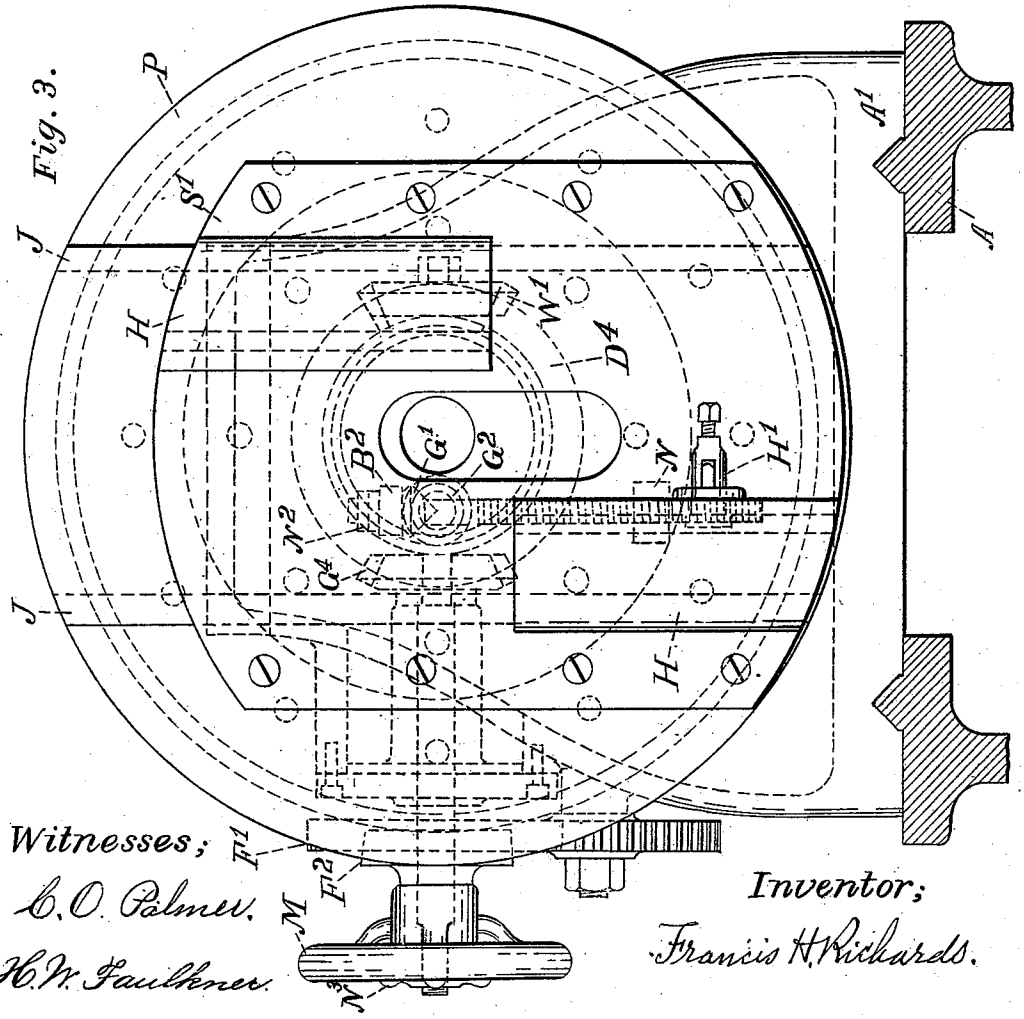


Fig. 3.



Witnesses;
C. O. Palmer.
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(No Model.) 4 Sheets—Sheet 4.

F. H. RICHARDS.

LATHE HEAD.

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Fig. 4.

