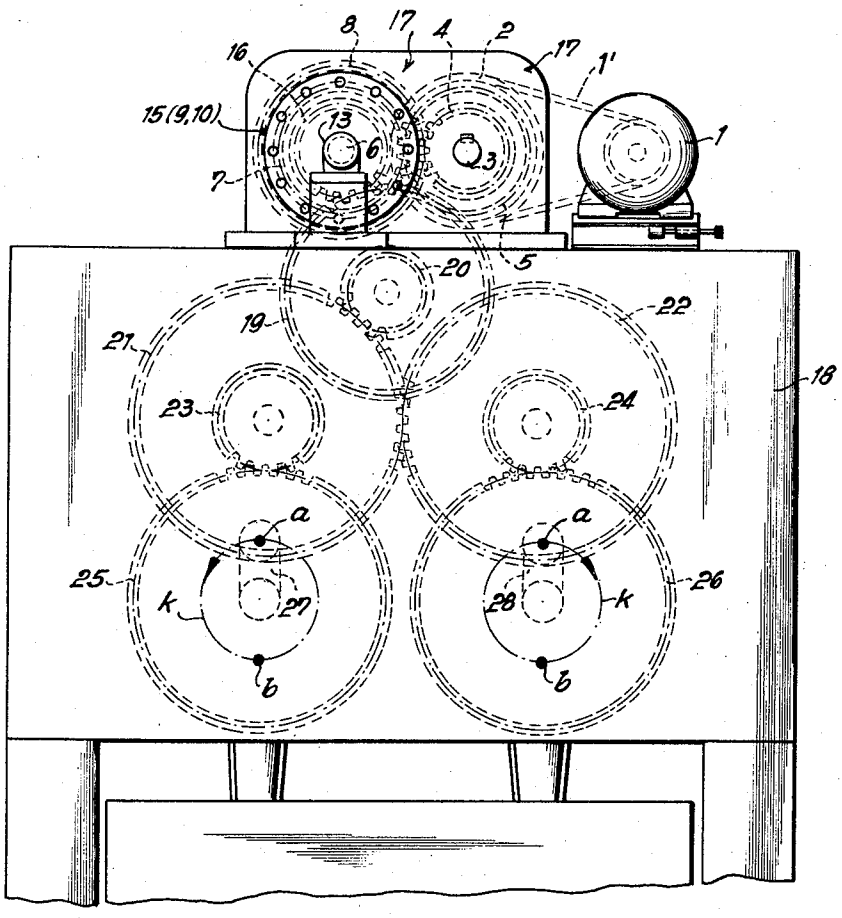
Nov. 10, 1959 F. MEYERCORDT 2,912,084

SPEED CHANGING TRANSMISSIONS FOR USE IN POWER PRESSES AND LIKE MACHINES

Filed Feb. 16, 1955 2 Sheets-Sheet 1

FIG. 1



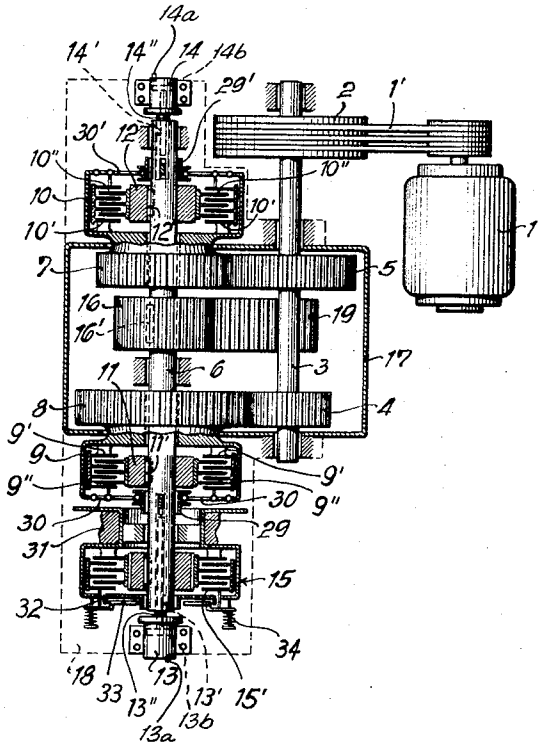
INVENTOR
FRITZ MEYERCORDT
BY Leon M. Strauss
AGT.

