April 17, 1962 P. VON ALLMEN 3,029,991

AUTOMATIC WORK-FEEDING DEVICE FOR MACHINE TOOLS

Filed June 15, 1959 2 Sheets-Sheet 1

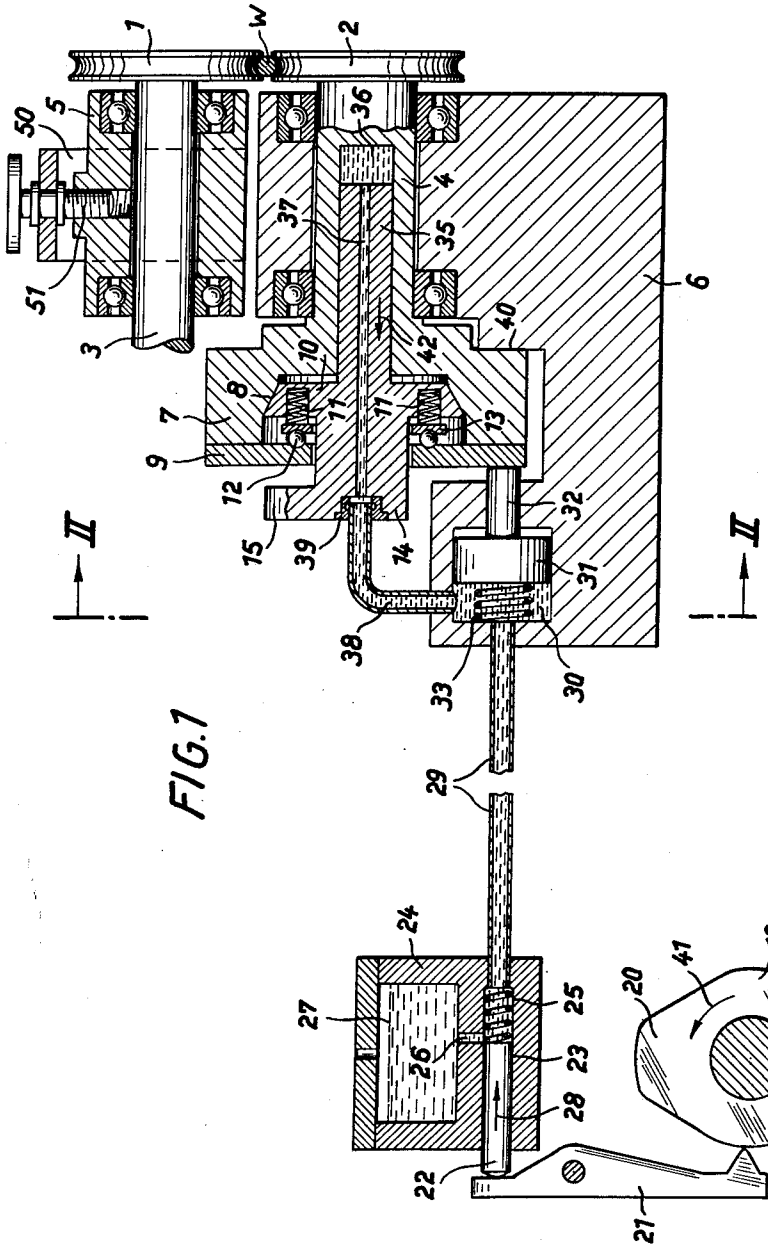


FIG. 1

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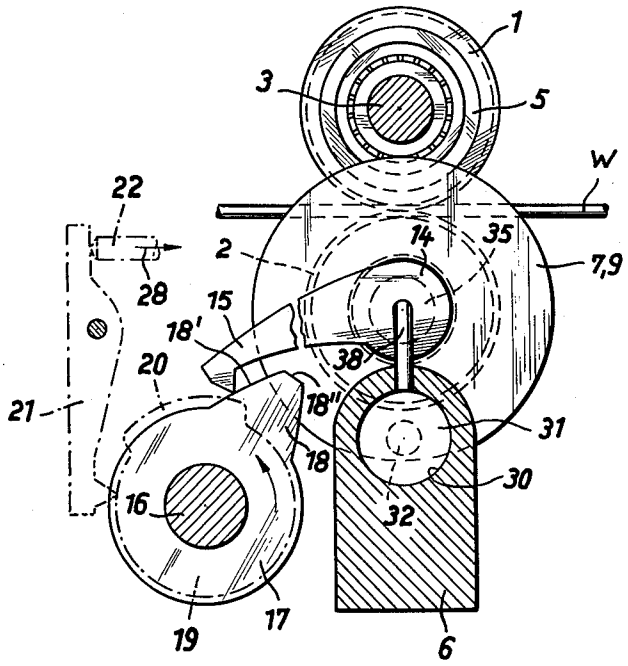
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AUTOMATIC WORK-FEEDING DEVICE FOR MACHINE TOOLS