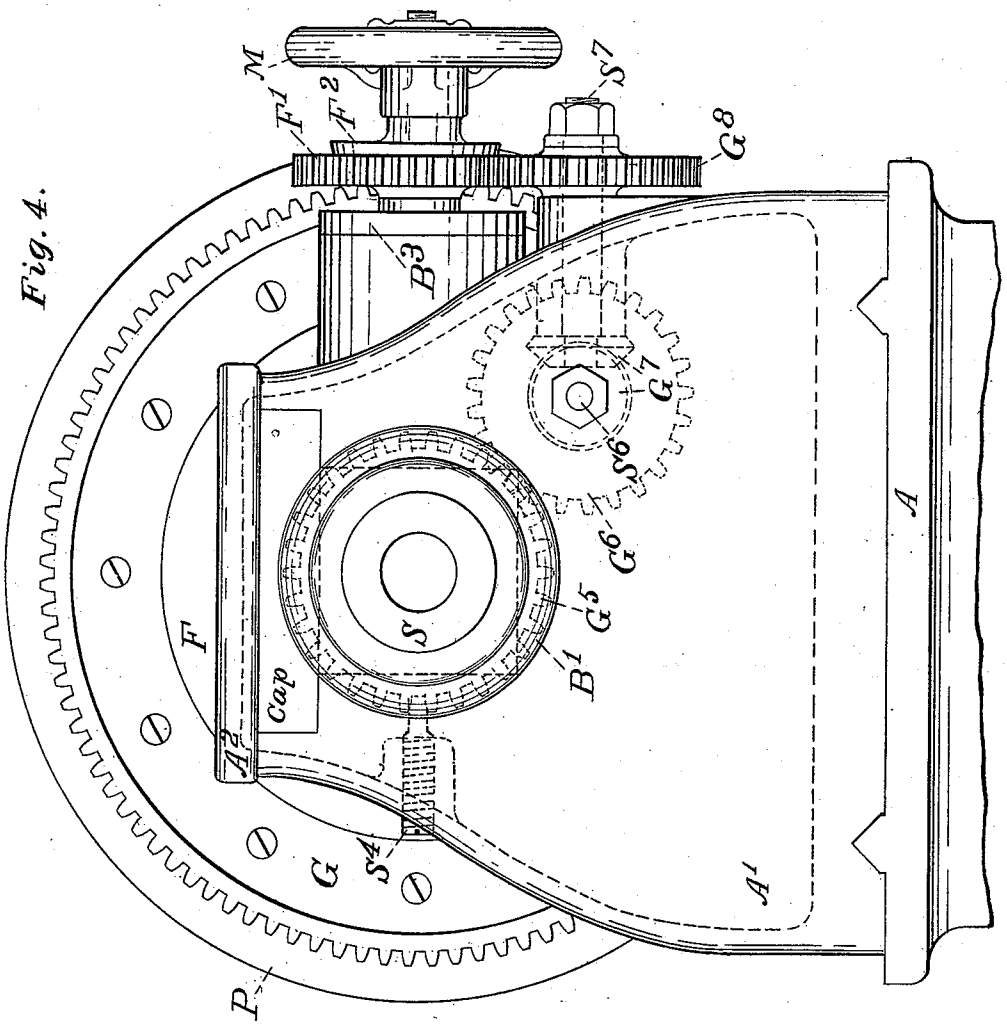
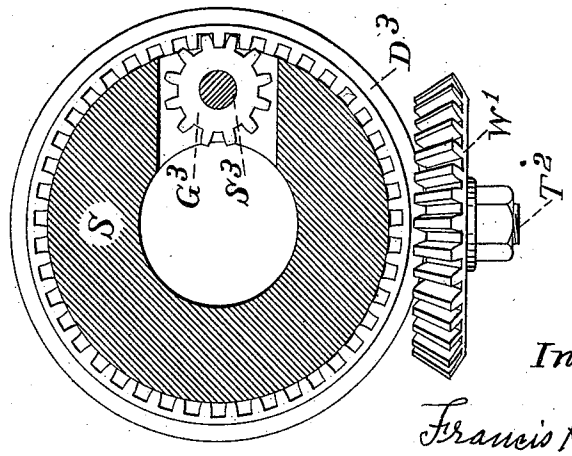


Fig. 6.



Witnesses;

C. O. Palmer.

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Inventor;

Francis H. Richards.

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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF SPRINGFIELD, MASS., ASSIGNOR OF ONE-HALF TO THE PRATT & WHITNEY COMPANY, OF HARTFORD, CONN.

LATHE-HEAD.

SPECIFICATION forming part of Letters Patent No. 354,737, dated December 21, 1886.

Application filed January 21, 1886. Serial No. 189,298. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Lathe-Heads, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a lathe-head embodying my improvements, in which the upper parts are broken away the better to show the inclosed mechanism. Fig. 2 is a front side elevation, partially in section, of the same. Fig. 3 is a front end elevation. Fig. 4 is a rear end elevation. Fig. 5 is an enlarged view of a part of Fig. 1; and Fig. 6 shows a cross-sectional view of the spindle in line *a a*, Fig. 1.

Similar letters refer to similar parts throughout all the views.

This invention relates to that class of lathe-heads which have a tool-carrying slide on their face-plates for the purpose of turning off pieces which do not themselves revolve.

The object of my invention is to provide a lathe-head of the aforesaid class of such construction and having a tool-feeding mechanism of such a nature that there is always a positive connection between a hand-wheel shaft conveniently located and the tool-carrying slide, which shall be unaffected by the starting, revolving, or stopping of the lathe-spindle.

For the accomplishment of this object the invention consists in certain combinations of mechanism illustrated by the drawings and hereinafter described and claimed.

