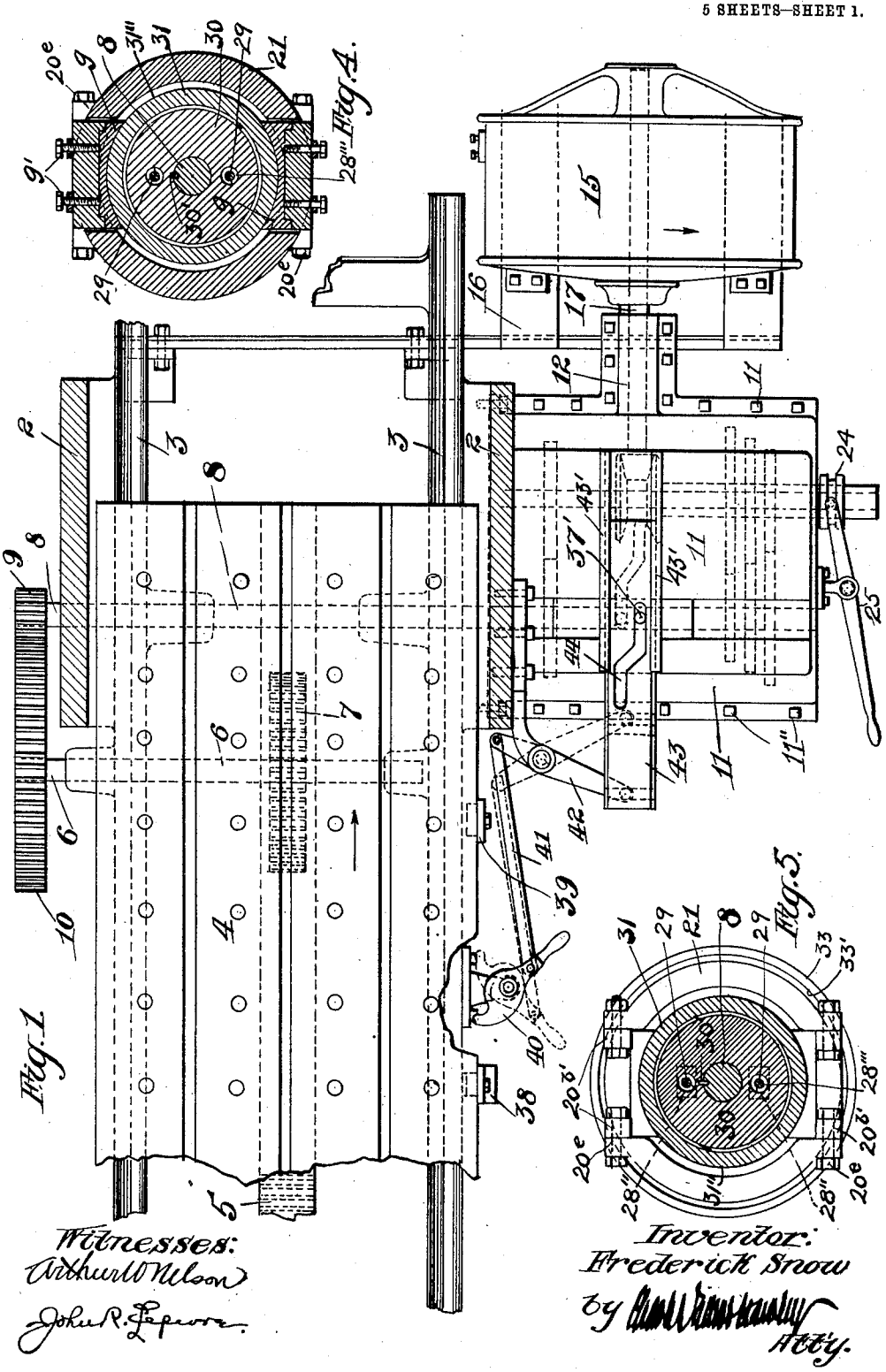
F. SNOW.

DRIVING AND REVERSING MECHANISM FOR PLANERS AND THE LIKE.

APPLICATION FILED JUNE 27, 1908.

1,003,156. Patented Sept. 12, 1911.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

Fig. 2

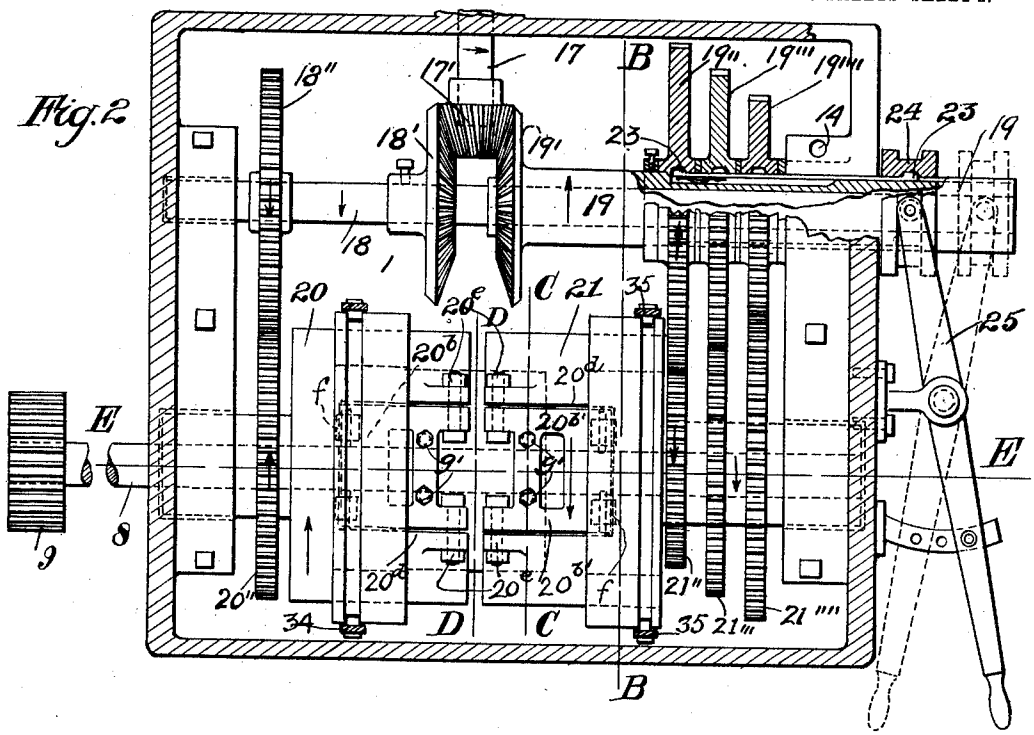
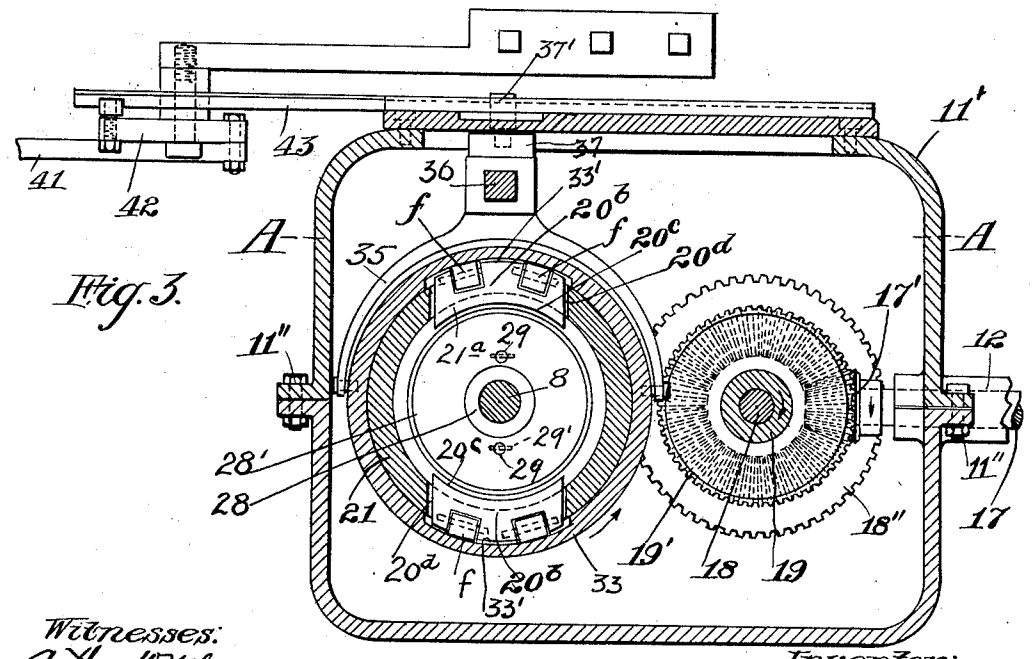


Fig. 3.



