A. D. WILLIAMSON.

GEARING.

APPLICATION FILED MAY 18, 1908.

938,805.

Patented Nov. 2, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

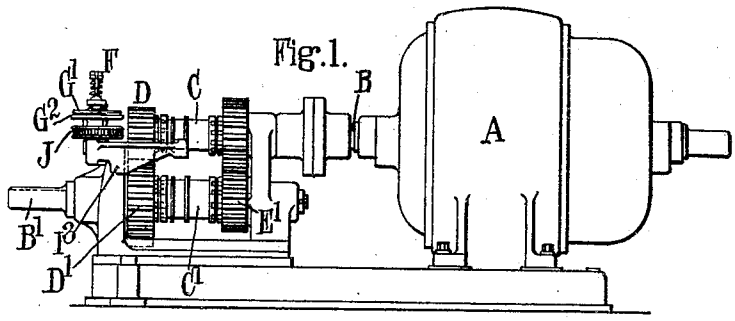



Fig. 2.

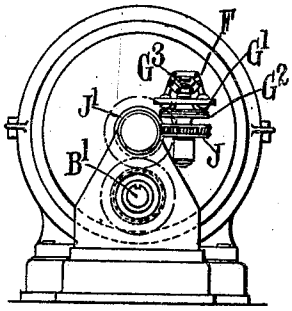



Fig. 3.

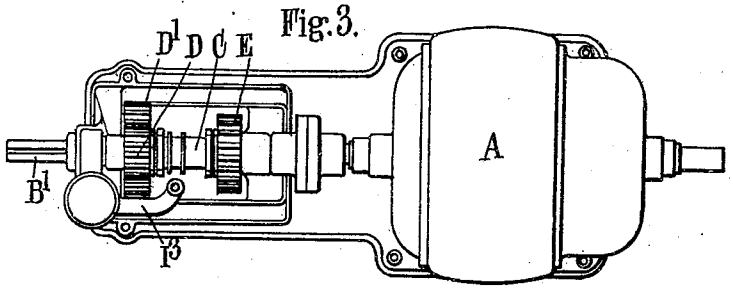



Fig. 6.

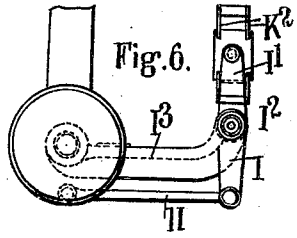



Fig. 5.

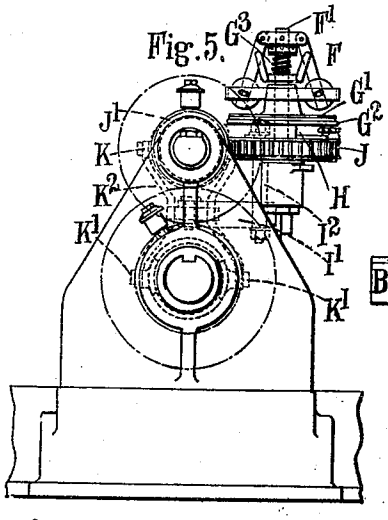
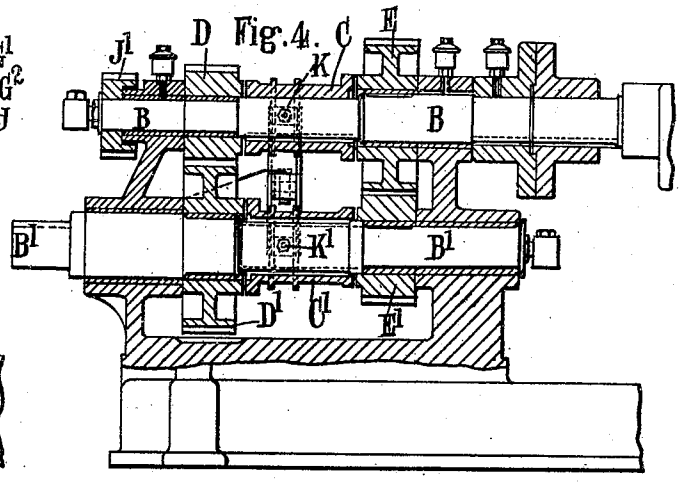



Fig. 4.

