April 5, 1938. E. C. EKSTROMER 2,112,835

DRIVING MECHANISM

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Fig. 1.

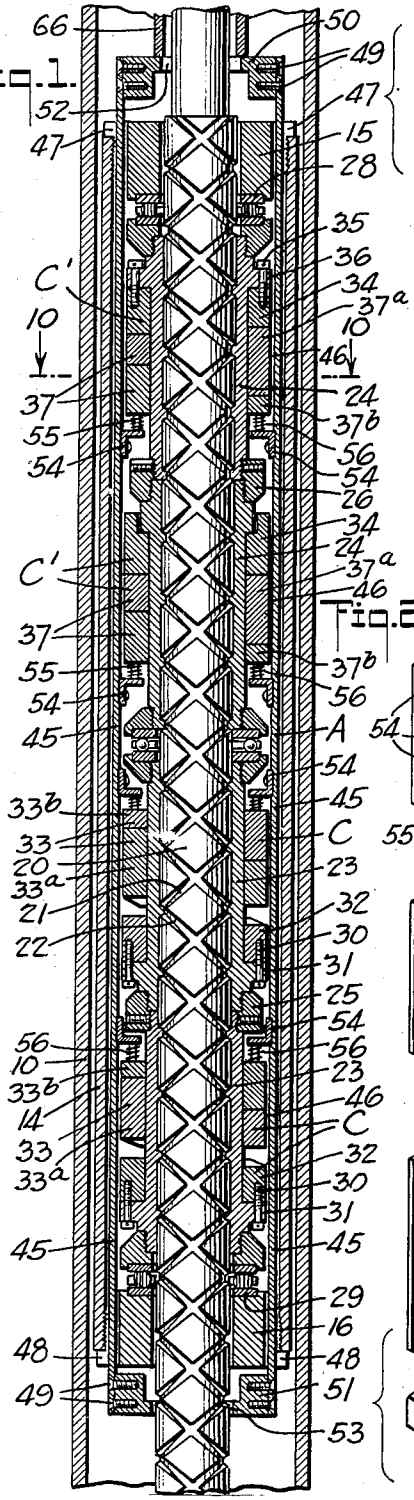


Fig. 2.

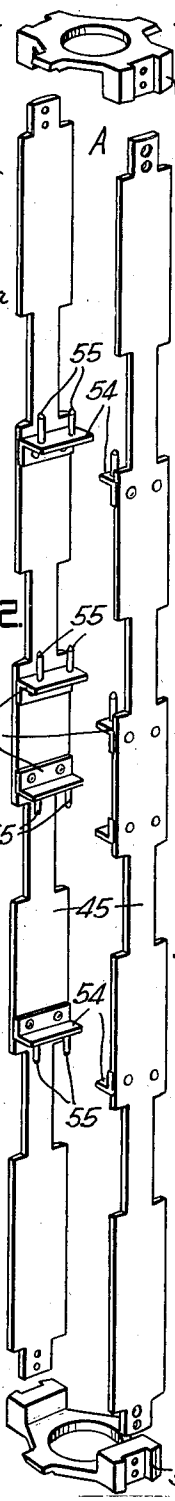


Fig. 4.

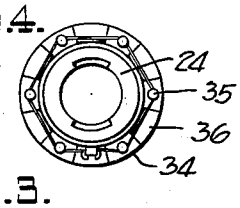


Fig. 3.

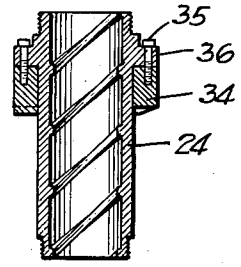


Fig. 5.

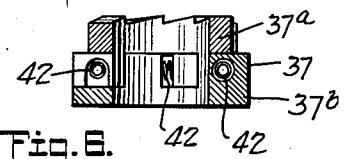


Fig. 6.

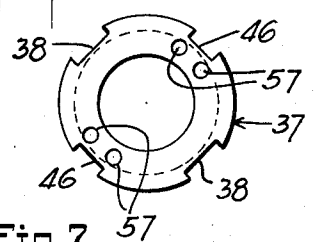
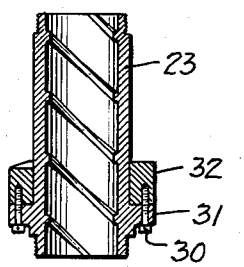


Fig. 7.