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6 SHEETS—SHEET 3.

Fig. 6.

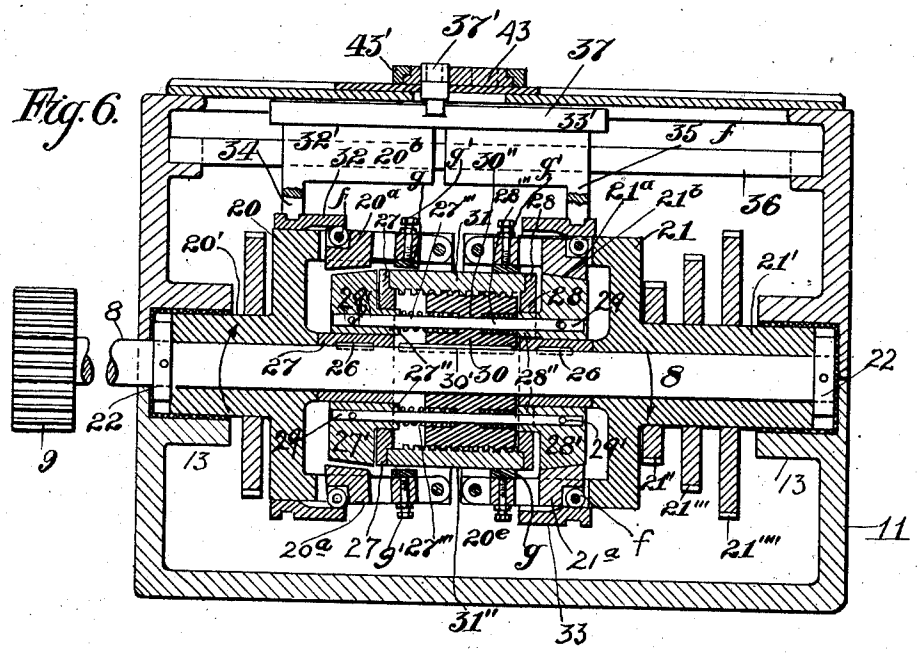
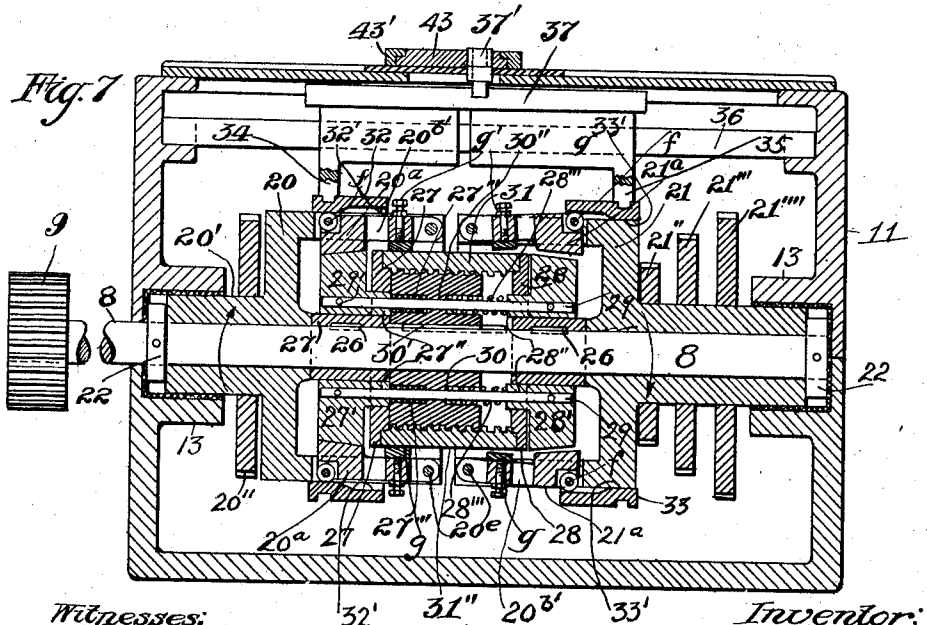


Fig. 7.



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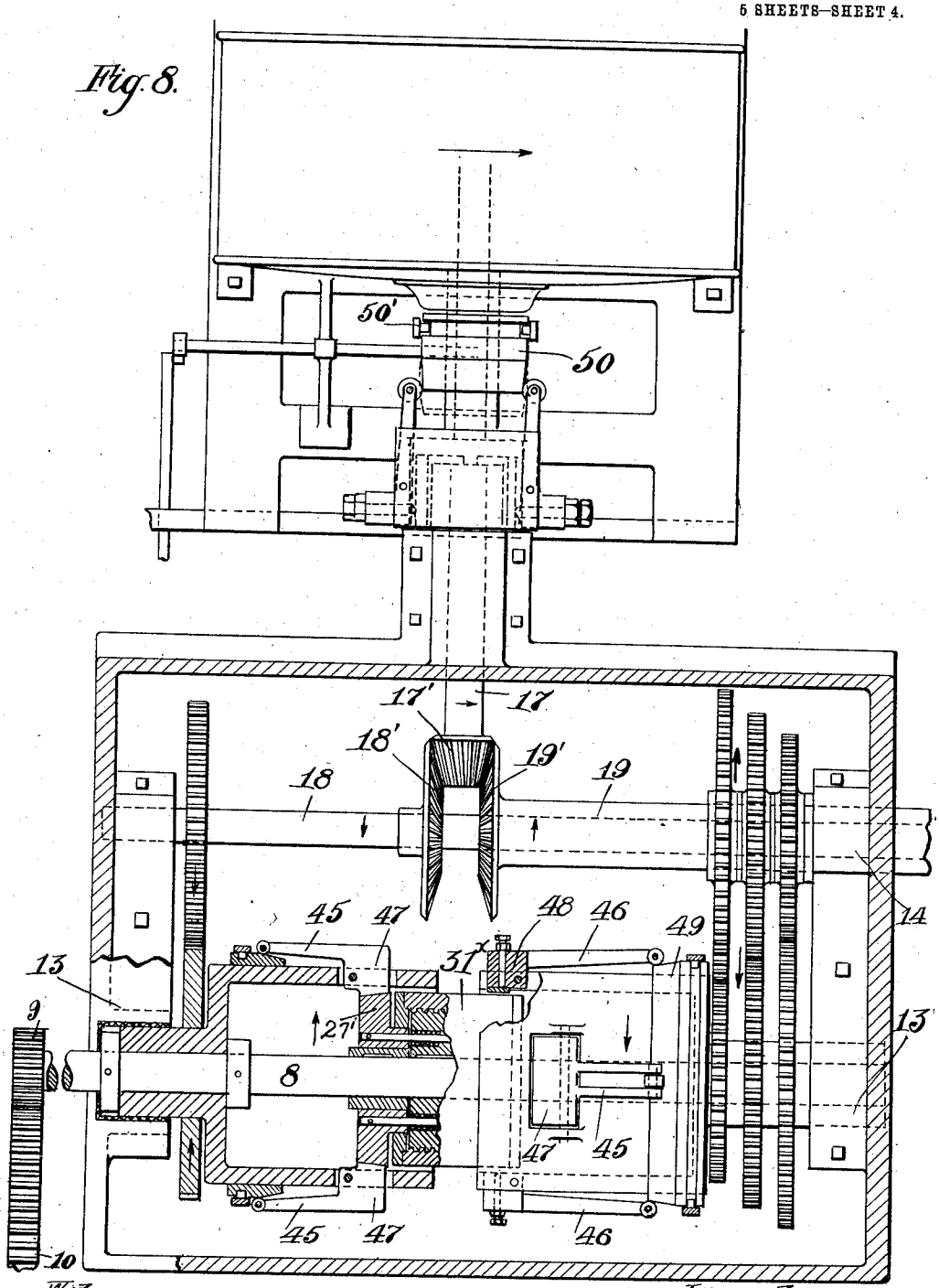
1,003,156. **Patented Sept. 12, 1911.**

5 SHEETS—SHEET 4.

Fig. 8.



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5 SHEETS—SHEET 5.