Nov. 10, 1959 F. MEYERCORDT 2,912,084

SPEED CHANGING TRANSMISSIONS FOR USE IN POWER PRESSES AND LIKE MACHINES

Filed Feb. 16, 1955 2 Sheets-Sheet 2

FIG. 2



INVENTOR
FRITZ MEYERCORDT
BY Leon M. Strauss
AGT.

United States Patent Office 2,912,084
Patented Nov. 10, 1959

2,912,084

SPEED CHANGING TRANSMISSIONS FOR USE IN POWER PRESSES AND LIKE MACHINES

Fritz Meyercordt, Goppingen, Germany, assignor to L. Schuler A.G., Goppingen, Wurttemberg, Germany

Application February 16, 1955, Serial No. 488,640

Claims priority, application Germany March 19, 1954

7 Claims. (Cl. 192—4)

This invention relates to power presses, and more particularly to speed changing mechanisms for use in presses and like power-operated machines.

It is an object of the present invention to provide means facilitating a compact mechanism of the aforesaid type, which requires a minimum of space and is economic and time-saving in operation by imparting to the operating element or elements of a press a relatively greater speed during the return strokes than during the forward or power strokes.

It is another object of the present invention to provide means affording greatly simplified and highly accurate mechanisms for regulating the speed of travel of a ram or like element of a power press during both the power and return strokes, whereby said ram is advanced to its working or operative position at a relatively slow rate and is returned to its starting or inoperative position at a relatively fast rate.

Still another object of the present invention is to provide means contributing to novel and improved mechanisms ensuring movement of a ram of a power press or like machine at a relatively greater speed during its return stroke than during its power stroke, which mechanisms may be used with power presses and like machines equipped with conventional constant-speed driving means without necessitating any changes in the operational speed of the driving means to effect changes in ram speed.

A further object of the present invention is to provide means conducive to extremely efficient speed varying mechanisms for power presses and like machines, which mechanisms are inexpensive to manufacture and may be constructed for use with and for ready adaptation to existing machines, presses, and like power-operated aggregates.

Still a further object of the present invention is to provide means presenting highly effective, clutch-operated, speed changing mechanisms and transmissions for use with power presses and like machines, to be directly mounted on the frame of the latter so as to constitute an easily accessible connection between the power drive on the one hand and the power transmission means for the operating elements on the other hand.

It is also an object of the present invention to provide means leading to self-contained and automatic speed changing transmissions for use with power presses and like machines, whereby operation of said transmissions may be easily controlled directly or indirectly by the operating elements of such presses or machines.

Generally it is known to move the ram or operating element of a power press or like machine during its return stroke at a greater speed than during its power stroke. For example, it is common practice to retract the ram of a metal drawing machine at double the speed with which it is advanced during the drawing operation. The greatest advantage of such a manner of operation is the time saving involved.

In some known constructions, these higher speeds of

return stroke movement of the ram are attained by means of a Ward-Leonard control, the r.p.m. of the drive motor of such control being reduced during the power stroke of the ram and increased during the return stroke. Such an arrangement, however, has the disadvantage that, by virtue of the speed changes occurring, no flywheel can be employed as the power means, so that the drive motor must be powerful enough to be able to sustain the entire load.

It is further known to attain variable ram speeds during an operating cycle of the load shaft by means of a linkage or lever system. Such constructions are, however, extremely complicated and correspondingly expensive to install and maintain in working condition.

