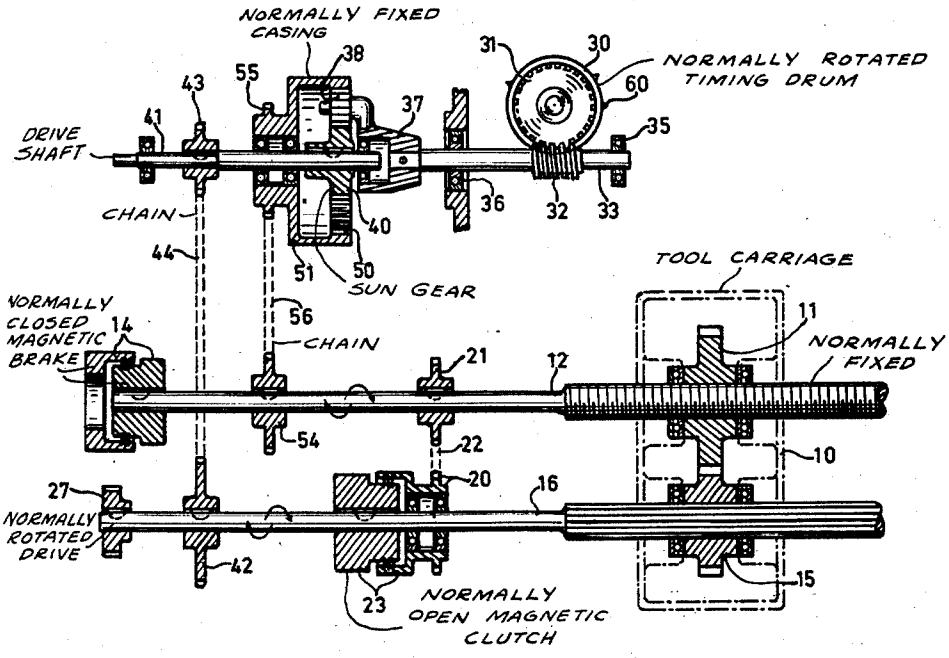
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DIFFERENTIAL TIMING DEVICE MECHANISM

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INVENTOR.
EDWIN R. SMITH
CONSTANTINE F. CAFOLLA
BY
Charles T. Hawley
ATT'Y

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DIFFERENTIAL TIMING DEVICE MECHANISM

Edwin R. Smith, Seneca Falls, and Constantine F. Cafolla, Waterloo, N.Y., assignors to Seneca Falls Machine Company, Seneca Falls, N.Y., a corporation of Massachusetts

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1 Claim. (Cl. 74—689)

This invention relates to means for coordinating the angular or rotational movement of a timing drum with the linear feed or displacement of a moving member, such as a tool carriage.

In the drawing, we have shown primary and secondary means for separately or jointly feeding a moving member, and we have shown a timing contact drum by which such feeding operations or other machine functions may be controlled.

It is the general object of this invention to provide improved mechanism by which the angular movement of the timing drum will be at all times coordinated with the linear movement of the tool carriage, when either singly or jointly operated and controlled.

To the attainment of these objects, we utilize a differential connection between the drum and the primary and the secondary means for feeding the moving member or tool carriage.

The single figure of the drawing is a diagrammatic plan view, partly in section, of the driving mechanism adapted to the stated purposes of this invention.

Referring to the accompanying drawing, a tool carriage **10** rotatably supports a gear nut **11** threaded on a lead screw **12**. The screw **12** is normally held stationary by a magnetic friction brake **14**. The gear nut **11** is revolved by a meshing gear **15**, also rotatably supported on the carriage **10**. The gear **15** is slidable on a rotated splined shaft **16**. Rotation of the gear **15** by the shaft **16** rotates the gear nut **11** on the stationary lead screw **12**, and causes the nut **11** to be moved axially of the lead screw and to move the tool carriage **10** along with it.

The shaft **16** may rotate the lead screw **12** through sprockets **20** and **21** and a chain **22**. The sprocket **20** is driven from the shaft **16** through a magnetic clutch **23**. When the clutch **23** is activated, the screw **12** will be rotated by the shaft **16**, and the gear nut **11** thus receives an additional axial movement, providing a differential increase in the rate of tool carriage travel. Suitable control means determines that when the clutch **23** is to be closed, the brake **14** will be automatically released.

The shaft **16** will be normally and continuously rotated by a gear **27** from any suitable source of power.

A control or timing drum **30** is to be turned angularly in either direction in predetermined relation to the rotation of the feed shaft **16** and lead screw **12**.

The drum **30** has a worm gear **31** continuously rotated by a worm **32** on a worm shaft **33**. The shaft **33** is mounted in bearings **35** and **36** and has an offset arm **37** on which a planet pinion **38** is freely rotatable.

A sun gear **40** is mounted on a drive shaft **41** which is rotatably mounted for timed rotation by the splined shaft **16** through sprockets **42** and **43** and a chain **44**.

The planet pinion **38** also meshes with internal gear teeth **50** on a differential casing **51**, which in turn is loosely mounted on the drive shatt **41**. The casing **51** is driven by sprockets **54** and **55** and a chain **56** from the lead screw **12**.

As has been previously explained, the normal linear movement of the tool carriage **10** is effected by turning the gear nut **11** on the normally fixed lead screw **12**. Such rotation of the gear nut **11** is also communicated to the sun gear **40** through the sprockets **42** and **43** and chain **44**.

The differential casing **51** is normally held from rotation by the brake **14**, and the sun gear **40** rotates the arm **37** and worm **32** to turn the worm gear **31** and timing drum **30** at a proportional but much reduced speed.

For faster carriage travel, the lead screw **12** is itself rotated by closing the magnetic clutch **23** and by simultaneously opening the magnetic clutch **14**, thus imparting an additional and bodily axial movement to the nut **11** and carriage **10**. Such rotation of the lead screw **12** also acts through the sprockets **54** and **55** and chain **56** to rotate the casing **51** and to thus superpose additional rotational speed on the drum **30** to correspond to the increased tool carriage travel.

The rotation of the drum **30** is thus at all times coordinated with the travel of the carriage **10**, and this proportional relation between linear travel and angular displacement is maintained unchanged by changes in either the speed or the direction of carriage travel.

Contact pins **60** in one or more series may be selectively mounted in the drum **30** and may activate any usual limit switches to effect desired changes in speed or direction of carriage travel, or other machine functions.

It is to be understood that the magnetic brake **14** will be released whenever the magnetic clutch **23** is activated, and vice-versa.

Any suitable provision may be made for selective control of the brakes and switches in accordance with tool carriage travel. One such arrangement is shown in the patent to Dinsmore and Smith #2,714,324 issued August 2, 1955.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claim, but what we claim is:

In a machine tool having a tool carriage, in combination, a normally-stationary and axially-fixed lead screw, a gear nut mounted on said carriage and having its nut portion threaded on said lead screw, normally-operated means to rotate said nut on said normally-fixed lead screw to shift said tool carriage bodily axially of said normally-fixed lead screw in said machine tool, a drum rotated in predetermined relation to the axial movement of said tool carriage, and driving means for said drum comprising a three-part differential gear means having an outer but internally-toothed driven gear, an inner but externally-toothed driving gear, and an interposed gear mounted on a bearing portion of a crank arm and connecting said gears, an operating connection from one part of said differential gear means to said lead screw, and an operating connection from a second part of said differential gear means to the means for rotating the gear nut, whereby rotation of the control drum is made responsive to any and all axial movements of said tool carriage.

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