J. J. CRAIN.

DRIVING MECHANISM.

APPLICATION FILED JAN. 22, 1917.

Patented Dec. 18, 1917.

4 SHEETS—SHEET 1.

1,250,564.

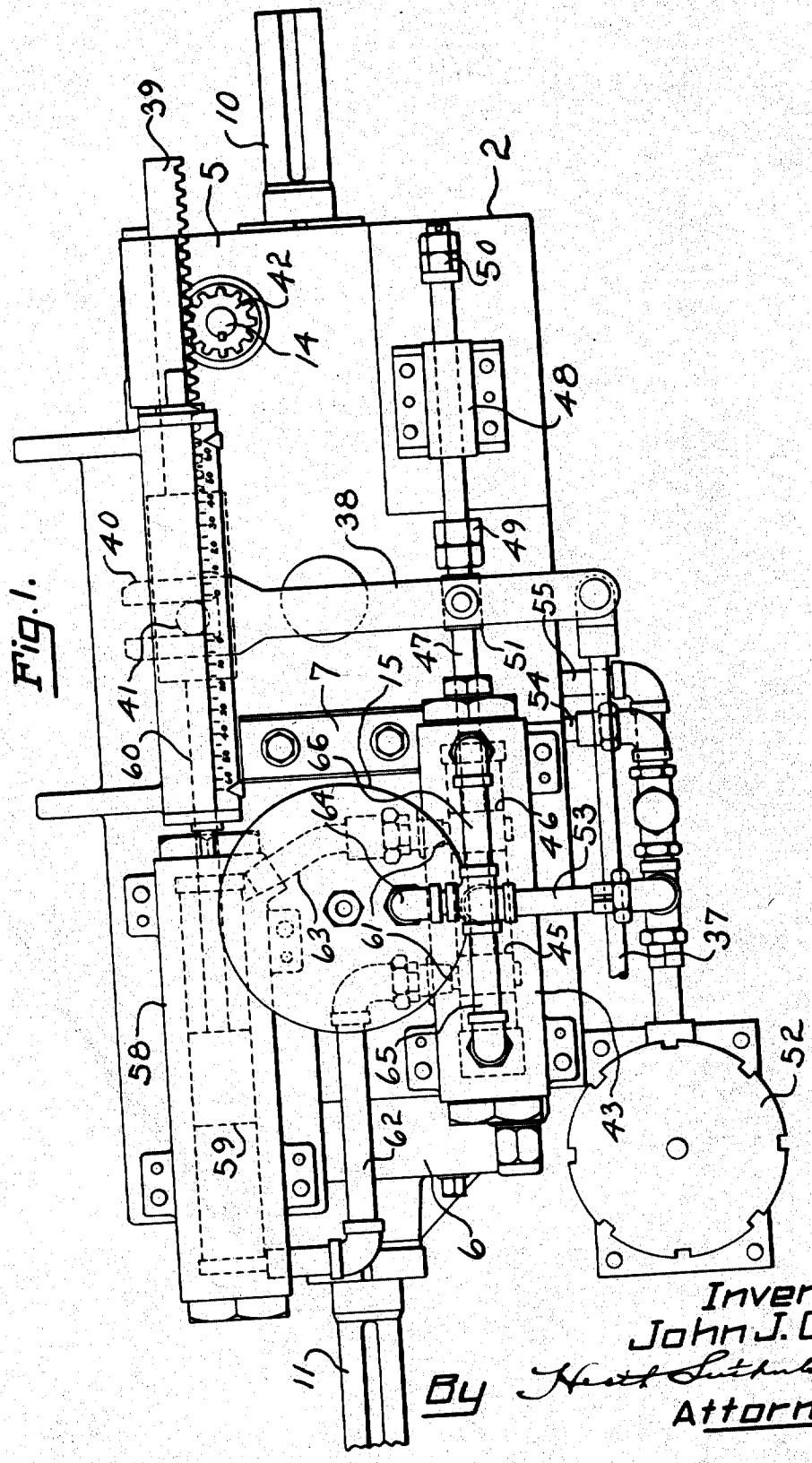


Fig. 1.