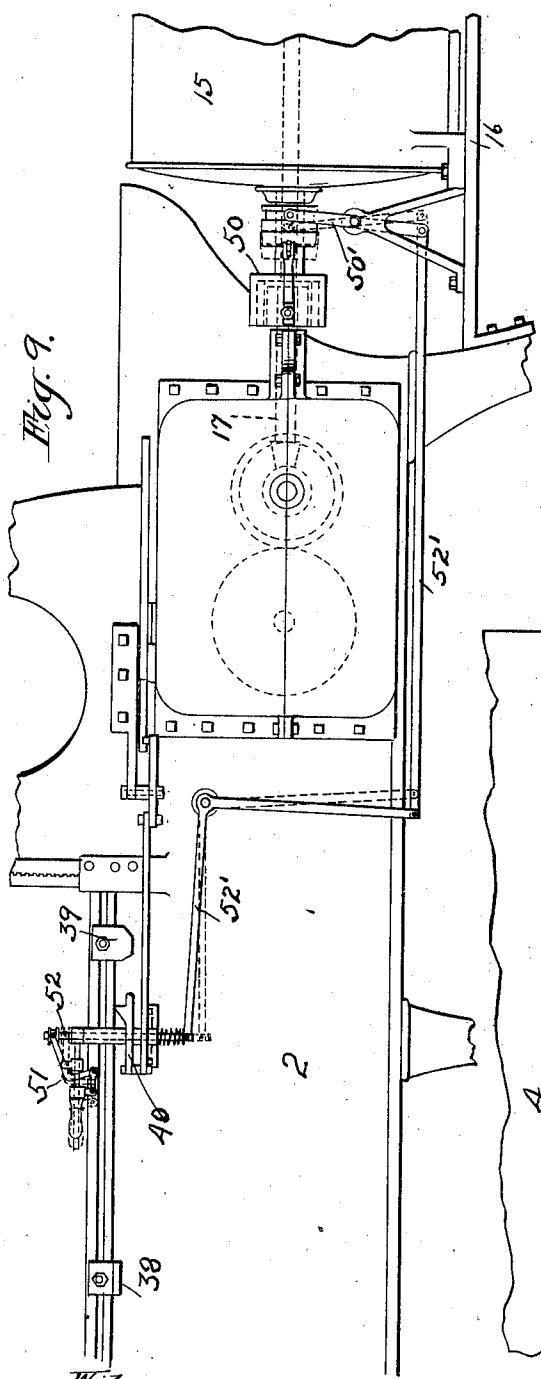

Fig. 9.

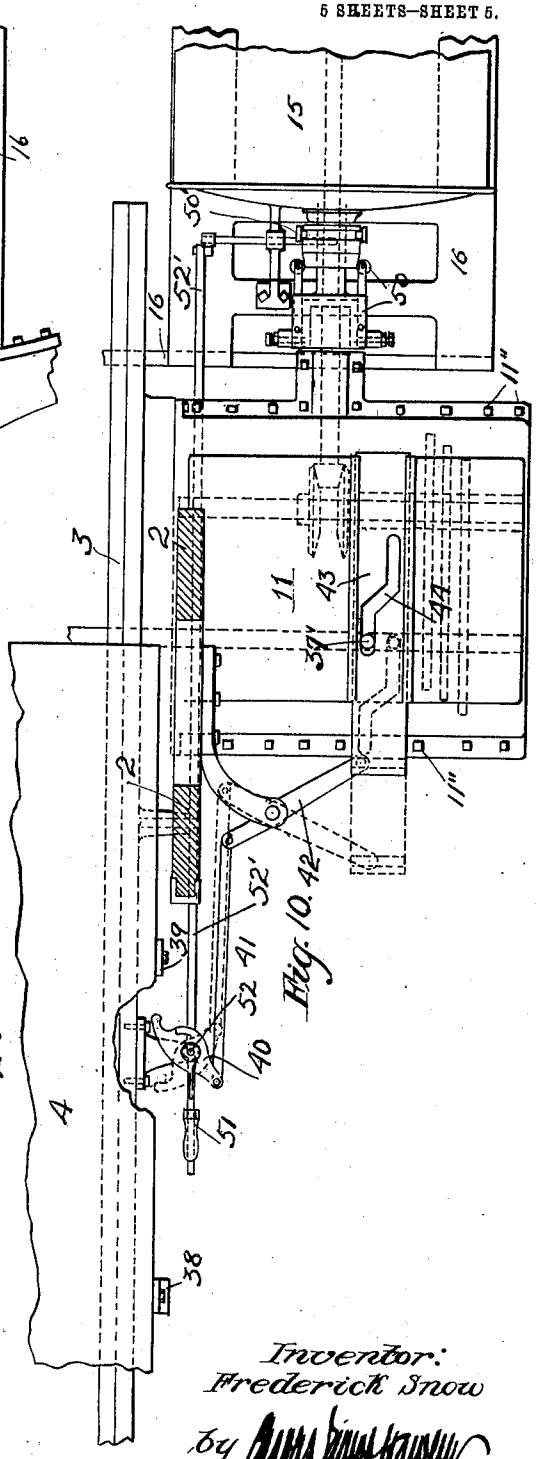

Fig. 10.

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UNITED STATES PATENT OFFICE.

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DRIVING AND REVERSING MECHANISM FOR PLANERS AND THE LIKE.

1,003,156. Specification of Letters Patent. **Patented Sept. 12, 1911.**

Application filed June 27, 1908. Serial No. 440,752.

To all whom it may concern:

Be it known that I, FREDERICK SNOW, a citizen of the United States, and a resident of Chicago, Cook county, Illinois, have invented a certain new, useful, and Improved Driving and Reversing Mechanism for Planers and the Like, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in driving and reversing mechanisms and has special reference to an improved mechanism for actuating heavy machinery of the class or classes provided with or having members which require either oscillatory, reciprocatory or rotary reciprocation.

The object of my invention is to provide a mechanism which shall be adapted for use with and upon such tools and machines as planers, rotary washing machines, elevators and the like and which shall be adapted to impart regular and exact reciprocations thereto, with absolute positiveness and yet without jar or shock at the moments of reversal.

The further and special objects of my invention will appear hereinafter.

My invention consists generally in a driving and reversing mechanism and means for attaching the same to and working it in correlation with reciprocating or reciprocatory machines and apparatus of various and many kinds, all as hereinafter described and particularly pointed out in the appended claims.

My invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification and in which:

Figure 1— is a plan view of a planer equipped with mechanism embodying my invention. Fig. 2.— is a top view of the mechanism, the cover of the casing being removed on the line A—A of Fig. 3 to disclose the same. Fig. 3.— is a vertical transverse section, on the line B—B of Fig. 2. Fig. 4.— is a like section on the line C—C of Fig. 2. Fig. 5.— is a further section on the line D—D of Fig. 2. Fig. 6.— is a vertical, longitudinal section on the line E—E of Fig. 2. Fig. 7.— is a sectional view identical with Fig. 6 except that the clutch members are shown in reversed or opposite positions; Fig. 8.— is a horizontal sectional view illustrating a modified form of the mechanism; and Figs. 9 and 10 are respectively side and plan views of a planer, showing the mechanism for operating the motor clutch illustrated in Fig. 8.

Referring now to Fig. 1 of the drawings, 2 represents the frame or bed of a planer provided with the parallel ways 3—3. The platen, 4, is adapted to slide or reciprocate on the ways, 3—3, and is the part upon which "work" is secured. The underside of the platen is provided with the usual rack, 5, and motion is communicated to the platen from the slow speed shaft, 6, through the medium of the gear, 7, (see dotted lines) which meshes with the rack, 5. The usual high speed shaft, 8, is parallel with the shaft, 6, and is connected therewith by the pinion, 9, on shaft 8 and the large gear, 10, on shaft 6. As indicated by dotted lines the shafts 6 and 8 are held in bearings in the frame of the machine. The shaft, 8, extends through the side of the planer frame and carries certain members of the driving and reversing mechanism about to be described.

11 represents the housing or casing of the reversing mechanism. This as represented is preferably made in two parts, the lower of which has its end bolted to the side of the planer; the upper part of the casing, 11, is held in place by a number of bolts, 11″, and when these are loosened may be readily lifted off the lower part to expose the reversing mechanism. The rear side of casing contains a bearing, 12, for the power shaft and the ends contain bearings, 13—13 and 14—14 for the shaft, 8, and another shaft, hereinafter mentioned, within the casing. I prefer that one half of each bearing shall be in the lower part of the casing and the other half in the upper part thereof, so that when the upper part is removed all of the elements of the reversing mechanism can be readily removed and as readily replaced.

15 represents an electric motor, the armature of which is adapted to rotate continuously in one direction. My invention makes this possible and it is at no time necessary to reverse the electric motor. A bed or bracket, 16, bolted upon the end of the planer frame supports the motor, 15. The shaft, 17, of the motor passes through and

is held by the bearing, 12, in the casing 11, and on its inner end is provided with a beveled pinion, 17′.