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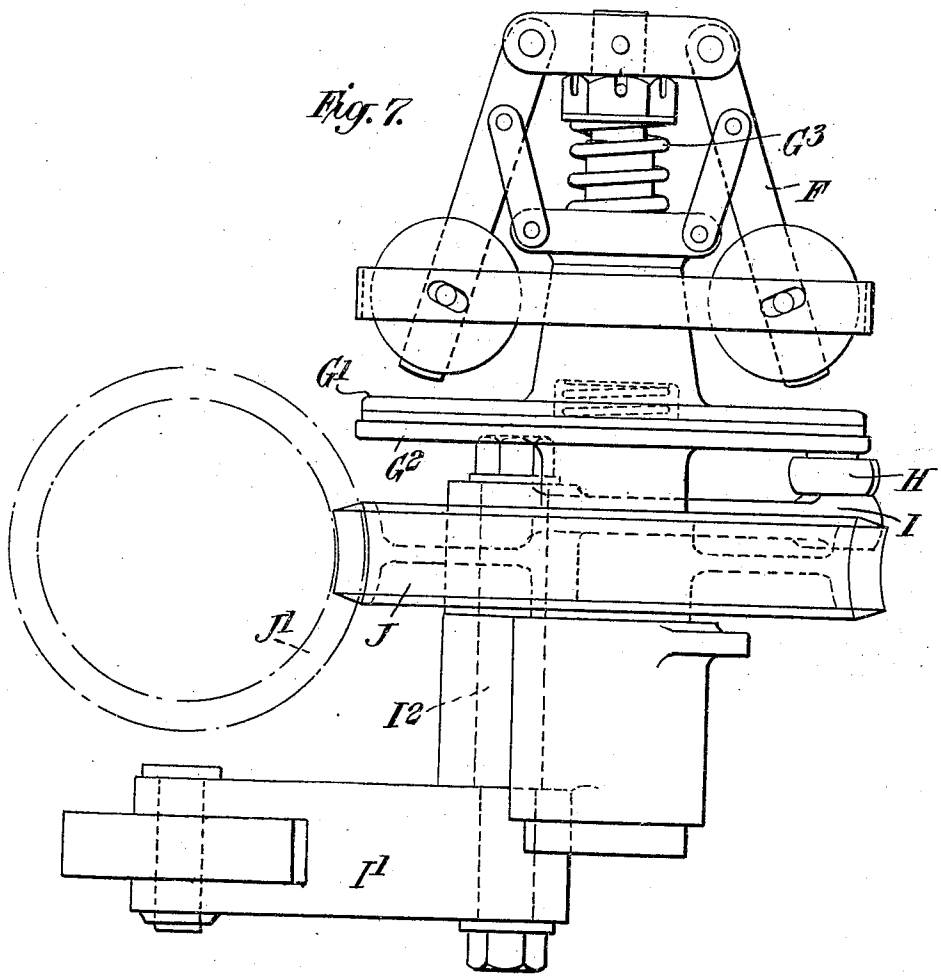
3 SHEETS—SHEET 2.

Fig. 7.

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3 SHEETS—SHEET 3.