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FIG. 2



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3,029,991
AUTOMATIC WORK-FEEDING DEVICE FOR MACHINE TOOLS

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5 Claims. (Cl. 226—156)

The present invention relates to machine tools.

More particularly, the present invention relates to work-feeding devices for machine tools.

In certain types of automatic machine tools, such as automatic screw machines, for example, the work is automatically fed at given intervals through given increments. In one type of structure which is designed for this purpose the work is in the form of an elongated bar frictionally held by a pair of feeding rolls one of which is turned at the given intervals through a given angle so as to advance the work through a predetermined amount. In order to accomplish this result it is conventional to provide a frictional transmission of a turning means to one of the work-feeding rolls so as to turn the latter through a given angle, and it is also conventional to include a brake structure for holding at least one of the feed rolls stationary so as to attempt to guarantee that the work is very precisely fed by the desired amount at each actuation of the feeding structure. This type of construction involves close cooperation between the brake means and the means which turns the work-feeding roll in such a way that the work-feeding roll can only be turned by the desired amount. However, in conventional structures of this type certain problems arise which prevent this conventional structure from reliably producing the desired results. These problems arise because of the fact that the brake structure and roll turning structure are in the form of frictional surfaces which are placed alternately in engagement so as to have frictional contact of the brake when the work-feeding structure is out of frictional contact with the work-feeding roll and vice versa, and in this structure it has been discovered that it is impossible to maintain the frictional contact of both the brake and the work-feeding devices uniform at all times so that inaccuracies in the feeding of the work inevitably result. For example, it has been found that if the amount of lubricant at the surfaces which frictionally engage each other varies from the braking device to the work-feeding device inaccuracies will result. This arises from the fact that in order to attempt to guarantee precise feeding of the work at each actuation of the work-feeding structure the braking structure is designed to already engage the work-feeding roll with a a considerable force before the work-feeding structure itself is entirely disengaged so as to attempt to prevent any uncontrolled turning of the work-feeding roll during disengagement of the work-feeding structure which acts on the work-feeding roll, and because of this overlap in the operation of the brake and work-feeding devices slippage inevitably occurs to prevent accuracy.

It is, therefore, a primary object of the present invention to provide a work-feeding device of the above type which will very reliably guarantee extremely precise feeding of the work at each actuation of the work-feeding structure.

Another object of the present invention is to provide a work-feeding structure of the above type which will operate in such a way that it is completely immaterial how any frictional engaging surfaces are lubricated.

It is a further object of the present invention to provide a structure of the above type which is very rugged and which will not have any components which are subject to shocks which will provide undesirable play in the parts. For example, in conventional devices of the above type certain cams are unavoidably constructed so as to have axial camming projections which during their camming produce axial thrusts on the cam shaft resulting inevitably in undesirable axial play of the cam shaft, and it is an object of the present invention to provide a structure which will avoid this drawback.

With the above objects in view the present invention includes in a work-feeding device of the machine tool a pair of work-feeding rolls adapted to cooperate with the work so as to feed the latter whenever one of these rolls is turned through a given angle. A turning means cooperates with this one roll to turn the latter through this angle, this turning means turning from a given starting position to a given end position in order to turn this feeding roll. A spring means is provided to hold the turning means in frictional engagement with the feeding roll so as to transmit turning movement to the latter, and a brake means cooperates with the feeding roll to prevent turning of the latter except during operation of the turning means. In accordance with the present invention a hydraulic means cooperates both with the brake means and with the turning means to increase the pressure with which the brake means bears against the feeding roll so as to reliably prevent turning of the latter while at the same time cooperating with the turning means to move the latter in opposition to the spring means out of engagement with the roll so that the turning means can return to its starting position while the feed roll is maintained stationary by the brake means which is now at an elevated braking pressure. This hydraulic means of the invention will provide a reliable braking force guaranteeing any undesired turning of the feeding roll even before the turning means is placed out of engagement with the feeding roll.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a partly schematic sectional elevation of a structure according to the present invention, the structure shown at the left of FIG. 1 being turned through 90° out of the plane in which it is actually located for the sake of clarity; and

FIG. 2 is a transverse sectional view taken along line II—II of FIG. 1 in the direction of the arrows.