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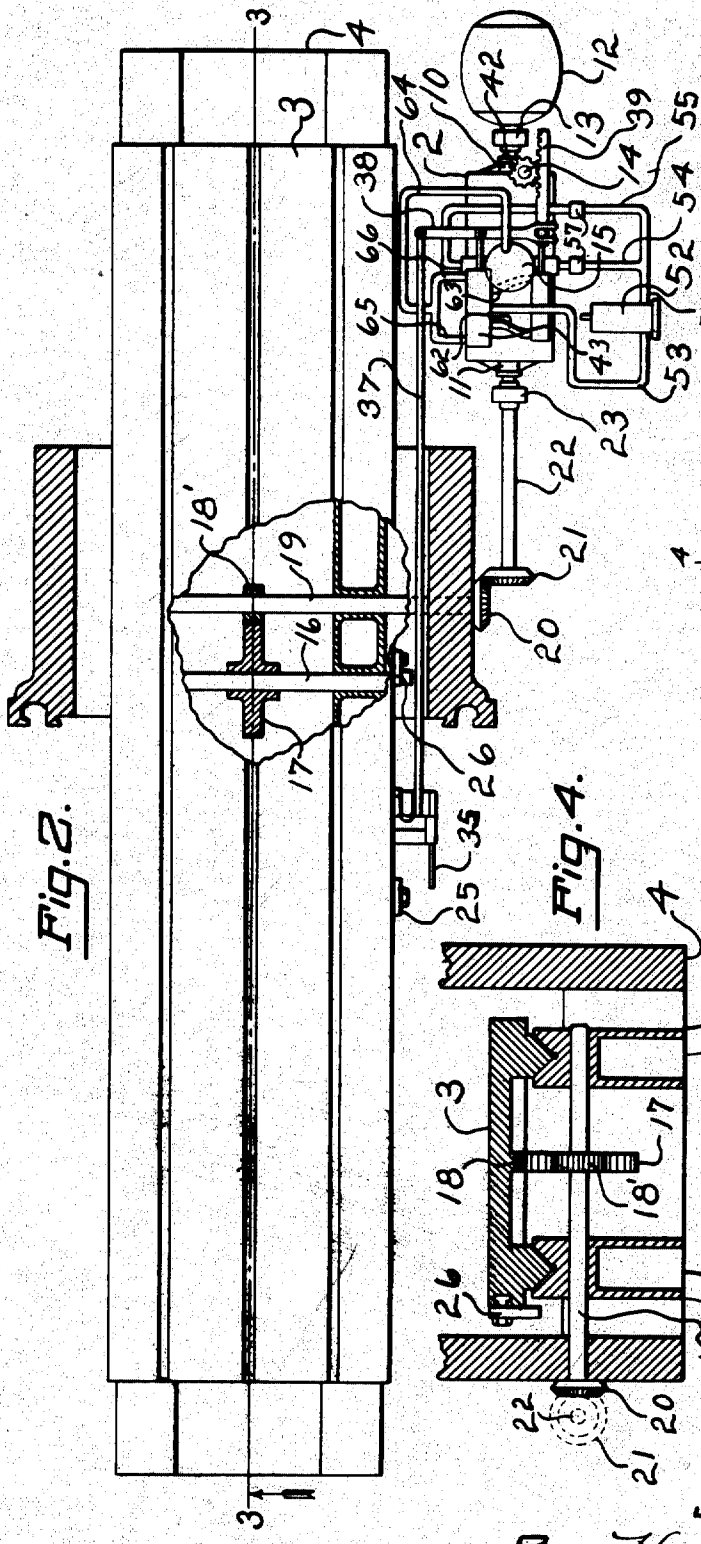


Fig. 2.