The shaft, 8, as shown passes through the casing, 11, and on this shaft, within the casing, I arrange the clutch members of the mechanism. The second shaft, before alluded to, is a divided shaft and comprises the shaft, 18, and the sleeve shaft, 19. The ends of the divided shaft are held in the bearings 14—14. A bevel gear 18′ is fixed on the shaft, 18, and meshes with one side of the pinion, 17′; a bevel gear, 19′ is fixed on the sleeve, 19, and engages the other side of the pinion, 17′; obviously the shafts 18 and 19 are rotated in opposite directions by the pinion, 17′. As the rotative direction of the motor and the motor driven pinion, 17′, is constant, as explained, it is further obvious that the directions of rotation of the shafts 18 and 19 are likewise constant. The several directions of rotation are indicated by arrows in the several figures of the drawings. The shaft or sleeve, 19, is the part from which, in a planer mechanism, the positive or forward movement is imparted to the platen of the planer. The shaft 18 is the part from which motion is transmitted to return the platen.

In handling or operating machine tools like planers it is desirable to return the reciprocating part, *i. e.*, the platen, at several times the speed at which it is propelled in the forward direction, and it is also desirable to not only impart slower positive or forward movement to the platen, but also to equip the operator with means whereby he may vary the positive or forward speed of the platen. With these purposes in view I interpose a high speed gear connection between the shaft, 18, and the shaft, 8, which represents the platen, and arrange a variable speed connection, or mechanism, between the positive direction shaft, 19, and the shaft 8. It will be noted that the shaft, 8, and the platen, geared thereto, take motion from both the shaft, 18, and the shaft, 19, but only one driving shaft is operatively connected at any given moment, the clutch mechanism, about to be described, serving to alternate the connections of the shafts 18 and 19 with the driven shaft 8. The members of the clutch mechanism are coaxial or concentric with the driven shaft, 8, but though so shown in the drawings need not all be mounted directly upon the shaft, 8; instead, certain thereof may, (by any mechanic), be provided with independent concentric bearings.

20 and 21 are two main clutch members which rotate in opposite directions. As shown in Figs. 2, 6 and 7 these members are loosely mounted on the shaft, 8; they are identical in construction but occupy reverse positions on the shaft and the hub 20′ of the member 20 is shorter than the hub 21′ of the member 21. Longitudinal movement of the members 20 and 21, on the shaft, 8, is prevented, as by collars 22, on the shaft, 8, and members 27 and 28, which are secured or fixed on the shaft between the members 20 and 21, as hereinafter explained. A gear 20″ is fixed on the hub of the member 20 and meshes with the gear 18″ of substantially the same diameter, on the shaft 18. Thus the member 20 is positively connected to the shaft, 18 and hence is adapted to be continuously driven thereby. In like manner the hub of the member 21 is connected with the sleeve or shaft, 19, but instead of a single pair of gears I provide several pairs thereof, the pairs differing in ratio. The gears 21″, 21‴ and 21⁗ are fixed on the hub 21′ of the member 21 and mesh with gears 19″, 19‴ and 19⁗, which are mounted on the sleeve, 19. The pair of gears, 21″, 19″ are adapted to impart the highest speed to the member, 21 and the pair of gears 21⁗ and 19⁗ impart the lowest speed thereto. The gears 19″, 19‴ and 19⁗ are loosely mounted on the sleeve, 19, and are held against longitudinal movement thereon. Only one of the gears 19″, 19‴ and 19⁗ may be connected with the shaft 19 at a time and for selectively fixing the same thereon I employ a sliding key, 23, in the sleeve, 19, adapted to enter one by one the key ways in the gears, (see Fig. 2.) The sleeve 19, preferably extends through the end of the casing, 11, and at its outer end the key is engaged with a collar, 24, thereon. The collar is movable by means of a lever, 25, and by shifting this lever either gear may be joined to the shaft, 19. It will now be obvious that by means of the several pairs of gears and the sliding key the speed of the member 21 may be varied at the will of the operator. As one or the other of the gears is always connected to the shaft, 19, continuous rotation is thereby imparted to the member 21 as long as the motor is in operation.

It being now understood that the clutch members 21 and 20 are continuously rotated in opposite directions I shall now describe the means by which they are alternately connected to the shaft 8 to reciprocate the platen of the planer.

Spaced apart on the shaft 8 and fixed thereto by keys 26 are two oppositely positioned parts, 27 and 28, being disks having long hubs, as shown in Figs. 6 and 7. On the hubs of the parts 27 and 28 are oppositely positioned truncated cones, 27′ and 28′. The cones are slidable on the hubs, but are held against rotation thereon by lugs, 27″ and 28″, respectively, which extend through holes in respective disks, 27, 28. The cones, 27′, 28′ are farther apart than the disks 27, 28 and are connected by rods, 29, extending

from one to the other and suitably fixed therein, as by pins 29′. The cones as shown are capable of slight longitudinal movement with reference to the fixed disks or members 27, 28 and when either cone is pushed against its disk the ends of its lugs 27″ or 28″, as the case may be, project through and from the inner side or face of the disk. Each clutch member, 20, 21 is equipped with an expansible female cone to receive respective cones 27′, 28′ fixed on shaft 8 as described. In lieu of the expansible cone or friction part each member, 20, 21 may be provided with an ordinary inexpansible internal cone for coöperation with the male cones; and for the purpose of a clear understanding of the operation thereof may be so considered, but in practice I prefer the use of the expansible friction cones as they afford advantages which cannot be secured where both members or cones are of fixed dimensions. The advantages and the construction of the expansible friction cones will be explained presently. Meantime it should be understood that the female cones or friction parts 20^a and 21^a of the two members, 20, 21 are more widely separated than the cones 27′ and 28′, and as relatively longitudinal movement of the female cones is prevented by the collars which hold the members 20, 21 against movement on the shaft, 8, the male cones are required to move longitudinally in order to engage respective female cones. It will also be clear that both pairs of friction cones can not in this arrangement be in engagement at the same time and therefore the longitudinal movement that causes the engagement of one pair of cones first occasions the disengagement of the other pair of friction cones or members. The described movement of the male cones is automatically imparted thereto by two threaded members, viz: the externally threaded nut, 30 and an internally threaded sleeve, 31, engaged therewith, as shown in Figs. 6 and 7. The sleeve, 31, is shouldered upon the disks 27, 28 and is adapted to rotate freely thereon. The disks thus, preferably, rotatively guide or hold the sleeve 31 and prevent the same from moving longitudinally with respect to the shaft, 8. As illustrated, the nut, 30, is shorter than the sleeve, 31 and is slidably fixed upon the shaft, 8, by means of the spline or feather, 30′. All of the parts 30, 27, 28, 27′ and 28′ rotate with the shaft, 8 and the rods, 29 extend through openings in the nut, 30. As shown, they also pass through the lugs 27″, 28″ of the male cone. The nut is recessed to receive the springs, 27‴ and 28‴ on opposite sides of the nut, solid portions or partitions, 30″ remaining between the recesses to separate the opposed springs. The outer ends of the springs bear against the inwardly projecting lugs of respective male cones. The springs are under compression at all times and the movement of the nut to one side or the other of its mid position between the disks, 27, 28 places the springs on that side under further compression which, obviously, is effective upon the respective male cone, tending to force the same away from its carrying disk and into engagement with the female cone. It may now be explained that the rotation of the threaded sleeve, 31 with respect to the disks and the shaft, 8, however produced, causes the nut to travel between the disks according to the direction of relative rotation. And as the direction from time to time is changed the nut is shifted to shift or reverse the friction clutches.

The two female friction clutches 20^a, 21^a occupy opposite positions in respective members 20 and 21 and are identical in construction. Each is made up of two pivoted parts 20^b having conical surfaces 20^c formed to exactly fit the male cone or friction member. The segments are radially slidable in guide openings 20^d in the large member. The members 20^b are leverlike in form, having two inwardly extending arms, $20^{b'}$ pivoted at the inner edge of the clutch member by pins 20^e. The heavy ends or clutch parts 20^b of these levers cause them to be thrown outward away from the main clutch when freed during the rotation of the clutch members. The outer positions of the female clutch members are the normal positions thereof. A ring, 32, on the member, 20, and a like ring, 33, on the member 21, are used for operating respective female clutch parts and when the latter are free prevent excessive outward movement thereof. The clutch parts, 20^b and 21^b are preferably provided with anti-friction rolls, *f*, which are in constant engagement with respective sliding or shifting rings, 32, 33. The interior cam surfaces 32′ 33′ are provided on the rings, in such form that when a ring is moved outwardly on the member which carries it, the female clutch parts are freed and move out, away from the male clutch part. Reversely, inward movement of a sliding ring forces the respective clutch part inwardly and positions them to receive the male cone. The rings, 32 and 33 are grooved and are shifted by means of yokes, 34 and 35, respectively, the latter having lugs projecting into the grooves of the rings. The yokes are slidable on the guide rod, 36 in the upper part of the casing and are formed on or connected by the plate, 37, so that the yokes move together. The yokes and rings, respectively, are separated at such distance that when in the middle position both female clutches, *i. e.*, the parts in the members, 20 and 21, are free and out of engagement with and out of the path of the male cones. As by means of the shifting yokes the rings may be moved to mid position it follows that the

clutches may be opened at any time to disconnect and stop the shaft, 8. This is the particular advantage before alluded to in comparing the merits of expansible and inexpansible female clutch members.