One of the primary objects of the invention is, therefore, to overcome the aforesaid disadvantages inherent in the known drives for power presses or like machines and to provide means considerably improving function, operation and surveyance of such such presses while still employing electrical motor means and a flywheel as drive means.

In accordance with the invention, the advantage is obtained that, despite the variation of operating speeds during any one cycle of the press, ordinary electric constant-speed motors can be employed in conjunction with a flywheel to actuate the press. No matter how great the variation in operating speed, the rotational speeds of the drive motor and the flywheel remain constant throughout the entire operating cycle. The energy stored in the flywheel by virtue of the greater speed of the operating element during its return stroke is subsequently employed, after the speed is decreased, for aiding the operation of said element during its power stroke.

The invention will be more fully and comprehensively understood from a consideration of the following detailed description when read in connection with the accompanying drawings which form part of the application, with the understanding, however, that the improvement is capable of extended application and is not confined to the exact showing of the drawings nor to the precise construction described and, therefore, such changes and modifications may be made therein as do not affect the spirit of the invention nor exceed the scope thereof as expressed in the appended claims.

In the drawings:

Fig. 1 is a schematic front view in elevation of the upper portion of a power press or like machine incorporating a speed varying transmission or mechanism embodying the present invention; and

Fig. 2 is a schematic top plan view of the mechanism of Fig. 1, certain parts being shown in section.

Referring now more particularly to the drawings, an electric drive motor 1 is mounted on and suitably affixed to the top of upper portion 18 of a power press frame. A flywheel 2 is driven by motor 1 through V-belts 1', the flywheel being mounted on or otherwise connected to an input shaft 3 of the speed changing mechanism 17. Affixed to shaft 3 at spaced locations thereon are two gears 4 and 5.

An output shaft 6 is journaled in housing 17 of the speed changing transmission and extends parallel to input or counter-shaft 3. Gears 7 and 8, which, together with gears 4 and 5, constitute the means for transmitting the motion of shaft 3 to shaft 6, are loosely disposed on drive shaft 6 so as to be freely rotatable thereon, gear 7 meshing with gear 5, and gear 8 meshing with gear 4.

In the illustrated embodiment of the invention, gears 5 and 7 have the same diameter and number of teeth, while gear 8 has a considerably greater diameter than gear 4 and a correspondingly larger number of teeth. The dimensions of the respective gears are so chosen that

gear 8 is driven at approximately half the rotational speed at which gears 4, 5, and 7 are driven.

Disposed on shaft 6 on either side of housing 17 are two disc or plate clutches 9 and 10. Gear 8 is fixedly connected with the housing of clutch 9, and gear 7 is fixedly connected with the housing of clutch 10. In each of the two clutch housings there is provided a plurality of fixed clutch plates 9' and 10'. Attached to shaft 6, as by keys 11' and 12', and disposed within the housings of clutches 9 and 10, respectively, are plate supports 11 and 12 which carry groups of plates 9'' and 10'' corresponding to the plates carried by the housings and projecting in between the last-mentioned plates.

The clutches are actuated by axial displacement of sleeves 29 and 29' which slidably surround shaft 6 and act on levers 30 and 30', respectively, these levers being pivotally supported on housings 9 and 10. Displacement of sleeves 29 and 29' is effected by means of suitable, preferably pneumatic pressure devices, which include pneumatic cylinders 13 and 14 disposed adjacent the ends of shaft 6 and connected to sources of air under pressure through pipes or conduits 13*a* and 14*a*, respectively. Shaft 6 is provided with central bores 13' and 14' which extend therethrough to the housings of clutches 9 and 10, piston rods 13'' and 14'' being slidably arranged in said bores, respectively, and actuated by pistons 13*b* and 14*b* located within the cylinders. These piston rods are connected to sleeves 29 and 29' by means of projections or like elements extending through transverse slots in the wall of shaft 6.