In the drawings, A represents a portion of the bed of a lathe, and A′ the lathe-head frame, which is therein shown of a box-shaped form, provided with a cover, A^2, and which incloses the principal parts of the mechanism. This frame has bearings B B′ for supporting the lathe-spindle S, and it is also formed as required to receive and hold in place the several details which are not carried by said spindle. This spindle is provided with a flange, F, for convenience in attaching the face-plate P, and may be driven by a gear, G, secured to said face-plate, or otherwise, as desired. The face-plate is furnished with suitable ways, as J, to which the tool-carrying slide S′ is secured by straps T and screws, in the usual manner. This slide has one or more suitably-formed projections, H, adapted to carry the tool post or holder H′. When spindle S is hollow, slide S′ is made with a central slot, as shown in Figs. 1 and 3. Lying back of slide S′, in a channel formed in the face-plate, there is a screw, S^2, which works said slide by means of nut N. Said screw is held in place by bearing B^2 and nuts N^2, (shown by dotted lines in Figs. 2 and 3,) and is driven by shaft S^3 through gears G^2 and G′, fixed, respectively, to this shaft and said screw.

Shaft S^3 is carried in a hole formed within spindle S, and is furnished with gear G^3, whereby it is driven. It communicates motion to the face-plate mechanism from a system of sun-and-planet gearing, which is a principal part of my present invention, and the construction of which I will next describe. This system of gearing consists of two sun-and-planet motions set in opposition to each other, and connected by an intermediate sun-wheel (common to both sun-and-planet motions) in such a manner that the movements derived from the first of said motions is, in a sense, counteracted in the other. Referring to Figs. 1 and 6, in which this gearing is most completely shown, D is the sun-wheel of the first sun-and-planet motion. It is fitted loosely onto spindle S, and is permanently kept from rotating by a screw, S^4, in frame A. Next to that sun-wheel a ring, D′, is rigidly fixed to said spindle and furnished with a fixed stud, T′, for carrying the first planet-wheel, W. Stud T′ may be fixed to the spindle without the intervention of ring D′, if preferred; but I do not consider this construction as convenient in practice as that shown. Next to ring D′, opposite to sun-wheel D, an intermediate sun-wheel, D^2, is loosely fitted to spindle S. This wheel has teeth on each side of it, of which those on the left-hand side, O, mesh with the teeth of planet-wheel W, and those on the right hand with the teeth of the second planet-wheel, W′. This wheel W′ is carried on a stud, T^2, similar to T′, which is fixed to the internally-toothed ring D^3, loosely fitted to spindle

S, and similar to ring D'. The teeth of this ring mesh with those of gear G^3, before described, as shown best in Fig. 6. At the right hand of this ring the second sun-wheel, D^4, which may be and is shown here as a duplicate of sun-wheel D^2, is placed loosely on said spindle. This sun-wheel has teeth O^2 on one side, meshing with the second planet-wheel, W', and teeth O^3 on the other side, meshing with the pinion G^4 on hand-wheel shaft S^5.

Having now enumerated all the essential parts of the said sun-and-planet motions, I will next describe one form of mechanism illustrative of a numerous class of such mechanisms, which are adapted to be used for imparting a continuous feeding motion through them and the parts previously described to the tool-carrying slide.

An intermediate shaft, S^6, is driven from spindle S by gears G^5 and G^6, and is fitted at its outer end, E, to receive a gear for driving the usual screw-cutting mechanism of the lathe. Another intermediate shaft, S^7, is driven from that one through gears G^7. This shaft carries a gear, G^8, meshing with the intermediate gear, G^9, which drives the friction-wheel F' on shaft S^5. A clutch-wheel, F^2, is splined to this shaft S^5, and is operated by means of nut N^3, which nut, by means of pins P', fitted to slide freely through the hub of hand-wheel M, can be made to force the said clutch-wheel against said friction-wheel whenever required. The hand-wheel is of course rigidly fixed on its shaft, which, for convenience in disassembling the machine, is supported in a removable flanged bearing, B^3. Gears of different sizes may be substituted for G^8 and G^9 by a suitable modification of the parts supporting them, for the purpose of changing the speed of shaft S^5 relative to spindle S. The operation of this gearing, with its shafts and auxiliary parts, to communicate motion from the spindle to the hand-wheel shaft will be obvious from this description and the drawings with my explanation.