INVENTOR
EDWARD C. EKSTROMER
BY
Munn, Anderson & Liddy
ATTORNEYS

April 5, 1938. E. C. EKSTROMER 2,112,835

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Fig. 8.

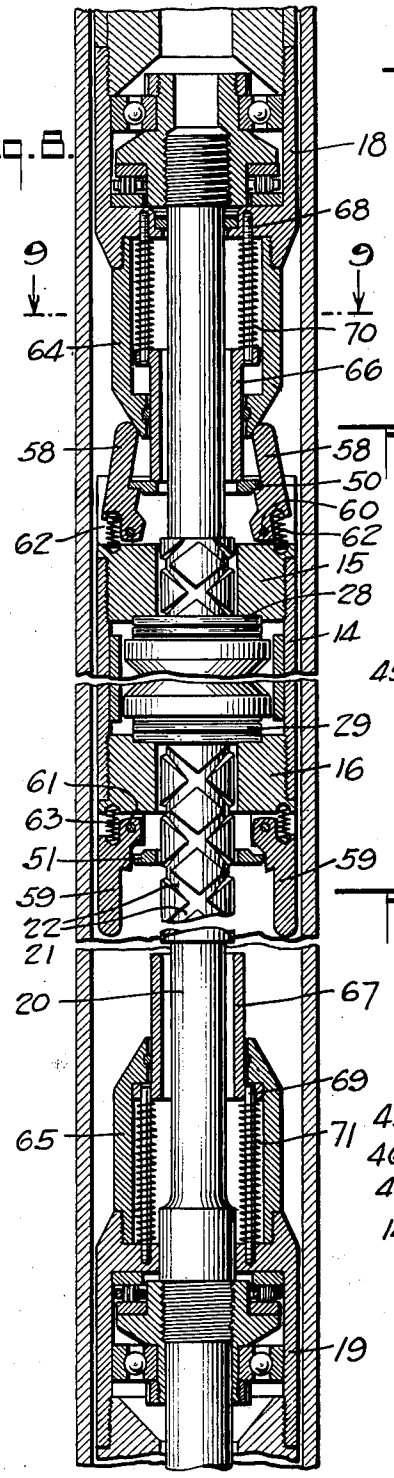


Fig. 9.

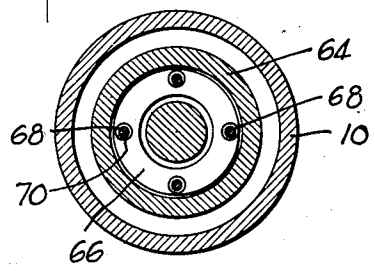


Fig. 10.

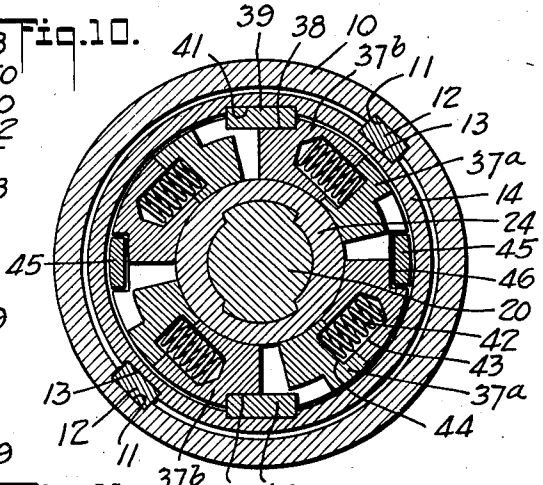
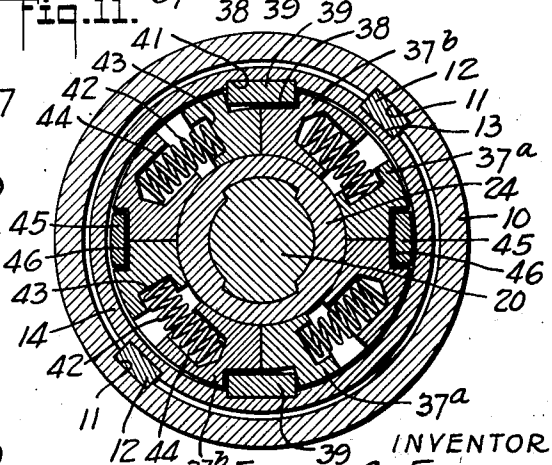


Fig. 11.