Referring now to the drawings, it will be seen that the work W in the form of an elongated bar is held between a pair of annularly grooved feeding rolls 1 and 2. The roll 1 is carried by a rotary shaft 3 supported for free turning movement by a bearing 5, and the bearing 5 is adjustable in a known way in elevation so as to be able to provide the desired pressure of the rolls 1 and 2 on the work W so as to guarantee no slippage of the work with respect to the feeding rolls. For this purpose, the bearing 5 of rotary shaft 3 is slidable in a guidance 50 by a threaded spindle 51. The structure of the invention operates on the lower feeding roll 2 to turn the latter through a given angle at each feeding stroke so as to feed the work by precise increments.

The lower roll 2 is fixedly carried by an elongated hollow outer shaft 4 which is supported for rotation by a stationary bearing structure 6. This outer hollow shaft 4 is provided in its interior with an elongated cylindrical inner surface providing the pressure chamber 36 as well as with a portion of enlarged diameter 7 having a hollow interior provided with a frustoconical surface 8.

A turning means cooperates with the shaft 4 to turn the latter, and this turning means includes the elongated inner shaft 35 which is slidable within this cylindrical interior of the outer shaft 4 so as to act as a piston, the chamber 36 being located within the hollow shaft 4 to the right of the elongated shaft 35, as is evident from FIG. 1. It will be noted that the inner frustoconical surface 8 of the hollow shaft 4 is spaced axially from the inner cylindrical surface thereof and is of a larger diameter than this cylindrical surface, and the shaft 35 of the turning means is provided with a flange 10 having a frusto conical peripheral surface which cooperates with the surface 8 so as to provide frictional engagement between the inner shaft 35 and the outer shaft 4 to transmit turning of the inner shaft 35 to the outer shaft 4.

The hollow interior of the outer shaft 4 is closed by an end wall 9 which is fixed to the enlarged portion 7 of the shaft 4, and the inner shaft 35 has an elongated portion 14 extending to the exterior of the outer shaft through an opening in the end wall 9. A thrust bearing 12, 13 cooperates with the inner, right surface of the end wall 9, as viewed in FIG. 1, and the race 13 of this thrust bearing bears against the left ends of a plurality of coil springs 11 located in the bores of the flange 10, as illustrated in FIG. 1, the right ends of these springs 11 pressing against the inner ends of these bores, respectively, so that the springs 11 form a spring means urging the inner shaft 35 into frictional contact with the outer shaft 4 to maintain these shafts in driving engagement with each other.

The outer end of the shaft portion 14 is fixedly connected with the elongated lever 15 (FIG. 2) which cooperates with the camming portion 18 of a cam 17 which is fixed to a cam shaft 16 for rotation therewith. This cam shaft 16 is conventional in machines of this type and is turned at a predetermined speed so as to operate the machine to cause all of the several operations to take place in a predetermined sequence, as is well known. Of course, the lever 15 is considenably longer than illustrated in FIG. 2 and the cam 17 is actually at a greater distance to the left of the bearing 6 than illustrated in FIG. 2 so that during turning of the cam 17 in the direction of the arrow 41 the projection 18 will clear the bearing structure 6 and will cooperate properly with the lever 15. The sloping surface 18' of cam 18 leads to a short cam portion 18'' which is concentric to the axis of shaft 16.

It will be noted from FIG. 1 that the elongated inner shaft 35 is formed with an axial bore 37, and a conduit 38 communicates with this axial bore 37 through a fluid-tight fitting 39 which provides free turning of the shaft 35 with respect to the conduit 38 while at the same time maintaining the fluid connection tight.

This conduit 38 communicates with the interior of a brake cylinder 30 formed in the bearing structure 6, and this brake cylinder 30 accommodates a brake piston 31 which has a piston rod 32 extending slidably through a wall of the bearing structure 6 into engagement with the wall 9 to act through the latter on the shaft 4 and the feeding roll 2 to maintain the latter stationary except when acted upon by the turning means. A relatively light spring 33 cooperates with the piston 31 to maintain the piston rod 32 at all times in at least light engagement with the wall 9, and the parts 30—33 form a brake means to cooperate with the feed roll structure in a manner described below.