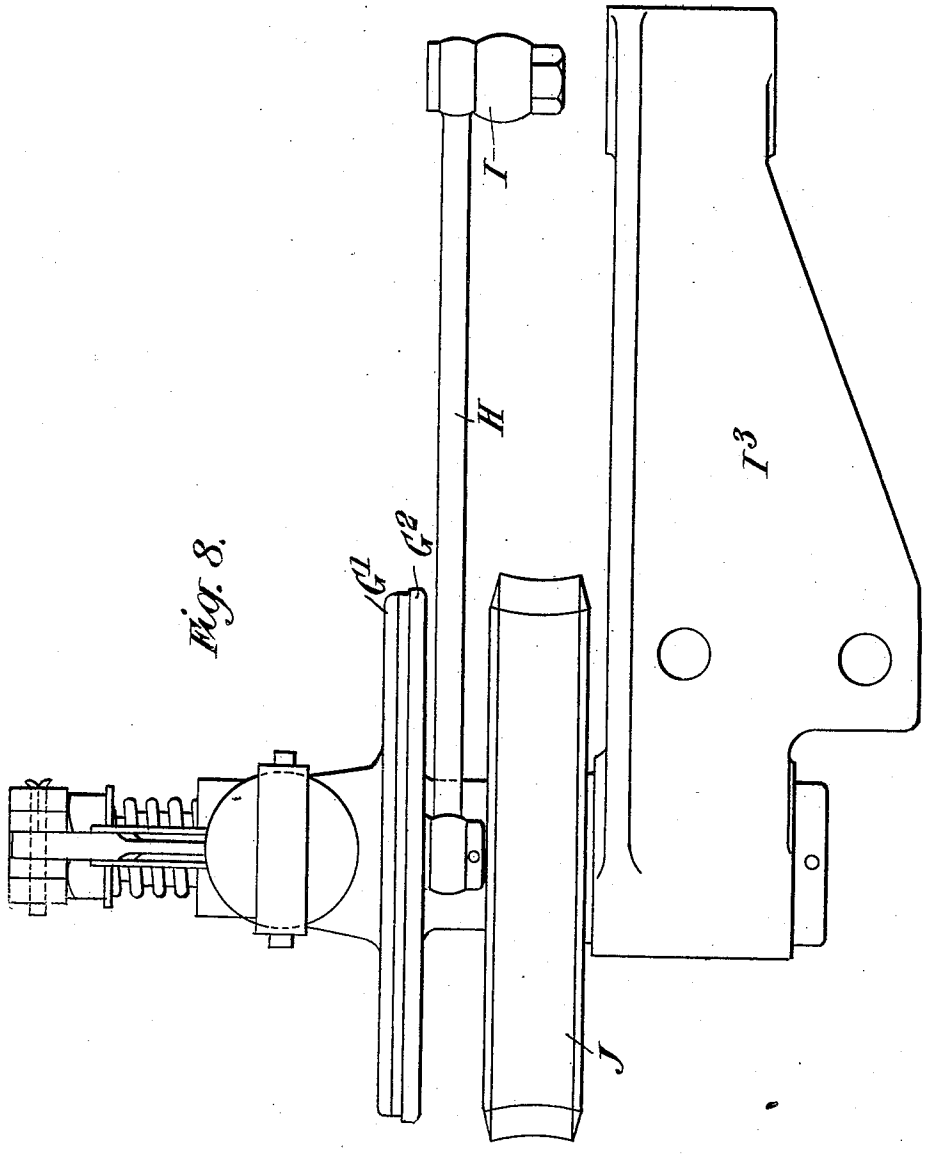


Fig. 8.

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# UNITED STATES PATENT OFFICE.

ALFRED DAVID WILLIAMSON, OF SHEFFIELD, ENGLAND, ASSIGNOR TO VICKERS SONS & MAXIM, LIMITED, OF SHEFFIELD, ENGLAND.

## GEARING.

938,805. Specification of Letters Patent. Patented Nov. 2, 1909.

Application filed May 18, 1908. Serial No. 433,615.

*To all whom it may concern:*

Be it known that I, ALFRED DAVID WILLIAMSON, a subject of the King of Great Britain, residing at River Don Works, Sheffield, in the county of York, England, have invented certain new and useful Improvements Relating to Gearing, of which the following is a specification.

This invention relates to planing and other reciprocating machines or mechanisms that are driven in opposite directions at different speeds by reversing electric motors. These machines are, broadly speaking, of two kinds, namely, those which work with a variable cutting speed and those which work with a constant cutting speed.

According to this invention change speed gearing is provided for driving the machine from the electric motor at a certain speed on the cutting stroke and at a different speed on the return stroke in combination with means governed by the direction of the rotation of the motor for automatically controlling the aforesaid change speed gearing. Thus with a machine having a constant cutting speed, the gearing may be such as to reduce the speed at which the motor drives the machine on the cutting stroke to a speed of, say, twenty feet per minute. After the completion of the cutting stroke and while the motor is accelerating in speed for the quick return stroke, the gearing may operate to disengage or render inoperative its speed-reducing portion and to bring into operation its speed increasing portion so as to obtain a suitable speed ratio for the return stroke say eighty feet per minute, or more as may be desired. Obviously this arrangement of gearing is also advantageous when used with a reversible variable speed electric motor.