INVENTOR
EDWARD C. EKSTROMER
BY
Minnis, Anderson & Liddy
ATTORNEYS

April 5, 1938. E. C. EKSTROMER 2,112,835

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Fig. 14.

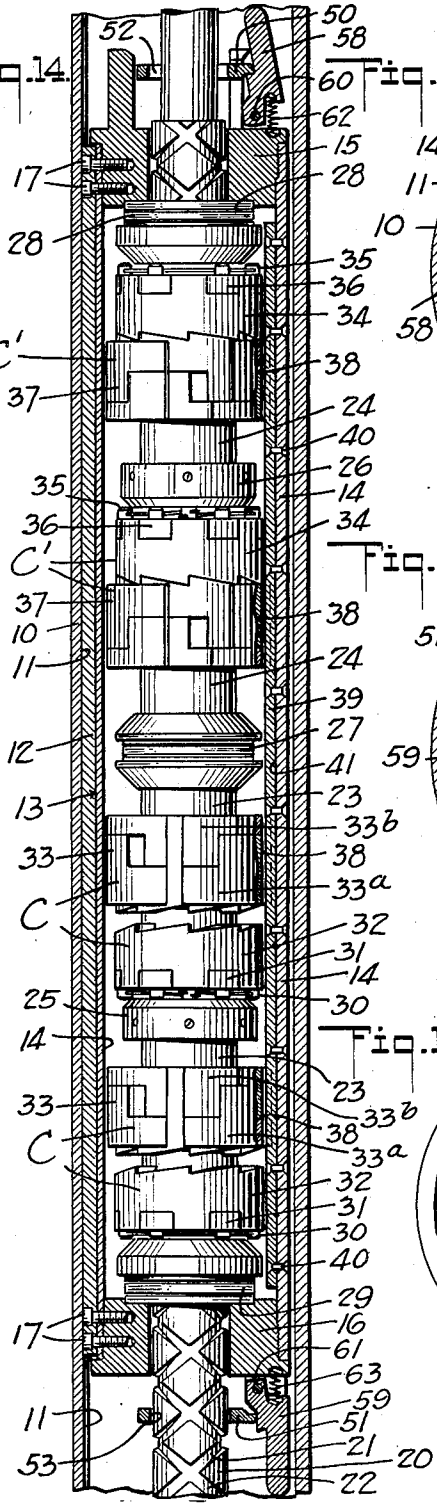


Fig. 12.

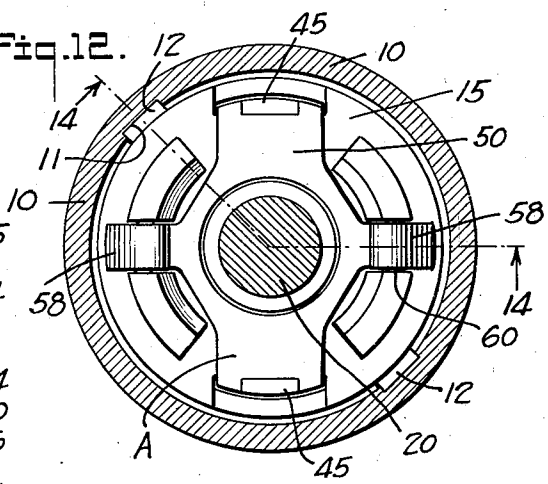


Fig. 13.