A conduit 29 also communicates with the interior of the brake cylinder 30, and this conduit 29 also communicates with a pressure cylinder 23 of a structure separate from the above-described structure. This pressure cylinder 23 communicates through a passage 26 with a reservoir 24 containing a hydraulic fluid 27 at atmospheric pressure so that when the passage 26 is open the hydraulic fluid from the reservoir 27 will communicate through the passage 26 with the cylinder 23 and from the latter to the conduit 29 with the brake cylinder 30 and also from the latter through the conduit 38 and axial bore 37 with the pressure chamber 36 in the interior of the hollow shaft 4.

A piston 22 is axially slidable in the pressure cylinder 23 from the rest position illustrated in FIG. 1 to the right in the direction of the arrow 28 to an operating position where this piston 22 decreases the volume of the pressure cylinder 23 to increase the pressure of the fluid in the cylinder 30 and chamber 36. A spring 25 within the cylinder 23 urges the piston 22 to the illustrated rest position thereof, and this spring 25 serves to maintain the left free end of the piston 22, as viewed in FIG. 1, in engagement with a lever 21 which is supported for turning movement by a stationary pivot pin and which cooperates with the cam 19 which is illustrated in FIG. 1. This cam 19 is also fixedly carried by the cam shaft 16 and has with respect to the cam 17 the angular position which is evident from FIG. 2 where the cam 19, lever 21 and piston 22 are shown in dot-dash lines. This cam 19 has a radial camming projection 20 which cooperates with the lever 20 to turn the latter, the cam 19 also turning in the direction of the arrow 41 during rotation of the cam shaft 16. This radial projection 20 of the cam 19 is of considerable advantage since it eliminates the hitherto necessary axial camming portions which through cooperation with a lever provided axial stresses on the shaft 16 resulting eventually in undesirable axial play of the shaft 16.

The above-described structure of the invention operates as follows:

When the parts are in the position indicated in FIG. 2, the cams are turning in the direction of the arrow 41 and the camming projection 18 cooperates with the lever 15 to turn the latter together with the inner shaft 35 in a clockwise direction, as viewed in FIG. 2. Since the spring means 11 at this time maintains the flange 10 in frictional engagement with the outer shaft 4, the latter is turned together with the roll 2 so as to advance the work W through the desired increment to the right, as viewed in FIG. 2. As soon as the concentric cam portion 18'' of the camming projection 18 engages the lever 15 the advancing of the work stops. It should be noted that during turning of the lever 15 by the camming projection 18 the shaft 4 is turned while the end wall 9 slides with respect to the piston rod 32 which is pressed against the end wall 9 at this time through the relatively light force of the spring 33. The spring means 11 is far stronger than the spring means 33 and guarantees that the brake means 30—32 does not in any way prevent the desired feeding. When the concentric cam portion 18'' of the camming projection 18 acts on the cam follower tip of the lever 15, the latter will simply remain in the position to which it has been turned by the cam 18 due to the action of the brake means 30—32 under the influence of the spring 33.

Shortly after the lever 15 has reached its end position on the upper concentric portion of cam 18 so that the feeding of the work has terminated, the cam 20 comes into engagement with the lever 21, as is evident from FIG. 2. When this happens the piston 22 moves to the right in the direction of the arrow 28 of FIG. 1, and at this time the passage 26 will be closed and the piston 22 will greatly increase the pressure of the fluid of the hydraulic means. Because of the size of the cylinder 30 and chamber 36 as well as the force of the springs 11, the pressure of the hydraulic fluid in the cylinder 30 will become quite substantial before the pressure of the fluid in the chamber 36 is great enough to move the shaft 35 to the left, as viewed in FIG. 1 in opposition to the spring means 11, and therefore the braking force with which the piston rod 32 engages the plate 9 will be relatively large before the inner shaft 35 is placed out of frictional contact at its flange 10 with the outer shaft 4. As soon as the shaft 35 has been shifted in this manner slightly to the left, as viewed in FIG. 1, so that the

frustoconical surfaces no longer engage each other, the feeding lever 15 may fall down in a counterclockwise direction towards the smallest radius of the cam disc 17, the concentric portion 18'' of cam 18 having passed below lever 15. However, the lever 15 can not yet fall down as the lever 15 is still supported by the concentric cam portion 18''. As the cam portion 18'' is concentric relative to the axis of shaft 16, the lever 15 will remain in the position thus reached.