At present it is customary to use with planing machines an electric motor having a speed range of 3:1 or 4, but producing a cutting speed of say 20 feet per minute and a corresponding quick return of from 60 to 80 feet per minute. An electric motor adapted to operate a planing machine in this manner is set forth in the specification of the prior United States Patent No. 760289. In certain classes of work, however, it is necessary to have as low a cutting speed as ten feet per minute, and with a motor having a speed range of 3:1 the quick return motion would be only thirty feet per minute which is unsatisfactory. By the use of the speed changing device herein described the speed of the quick return stroke may be made as rapid as desired.

It is not necessary to use the highest speed of the motor for the quick return stroke; for instance, a motor having a speed varying from three hundred to nine hundred revolutions per minute on the cutting stroke may be run at six hundred revolutions per minute or even less on the quick return stroke, and thus the better acceleration due to the stronger field may be utilized.

In order that the said invention may be clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation, Fig. 2 an end elevation, and Fig. 3 a plan of one form of change speed gearing, constructed according to this invention. Fig. 4 is a sectional side elevation, and Fig. 5 a more detailed end elevation of the same arrangement. Fig. 6 is a plan view showing the lever mechanism for operating the clutches of the change speed gearing and Figs. 7 and 8 are enlarged elevations taken at right angles to one another of a centrifugal controller and coöperating parts for actuating the aforesaid lever mechanism.

A is an electric motor to which is directly coupled the shaft B, hereinafter called the motor or driving shaft. Parallel to the shaft B is arranged a shaft B′ connected with the reciprocating mechanism of the planing or other machine and hereinafter called the driven shaft.

The change-speed gearing comprises a pair of clutches C C′ adapted to slide longitudinally upon and revolve with the two parallel shafts B B′. On the shaft B are loosely mounted two gear wheels D E, situated one at each end of the clutch C and adapted to become engaged or interlocked with the latter at the correct intervals. Similarly two gear wheels D′ E′ are mounted upon the shaft B′. The gear wheels upon the two parallel shafts are arranged to mesh with one another in pairs, the velocity ratio of one pair namely D D′ being such as to reduce the speed of the driven shaft to an appropriate value for the cutting stroke, and that of the other pair namely E E′ being such as to increase the speed of the driven shaft to an appropriate value for the quick

return stroke. The two clutches may be automatically moved into engagement with one or other of the two pairs of loose intermeshing gear wheels, depending upon the direction of motion to be given to the machine, by any suitable contrivance controlled by magnetic, hydraulic, pneumatic, or mechanical means.

In the drawings there is shown mechanism comprising a centrifugal governor F mounted upon a spindle F′ and attached to one member G′ of a friction clutch, the other member $G^2$ of which is connected by a rod or link H with lever mechanism adapted to control the movement of the clutches. The lever mechanism comprises an upper arm I, a lower arm I′, and a spindle $I^2$ to which said arms are secured. The spindle $I^2$ is mounted in bearings in a bracket $I^3$. The aforesaid governor spindle F′ and hence the governor F is connected through the worm wheel J, and worm J′ on the shaft B, with the electric motor shaft. Thus when the motor commences to rotate for the cutting stroke, the aforesaid worm gearing J J′ causes the governor F to rotate and thereby drive the member G′ of the friction clutch attached to it. Friction between the two members G′ $G^2$ of the friction clutch tends to cause the rotation of the aforesaid member G′ to be transmitted to the other member $G^2$ so that the lever mechanism is operated and the speed-change clutches are moved to bring into operation the speed reducing pair of gear wheels D D′. At the end of the cutting stroke the motor is brought to rest and started in the opposite direction by reversing switches. The motor starts slowly and the direction of rotation and movement being now reversed, the lever mechanism, by means of the governor and friction clutch, automatically actuates the speed change clutches to bring into operation the speed increasing pair of gear wheels E E′ suitable for the quick return stroke. As the speed increases, the balls of the governor F tend to fly outward, and the friction clutch member G′ is thus raised out of contact with the other member $G^2$ of said friction clutch and thereby obviates unnecessary wear of the friction surfaces. The friction clutch member G′ is controlled by springs $G^3$ for restoring the members of the friction clutch to their engaging position when the governor is stationary or its speed is low. This pressure-relieving arrangement may be dispensed with if the normal speed is low. The lever arm I′ for controlling the movements of the change speed clutches C C′ may be provided with a yielding or resilient connection with the shoes K K′ engaging with said clutches so that if one clutch engages or interlocks with an adjacent gear wheel slightly before the other clutch engages with the corresponding gear wheel, a force is exerted upon the latter clutch to cause it to move into engagement almost instantly after the engagement of the former clutch. For this purpose an arrangement is shown in the drawings consisting of strips of steel $K^2$ connecting the shoes K K′ and engaged by the lever arm I′ midway between the upper pair of shoes K K and the lower pair K′ K′.