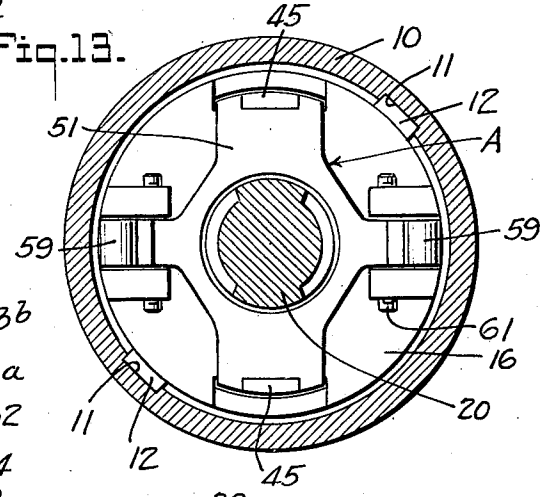
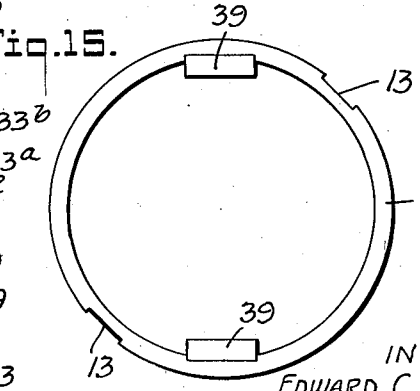


Fig. 15.



INVENTOR
EDWARD C. EKSTROMER
BY
Munn, Anderson & Liddy
ATTORNEYS

Patented Apr. 5, 1938 2,112,835

UNITED STATES PATENT OFFICE

2,112,835

DRIVING MECHANISM

Edward C. Ekstromer, Los Gatos, Calif., assignor to Electrolift Corporation, Reno, Nev., a corporation of Nevada

Application August 12, 1936, Serial No. 95,556

9 Claims. (Cl. 74—57)

This invention relates to driving mechanism, and more particularly to a mechanism of the character embodied in my U. S. Patent No. 1,799,458, issued April 7, 1931, and wherein means is provided for converting rotary motion of a power plant into reciprocating motion to correspondingly actuate a pump.

The object of the present invention is to provide a motion converting mechanism wherein the means for effecting conversion of rotary motion into reciprocating motion is characterized by its simplified structure; positiveness and accuracy of operation; high efficiency and low frictional losses; and its long life in transferring the rotary power of a prime mover to a reciprocable element.

Another object of the invention is to provide a motion converting mechanism embodying jaw clutches adapted to be alternately engaged and disengaged to respectively cause right and left hand nuts to co-act with a feed shaft in actuating a shuttle or other reciprocable member, with means for insuring positive and accurate operation of the clutches in proper timed relationship to the movements and positions of the reciprocable member.

With these and other objects in view, the invention consists in the combinations, arrangements and functional relationships of elements as set forth in the following specification and particularly pointed out in the appended claims.

In the accompanying drawings,

Figure 1 is a view showing in central longitudinal section the motion converting mechanism embodying this invention;

Figure 2 is a perspective view illustrating four parts comprising a reversing member assembly embodied in the invention;

Figure 3 is a detail view in longitudinal central section of a left hand nut and fixed jaw assembly embodied in the invention;

Figure 4 is a plan view of the parts shown in Figure 3;

Figure 5 is a detail view in central section of the movable jaw of the clutch shown in Figures 3 and 4;

Figure 6 is a bottom plan view of the fixed jaw shown in Figure 5;

Figure 7 is a view similar to Figure 3, but showing a right hand nut and fixed jaw assembly embodied in the invention;

Figure 8 is a central longitudinal sectional view similar to Figure 1 but with the intermediate portion of the mechanism broken out and the terminal portions thereof illustrated in detail;

Figure 9 is a transverse sectional view taken on the line 9—9 of Figure 8;

Figure 10 is an enlarged transverse sectional view taken on the line 10—10 of Figure 1;

Figure 11 is a view similar to Figure 10, but showing another position of the illustrated parts;

Figure 12 is a top plan sectional view of the mechanism;

Figure 13 is a bottom plan sectional view of the mechanism;

Figure 14 is a vertical longitudinal sectional view taken on the lines 14—14 of Figure 12;

Figure 15 is a plan view of a shuttle member assembly embodied in the invention.

Referring specifically to the drawings, the invention, in its present embodiment, is enclosed by and works in a tubular housing 10 which in all respects is identical to that disclosed in my co-pending application for patent on Pumping mechanism, now Patent No. 2,098,958, filed August 12, 1936. For the present application it will suffice to state that this housing is cylindrical in cross section and is provided internally at diametrically opposed points with longitudinally extending grooves 11—11 in which work keys 12—12 (Figures 10 and 14) seating in longitudinal grooves 13—13 formed externally in a cylindrical shuttle 14, the ends of which are closed by top and bottom caps 15 and 16, respectively, having threaded connection with the shuttle and being locked to the shuttle by screws 17 which also serve to secure the keys 12 to the shuttle.