The plate 37 carrying the ring shifting yokes, above described is automatically operated from the platen of the planer and is also adapted for manual operation, as hereinafter more fully described. To secure relative rotation between the sleeve 31 and the parts mounted on the shaft, 8, whereby to shift the male cones I provide the female clutch levers with auxiliary friction parts g, attached to the lever by and adjustable by means of the set screws g' in said levers (see Figs. 6 and 7). The auxiliary parts g of the two sets of female members are positioned to engage the cylindrical surface, 31'' of the sleeve 31. They are so adjusted that when the female clutch members are free, *i. e.*, in distended positions the auxiliary members or parts g are out of contact with the member 31. All of the female clutch members 20^a and 21^a and the parts g thereof may be disengaged from the male cones and the part 31 at any given instant, but on the other hand only one set of female clutch members and parts g can be forced into engagement at a given instant. The reason is that the shifting rings 32' and 33' are so related that one does not press upon the female clutch parts until the other has moved sufficiently to disengage its respective clutch parts from the male cone, but immediately following the disengagement of previously engaged male and female members the ring of the opposite set forces the female members thereof inwardly and thus presses respective parts g upon the member 31 and moves the female parts into the path of the respective male cone. The instant that this occurs the member 31 is connected with the clutch member 20 or 21 whose female clutch parts or levers have been operated with the result that the member 31 begins to rotate with such part or member. This being the case and the shaft 8 at such moment being either stationary or in rotation in the opposite direction the member 31 rotates around the nut, 30, and forces the same toward the then actuating clutch member; this movement of the nut, acting through the compression springs, and finally through the direct engagement of the nut with the lugs of the male cone, forces the male cone into firm contact with the inwardly held female clutch parts. The member, 31, continues to drive the nut until the frictional grip or engagement of the male and female clutch members becomes sufficient to rotate the shaft 8 in consonance with the main rotating clutch member; thereupon the parts become locked and no further movement ensues between the parts g 30 and 31, all then rotating together.

As before stated, the shifting yokes, 34 and 35 are operatively connected with the reciprocating member of the planer. The operating mechanism, as clearly shown in Figs. 1, 3, 6 and 7 comprises dogs, 38 and 39 on the platen, 4; a lever, 40, pivoted on the frame of the machine; a link, 41; a lever, 42, pivoted on the machine; a plate, 43, having a cam slot, 44; and a cam pin, 37' on the yoke plate, 37. The plate 43 is movable at right angles to the plate, 37, and its cam, therefore (see Fig. 1) is adapted to shift the yokes from one extreme position to the other when the plate, 43, is shifted. The plate, 43, is held by guides, 43' on the top of the casing, 11, and is moved or shifted each time that a dog on the platen, 4, strikes the lever, 40. Except at moments of engagement with the dogs, 38, 39, the lever, 40 is free; and may be shifted or thrown by hand. Such movement, communicated through the link, 41 and lever 42, may be either complete or partial; in the first case a reversal of the driving mechanism will occur and when in the second case the lever, 40, is simply moved to its middle position, the pin, 37' will be taken into the middle of the offset or angular portion of the cam slot, 44, shifting the rings, 32 and 33 to mid positions and consequently disengaging the reversing clutches from the shaft, 8, causing the planer platen to stop.

For the purpose of clarifying the foregoing description of the parts of the mechanism and their individual functions, I shall now describe the mechanism and its operation when in the condition depicted in Fig. 6 and shall then trace the operations which cause the reversal of rotation of the shaft, 8. Fig. 6 shows the forward clutch member 21 engaged with the shaft 8, and, the return movement, member 20, disengaged therefrom. The engagement between the member 21 and the shaft 8 is, first, through the rings 33, which hold the female clutch levers in contracted condition; second, through the clutch members, 21^b and the male cone, 28'; third, through the lugs 28'' of the male cone and the disk, 28, which latter is keyed to the shaft, 8. Obviously, with the parts in this condition the shaft 8 will be rotated in the same direction as the clutch member, 21, and the load capacity is measured by the strength of the engagement between the male and female clutch members. Should there be a tendency to slip, the friction parts g, at such time forcibly engaged with the member 31, cause the latter to take up the slack by rotating upon the nut, 30, on shaft 8, thereby more forcibly thrusting the nut against the male cone, 28', and increasing the friction between the same and the female

members. It will thus be seen that my novel clutch takes up its own wear.

Fig. 7 shows the clutches in reverse position, the clutch member 20 being here connected with the shaft 8, through the parts, 32, 20^b, 27′, 27 and 26. Such reversal is occasioned by the throwing of the plate, 43, and consequent shifting of the yokes, 34, 35 and the rings 32, 33. The movement of the ring 33 relieves the female clutch members and thereby instantly disconnects the member 21 from the shaft 8. An instant later the ring 32, forces the female clutch member 20^b inwardly into position to be engaged by the male member 27′. Such engagement is brought about by pressing the parts *g* on members 20^b, against the member 31, and positively starting the rotation thereof in an opposite direction from that previously imparted by the member 21. Such opposite movement of 31 starts the nut 30 toward the disk, 27; and as the nut travels it relieves the pressure on the springs 28‴ and begins to compress the springs 27‴. On passing the mid position the continued movement of the nut, 30, acting through the springs 27‴ begins to move the connected male cones and the cone 27′ is gently thrust against the female members, 20^b. The pressure of the springs increases rapidly, and yet gradually, as the nut continues to move and sufficient friction is obtained to start the shaft into reverse rotation. The final engagement of the end of the nut with the lugs, 27″, and the final movement of the nut positively thrusts and locks the cone 27′ against the female members, after which slippage between the shaft 8 and the member 20 is practically impossible. As before explained the plate, 43, may be moved to mid position at will by means of the reversing lever, 40, and it is possible to disengage both friction clutches. If at the moment of such disengagement one clutch is in operation and is thrown out of action either the same clutch or the opposite one may be again thrown into action by means of the hand lever, 40, inasmuch as the clutch shifting operation is accomplished by the positive engagement between the threaded member 31 and the main clutch member to which it is desired to connect the driven shaft, 8. There is no moment during the operation of the mechanism when it is possible to leave the clutch members in a dead center position from which they will not be instantly dislodged and set in motion by either the automatic or the manual actuating of the shifting lever, 40.

In adjusting my mechanism I prefer to set the friction members *g* in such manner that they will always engage and start the action of the threaded parts at the instant and not before the respective female friction parts reach their inner, working positions. In the case of very high speed mechanisms it is desirable to allow a somewhat greater interval between the setting of the female friction members to receive the male cones and the starting of the cone shifting screw. In such cases I prefer to modify the herein before described mechanism to the extent and in the manner depicted in Fig. 8. As therein shown the operating clutch members are longer and separate levers, 45 and 46, are provided for operating the female friction members, 47 and the screw friction members, 48, respectively. Each main clutch member is equipped with two levers 46 and two levers 45. They are operated by a single sliding ring, 49 and are so adjusted that the levers 45 work in advance of the levers 46. Consequently the friction members 47 are always set down to working position before the connection is established between the main clutch member and the threaded sleeve, 31^x, thereby insuring the arrival of the female members in the path of the male member before the latter starts its clutching action. The emergency function of the hand lever, 40, before described, *i. e.* the simultaneous disconnection of both clutches, may in some cases be advantageously supplemented or replaced by an independent clutch, 50, between the shaft, 17 and the motor, together with a manual lever, 51, for controlling the clutch, 50. In such cases I do not disturb the lever, 40, but provide the same with a hollow shaft and mount the lever, 51, above it (see Figs. 9 and 10). The lever, 51, may be pivoted on the frame of the machine and operates a plunger shaft, 52, in the lever 40. The shaft, 52, is joined to the shifting lever, 50′, of the clutch by suitable connection, 52′. I prefer that the arrangement shall be such that the clutch, 50, is normally "set" by a spring and such that vertical movement of the handle of lever, 51, in either direction will overcome the spring and throw out the clutch, this part of my mechanism being of purely an emergency character.

The principle of my invention is capable of embodiment in numerous forms and mechanisms, each specially adapted for use with one or more classes of tools or machines.