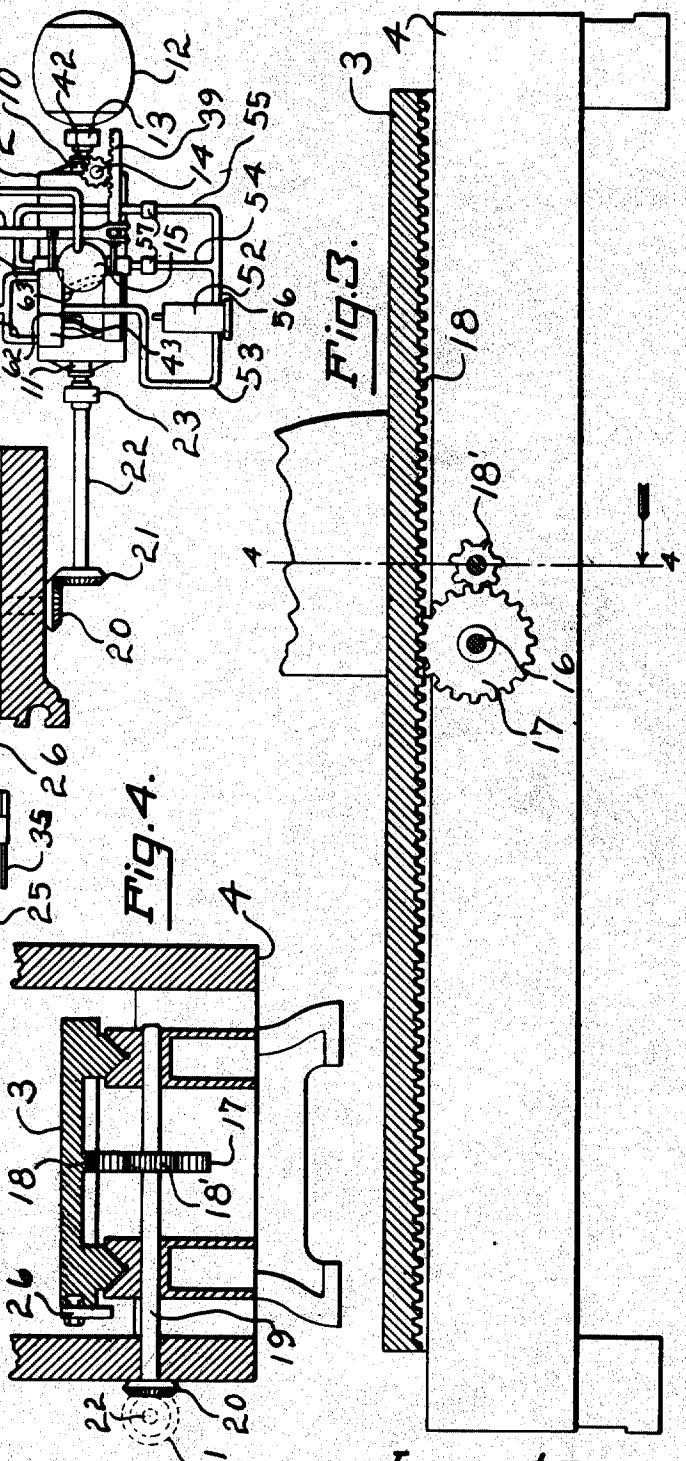


Fig. 3.

Fig. 4.