The shuttle 14 is confined by the keys 12—12 to movement axially in the housing, and is adapted to be reciprocated therein between upper and lower bearings 18 and 19, respectively, within which is journaled to extend through the shuttle in co-axial relationship thereto a feed shaft 20 having externally thereof, right and left hand spiral grooves 21 and 22, respectively.

The bearings 18 and 19 provide for both radial and end thrusts upon the shaft 20; and the boxes of these bearings are rigidly secured to other units (not shown) of the assembly making up the pumping mechanisms of my co-pending application above referred to, all to the end that the bearing boxes will be fixed in the housing against rotation and axial displacement relative thereto and will confine the feed shaft 20 to rotational movement in the housing.

Threadedly mounted on the feed shaft 20 within the shuttle are right and left hand nuts 23 and 24, respectively, of which there are two of each arranged end to end and rigidly connected by collars 25 and 26, respectively. Intermediate

the pairs of nuts is an anti-friction thrust bearing 27, and intermediate the uppermost and lowermost nuts of the pairs are anti-friction thrust bearings 28 and 29 which respectively abut the top and bottom caps 15 and 16 whereby to confine the nuts against axial displacement relative to the shuttle, and all as clearly shown in Figure 1.

Secured by screws 30 to interfitting flanges 31 on the pair of nuts 23—23 are fixed clutch jaws 32 with respect to which movable jaws 33 are adapted to be engaged and disengaged, these movable jaws being slidably mounted on the cylindrical peripheries of the nuts for movement axially relative to the respective fixed jaws. Other fixed clutch jaws 34—34 are secured by screws 35 to interfitting flanges 36 on the nuts 24, for coaction with movable jaws 37—37 which latter jaws are freely mounted on the cylindrical peripheries of the nuts 24 for movement axially relative to such fixed jaws.

It is to be noted from a consideration of Figure 14 that the co-acting teeth of the jaws 32 and 33 are adapted for driving engagement in one direction, whereas the co-acting teeth of the jaws 34 and 37 are adapted for driving engagement in the reverse direction. Furthermore, as shown in Figure 14 and Figures 10 and 11, the movable jaws 33 and 37 are respectively composed of two sections 33*a*—33*b* and 37*a*—37*b*, the sections 33*a* and 37*a* being provided with the clutch teeth, and the sections 33*b* and 37*b* being provided with axially extending and diametrically opposite grooves 38—38 receiving keys 39—39 secured by rivets 40 in longitudinal recesses 41—41 of the shuttle 14 so as to positively prevent such sections from rotating relative to the shuttle member while rendering the sections 33*a* and 37*a* free for limited circumferential movement relative to the respective sections 33*b* and 37*b*. Coil springs 42 seating in pockets 43 and 44 formed in the respective sections 33*a*—37*a* and 33*b*—37*b* urge the sections 33*a* in one direction relative to the sections 33*b*, and the sections 37*a* in the opposite direction relative to the sections 37*b*, all for a purpose to be hereinafter fully described.

Each pair of fixed and movable jaws 32 and 33 constitutes a clutch C, whereas each pair of fixed and movable jaws 34 and 37 constitutes a clutch C′, the clutches C—C being adapted for engagement and the clutches C′—C′ for disengagement or vice versa, to accordingly render the nuts 23—23 co-operable with the shaft 20 to feed the shuttle 14 in one direction, or the nuts 24—24 co-operable with the shaft to feed the shuttle in the reverse direction.

For this purpose a clutch actuating mechanism A is provided and comprises a pair of diametrically opposed actuating rods 45—45 of square cross section which clear the jaws 32 and 34 and extend freely through grooves 46—46 of the jaw sections 33*b* and 37*b* and through grooves 47 and 48 of the top and bottom caps 15 and 16 (Figure 1) for rigid connection at their ends by screws 49 to cross plates 50 and 51 respectively above and below the top and bottom caps. The cross plates also have central openings 52 and 53, respectively, freely receiving the feed shaft 20, as clearly shown in Figures 1 and 10.