As it is obvious that the driven shaft of my mechanism may be coupled to any machine element which requires alternative or reciprocatory actuation and as numerous modifications of the structure herein shown and specifically described will readily suggest themselves to those skilled in the art I do not limit or confine my invention thereto.

Having thus fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. A driving and reversing mechanism comprising oppositely rotative clutch parts

in combination with a shaft to be driven, a clutch member connected with said shaft to rotate with the same and adapted to alternately co-act with said clutch parts, clutch shifting means for alternating the engagement between said member and said parts and frictional mechanism upon each said clutch part for actuating said shifting means, substantially as described.

2. A driving and reversing mechanism comprising oppositely rotative clutch parts in combination with a shaft to be driven thereby, a clutch member shiftable from one to the other of said parts and through the medium of which said shaft is driven thereby, means for positively shifting said member and means for frictionally engaging said shifting means with said clutch parts alternately, as and for the purpose specified.

3. A driving and reversing mechanism comprising oppositely rotative clutch parts in combination with a shaft to be driven thereby, a shiftable clutch member through the medium of which the shaft is driven by the clutch parts, a screw motion mechanism for shifting said member and means upon said clutch parts for setting said mechanism in operation to engage the shiftable member therewith, substantially as described.

4. A driving and reversing mechanism comprising oppositely rotative clutch parts in combination with a shiftable clutch member for alternate engagement therewith, a shaft alternately driven by said clutch parts through the medium of the shiftable member, co-acting threaded parts revoluble with said shiftable member and adapted to shift the same, frictional devices carried by respective clutch parts and means for engaging the same with one of said threaded parts to shift said member, substantially as described.

5. A driving and reversing mechanism comprising a shaft to be driven in combination with clutch parts concentric therewith, and adapted for rotation in opposite directions, an intermediate clutch member mounted upon the shaft and through the medium of which the same is alternately rotated by said clutch parts, clutch shifting means and frictional devices for engagement therewith, said frictional devices being carried by respective clutch parts and means for operating said devices, substantially as described.

6. A driving and reversing mechanism comprising a shaft to be driven, in combination with oppositely driven clutch parts concentric therewith, an intermediate clutch member shiftably mounted on said shaft and through the medium of which said shaft is rotated, clutch shifting means carried by said intermediate member and mechanism upon each clutch part adapted to actuate said clutch shifting means for alternating the engagement between said intermediate clutch member and said oppositely driven clutch parts, substantially as described.

7. A driving and reversing mechanism comprising a shaft to be driven in combination with opposite direction clutch parts concentric therewith, an intermediate shiftable clutch member mounted on said shaft for alternate engagement with said parts, clutch shifting means carried by said shaft and adapted to positively engage the shiftable member with either of said parts, frictional devices upon said clutch parts for engagement with said clutch shifting means, and means for actuating said frictional devices, substantially as described.

8. A driving and reversing mechanism comprising a shaft to be driven in combination with opposite direction clutch parts concentric therewith, a clutch member mounted on said shaft for alternate engagement with said parts, screw motion clutch shifting means revoluble with said member but having a portion which is revoluble with respect to the shaft, and frictional devices upon said clutch parts for alternate engagement with said portion, substantially as described.

9. A driving and reversing mechanism comprising a shaft to be driven in combination with oppositely rotative clutch parts coaxial therewith, a clutch member shiftable upon the shaft and through the medium of which the shaft is alternately driven by said clutch parts, co-acting threaded parts revoluble with said member, said threaded parts being relatively movable and adapted to shift said member from one to the other of said clutch parts, and means whereby said threaded parts may be caused to co-act with either of said clutch parts for actuation thereby, substantially as described.

10. A driving and reversing mechanism comprising a shaft to be driven in combination with oppositely rotative clutch parts coaxial therewith, a member mounted on said shaft and adapted for alternate engagement with said clutch parts, threaded mechanism mounted upon said shaft and adapted to produce relative longitudinal movement of said parts and member in both directions, and an actuating mechanism upon each clutch part frictionally engageable with said threaded mechanism and adapted to cause its forcible engagement with the said member through the medium of said threaded mechanism, substantially as described.

11. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts co-axial therewith, means preventing longitudinal movement of said clutch parts, a clutch member shiftably mounted on said shaft for alternate engagement with said parts, a clutch shifting member revoluble with, and also with respect to said clutch member, and

adapted to shift said clutch member when rotated with respect thereto, and means for operatively joining said clutch shifting member to first one and then the other clutch part, substantially as described.

12. A driving and reversing mechanism comprising a shaft to be driven in combination with oppositely rotative clutch parts co-axial therewith, means preventing longitudinal movement of said clutch parts, a clutch member shiftably mounted on said shaft for alternative engagement with said parts, a clutch shifting member revoluble with said clutch member and shaft and also revoluble with respect to said shaft, and means upon each clutch part for causing relative rotation between said shaft and said clutch shifting member to shift said clutch member, substantially as described.

13. A driving and reversing mechanism comprising a shaft to be driven in combination with clutch parts fixed against relative longitudinal movement, means for rotating said parts in opposite directions, a clutch member shiftably mounted on said shaft for alternative engagement with said clutch parts, a clutch shifting member revoluble with said shaft and adapted to shift said clutch member thereon, and means upon each clutch part for frictionally engaging the same with said shifting member and through the medium thereof adapted to correspondingly shift said clutch member, substantially as described.

14. A driving and reversing mechanism comprising a shaft to be driven alternately by different members, in combination with oppositely rotating clutch parts longitudinally fixed with relation to said shaft, a clutch member shiftably mounted on said shaft for alternate engagement with said parts, a hollow member fixed on said shaft, shifting means carried by said shaft operatively within the said hollow fixed member and between ends of the said clutch member, and devices upon the said clutch parts for actuating said shifting means, substantially as described.

15. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch member, said clutch parts and member being relatively shiftable, a clutch shifting mechanism revoluble with the shaft and means for frictionally connecting said mechanism with said clutch parts alternately, substantially as described.

16. A driving and reversing mechanism comprising a shaft to be alternately driven in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch part upon the shaft, a clutch shifting mechanism arranged upon the shaft between the ends of said intermediate clutch part and comprising two co-acting threaded members, one of which is revoluble with the shaft and the second revoluble with respect thereto and means connecting said second threaded member with said clutch parts alternately, substantially as described.

17. A driving and reversing mechanism comprising a shaft to be alternately driven in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch part upon the shaft, a clutch shifting mechanism arranged upon the shaft between said clutch parts and comprising two co-acting threaded members, one of which is revoluble with the shaft and the second revoluble with respect thereto and frictional means for connecting said second threaded member with said clutch parts alternately, substantially as described.

18. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch part upon the shaft, a clutch shifting mechanism comprising screw threaded members adapted for relative rotation, one of said parts being held against longitudinal movement with respect to the shaft, and the other being longitudinally movable to shift the clutches and means for frictionally coupling either clutch part to the longitudinally fixed threaded member, substantially as described.

19. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts co-axial with said shaft, an intermediate clutch member on the shaft and through the medium of which the same is rotated, a clutch shifting mechanism having a part which is longitudinally movable on said shaft and revoluble therewith, springs through the medium of which the longitudinally movable part is adapted to shift the clutches and means for frictionally coupling the clutch shifting mechanism to said clutch parts alternately, substantially as described.

20. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts, means on said shaft fixing the same against longitudinal movement with respect to said clutch parts, an intermediate clutch part longitudinally movable on said shaft and revoluble therewith, co-acting threaded parts one longitudinally movable upon said shaft, springs interposed between the same and the intermediate clutch part, the other threaded part being held against longitudinal movement with respect to the shaft, said threaded parts being relatively revoluble and means for coupling the longitudinally fixed threaded part to the oppositely rotative clutch parts alternately, substantially as described.

21. A driving and reversing mechanism

comprising a shaft in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch member, said clutch parts and member being relatively shiftable, means for shifting the clutches, said means including interposed springs causing light initial engagement of the clutches, and means revoluble with said clutch parts adapted to actuate the clutch shifting means, substantially as described.

22. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative clutch parts co-axial therewith, an intermediate clutch member movable from one to the other of said clutch parts, a stationary member on said shaft, a traveling nut revoluble with the shaft, springs interposed between the same and said intermediate clutch member, a threaded part engaged with said nut and held by said stationary member and means for frictionally engaging said threaded part with said clutch parts alternately, substantially as described.

23. A driving and reversing mechanism comprising oppositely rotative clutch parts, in combination with a driven shaft concentric therewith, a clutch member upon said shaft to co-act alternately with said parts, positive clutch shifting means and frictional means upon said clutch parts for actuating said shifting means in respective directions, substantially as described.