The mode of operation of my improvement is as follows: When the spindle is at rest, the tool-slide is first moved to the desired position for beginning a cut. This is done by taking hold of wheel M and turning shaft S^5 and pinion G^4, and thereby sun-wheel D^4. The revolution of this wheel, owing to the well-known nature of the sun-and-planet motion, the wheel D^2 being at rest, (that is, while spindle S is also at rest,) acts through planet-wheel W' and stud T^2 to turn ring D^3 with one-half of the velocity of said wheel D^4. The ring D^3 acts through gear G^3, shaft S^3, gears G^2 and G', and screw S^2 to move the slide as required. The tool having been properly set, the spindle may now be started revolving, when the operation of the mechanism will be as follows: In this case it is supposed that sun-wheels D and D^4 and the hand-wheel and shaft are for the time being at rest. It is then obvious that, as stud T^2 is carried around with the spindle, planet-wheel W will be revolved on said stud, and, owing to the nature aforesaid of this class of mechanical movements, will cause sun-wheel D^2 to revolve in the same direction and with double the velocity as said spindle. This is the result considering the motion of the wheel D^2 as derived from wheel D through wheel W. If, now, we consider wheel D^4 to be at rest and ring D^3 to turn uniformly with the spindle, the same as ring D', then it is obvious that the motion of wheel D^2 thus derived from wheel D^4 through wheel W' would be the same as before; hence, as the ring D^3 gears with gear G^3, which is connected to the tool-slide, and as the said ring in this case turns uniformly with the spindle while the hand-wheel is at rest, the revolution of said spindle cannot, therefore, be the cause of any movement of the said tool-slide, for it clearly requires a movement of said ring relative to said spindle to cause a movement of said slide.

Now, if we consider how, as above explained, the tool-slide can be moved by means of hand-wheel M, acting through the sun-and-planet motion, while the spindle is at rest, and how the rotation of the spindle has of itself no power to effect or affect the movement of said slide, it will then be evident without further explanation that in all cases, whether the spindle is at rest or in motion, the said slide will be moved directly in proportion to any movement of the hand-wheel, and that thus will be accomplished the principal object of the invention.

In practice I have not found it necessary to provide any means for preventing the rotation of gear G^4, since the friction of the several bearings and of the slide naturally has that effect; but to secure this result I fit the parts D^2, D^3, and D^4 to turn freely on spindle S.

This system of gearing is not limited in its applications to lathe-heads; but it may be employed to effect a similar purpose to that here described in any kind of machinery.

I have shown and described face-plate P as being made separately from the spindle and secured thereto; but it may obviously be made integral therewith. It may also be made of various forms other than a circular one. I have also shown slide S' arranged with its line of motion at right angles to the axis of the spindle; but it may be arranged to have said line of motion make any other angle therewith, or even to be parallel thereto, by suitable modifications of the several parts.

The means shown in the drawings for rotating sun-wheel D^4 is an arrangement of gearing; but the same result may be attained by means of a belt running over that sun-wheel between the teeth O^2 and O^3 from a suitable driving-shaft parallel to the spindle. A chain may also be used in the same manner; or the bevel-gearing for this purpose may be replaced by spur-gearing.

I claim as my invention—

1. A main spindle, a shaft carried by said spindle and having a gear thereon, a toothed

ring carried upon said spindle and meshing with the gear of said shaft, a double sun-and-planet mechanism, substantially as described, a shaft adapted to be revolved in a fixed position at the will of the operator, and gearing between this shaft and said mechanism for imparting to said toothed ring a rotary motion relative to said spindle, combined and operating substantially as set forth.

2. A main spindle, a shaft carried within said spindle and having a gear thereon projecting outside of the periphery thereof, an internally-toothed ring carried upon said spindle and meshing with the gear of said shaft, a sun-and-planet mechanism, substantially as described, a shaft adapted to be revolved in a fixed position at the will of the operator, and connecting-gearing between this shaft and said mechanism for imparting to said toothed ring a rotary motion relative to said spindle, combined and operating substantially as specified.

3. In a lathe-head, a spindle having a shaft within it and ways for a tool-carrying slide, a tool-carrying slide adapted to slide on said ways, feed-gearing, substantially as described, between said slide and said shaft, a system of sun-and-planet gearing, substantially as described, and gearing to connect same with said shaft, all combined and operating substantially as set forth.

4. A spindle, as S, sun-wheels D, D^2, and D^4, planet-wheel W, carried on a stud, T′, affixed to said spindle, planet-wheel W′, carried on a stud, T^2, affixed to ring D^3, gearing from ring D^3 to shaft S^3, and shaft S^3, combined and operating substantially as described.

5. In a lathe-head, a suitable frame-work, a spindle, as S, with a face-plate and its ways, a slide on said ways, the sun-and-planet mechanism on said spindle, the connecting mechanism between said sun-and-planet mechanism and said slide, a gear, as G^5, fixed on said spindle, and intermediate connecting feed-gearing, substantially as described, between said gear G^5 and sun-wheel D^4 of said sun-and-planet mechanism, all combined substantially as and for the purpose set forth.

FRANCIS H. RICHARDS.

Witnesses:
FRANK H. PIERPONT,
ROBERT L. PECK.