Projecting inwardly from each of the rods 45—45 are brackets 54, one for each of the movable jaws 33—33 and 37—37, and each provided with a pair of pins 55 surrounded by coil springs 56 and projecting into openings 57 (Figure 6, for example), in the respective movable jaws, the relationships of the brackets, pins, springs, and movable jaws being clearly shown in Figure 1.

The clutch actuating mechanism A formed by the assembly of rods 45 and cross bars 50 and 51, operatively associated with the movable jaws by the pins 35 and springs 56, as above described, is adapted to be latched in one extreme position or another axially with respect to the shuttle 14 to retain either the clutches C—C engaged and the clutches C′—C′ disengaged or vice versa, by latch dogs 58 and 59, respectively, pivoted at 60 and 61 on the top and bottom caps 15 and 16, respectively, the dogs 58 and 59 being normally urged to latching positions for latching engagement, respectively with the cross plates 50 and 51 by springs 62 and 63, as shown in Figure 14.

The dogs 58 and 59 are adapted to be respectively moved to non-latching or released positions relative to the cross plates 50 and 51 according as the shuttle 14 reaches one extreme position or another in the housing 10. For this purpose, conical ended collars 64 and 65 are fixed, respectively, to the boxes of the bearings 18 and 19 in the path of movement of the dogs, as shown in Figure 8. Sleeves 66 and 67 are slidably mounted in the collars 64 and 65 on rods 68 and 69 having springs 70 and 71 thereon for urging the respective sleeve to an advanced position for engagement and retraction against the action of the respective springs, by the respective cross plate 50 or 51 as the shuttle approaches the corresponding extreme position and before the respective latches are released. The springs 70 or 71, as the case may be, are thus placed under load, and the energy thus stored in the springs is utilized upon release of the respective latches, to move the clutch actuating mechanism A from one of its extreme positions in order to reverse the engagement and disengagement of the clutches C and C′ for the purpose of effecting reverse movement of the shuttle.

The operation of the invention is as follows:

Let it be assumed that the shuttle 14 occupies its lowermost extreme position shown in Figures 1, 8 and 14, wherein the clutches C—C are disengaged, and the clutches C′—C′ are maintained engaged by the latches 58—58 which are co-acting with the cross plate 50 to releasably retain the clutch actuating mechanism A in its uppermost extreme position relative to the shuttle.

As the left hand nuts 24—24 are now being held by the engaged clutches C′—C′ against rotation, and as the feed shaft 20 is assumed to be driven by a rotary prime mover (not shown) in a clockwise direction as viewed in top plan, these nuts will co-act with the left hand threads 22 of the shaft in moving the shuttle 14 upwardly in the housing.

As the shuttle approaches its upper extreme position, the cross plate 50 engages and retracts the sleeve 66 against the action of the springs 70, so as to place the latter under load and store energy therein. Continued upward movement of the shuttle causes the dogs 58 to engage the collar 64 and be moved thereby against the springs 62 to their released positions relative to the cross plate 50. The springs 70 are now free to shift the clutch actuating mechanism A towards its lowermost extreme position relative to the shuttle, so as to disengage the clutches C′—C′ and engage the clutches C—C.

Should the teeth of the clutches C—C fail to instantly mesh properly, the springs 56 mounted on those pins 55 associated with the movable jaws 33—33 will be compressed and will thus

act following the expenditure of the energy of the springs 62 to urge the movable jaws towards the fixed jaws 32—32 until such rotational movement of the latter jaws by the yet idle right hand nuts 23—23 rotating with the shaft 20, has been effected for their teeth to be properly engaged by the teeth of the respective jaws 33—33. The springs 56 thereby act as a supplemental means to the springs 70 to insure engagement of the clutches C—C in proper timed relationship to the upward movement of the shuttle. As the clutches C—C are engaged, they are latched by the dogs 59—59 against disengagement as these dogs now co-act with the cross plate 51 for this purpose. It will also be noted that upon engagement of the clutches C—C the coil springs 42 interposed between the sections 33*a* and 33*b* of the movable jaws 33 will be compressed to effectively absorb the shock of starting the load, and when thus compressed will facilitate disengagement of the clutches in a circumferential direction upon unlatching of the dogs 59.