24. A driving and reversing mechanism comprising a shaft to be driven in combination with a shiftable clutch member thereon, a non-shiftable part thereon, clutch shifting means carried by said shaft operable upon said shiftable member and re-acting against said non-shiftable part, oppositely rotating clutch members for engagement with said shiftable member, means on each for actuating said clutch shifting means in respective directions and a stationary shifter operatively connected therewith, substantially as described.

25. A driving and reversing mechanism comprising a shaft to be driven in combination with relatively shiftable intermediate and oppositely rotative clutch members concentric with said shaft and the first connected therewith, clutch shifting means revoluble with said shaft and devices upon the oppositely rotative members adapted for alternate engagement with said shifting means to alternate the clutches, substantially as described.

26. A driving and reversing mechanism comprising a shaft to be driven in combination with relatively shiftable intermediate and oppositely rotative clutch members concentric with said shaft and the first connected therewith, clutch shifting means revoluble with said shaft, devices upon the oppositely rotative members adapted for alternative engagement with said shifting means to alternate the clutches and automatic external shifting means operable upon said devices, substantially as described.

27. A driving and reversing mechanism comprising a shaft to be driven in combination with relatively shiftable intermediate and oppositely rotative clutch members concentric with said shaft and the first connected therewith, clutch shifting means revoluble with said shaft, devices upon the oppositely rotative members adapted for alternate engagement with said shifting means to alternate the clutches, automatic external shifting means, operable upon said devices, and manually operable means for unclutching the clutch members and alternating the same, irrespective of the automatic means, substantially as described.

28. A driving and reversing mechanism comprising a shaft to be rotated in two directions in combination with relatively shiftable concentric clutch members including members which are oppositely rotative, a traveling nut upon said shaft for positively and forcibly shifting the clutches, means carried by each of the oppositely rotative members for causing the operation, of said nut, and an external shifter co-acting therewith, substantially as described.

29. A driving and reversing mechanism comprising a shaft to be driven in combination with a clutch member mounted thereon, oppositely rotative clutch members for alternate engagement with a member on the shaft, a threaded nut on said shaft, a threaded sleeve engaged therewith, said nut and sleeve being relatively longitudinally movable to exchange the clutches and means upon the oppositely rotative clutch members for causing such relative movement of the nut and sleeve, substantially as described.

30. A driving and reversing mechanism comprising co-axial opposite direction clutch members, an intermediate clutch member, movable from one to the other of the first mentioned members, shifting means carried by the intermediate member for thus moving the same, a device upon which each of the opposite direction members, frictionally engageable with the shifting means carried by the intermediate member adapted to cause the operation thereof and respective, interlocked means for actuating said devices, substantially as described.

31. A driving and reversing mechanism comprising a shaft to be driven, in combination with oppositely rotative friction clutch parts in combination with an intermediate friction clutch part, a spiral or thread operatively interposed between said intermediate part and said shaft and means for coupling the same to said oppositely

rotative friction parts alternately to shift the intermediate member from one to the other thereof, substantially as described.

32. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative friction clutch members co-axial therewith, an intermediate friction clutch member adapted for alternate engagement with the oppositely rotative members, a shifting spiral or thread adapted for operative connection with the oppositely rotative members, means for establishing such connection therewith alternately and springs interposed between said shifting spiral and said intermediate member, substantially as described.

33. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative friction clutch members coaxial with said shaft, an intermediate friction clutch member on said shaft for alternate operation with the other members, a spiral or thread mechanism for shifting the clutches and yieldingly connected with the movable parts and means for frictionally and alternately coupling said mechanism to said oppositely rotative members to positively shift the clutches, substantially as described.

34. A driving and reversing mechanism comprising a shaft in combination with clutch members which are co-axial therewith, a shifting nut for moving one of said members into engagement with the other, a threaded sleeve for actuating said nut and means on the last mentioned clutch member for actuating said sleeve, substantially as described.

35. A clutch mechanism comprising a shaft to be rotated in combination with a clutch member longitudinally fixed with relation to said shaft and co-axial therewith, means for rotating said clutch member, a clutch member shiftable on said shaft for coöperation with the first member, a threaded sleeve longitudinally fixed with relation to said shaft, co-axial therewith, and adapted for rotation with respect to the same, a nut engaged with said sleeve revoluble with the shaft longitudinally movable thereon and adapted to operate the shiftable clutch member, means for frictionally coupling said sleeve and the first clutch member to operate said nut and shiftable member in one direction and means for reversing the rotation of said sleeve to move the shiftable member in the other direction, substantially as described.

36. A clutch mechanism comprising a shaft to be rotated in combination with a friction clutch member longitudinally fixed with relation to the shaft and revoluble coaxially therewith, means for rotating said clutch member, a second clutch member longitudinally shiftable on said shaft and adapted to rotate therewith, a threaded sleeve longitudinally fixed with relation to the shaft and adapted for rotation with respect to the same, a threaded nut engaged with said sleeve, revoluble with the shaft and longitudinally movable thereon, springs through the medium of which said nut is adapted to press said second member into engagement with said first member, said nut being also adapted to positively engage such said second member and means for coupling said sleeve and said first member whereby the latter is caused to operate the second clutch member, substantially as described.

37. A clutch mechanism comprising a shaft to be rotated in combination with a friction clutch member longitudinally fixed with relation to the shaft and revoluble coaxially therewith, means for rotating said clutch member, a second clutch member longitudinally shiftable on said shaft and adapted to rotate therewith, a threaded sleeve longitudinally fixed with relation to the shaft and adapted for rotation with respect to the same, a threaded nut engaged with said sleeve, revoluble with the shaft and longitudinally movable thereon, springs through the medium of which said nut is adapted to press said second member into engagement with said first member, said nut being also adapted to positively engage such said second member, means for coupling said sleeve to said first member to cause the engagement of the two clutch members and means for rotating the sleeve in an opposite direction to cause the disengagement of said clutch members, substantially as described.

38. In a clutch mechanism, a shaft, in combination with oppositely rotative clutch members co-axial therewith, an intermediate clutch member fixed for rotation with said shaft, means for alternating the engagement of the intermediate member with the other members comprising a threaded nut, a threaded sleeve engaged therewith, said nut and sleeve being relatively revoluble and relatively longitudinally movable, springs through which the shifting movement is thereby imparted to the clutches, frictional couplings for imparting motion to said sleeve and nut from said oppositely rotative members alternately and means for operating said couplings, substantially as described.

39. A clutch mechanism comprising a shaft to be rotated in combination with oppositely rotative clutch members co-axial therewith, an intermediate clutch member having friction parts for alternate engagement with the oppositely rotative members, said parts being fixed for rotation with the shaft and being longitudinally movable thereon, a shifting nut for alternative engagement with said friction parts, said nut

being fixed for rotation on the shaft and longitudinally movable thereon, a threaded sleeve engaged with the nut and revoluble with respect thereto, means upon the shaft preventing longitudinal movement of said sleeve and friction couplings for alternately engaging said sleeve with said oppositely rotative parts, as and for the purpose specified.

40. A clutch mechanism comprising a shaft to be rotated in combination with oppositely rotative clutch members co-axial therewith, an intermediate clutch member having friction parts for alternate engagement with said members, said parts being fixed for rotation with the shaft and longitudinally movable thereon, a shifting nut revoluble with the shaft and longitudinally movable thereon for alternate engagement with said parts, compression springs interposed between said parts and said nut, a threaded sleeve longer than the nut, means on the shaft preventing longitudinal movement of the sleeve, and friction couplings for connecting said sleeve with said oppositely rotative clutch members alternately, substantially as described.

41. A shaft to be rotated in combination with longitudinally fixed oppositely rotative clutch members co-axial with the shaft, means for rotating said members in opposite directions at the same and different speeds, an intermediate clutch member fixed for rotation with the shaft and shiftable thereon for alternate engagement with the other members, a spiral wedge part revoluble with the shaft, longitudinally movable thereon and yieldingly connected with said intermediate member, a revoluble part upon the shaft for operating said spiral wedge part and friction clutch levers on said oppositely rotative members to alternately engage and operate said revoluble part on the shaft, substantially as described.

42. A shaft to be rotated in combination with longitudinally fixed clutch members co-axial with the shaft, means for rotating the same in opposite directions, an intermediate clutch part longitudinally movable on said shaft and revoluble therewith, a shifting nut likewise movable on and with the shaft and connected with said intermediate part, a threaded sleeve engaged with said nut and having a cylindrical surface, means preventing longitudinal movement of the sleeve on the shaft to enable the same to operate the nut, when rotated, friction levers carried by said oppositely rotative clutch members for alternate engagement with said sleeve, lever operating rings on each said members, a yoke joining said rings and means for operating said yoke, substantially as described.

