

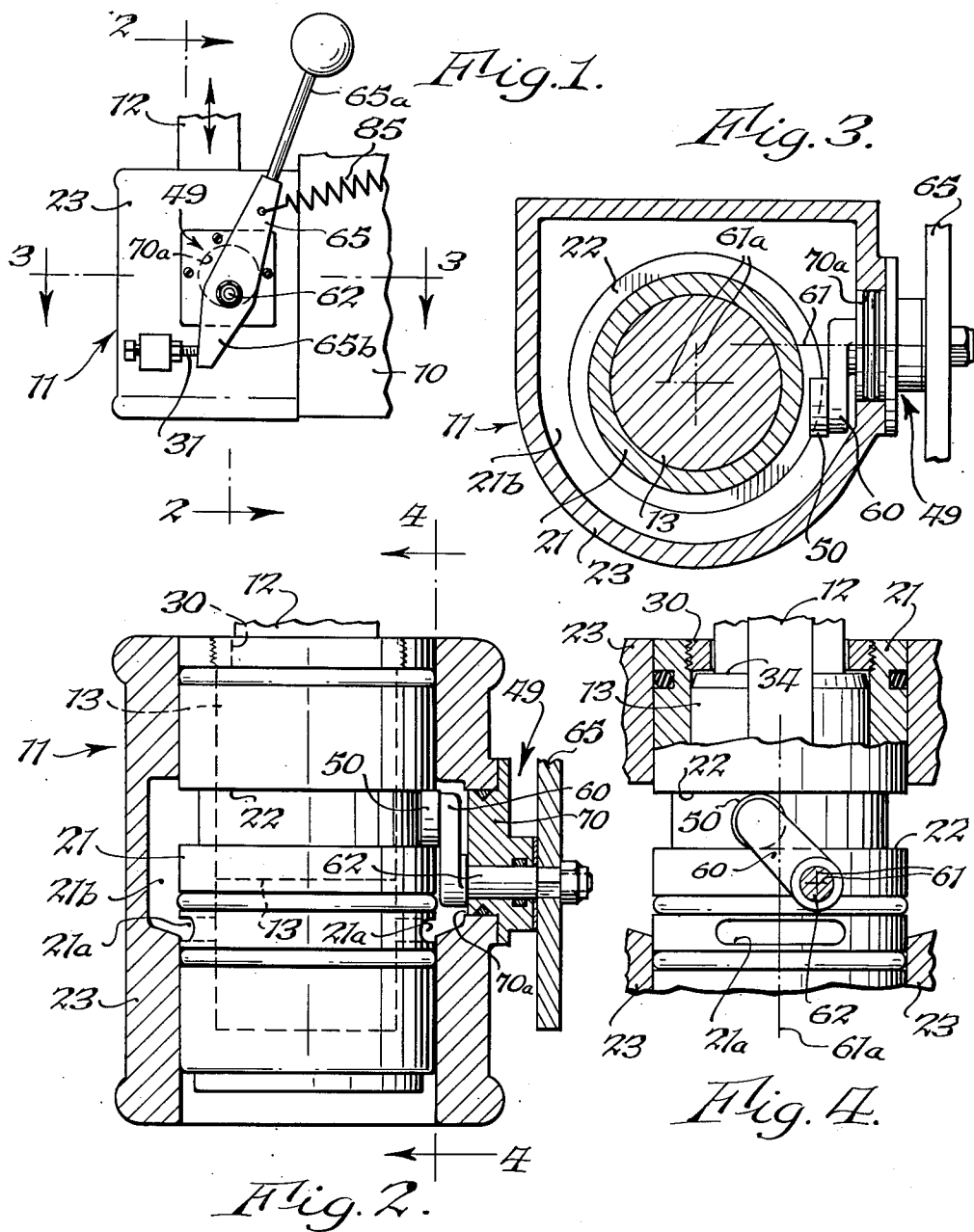
Feb. 19, 1952

E. F. PAXHIA

2,586,478

ACTUATING ELEMENT FOR RECIPROCABLE MACHINE ELEMENTS

Filed Jan. 13, 1950



INVENTOR.
Emanuel F. Paxhia
BY
Edwin B. Gary
Attorney.

UNITED STATES PATENT OFFICE

2,586,478

ACTUATING ELEMENT FOR RECIPROCABLE
MACHINE ELEMENTSEmanuel F. Paxhia, Tonawanda, N. Y., assignor
to Wales-Strippit Corporation, North Tona-
wanda, N. Y.