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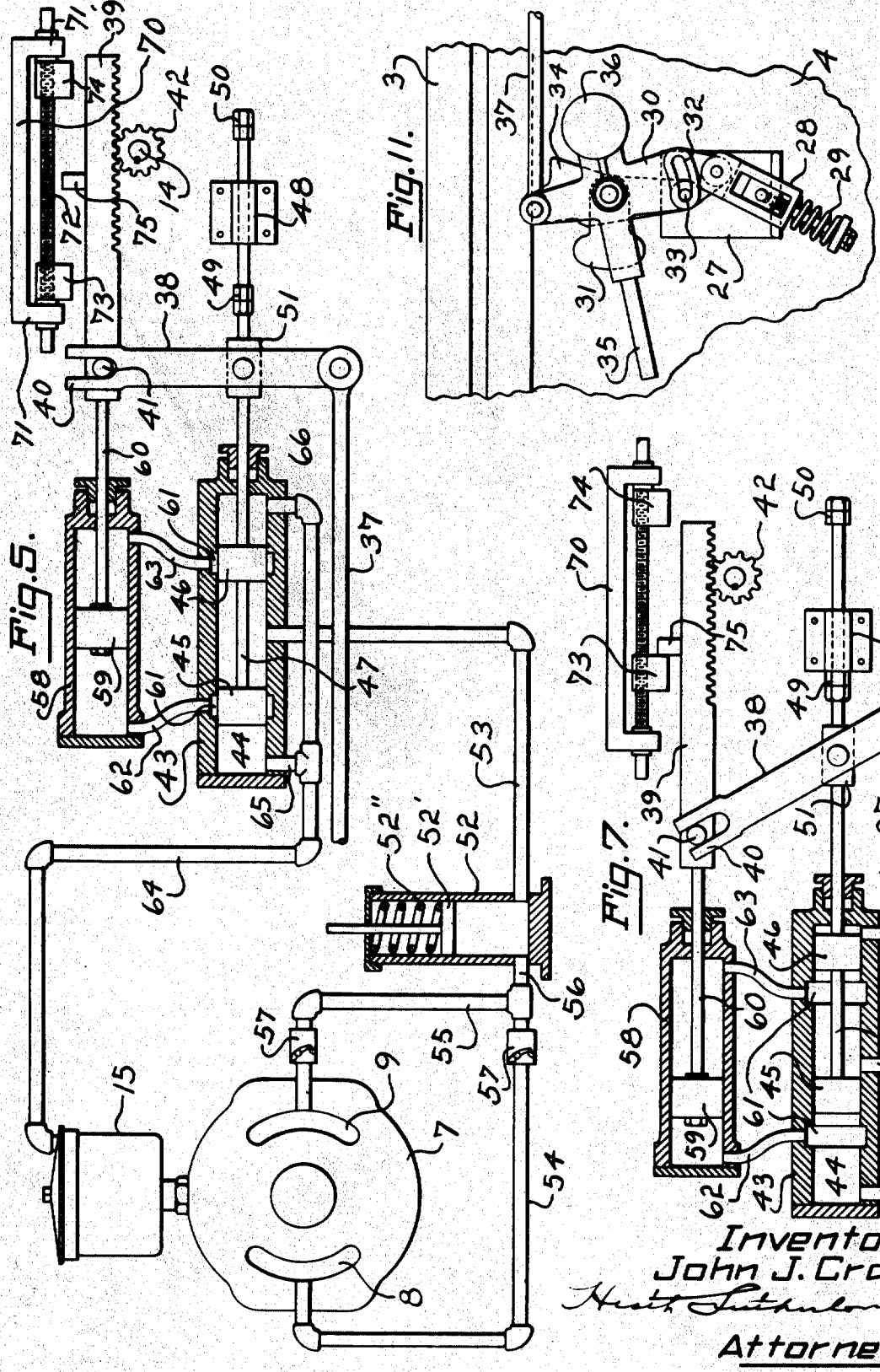
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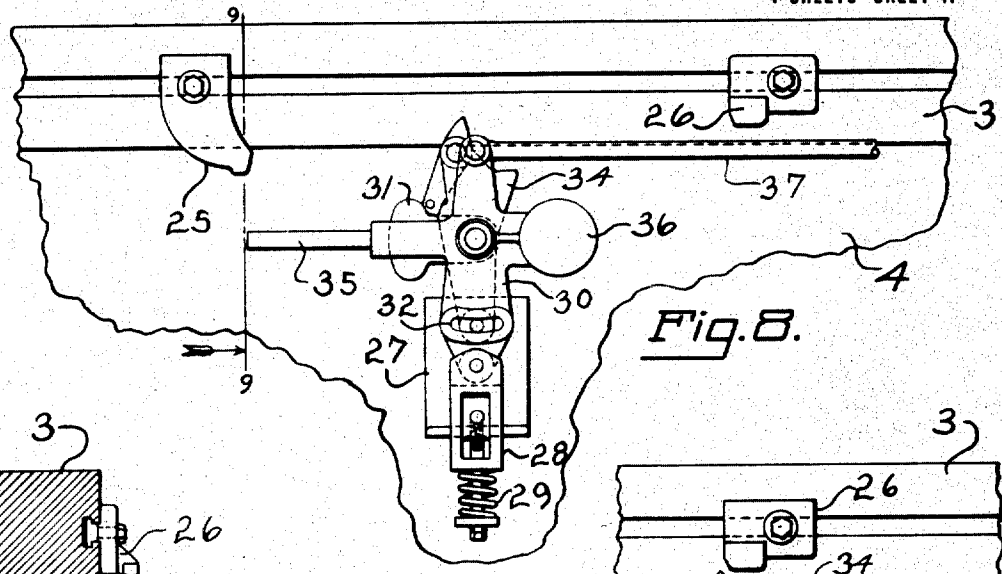


Fig. 8.