43. In a driving and reversing mechanism a shaft to be rotated in combination with a clutch member co-axial therewith and provided with clutch parts adapted to be expanded and contracted, means for thus operating the same, a clutch member shiftable upon the shaft to coöperate with said parts, a nut also shiftable upon the shaft for operating the shiftable member, a sleeve for actuating said nut, and frictional means for actuating said sleeve from the first mentioned clutch member, substantially as described.

44. In a driving and reversing mechanism a shaft to be rotated in combination with a clutch member co-axial therewith and provided with clutch parts adapted to be expanded and contracted, means for thus operating the same, a clutch member shiftable upon the shaft to coöperate with said parts, a nut also shiftable upon the shaft for operating the shiftable member, a sleeve for actuating said nut, and frictional means for actuating said sleeve from the first mentioned clutch member after the clutch parts have been positioned to receive the shiftable member, substantially as described.

45. A driving and reversing mechanism comprising oppositely rotative parts each provided with peripheral clutch members that are adapted to be radially opened and closed, a driven shaft concentric with said parts, clutch parts on said shaft for alternate engagement with respective members and means for shifting the last mentioned clutch parts upon said shaft to alternately engage and disengage the same from respective oppositely rotative parts, substantially as described.

46. A driving and reversing mechanism comprising a shaft to be driven in combination with oppositely driven clutch members, expansible clutch parts on each, means for expanding and contracting said parts, an intermediate clutch member and means for relatively shifting said intermediate and oppositely driven memoers, substantially as described.

47. A driving and reversing mechanism comprising a shaft to be driven in combination with shiftable clutch means thereon, clutch shifting means also thereon, springs operatively interposed between said clutch means and said shifting means through which the clutch means is initially actuated and co-acting opposed clutch members driven in opposite directions, substantially as described.

48. In a driving and reversing mechanism a shaft to be rotated in combination with oppositely rotative clutch members, an intermediate clutch member shiftable therebetween, the first mentioned clutch members being provided with independently movable clutch parts that co-act with the intermediate member, means upon said first mentioned members for operating respective

clutch parts and an intermediate-member-shifting-means also operable thereby, substantially as described.

49. A driving and reversing mechanism comprising a shaft to be rotated in combination with two drums co-axial therewith and revoluble in opposite directions, radially movable clutch parts upon each drum, means on each for operating the said respective parts, a yoke connecting said means for simultaneous operation, an intermediate shiftable clutch member on the said shaft and means controlled by said yoke for shifting said intermediate member, substantially as described.

50. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative drums co-axial therewith and longitudinally fixed, radially movable clutch parts on each drum, means on each drum for operating respective clutch parts, an intermediate shiftable member on said shaft, a shifting nut for actuating said member, a sleeve for operating said nut and sleeve actuating parts on each drum, substantially as described.

51. A driving and reversing mechanism comprising a shaft in combination with oppositely rotative longitudinally fixed drums co-axial therewith, an intermediate clutch member, a shifting nut on the shaft, compression springs between the same and said intermediate member, a threaded sleeve longitudinally fixed but rotative upon the shaft for actuating said nut, friction levers upon said drums for engagement with said sleeve, radially movable clutch parts on said drums and means upon each drum for actuating its friction lever and clutch parts, substantially as described.

52. A clutch mechanism comprising a shaft, disks mounted thereon, a nut movable between said disks and revoluble with the same and the shaft, friction clutch members also revoluble with the shaft and having parts extending through respective disks for engagement with said nut, means connecting said members, a threaded sleeve arranged between said members and capable of limited rotation to actuate said nut, oppositely rotative drums co-axial with said shaft, radially movable clutch parts therein for engagement with respective clutch members, means on each drum for operating its respective clutch parts, and means for frictionally coupling said sleeve to said drums alternately, substantially as described.

53. In a driving and reversing mechanism, two oppositely rotated driving clutch members, in combination with an intermediate clutch member, a shaft concentric with said members, means fixing the shaft and the oppositely rotated driving members against relative longitudinal movement, but permitting the free rotation thereof, a fixed member on said shaft, a clutch exchanging mechanism operatively interposed within said fixed member and between said intermediate clutch member and said fixed member for alternating the engagement of the intermediate clutch member with the oppositely rotated driving members, frictional means upon each driving member for actuating said mechanism, said frictional means in each case operating to first actuate said mechanism, cause the engagement of its driving member and the intermediate member and afterward serving to take up slip between said members and cause the engaged members, the shaft, and the actuating mechanism to operate as one part, substantially as described.

54. A driving and reversing mechanism comprising a clutch member, a shaft for rotation thereby and whereon the same is mounted and oppositely driven clutch members concentric with and revoluble about said shaft, for alternately driving the first mentioned clutch member and said shaft, in combination with two clutch exchanging or actuating members mounted for rotation with said shaft and adapted for relative movement while in rotation, to exchange the clutches, and means upon and revoluble with each of the oppositely driven clutch members for causing such relative movement of the actuating members to alternate or exchange the clutches, substantially as described.

55. In a driving and reversing mechanism of the class wherein oppositely rotating driving members are clutched alternately to the shaft to be driven, two members, one screwing within the other and one arranged for positive rotation with the shaft, in combination with mechanism adapted to check and reverse the rotation of the other screw member, by which mechanism one member may be caused to screw within the other and to impart longitudinal movement to the clutch devices so as to disconnect the shaft from one driving member and connect it to the other, substantially as described.

56. In a driving and reversing mechanism of the class described, oppositely rotated clutch members, in combination with an intermediate clutch member for alternate coöperation therewith, clutch exchanging mechanism carried by the intermediate member, arms upon said oppositely rotated members adapted to frictionally engage said mechanism and cause the exchange of clutches, substantially as described.

57. A driving and reversing mechanism comprising a shaft, in combination with oppositely rotative clutch parts, means on said shaft preventing longitudinal movement between the same and said clutch parts, an intermediate clutch member longitudinally movable on said shaft and revoluble there-

with, co-acting threaded parts, one longitudinally movable and the other longitudinally fixed upon the shaft, the former operatively interposed between the latter and the intermediate clutch member, and the latter adapted to receive the reaction of the former, said threaded parts being relatively revoluble and means for coupling the longitudinally fixed threaded part to the oppositely rotative clutch parts alternately, substantially as described.

58. A driving and reversing mechanism comprising a shaft to be driven, in combination with a shiftable clutch member thereon, a non-shiftable part thereon, clutch shifting means carried by said shaft, operable upon said shiftable member and re-acting against said non-shiftable part, oppositely rotating clutch members for engagement with said shiftable member, thrust means or collars on said shaft fixing said oppositely rotating members against longitudinal movement thereon, means on each of said last named members for actuating said clutch shifting means in respective directions and a stationary shifter operatively connected therewith, substantially as described.

59. A driving and reversing mechanism, comprising co-axial opposite clutch members; in combination with an intermediate clutch member, movable from one to the other of the first mentioned members; shifting means operatively related to the intermediate member for thus moving the same; means fixing said shifting means and said opposite direction clutch members against relative longitudinal movement; a device upon each of the opposite direction members frictionally engageable with the shifting means and adapted to cause the operation thereof; and, respective, interlocked means for actuating said devices, substantially as described.

60. A driving and reversing mechanism comprising a shaft to be driven, in combination with opposite direction friction clutch parts revoluble about said shaft, but fixed against longitudinal movement thereon, in combination with an intermediate friction clutch part having portions to engage the oppositely revoluble parts, a spiral or thread operatively interposed between the clutch engaging portions of said intermediate part and slidably secured to said shaft and means for coupling the sipral to said oppositely rotative friction clutch parts alternately to shift the intermediate part from one to the other thereof, substantially as described.

61. A clutch mechanism comprising a shaft to be rotated in combination with oppositely rotative clutch members co-axial therewith, means upon the shaft to receive the thrust of said members, an intermediate clutch member having friction parts for alternate engagement with the oppositely rotative members, said parts being fixed for rotation with the shaft and being longitudinally movable thereon, a shifting nut for pressing said friction parts into engagement with said member alternately, said nut being fixed for rotation on the shaft and longitudinally movable thereon, a threaded sleeve engaged with the nut and revoluble with respect thereto, means upon the shaft preventing longitudinal movement of said sleeve and friction couplings for alternately engaging said sleeve with said oppositely rotative members, as and for the purpose specified.

In testimony whereof, I have hereunto set my hand, this 1st day of June, 1908, in the presence of two subscribing witnesses.

FREDERICK SNOW.

Witnesses:

CHARLES GILBERT HAWLEY,

M. SIMON.