Application January 13, 1950, Serial No. 138,413

7 Claims. (Cl. 74—1)

1

This invention relates to mechanisms of the kind which involve the translation of a rotary movement into a rectilinear movement.

In various type of machines the movement of a pivotally mounted, or rotating, element is frequently utilized to impart a rectilinear movement to a driven element. Usually the pivotally mounted, or rotating, element has consisted of a pinion which is connected to the source of power while the driven element has consisted of a rack. Such gearing, however, has a number of objections. For example, it has a constant mechanical advantage, whereas many machines would operate more satisfactorily if the motion translating mechanism employed had a variable mechanical advantage which would compensate for the variable load conditions characteristic of the mode of operation of the particular machines. Gearing of the rack and pinion type also has the objection that it is costly and must be made specially for each particular machine on which it is to be used. Moreover, there is some play between the mating teeth of the gears and this necessitates the provision of a certain amount of override to insure that the driven element will be moved the required distance. Such play, in turn, is objectionable, particularly in the precision manufacture of machine elements when the travel of the elements must be accurately controlled.

The problem of translating a rotary movement into a rectilinear movement is one which is presented, for example, in connection with controlling the ram disclosed in copending applications Serial No. 73,271 and Serial No. 752,433, now Patent No. 2,528,198, issued October 31, 1950, assigned to our interests.

In the devices shown in the applications referred to, secondary problems are also presented. For example, when the element which drives the ram is idling between working strokes of the ram, or other driven element, those surfaces of the driving element and ram which are engaged when the ram is being retracted contact one another and produce a tapping sound which may be objectionable.

Also in application Serial No. 752,433 the weight of the ram is utilized to effect the desired initial movement to insure the abutting relationship between the driving element and the ram while in application Serial No. 73,271 the weight of the ram is utilized to seal off the ports through which the power transmitting fluid is permitted to flow under certain conditions. In order to insure proper operation of the

2

rams in the environments and in the manner described, it is the practice to make them relatively heavy.

Any such weight, and the attendant inertia forces, however, necessitate a corresponding reduction in the speed of the machine and is also objectionable from the standpoint of noise level and wear.

One solution for the problems referred to above is disclosed in application Serial No. 111,233, also assigned to our interests, wherein the axis of rotation of the roller arm of the translating device is angularly displaced with respect to the axis of the reciprocable ram so that the roller which engages the ram is caused to traverse a helical path of substantially the same diameter as the ram. This device has proved eminently successful in conjunction with the clutch disclosed in application Serial No. 73,271 in controlling the operation of a machine tool of the type covered by patent 2,364,011, also assigned to our interest. However, as the diameter of the helical path which is traversed by the ram engaging roller must in each instance be substantially the same as that of the ram, the roller arm of necessity must be designed in accordance with the specific diameter of the particular ram, or other reciprocable element with which it is to be employed. The manufacture of such special roller arms necessitates the use of special tools, fixtures and jigs.

The principal object of the present invention, therefore, is to provide a movement translating mechanism which is so designed that the use of gearing is avoided and which, at the same time, is so standardized as to avoid, to a large degree, the necessity for specially designing each roller arm and hence avoid the necessity for special and costly tools, fixtures and jigs in the production of such roller arms.

Another object is to provide a translating mechanism of the character generally described which will provide the desired mechanical advantage at the desired portion of travel of the driven element.

A related object is to provide a variable mechanical advantage in a linkage system which matches the requirements of the driven element.

A still further object is to provide a translating mechanism which is free of lost motion between it and the machine or device to be controlled.

Yet another object is a translating mechanism which is so designed that the weight of driven element need not be substantial in order

to insure a sensitive response of the associated machine, thereby providing a translating device wherein light weight parts may be employed and thus insuring quiet operation with a minimum of wear.

A still further object is a translating mechanism characterized by features which adapt it particularly for use in connection with driven elements of a cylindrical shape.

A still further object is a clutch wherein, in order to insure quiet operation, provision is made for permitting idling movement of the driving element without contact between the cooperating surfaces of the driving element and the driven element.

A still further object is a novel design and arrangement of the parts of the translating mechanism, whereby to facilitate assembly and disassembly of the parts and insure simplicity and economy in construction.

The invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a fragmentary side elevational view of a press-working machine tool showing a translating mechanism embodying the features of the invention associated therewith;

Figure 2 is an enlarged vertical section through the translating mechanism and is taken along line 2—2 of Figure 1;

Figure 3 is an enlarged horizontal section taken along the line 3—3 of Figure 1; and

Figure 4 is a vertical section taken along line 4—4 of Figure 2.

The translating mechanism of the invention is characterized by features which adapt it for various purposes and for various types of machine, devices and mechanisms wherein the rotary, or pivoted, movement of a driving element is transmitted to a driven element in such a manner that the latter is caused to move rectilinearly.

By way of example, the translating mechanism is illustrated in connection with a press-working machine tool, the latter being sufficiently illustrated for the purpose in view by a showing (Figure 1) of a fragmentary portion 10 of the frame thereof and the clutch 11 for connecting and disconnecting the press-working tool (ram or the like) to a pitman 12 which at its upper end is connected to an eccentric (not shown) on the power shaft of the machine.

The clutch 11 may, if desired, be of the type disclosed in applications Serial No. 752,433 or Serial No. 73,271. As illustrated, however, it is of the type disclosed in the latter application, having a piston 13 which is connected to, and which is actuated by pitman 12. (Figures 1, 2 and 3).

The piston 13 is reciprocable within a reciprocable cylinder 21 which is closed at its lower end and which in the embodiment illustrated, constitutes the ram of the machine. Ports 21a which are formed in the cylinder 21 permit, or prevent, the flow of hydraulic fluid between a reservoir 21b in the stationary housing 23 of the clutch and the interior of the cylinder 21, depending upon the position of the cylinder 21 in the housing. In this connection, it will be apparent that when the cylinder 21 occupies the position shown in Figure 2, the piston 13 may reciprocate therein without its movement being transmitted to the ram, the ports 21a permitting the hydraulic fluid to course back and forth between the interior of the cylinder 21 and the reservoir 21b. It will also be apparent that any downward movement

of the cylinder 21 which results in closing of the ports 21a will result in trapping of hydraulic fluid between the piston 13 and cylinder 21 so that the movement of the piston will be transmitted to the cylinder (ram) to cause the latter to perform a working stroke. Retractive movements of the cylinder 21, upon completion of the working strokes, are effected by the engagement of a shoulder 34 on the piston 13 with a lifting ring 30 threadedly secured in the upper, open end of the cylinder, the piston lifting the cylinder 21 to a position in which ports 21a communicate with the reservoir 21b as it approaches and reaches the upper limit of its range of movement.

In accordance with the invention, the translating mechanism, which is indicated generally at 49, is associated with the cylinder 21 of the clutch 11 in such a manner that it may be availed of to positively initiate movement of the cylinder 21 in a direction to effect closing of the ports 21a when it is desired to operate the ram of the machine. To this end the translating mechanism includes an arm 60 which carries a roller 50 and which is carried by a shaft 62, the latter being journaled eccentrically in a bearing element 70 which is carried in an opening 70a in the housing 23 and the roller 50 occupying an annular channel 22 formed in the cylinder 21.

Referring to Figure 4, wherein the cylinder 21 is shown at the upper limit of its range of movement, it will be noted that the axis 61 about which the roller arm 60 turns extends at right angles with respect to the axis 61a of piston 13 and cylinder 21 and is offset rearwardly with respect to the latter axis. The mounting of the arm 60 in the manner described insures that the roller 50, for a predetermined range of movement of the arm 60, will maintain contact with the walls of the channel 22, it being understood that the depth of the channel 22 may be predetermined so that the roller 50 will maintain contact with the walls thereof for a distance adequate to enable the desired movements to be imparted to the cylinder 21.

At its outer end, the shaft 62 carries an actuating arm 65 which in turn carries a handle 65a. A spring 85 (Figure 1) having one end connected to the machine frame and the other end connected to the arm 65 is normally operative to hold the arm 65 in the position shown in Figure 1, in which position a tail-piece 65b on the arm abuts an adjustable stop 31 and in which position the spring 85 and arm 65 hold the roller arm 60 in a position in which it holds the cylinder 21 in its upper retracted position against any slight tendency to follow the piston 13 on its downward strokes when the piston is idling. To positively initiate movement of the cylinder 21 downwardly and thereby close the ports 21a, the handle 65a is moved in a counterclockwise direction. Owing to the mounting of the arm 60 in the manner described, the roller 50 will remain in the channel 22, acting against the lower wall of the channel as the arm 60 moves in a counterclockwise direction, to move the cylinder 21 downwardly. Obviously, for any cylindrical or contoured member and any degree of stroke, the parts may be designed so that the ports 21a will be caused to function in the manner described. In this connection, it will be noted that the eccentric mounting of the shaft 62 in the manner illustrated, in conjunction with the permissible axial adjustment of the lifting ring 30, enables compensation to be made for errors or tolerances