Although the above described arrangements are convenient, modifications can be made in the construction of the gearing herein set forth to obtain the desired result without departing from the nature of the invention. One constructional modification forms the subject-matter of my divisional application Serial No. 488,298, filed April 6, 1909.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, change speed gearing interposed between the motor shaft and the driven shaft, and means actuated in accordance with the direction of rotation of the said motor shaft for automatically controlling the change speed gearing.

2. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, change speed gearing interposed between the motor shaft and the driven shaft, and mechanical means actuated in accordance with the direction of rotation of the said motor shaft for automatically controlling the change speed gearing.

3. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, change speed gearing interposed between the motor shaft and the driven shaft, and centrifugally-controlled means actuated in accordance with the direction of rotation of the said motor shaft for automatically controlling the change speed gearing.

4. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches for causing one or other of said pair of gear wheels to become operative, and means actuated in accordance with the direction of rotation of the said motor shaft for automatically controlling the aforesaid clutches.

5. In a planing or other reciprocating ma-

chine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches slidably carried by the aforesaid shafts so as to rotate therewith, means for throwing the aforesaid clutches into operative connection with one or other of the said pairs of intermeshing gear wheels, a device for transmitting motion to the aforesaid clutch actuating means, and a centrifugal governor driven from the motor shaft for operating the aforesaid device.

6. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches slidably carried by the aforesaid shafts so as to rotate therewith, lever mechanism for throwing the aforesaid clutches into operative connection with one or other of the said pair of intermeshing gear wheels, a friction clutch for operating the aforesaid lever mechanism, and a centrifugal governor driven from the motor shaft, for controlling the aforesaid friction clutch.

7. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a parallel shaft connected to the machine, two pairs of intermeshing gear wheels of different speed ratios loosely mounted upon the two shafts, a clutch slidably mounted on each shaft between the two gear wheels thereon, lever mechanism for throwing the clutches into operative connection with one or other of the said pairs of intermeshing gear wheels, a friction clutch for operating the aforesaid lever mechanism, and a centrifugal governor driven from the motor shaft for controlling the aforesaid friction clutch.

8. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches slidably carried by the aforesaid shafts so as to rotate therewith, shoes bearing upon the clutches, resilient means connecting the shoes, lever mechanism for actuating the aforesaid resilient means to throw the clutches into operative relation with one or other of the said pairs of intermeshing gear wheels, and means governed by the direction of rotation of the motor shaft for automatically controlling the aforesaid clutches.

9. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches slidably carried by the aforesaid shafts so as to rotate therewith, shoes bearing upon the clutches, resilient means connecting the shoes, lever mechanism for actuating the aforesaid resilient means to throw the clutches into operative relation with one or other of the said pairs of intermeshing gear wheels, a friction clutch for operating the lever mechanism and means governed by the direction of rotation of the motor shaft for automatically controlling the aforesaid friction clutch.

10. In a planing or other reciprocating machine, the combination with the shaft of a reversible electric motor, of a shaft connected to the machine and adapted to be driven by the motor shaft, two pairs of intermeshing gear wheels of different speed ratios interposed between the motor shaft and the driven shaft, clutches slidably carried by the aforesaid shaft so as to rotate therewith, shoes bearing upon the clutches, resilient means connecting the shoes, lever mechanism for actuating the aforesaid resilient means to throw the clutches into operative relation with one or other of the said pairs of intermeshing gear wheels, a friction clutch for operating the lever mechanism, and a centrifugal controller driven from the motor shaft for controlling the aforesaid friction clutch.

In testimony whereof I affix my signature in presence of two witnesses.

ALFRED DAVID WILLIAMSON.

Witnesses:
WALTER SWIFT JESSOP,
FRANK REDOL.