Upon engagement of the clutches C—C, the right hand nuts 23—23 will be held against rotation whereas the left hand nuts 24—24 will be free to idle by rotating with the shaft 20 in the aforestated clockwise direction. The nuts 23 will now co-act with the right hand threads 21 of the shaft 20 to move the shuttle 14 downwardly in the housing 10.

As the shuttle approaches its lower extreme position, the cross plate 51 engages and retracts the sleeve 67 against the action of the springs 71 so as to place the latter under load and store energy therein. Continued downward movement of the shuttle causes the dogs 59 to engage the collar 65 and be moved thereby against the springs 63 to their released positions relative to the cross plate 51. The springs 71 are now free to shift the clutch actuating mechanism A towards its uppermost extreme position relative to the shuttle so as to disengage the clutches C—C and engage the clutches C'—C'. Should the teeth of the clutches C'—C' fail to instantly mesh properly the springs 56 mounted on those pins associated with the movable jaws 37 function in the same manner as described for the movable jaws 33 during the other stroke of the shuttle. The coil springs 42 interposed between the sections 37*a* and 37*b* of the movable jaws 37 also function in the same manner as described for the jaws 33.

This cycle of operation is repeated so long as the shaft 20 is being rotated, from which it will be evident that the rotary motion of the shaft will be converted into reciprocating motion at the shuttle so that with a reciprocating member such as the plunger rod of a pump (not shown) operatively associated with the shuttle such element will be correspondingly reciprocated to perform useful work.

What is claimed is:

1. Motion converting mechanism comprising a reciprocable shuttle adapted for operative connection to an element to be reciprocated; a feed shaft adapted to be driven in one direction and having right and left hand threads; right and left hand threaded nuts on the feed shaft; means operatively connecting the nuts with the shuttle for movement therewith axially of the shaft; means including a jaw clutch for each nut, alternately engageable and disengageable to cause one nut or the other to be held against rotation, for co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction; and means co-acting with the jaws of said clutches to yieldingly absorb shocks imposed thereon by the starting load when the clutches are being engaged.

2. Motion converting mechanism comprising a reciprocable shuttle adapted for operative connection to an element to be reciprocated; a feed shaft adapted to be driven in one direction and having right and left hand threads; right and left hand threaded nuts on the feed shaft; means operatively connecting the nuts with the shuttle for movement therewith axially of the shaft; a jaw clutch for each nut, each clutch having a fixed jaw secured to a nut, and a jaw confined against rotation relative to the shuttle and movable axially to engage and disengage the respective fixed jaw; means for actuating the movable jaws to engage one clutch and disengage the other or vice versa to accordingly cause one nut or the other to be held against rotation and co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction; one jaw of each clutch being composed of two sections having a limited relative rotational movement; and spring means co-acting with said sections to relatively urge them in one direction for the absorption of shocks imposed on the jaws in the opposite direction by the starting load when the clutch is being engaged.

3. Motion converting mechanism comprising a reciprocable shuttle adapted for operative connection to an element to be reciprocated; a feed shaft adapted to be driven in one direction and having right and left hand threads; right and left hand threaded nuts on the feed shaft; means operatively connecting the nuts with the shuttle for movement therewith axially of the shaft; a jaw clutch for each nut, each clutch having a fixed jaw secured to a nut, and a jaw confined against rotation relative to the shuttle and movable axially to engage and disengage the respective fixed jaw; actuating means for the movable jaws operatively connected thereto and movable axially relative to the shuttle to engage one clutch and disengage the other or vice versa, according as the actuating means is moved to one extreme position or the other whereby to cause one nut or the other to be held against rotation for co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction; means for latching the actuating means in one or the other of its aforestated positions; means for storing energy to move the actuating means from one of its positions to the other or vice versa according as the shuttle approaches one predetermined extreme position or the other; means for releasing the latching means following the storing of energy as aforestated in order that said actuating means will be moved to actuate the clutches; and means providing a yieldable operative connection axially between said actuating means and movable jaws, by which engagement of the clutches will be effected should the aforestated energy be expended without the clutches becoming engaged.