As soon as on further turning shaft 16 the concentric cam portion 16'' has passed below lever 15, the lever will, on account of its own weight or under the influence of a return spring not shown, fall down towards the smallest radius of cam disc 17. At this moment, the shaft 4 is locked by piston rod 32, since cam 20 of cam disc 19 still acts on lever 21.

The continued turning of the shaft 16 will of course move the camming projection 20 of the cam 19 beyond the lever 21 so that the spring 25 will expand to return the piston 22 to its rest position where the passage 26 again communicates with the cylinder 23 so as to allow the fluid in the conduit and chambers 30 and 36 to return to atmospheric pressure, and of course the springs 11 automatically return the inner shaft 35 to the illustrated position where its flange 10 is again in frictional driving engagement with the outer shaft 4, so that when the cam 18 again turns almost to the position shown in FIG. 2 it will again cooperate with the lever 15 to again advance the work through the desired increment.

It will be noted that with the structure described above the particular condition of the frustoconical surfaces at the flange 10 and the interior of the enlarged portion 7 of the shaft 4 will be immaterial, and the force of the springs 11 can be made as large as desired so as to guarantee that there will be absolutely no slip irrespective of the conditions of these surfaces, and at the same time the hydraulic structure of the invention while simple and compact will provide the desired disengagement between the flange 10 and the shaft 4 to permit the turning means to return to its starting position while guaranteeing that the feed roll 2 does not turn so that very precise feeding increments of the work can be obtained with the structure.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of machine tools differing from the types described above.

While the invention has been illustrated and described as embodied in work-feeding devices for machine tools, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features, that from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. For use with a work-feeding device or the like having a pair of work-feeding rolls adapted to engage the work for feeding the latter during turning of one of said rolls, in combination, an elongated hollow outer rotary shaft carrying said one roll so that the latter turns during turning of said outer shaft, said hollow outer shaft having in its interior an elongated cylindrical surface and spaced axially from said cylindrical surface a frustoconical inner surface of a larger diameter than and concentric with said cylindrical surface; an inner shaft axially slidable within said outer shaft and having an elongated piston portion slidably engaging said cylindrical inner surface of said outer shaft, said inner shaft having a flange provided with a frustoconical peripheral surface mating with said frustoconical inner surface of said outer shaft so that when said frustoconical periphery of said flange of said inner shaft presses against said frustoconical surface of said outer shaft turning of said inner shaft will be transmitted to said outer shaft; spring means cooperating with said inner shaft for pressing the frustoconical periphery of said flange thereof against the frustoconical inner surface of said outer shaft; turning means cooperating with said inner shaft for turning the latter from a given starting position to a given end position to turn said outer shaft and one roll therewith through a given angle so as to advance the work by a given increment; a brake cylinder and a brake piston slidable therein, said brake piston having a piston rod engaging said outer shaft for braking the turning thereof; and common hydraulic means cooperating with and interconnecting said brake cylinder and the space within the outer shaft located beyond an end of said inner shaft for applying fluid under pressure in said brake cylinder and in the cylindrical interior of said outer shaft to increase the pressure of said piston rod on said outer shaft while simultaneously shifting said inner shaft in opposition to said spring means to a position where said flange of said inner shaft does not engage said outer shaft to release said inner shaft for return movement from said end position to said starting position thereof while the elevated pressure of said piston rod on said outer shaft prevents turning of the latter.