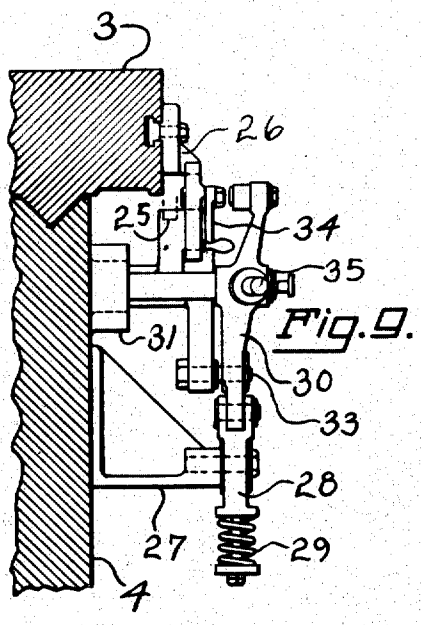


Fig. 9.

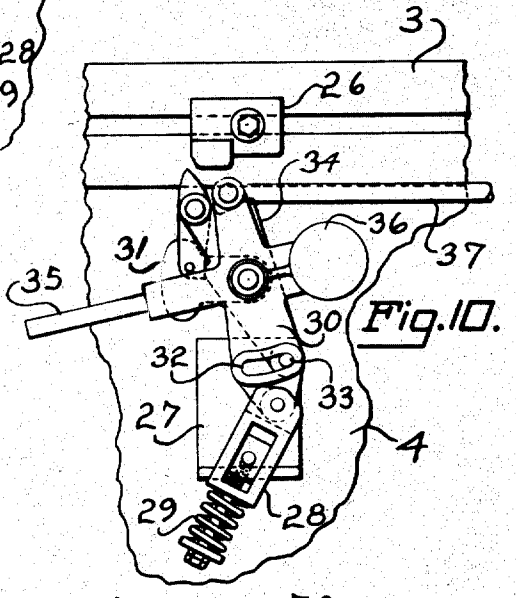
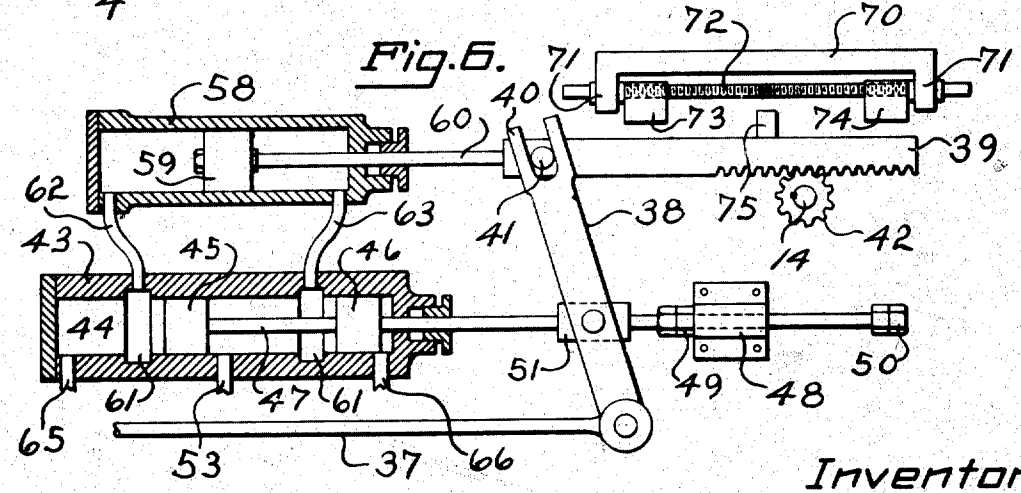


Fig. 10.

Fig. 6.