A disc-type brake, generally designated as 15, is provided on drive shaft 6 adjacent one end thereof, the fixed portion of the brake being mounted on an external support 31. Connected to the brake housing, as by being threaded thereinto, is a pressure cylinder 32 in which a pressure piston 33 having a small displacement stroke is located. Piston 33 may be forced by means of compressed air against springs 34, which ordinarily supply the braking forces, so as to lift the top disc or plate 15' of the brake from the remaining discs, thereby releasing the brake. A braking action on the shaft results when the compresed air is removed so as to permit springs 34 to press the top disc of the brake back against the remaining discs.

Fixed to shaft 6 by suitable means, such as a key 16', is a drive or output gear 16. Gear 16 meshes with an intermediate gear 19 (see Fig. 1) disposed in press frame 18. Gear 19 is fixedly connected to a pinion 20 disposed coaxially therewith and which drives a gear 21 meshing in turn with a gear 22 of like diameter. Fixedly connected with gears 21 and 22 and disposed coaxially therewith, respectively, are two pinions 23 and 24. Pinion 23 drives a crank shaft 27 through an intermediate gear 25, and pinion 24 drives a second crank shaft 28 disposed parallel to crank shaft 27 through an intermediate gear 26.

In operation, if the press is in the condition represented by crank shaft position *a* (see Fig. 1), which position indicates the starting of the press, clutch plates 9'—9'' are caused to engage by means of fluid under pressure fed to pneumatic device 13—13'' while brake 15 is released simultaneously. Output shaft 6 is, therefore, driven by gears 4 and 8 at a relatively low rotational speed all through the power stroke of the operating element of the press.

When crank shafts 27 and 28 reach position *b* (see Fig. 1), which position indicates the end of the power stroke and the start of the return stroke, the pneumatic device 13—13'' is automatically deactuated and pneumatic device 14—14'' actuated in its place, so that clutch plates 9'—9'' are disengaged and clutch plates 10'—10'' are brought into engagement. Thereafter, output shaft 6 is driven through gears 5 and 7 at a relatively high rotational speed adapted for the return stroke of the ram or other operating element.

As soon as the crank shafts come back to position *a*, pressure or pneumatic device 14—14'' is deactuated and clutch plates 10'—10'' disengaged. If the machine runs continuously, then the aforementioned procedure is repeated. If it be desired, however, to carry out a single cycle operation, or to delay the start of a new power stroke upon completion of a preceding return stroke, then the brake 15 is actuated automatically to inhibit rotation of shaft 6 and gear 16 jointly with release of the clutches. Releasing of the clutches upon deactuation of the pressure devices is effected in a known manner by means of return springs (not shown) acting on the movable clutch plates or by means of a reversal of the pressure applied to the pistons accomplished, for example, by manipulation of suitable reversing valves (not shown) interposed in the lines between the cylinders and the source of pressure.

The entire system is preferably so constructed that the time intervals between actuation of the pressure devices, corresponding to the periods of time required for the crank shafts to move from position *a* to position *b* and vice versa, are adjustable. The principles of the present invention may further be so developed and modified as to render them adaptable to implementation in connection with any press or like machine, whether the latter is driven continuously or with any desired number of single, interrupted cycles of operation.

It will also be readily realized that a speed changing mechanism in accordance with the present invention may be applied to all types of power presses, such as crank presses, eccentric presses, cam controlled presses, and single or double working toggle drawing presses, as well as to other machines, such as cutting and stamping machines, abrading machines, and the like, the common denominator thereof being the performance of the power stroke of the operating element of the press or machine at a lesser speed than that of the return stroke.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. A speed changing mechanism for use in connection with an operating element of a power press and like machine equipped with a flywheel drive for said operating element; comprising input shaft means adapted to be driven unidirectionally by said flywheel drive, output shaft means drivingly connectable to said operating element, at least two motion transmission means operatively connected to said input shaft means and drivable by the latter at different, predetermined codirectional speeds, clutch means operatively connected to said motion transmission means and operable to selectively connect said motion transmission means to said output shaft means to thereby enable the latter to be driven at successive, predetermined codirectional speeds commensurate, respectively, with the respective speeds of said motion transmission means, whereby said operating element may be driven through said output shaft means at one predetermined speed during a first portion of its operating cycle and at another predetermined speed during a second portion of its operating cycle, brake means operatively disposed relative to said output shaft means and normally engaged with the latter to inhibit motion thereof upon deactuation of said clutch means, and releasing means operatively connected to said brake means for operating the latter to release said output shaft means upon actuation of said clutch means.