2. For use with a work-feeding device or the like having a pair of work-feeding rolls adapted to engage the work for feeding the latter during turning of one of said rolls, in combination, an elongated hollow outer rotary shaft carrying said one roll so that the latter turns during turning of said outer shaft, said hollow outer shaft having in its interior an elongated cylindrical surface and spaced axially from said cylindrical surface a frustoconical inner surface of a larger diameter than and concentric with said cylindrical surface; an inner shaft axially slidable within said outer shaft and having an elongated piston portion slidably engaging said cylindrical inner surface of said outer shaft, said inner shaft having a flange provided with a frustoconical peripheral surface mating with said frustoconical inner surface of said outer shaft so that when said frustoconical periphery of said flange of said inner shaft presses against said frustoconical surface of said outer shaft turning of said inner shaft will be transmitted to said outer shaft; spring means cooperating with said inner shaft for pressing the frustoconical periphery of said flange thereof against the frustoconical inner surface of said outer shaft; turning means cooperating with said inner shaft for turning the latter from a given starting position to a given end position to turn said outer shaft and one roll therewith through a given angle so as to advance the work by a given increment; a brake cylinder and a brake piston slidable therein, said brake piston having a piston rod engaging said outer shaft for braking the turning thereof; and common hydraulic means cooperating wtih and interconnecting said brake cylinder and the space within the outer shaft located beyond an end of said inner shaft for applying fluid under pressure in said brake cylinder and in the cylindrical interior of said outer shaft to increase the pressure of said piston rod on said outer shaft while simultaneously shifting said inner shaft in opposition to said spring means to a position where said flange of said inner shaft does not engage said outer shaft to release said inner shaft for return movement from said end position to said starting position thereof while the elevated pressure of said piston rod on said outer shaft prevents turning of the latter, said hydraulic means including a reservoir for a hydraulic fluid, a pressure cylinder communicating with said reservoir to receive the fluid therefrom, said pressure

cylinder communicating also with said brake cylinder and said space within the cylindrical interior of said outer shaft, a piston slidable in said pressure cylinder from a rest position where said pressure cylinder communicates with said reservoir and is at low pressure to an operating position cutting off communication between said pressure cylinder and reservoir and increasing the pressure of the hydraulic fluid in said brake cylinder and in the cylindrical interior of said outer shaft, and means cooperating with said piston in said pressure cylinder for reciprocating said piston.

3. For use with a work-feeding device or the like having a pair of work-feeding rolls adapted to engage the work for feeding the latter during turning of one of said rolls, in combination, an elongated hollow outer rotary shaft carrying said one roll so that the latter turns during turning of said outer shaft, said hollow outer shaft having in its interior an elongated cylindrical surface and spaced axially from said cylindrical surface frustoconical inner surface of a larger diameter than and concentric with said cylindrical surface; an inner shaft axially slidable within said outer shaft and having an elongated piston portion slidably engaging said cylindrical inner surface of said outer shaft, said inner shaft having a flange provided with a frustoconical peripheral surface mating with said frustoconical inner surface of said outer shaft so that when said frustoconical periphery of said flange of said inner shaft presses against said frustoconical surface of said outer shaft turning of said inner shaft will be transmitted to said outer shaft; spring means cooperating with said inner shaft for pressing the frustoconical periphery of said flange thereof against the frustoconical inner surface of said outer shaft; turning means cooperating with said inner shaft for turning the latter from a given starting position to a given end position to turn said outer shaft and one roll therewith through a given angle so as to advance the work by a given increment; a brake cylinder and a brake piston slidable therein, said brake piston having a piston rod engaging said outer shaft for braking the turning thereof; and common hydraulic means cooperating with and interconnecting said brake cylinder and the space within the outer shaft located beyond an end of said inner shaft for applying fluid under pressure in said brake cylinder and in the cylindrical interior of said outer shaft to increase the pressure of said piston rod on said outer shaft while simultaneously shifting said inner shaft in opposition to said spring means to a position where said flange of said inner shaft does not engage said outer shaft to release said inner shaft for return movement from said end position to said starting position thereof while the elevated pressure of said piston rod on said outer shaft prevents turning of the latter, said hydraulic means including a reservoir for a hydraulic fluid, a pressure cylinder communicating with said reservoir to receive the fluid therefrom, said pressure cylinder communicating also with said brake cylinder and said space within the cylindrical interior of said outer shaft, a piston slidable in said pressure cylinder from a rest position where said pressure cylinder communicates with said reservoir and is at low pressure to an operating position cutting off communication between said pressure cylinder and reservoir and increasing the pressure of the hydraulic fluid in said brake cylinder and in the cylindrical interior of said outer shaft, a lever cooperating with said piston of said pressure cylinder for advancing the piston along its pressure stroke, a spring in said pressure cylinder cooperating with said piston therein for returning said piston of said pressure cylinder to said rest position thereof, and a rotary cam having a radially projecting camming portion cooperating with said lever for turning the latter.