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UNITED STATES PATENT OFFICE.

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DRIVING MECHANISM.

1,250,564. Specification of Letters Patent. Patented Dec. 18, 1917.

Application filed January 22, 1917. Serial No. 143,706.

To all whom it may concern:

Be it known that I, JOHN J. CRAIN, a citizen of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Driving Mechanism, of which the following is a specification.

This invention relates to driving mechanism, one of the many objects of the invention being the provision of means of the kind set forth by which speed changes or variations in velocity and also when required in direction of movement, can be obtained. Said mechanism can be incorporated with utility in apparatus of widely different kinds, although it is of especial advantage for effecting the movement of a member in a forward and backward direction, that is either the reciprocation or oscillation of such a member.

In the drawings accompanying and forming part of the present specification I have shown in detail one convenient form of embodiment of the invention which will be set forth fully in the following description. I do not limit myself to this disclosure; I may depart therefrom in several respects within the scope of the invention defined by the claims following said description. In this particular form of embodiment of the invention, it is shown as embodied in a planer and for effecting the forward and backward movements of the reciprocatory bed thereof at the desired speeds.

Referring to said drawings:

Figure 1 is a top plan view of certain of the parts of the driving mechanism.

Fig. 2 is a top plan view with parts broken away and in horizontal section of a planer having associated with it the said driving mechanism.

Fig. 3 is a longitudinal section on the line 3—3 of Fig. 2, looking in the direction of the arrow.

Fig. 4 is a transverse section on the line 4—4 of Fig. 3, also looking in the direction of the arrow.

Fig. 5 is a diagrammatic section of certain of the principal parts of the driving mechanism.

Figs. 6 and 7 are sectional views of certain cylinders illustrated in Fig. 5 and adjunctive elements in different positions.

Fig. 8 is a detail view in front elevation of a portion of the base and bed of the planer showing also the dogs on the bed and part of the reversing mechanism.

Fig. 9 is a cross section on the line 9—9 of Fig. 8, looking in the direction of the arrow.

Figs. 10 and 11 are views corresponding practically to Fig. 8, Fig. 10 showing only one of the dogs and both of them being omitted in Fig. 11.

Like characters refer to like parts throughout the several views.

As I have already observed driving mechanism involving the present invention can be employed with advantage in many different connections where it is necessary to move an element back and forth, there being provision to effect automatic reversal of such an element and also the necessary or desired speed of said element on each of its strokes. The changes in direction of movement of the reciprocatory element are effected in a highly advantageous manner, and as will be hereinafter more particularly pointed out by hydraulic means. In the drawings I have shown parts of a planer, and driving mechanism when combined therewith is adapted to reciprocate the bed of the planer and through the agency of suitable means to vary the velocity of the bed on each of its movements, and what is most important to reverse the movement of the bed or equivalent part by hydraulically operated control means. The bed of a planer as will be understood is merely one example of a reciprocatory or oscillatory element with which the driving mechanism can be operatively related.

As a part of the driving mechanism is what I term a transmission device, that denoted in a general way by 2 answering my requirements in a satisfactory manner. This transmission device is of such character as to effect the necessary changes in speed and also reversals in direction of movement of a member operatively connected therewith. While I am not necessarily limited to any particular kind of transmission device, that illustrated and designated by 2 is what is known as a hydraulic variable speed gear and of which a somewhat brief description will be hereinafter given.

As I have already noted one of several uses to which the mechanism can be put is for driving the reciprocatory bed of a

planer, and in this particular use said mechanism with the aid of suitable means will reciprocate said bed such as that denoted in a general way by 3, the framework 4 of the planer having ways on its upper side to support and guide the bed 3.