5

in machining as well as adjustments to meet conditions peculiar to one or a series of machines. When the ports 21a are closed in the manner described, the hydraulic fluid trapped between the piston 13 and the cylinder 21 will positively connect the piston and cylinder so that during the remainder of the movement of the piston its movement will be transmitted to the cylinder 21 through the trapped hydraulic fluid. During the return stroke of the piston 13, the latter, acting against the lifting ring 30, will carry the cylinder 21 with it.

During idling periods of the machine, the roller arm 60, as noted, holds the cylinder 21 at the upper limit of its range of movement while the piston 13 reciprocates in the cylinder 21 and while the hydraulic fluid flows back and forth between the cylinder and the reservoir 21b. In accordance with the invention, the translating mechanism is utilized to support the cylinder 21 in a position such that the shoulder 34 on the piston 13 will not contact the lifting ring 30 and produce an objectionable tapping noise during such periods. Referring in this connection to Figure 4, it will be noted that there is a slight clearance between the shoulder 34 of the piston 13 and the lifting ring 30, the piston being shown at the upper limit of its range of movement. The mechanism is so designed that as the cylinder 21 reaches the position to which it is carried by the piston 13 acting against the lifting ring 30 (the position at which the piston reaches dead center), the spring 85 acting upon the arm 65, will be operative to turn the latter in a clockwise direction and thereby lift the cylinder out of the range of movement of, and hence out of contact with, the piston. In this connection it will be noted that owing to the angular position of the arm 60, the resilient force exercised by the spring 85 and exerted on the arm 65 is greatly increased to apply a strong lifting force to the cylinder 21 in lifting it out of the range of movement of the piston 13.

It will be apparent that to energize the clutch the handle 65a is moved in a counterclockwise direction until the piston 13 engages the lifting ring 30. Owing to the counteracting spring 85 and the normal friction of the cylinder 21, movement beyond this point would be difficult for the operator except in the proper position and sequence of operation of the clutch elements. The proper time for movement of the cylinder 21 to effect a full stroke of the ram is at the instant the piston 13 has reached the top of its stroke and is starting downwardly again. In the downward travel of the piston 13, the normal friction offered by the cylinder 21 is about the same as the frictional resistance which the housing 23 offers to the downward movement of the cylinder 21. Hence, as the piston 13 starts downwardly in its cycle, frictional forces being substantially zero, the operator can easily continue to move the handle 65a in a counterclockwise direction as it is only necessary to overcome the low resistance offered by the spring 85. The operator, therefore, rotates handle 65a counterclockwise in time with the machine, trapping hydraulic fluid between piston 13 and ram 21, as described. Upon the return stroke of the piston 13, its engagement with the ram causes the latter to move upwardly and the operator, by easing the handle load which is being applied, allows the handle 65a to rotate in accordance with the movement of the piston 13 and ram 21. As piston 13 reaches the top of

6

its reciprocatory stroke, the resilient force of spring 85 applied through arm 65 to arm 60 causes the latter to continue to rotate in a clockwise direction, thereby lifting ram 21 further so that lifting ring 30 will be held out of contact with the reciprocating piston 13. Tapping noises which would otherwise occur as a result of engagement between the piston and the lifter ring are thus prevented.

From the foregoing, it will be apparent that the translating mechanism described has the advantage that it provides a mechanical means for positively controlling the ram 21, being available both to initiate downward movement of the ram at the beginning of a working stroke and to move the ram out of the range of movement of the piston 13 upon completion of the working stroke. The use of heavy rams such as are required when the weight of the ram is relied upon to initiate the desired downward movement is avoided together with the attendant disadvantage of low speed operation, high noise level and increased wear.