4. For use with a work-feeding device or the like having a pair of work-feeding rolls adapted to engage the work and advance the latter when one of said rolls is turned, in combination, an elongated hollow outer rotary shaft coaxial with and carrying said one roll for turning the latter when said outer shaft turns, said outer shaft being formed in its interior with an elongated cylindrical surface and spaced axially from said cylindrical surface with an annular frustoconical surface coaxial with said cylindrical surface; an elongated inner shaft having an elongated cylindrical piston portion axially slidable in said cylinder of said outer shaft and having a free end spaced from an end of said cylinder in said outer shaft to provide a pressure chamber in said cylinder of said outer shaft, said inner shaft being axially bored and having a flange provided with a frustoconical periphery cooperating with said inner frustoconical surface of said outer shaft to place said inner shaft in driving engagement with said outer shaft when said flange is pressed against said frustoconical inner surface of said outer shaft; spring means cooperating with said inner shaft for pressing said flange thereof against said frustoconical inner surface of said outer shaft; turning means cooperating with said inner shaft for turning the latter from a starting position to an end position so as to also turn said outer shaft and one roll therewith, said turning means returning with said inner shaft to its starting position when said flange is out of engagement with said outer shaft; a brake cylinder; conduit means providing communication between said brake cylinder and said axial bore of said inner shaft; a brake piston slidable in said brake cylinder and having an elongated piston rod engaging said outer shaft to frictionally hold the latter against turning; a reservoir for a hydraulic fluid; a pressure cylinder communicating with said reservoir to receive hydraulic fluid therefrom; conduit means placing said pressure cylinder in communication with said brake cylinder; a pressure piston slidable in said pressure cylinder from a rest position where said pressure cylinder communicates with said reservoir to an operating position where said pressure piston cuts off communication between said pressure cylinder and said reservoir and increases the pressure of the hydraulic fluid in said brake cylinder and in the pressure chamber of said cylinder in the interior of said outer shaft for increasing the braking force of said piston rod on said outer shaft and for then moving inner shaft in opposition to said spring means to a position where said flange does not engage said outer shaft to free said turning means for return movement to its starting position; and means cooperating with said pressure piston for reciprocating the latter.

5. For use with a work-feeding device or the like having a pair of work-feeding rolls adapted to engage the work and advance the latter when one of said rolls is turned, in combination, an elongated hollow outer rotary shaft coaxial with and carrying said one roll for turning the latter when said outer shaft turns, said outer shaft being formed in its interior with an elongated cylindrical surface and spaced axially from said cylindrical surface with an annular frustoconical surface coaxial with said cylindrical surface; an elongated inner shaft having an elongated cylindrical piston portion axially slidable in said cylinder of said outer shaft and having a free end spaced from an end of said cylinder in said outer shaft to provide a pressure chamber in said cylinder of said outer shaft, said inner shaft being axially bored and having a flange provided with a frustoconical periphery cooperating with said inner frustoconical surface of said outer shaft to place said inner shaft in driving engagement with said outer shaft when said flange is pressed against said frustoconical inner surface of said outer shaft; spring means cooperating with said inner shaft for pressing said flange thereof against said frustoconical inner surface of said outer shaft; turning means cooperating with said inner shaft for turning the latter from a starting position to an end position so as to also turn said outer shaft and one roll therewith, said turning means returning with said inner shaft to its starting position

when said flange is out of engagement with said outer shaft; a brake cylinder; conduit means providing communication between said brake cylinder and said axial bore of said inner shaft; a brake piston slidable in said brake cylinder and having an elongated piston rod engaging said outer shaft to frictionally hold the latter against turning; a reservoir for a hydraulic fluid; a pressure cylinder communicating with said reservoir to receive hydraulic fluid therefrom; conduit means placing said pressure cylinder in communication with said brake cylinder; a pressure piston slidable in said pressure cylinder from a rest position where said pressure cylinder communicates with said reservoir to an operating position where said pressure piston cuts off communication between said pressure cylinder and said reservoir and increases the pressure of the hydraulic fluid in said brake cylinder and in the pressure chamber of said cylinder in the interior of said outer shaft for increasing the braking force of said piston rod on said outer shaft and for then moving said inner shaft in opposition to said spring means to a position where said flange does not engage said outer shaft to free said turning means for return movement to its starting position; means cooperating with said pressure piston for reciprocating the latter; and the light spring means cooperating with said brake piston for maintaining said piston rod at all times in at least light frictional engagement with said outer shaft.

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