2. A mechanism according to claim 1, said brake means comprising a disc brake including plate-like braking elements and resilient means operatively connected to some of said braking elements to normally bias the latter into braking action with respect to said output shaft means, said releasing means comprising fluid-operated piston and cylinder means operatively connected to said resilient means and operable to counteract the braking

forces engendered by said resilient means upon said braking elements.

3. A speed changing transmission, comprising a housing, parallel input and output shafts journaled in said housing for unidirectional rotation, respectively, at least two input gears fixed at spaced locations on said input shaft for unidirectional and codirectional rotation therewith, at least two output gears loosely supported on and concentrically with said output shaft, each of said output gears meshing with a respective one of said input gears, said output gears having different diameters with regard to one another, whereby said output gears are driven with predetermined unidirectional and codirectional angular speeds different from one another, at least two clutches operatively connected, respectively, to said output gears and operable to selectively connect the latter to said output shaft to impart to the latter, respectively, said predetermined angular speeds, a brake having a first braking portion connected to said output shaft and rotatable therewith, a second braking portion fixed relative to said output shaft, and means operatively connected to one of said braking portions for selectively engaging and disengaging the same from the other braking portion.

4. The combination, in a power press and like machine tool having an operable element performing at least one cyclic operation, of unidirectionally driven input shaft means, output shaft means, a gearing interconnecting said input shaft means with said output shaft means, said gearing including respective pairs of meshing gears having a space therebetween and being of predetermined speed ratios to move said operable element at relatively slow speed during one part of said cyclic operation and at relatively greater speed during another part of said cyclic operation, clutch means disposed at either side of said gearing and on said output shaft means, respective operable means carried by said output shaft means for actuating and deactuating said clutch means, selectively, and output gear means operatively connected to said operable element and carried by said output shaft means in said space between said pairs of respective meshing gears.

5. The combination according to claim 4, including

brake means for said output shaft means and mounted on the latter adjacent one of said clutch means to stop said operable means during said cyclic operation.

6. The combination, in a power press and like machine tool having an operable element performing at least one cyclic operation, of unidirectionally driven input shaft means, output shaft means, a gearing interconnecting said input shaft means with said output shaft means, said gearing including respective meshing gears of predetermined speed ratios to move said operable element at relatively slow speed during one part of said cyclic operation and at relatively greater speed during another part of said cyclic operation, clutch means disposed at either side of said gearing and on said output shaft means, respective operable means carried by said output shaft means for actuating and deactuating said clutch means, selectively, output gear means operatively connected to said operable element, and brake means on said output shaft means to operate the latter during said cyclic operation for stopping said operable element.

7. The combination, in a power press having an operable element performing at least one cyclic operation, of a pair of rotatable shafts, a gearing interconnecting said pair of shafts, said gearing including respective pairs of meshing gears having a space therebetween and being of predetermined speed ratios to move said operable element at relatively slow speed during one part of said cyclic operation and at relatively greater speed during another part of said cyclic operation, clutch means disposed on one of said pair of shafts, respective operable means carried by said one of said shafts for actuating and deactuating said clutch means, selectively, and output gear means operatively connected to said operable element and carried by said one shaft in said space between said pairs of respective meshing gears.

References Cited in the file of this patent

UNITED STATES PATENTS

2,304,032	Schmitter	Dec. 1, 1942
2,465,942	Von Sundt	Mar. 29, 1949
2,557,896	Soule et al.	June 19, 1951