The hydraulic variable speed gear 2 is practically a duplicate of that shown, described and claimed in Letters Patent No. 924,787 granted to Reynold Janney on June 15, 1909, and to which reference may be had for an explicit understanding of such a device. I deem it desirable to go into detail respecting such a hydraulic variable speed gear to an extent sufficient to understand its action and the way it operates and is in turn acted upon by the bed 3 or equivalent forwardly and backwardly moving member. This hydraulic variable speed gear although shown in Fig. 2 is illustrated on a larger scale in Fig. 1, and it comprises what is known in the hydraulic art as an A-end 5 and a B-end 6. The A-end consists of a hydraulic pump, while the B-end is in the nature of a hydraulic motor driven from the pump. The two ends of the hydraulic variable speed gear are separated by what is called a mid-plate 7, the mid-plate having elongated arcuate ports 8 and 9 (Fig. 5) for the passage of the necessary liquid employed in connection with the action of the transmission device or hydraulic variable speed gear as 2. Extending into the case of the A or pump end is a shaft 10, while extending into the case of the motor or B-end is a shaft 11, the two being coaxial. The shaft 10 might be considered as a driving shaft, while that at 11 can be considered a driven shaft. The shaft 10 is generally continuously driven and for this purpose any suitable motive agent may be employed, the electric motor 12 (Fig. 2) being shown for the purpose. The electric motor is connected with the shaft 10 in some convenient way as by the coupling 13. The pistons in the pump end 5 are through the agency of suitable means reciprocated through the agency of and by operative connections with the shaft 10 or its equivalent, and these pistons in turn operate pistons in the B or motor end 6, the pistons of the latter in turn, through proper connections, rotating the shaft 11 which in the organization illustrated is operatively connected with the reciprocatory bed or analogous element. As will be understood by a reading of the patent already identified when the pistons in the pump end 5 are at rest or in neutral positions, the pistons in the motor or B-end will also be at rest, and as a consequence the shaft 11 will not be rotated. By reciprocating the pistons in the A-end 5, however, the shaft 11 will be rotated and the speed of rotation will be governed by the length of stroke of said pistons in said A or pump end. By reversing the movement of the pistons in the A-end corresponding reverse in rotation of the shaft 11 or its equivalent follows.

The positions of the pistons in the pump end are effected through what may be broadly considered as a regulator or what is specifically known as a tilting box. This tilting box when occupying its neutral or mid position effects a corresponding positioning of the pistons in the pump end 5. If it be moved from the neutral position in one direction a progressive increase in speed of the shaft 11 follows in one direction, whereas if the tilting box be moved in the opposite direction from the neutral a progressive increase in speed of said shaft in the opposite direction follows. It will also be understood that by moving the tilting box from a shifted position toward and across the neutral position, the direction of movement of the shaft 11 will be reversed, and it will also be clear that corresponding actions take place with regard to a member operatively connected with said shaft 11. In the present case this member is the reciprocatory bed 3 and I will hereinafter describe suitable connections between the shaft 11 and bed 3. The tilting box is operated through a control member or shaft as 14, shown best in Fig. 1 and also appearing in Figs. 2, 5, 6 and 7. In said Fig. 1 the control shaft 14 is supposed to be occupying its neutral position, the shaft 11 at this time being stationary. It will, therefore, be understood that by the rotation of the control member or shaft 14, the tilting box can be moved to opposite directions from its neutral position or that it can be caused to cross the neutral position to effect the necessary movements in speed and change in direction of movement of the shaft 11. The liquid in passing from the pump end 5 to the motor end 6 does so by way of the ports 8 and 9. If it be desired for instance to rotate the shaft 11 in one direction, the pistons of the pump end will drive the liquid through the port 8, and this liquid will be returned to the pump end by the port 9, whereas if the shaft 11 should be oppositely rotated the reverse action takes place. The liquid is circulated and in circulating travels through these two ports. All of this is fully set forth in said Letters Patent. Surmounting the hydraulic variable speed gear and carried for instance by the mid-plate 7 thereof, is the storage chamber or receptacle 15 which has a communication with the liquid circulating system of which the ports 8 and 9 form a part of the hydraulic variable speed gear 2. Supported by the sides of the base 4 is a shaft 16 having fastened thereto the pinion 17 in mesh with the rack 18 on the under side of the bed 3 (see Figs. 2, 3 and 4). This pinion 17 meshes in turn with a smaller pinion 18′ fastened to the shaft 19 also sup-