4. Motion converting mechanism comprising a reciprocable shuttle adapted for operative connection to an element to be reciprocated; a feed shaft adapted to be driven in one direction and having right and left hand threads; right and left hand threaded nuts on the feed shaft; means operatively connecting the nuts with the shuttle for movement therewith axially of the shaft; a jaw clutch for each nut, each clutch having a fixed jaw secured to a nut, and a jaw confined against rotation relative to the shuttle and mov-

able axially to engage and disengage the respective fixed jaw; actuating means for the movable jaws operatively connected thereto and movable axially relative to the shuttle to engage one clutch and disengage the other or vice versa, according as the actuating means is moved to one extreme position or the other whereby to cause one nut or the other to be held against rotation for co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction; means for moving the actuating means to one or the other of its aforestated positions when the shuttle reaches one predetermined extreme position or the other, said actuating means comprising rods slidably mounted on the shuttle; axially disposed pins on said rods entering the movable jaws; and springs on the pins co-acting therewith to provide a yieldable operative connection between the rods and jaws in an axial direction for the purpose described.

5. Motion converting mechanism comprising a reciprocable shuttle; a double acting feed shaft adapted to be driven in one direction; right and left hand nuts operatively connected to the shuttle to travel along the shaft axially with the shuttle; actuating means including a jaw clutch for each nut, alternately engageable and disengageable to cause one nut or the other to be held against rotation, for co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction, each of said clutches having a fixed jaw secured to a nut, and a jaw confined against rotation relative to the shuttle and movable to engage and disengage the fixed jaw, one jaw of each clutch being composed of two sections having a limited relative rotational movement; and spring means co-acting with said sections to relatively urge them in one direction for the absorption of starting shocks imposed on the jaws in the opposite direction as the clutch is engaged.

6. Motion converting mechanism comprising a reciprocable shuttle; a double acting feed shaft adapted to be driven in one direction; right and left hand nuts operatively connected to the shuttle to travel along the shaft axially with the shuttle; actuating means including a jaw clutch for each nut, alternately engageable and disengageable to cause one nut or the other to be held against rotation, for co-action with said shaft in reciprocating the shuttle as the shaft rotates in one direction; and means co-acting with the jaws of said clutches to yieldingly absorb shocks imposed thereon by the starting load as the clutches are being engaged.

7. Motion converting mechanism comprising a shuttle; a rotary driving member; reversing mechanism including jaw clutches for operatively connecting said member to the shuttle; actuating means for alternately engaging said clutches to effect reciprocation of the shuttle; means for latching the actuating means in one position or another; means for storing energy to move the actuating means from one of its positions to the other or vice versa according as the shuttle approaches one predetermined extreme position or the other; means for releasing the latching means following the storing of energy as aforesaid in order that said actuating means will be moved to actuate the clutches; and means providing a yieldable operative connection axially of the shuttle between said actuating means and clutches, by which engagement of the latter will be effected should the aforesaid energy be expended without the clutches becoming engaged.

8. Motion converting mechanism comprising a shuttle; a rotary driving member; reversing mechanism including jaw clutches for operatively connecting said member to the shuttle; actuating means for alternately engaging said clutches to effect reciprocation of the shuttle; means for latching the actuating means in one position or another; means for storing energy to move the actuating means from one of its positions to the other or vice versa according as the shuttle approaches one predetermined extreme position or the other; means for releasing the latching means following the storing of energy as aforestated in order that said actuating means will be moved to actuate the clutches; and means co-acting with the actuating means and clutches by which additional energy will be stored to insure engagement of the clutches should the aforestated energy be expended without the clutches becoming engaged.

9. Motion converting mechanism comprising a shuttle; a rotary driving member; reversing mechanism including jaw clutches for operatively connecting said member to the shuttle; actuating means for alternately engaging said clutches to effect reciprocation of the shuttle; means for latching the actuating means in one position or another; means for storing energy to move the actuating means from one of its positions to the other or vice versa, according as the shuttle approaches one predetermined extreme position or the other; means for releasing the latching means following the storing of energy as aforestated in order that said actuating means will be moved to actuate the clutches; said actuating means including rods slidably mounted on the shuttle; pins on the rods; and springs on the pins co-acting with the clutches to provide yieldable operative connections therewith for the purpose described.

EDWARD C. EKSTROMER.