In addition to the foregoing advantages, the mounting of the shaft 62 and the roller 50 in the manner described has the advantage that assembling and disassembling operations are facilitated. For example, by backing off sufficiently the set-screw of the stop 31 and turning the handle 65a in a clockwise direction, the roller arm 60 may be moved to a position in which the roller 50 is located out of and wholly clear of the channel 22. When the roller arm and roller occupy these positions, the ram may be readily removed or replaced. A simple method is thus provided for connecting the roller 50 to, and for disconnecting it from, the ram.

Although the translating mechanism has been described in connection with a specific type of clutch for a press-working machine, it is to be understood that this is intended for purposes of illustration only and that the advantages of the invention may be attained by the use of the translating mechanism in connection with various other kinds of devices, machines and mechanisms.

I claim as my invention:

1. A mechanism including an element which is movable rectilinearly, means including a driven member for moving said element back and forth between predetermined limits, said element and member having cooperating surfaces which engage one another when said member moves said element in one direction, and means for moving said element beyond the limit to which it is moved by said member when said surfaces are engaged, whereby said member may idle without contact between said surfaces, said last named means including an actuating shaft having an axis which is substantially normal and offset with respect to the line of movement of said element.

2. A mechanism including an element which may reciprocate, means including a reciprocating driven member for moving said element back and forth between predetermined limits, said element and member having cooperating surfaces which engage one another when said member moves said element in one direction, and means for moving said element beyond the limit to which it is moved by said member when said surfaces are engaged, whereby said member may idle without contact between said surfaces, said last named means including an actuating shaft having an axis which is substantially nor-

7

mal and offset with respect to the line of movement of said element.

3. An actuating mechanism for an element which is movable rectilinearly and which is associated with a member which is movable back and forth between predetermined limits and which may be connected to said element to cause the latter to move with it, said element and member having cooperating surfaces which are engaged when said member moves said element in one direction, and means independent of said member for moving said element in one direction, said means including an actuating shaft and also being operative to move said element in the opposite direction beyond the limit to which it is moved by said member so that said member may idle without contact between surfaces, the axis of said actuating shaft being normal and offset with respect to the line of movement of said element.

4. The combination with a clutch having a driven element which may reciprocate and means including a cooperating, reciprocating driving element for moving said driving element back and forth between predetermined limits, said elements having cooperating surfaces which are engaged when the driving element is moving the driven element in one direction, of means for moving said driven element beyond the limit to which it is moved in said direction by said driving element, whereby said last named driving element may idle without contact between said surfaces, said means including an actuating shaft, and an adjustable eccentric in which said shaft is journaled.

5. The combination with a clutch having a driven element which may reciprocate, said element having transversely extending contact surfaces and means including a cooperating, reciprocating driving element for moving said driven element back and forth between predetermined limits, said elements having cooperating areas which are engaged when the driving element is moving the driven element in one direction, of a pivotally mounted arm having an end which engages said contact surface, a shaft for turning said arm so that said driven element may be moved beyond the limit to which it is moved in said direction by said driving element, whereby said driving element may idle without contact between said areas, the axis of said shaft being substantially normal and offset with re-

8

lation to the line of movement of said driven element.

6. The combination with a clutch having a driven element which may reciprocate, said element having a transversely extending channel and means including a cooperating, reciprocating driving element for moving said driven element back and forth between predetermined limits, said elements having cooperating surfaces which are engaged when the driving element is moving the driven element in one direction, of a roller which occupies said channel, an arm which carries said roller, a shaft for turning said arm so that said driven element may be moved beyond the limit to which it is moved in said direction by said driving element, whereby said driving element may idle without contact between said surfaces, and an eccentric in which said arm is journaled.

7. The combination with a clutch having a cylindrical driven element which may reciprocate, said element having a circumferentially extending channel and means including a cooperating, reciprocating driving element for moving said driven element back and forth between predetermined limits, said elements having cooperating surfaces which are engaged when the driving element is moving the driven element in one direction, of a roller which occupies said channel, an arm which carries said roller, and a shaft for turning said arm so that said driven element may be moved beyond the limit to which it is moved in said direction by said driving element, whereby said driving element may idle without contact between said surfaces, the axis of said shaft being substantially normal and offset with relation to the axis of said driven element.

EMANUEL F. PAXHIA.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
709,940	Thomas	Sept. 30, 1902
852,275	Keener et al.	Apr. 30, 1907
1,843,733	Powell	Feb. 2, 1932
2,262,786	Warren	Nov. 18, 1941
2,507,555	Berthiez	May 16, 1950