ported by the sides of the base 4, the shaft being extended beyond the base 4 and having fastened to it the bevel gear 20 in mesh with the bevel gear 21 rigid with the shaft 22 connected as by the coupling 23 with the shaft 11. It will be apparent that the bed 3 can be advanced for instance at one speed and retracted at another, and I show means hereinafter described by which a certain velocity of the bed on each of its movements can be accurately governed and in fact varied by reason of which I can move the bed forward slowly and return it quickly or can obtain other desired speed conditions. This is not broadly new with me, but is illustrated in the application of Reynold Janney for patent for driving mechanism filed February 21, 1913, Serial No. 749,789. One of the principal differences in the present machine, however, over that covered in said application is the fact that the direction of movement of the reciprocatory part is effected by hydraulically operative means, the necessary liquid to act upon which is preferably obtained from the hydraulic variable speed gear, by virtue of which simplicity in construction and compactness of parts are insured.

The means for reversing the stroke of the reciprocatory bed, table or carriage 3 may be of any desirable kind, although the means shown for this purpose includes the dogs 25 and 26. These dogs are carried by the bed or table 3 for adjustment longitudinally thereof as common in planers and other types of metal working machines. It will be understood that the reversal in movement of the bed 3 is effected automatically when the same concludes its respective strokes, and the reversal in movement is primarily effected in the organization shown by the dogs 25 and 26 acting through intermediate parts upon the control shaft 14. I will hereinafter describe means whereby this particular action can be effected. In conjunction with the stops, however, I prefer to provide means of which a suitable form will be hereinafter described by which the control shaft is alternately given an accelerated movement from one predetermined shifted position to another predetermined shifted position. These predetermined shifted positions as will hereinafter appear can be adjusted so that in this way the speed of the bed 3 on its respective strokes will be governed.

The base or frame 4 is shown supporting on one side thereof (Figs. 8 to 11 inclusive) the bracket 27 to which is pivotally connected the spring-actuated toggle member 28, the spring 29 of which is under constant compression. Coöperative with this toggle member 28 is a second toggle member 30, the two being pivoted and the toggle member 30 being pivotally supported by a bearing 31 on the frame 4. The toggle member 30 has an arcuate slot 32 to receive the pin 33 on the rocker 34 coaxial with the toggle member 30, the rocker 34 being extended above the toggle member 30 and being alternately in the path of the dogs 25 and 26. This toggle and rocker construction for giving a snap movement to a reversing element is not new with me, but is quite familiar in planers and other kinds of metal working machines. In Fig. 8 the parts are supposed to be at rest, the toggle centers being in line and the pin 33 being midway between the ends of the arcuate slot 32. The arc of this slot is struck from the center of oscillation of the parts 30 and 34. The toggle member 30 as shown is provided with a handle 35 by which the machine can be thrown into action manually. It may also be provided with a counterbalance as the weight 36 which tends to hold the parts neutral.

Extending from the upper branch of the toggle member 30 is the rod 37 pivoted or otherwise suitably connected therewith and also to one end of the floating lever 38, the other end of said lever having an operative connection of suitable kind with the rack or equivalent element 39. As shown the end of the lever 39 opposite that to which the rod 37 is connected is forked as at 40 to receive a pin or stud 41 on the rack. The teeth of this rack are in mesh with the pinion 42 connected as by pinning or otherwise with the control shaft 14. In Figs. 1 and 8 the parts are assumed to be occupying their neutral positions, the shaft 10, however, being rotated by the motor. To start the machine the handle 35 will be grasped and swung either up or down. In Fig. 10 it is assumed to have been swung down. Owing to this fact the rod 37 will be moved endwise to swing the lever 38 and in a manner hereinafter described rotate the control shaft 14 to effect the action of the shaft 11 and thereby through the described parts the movement of the reciprocatory bed 3, the direction of initial movement of the bed depending upon the direction of movement of the handle 35 either up or down or in any other desired directions. After the machine has commenced its action, it will be automatically reversed by hydraulically operated means of which a construction suitable for this purpose will be hereinafter described.

Surmounting the case of the hydraulic variable speed gear 2 as shown in Figs. 1 and 2 is a casing 43 containing a valve such as that denoted in a general way by 44. As shown this valve (Fig. 5) comprises duplicate heads or valve portions 45 and 46 connected by the stem 47 extending outward through a stuffing box in the valve casing 43 and slidable through a guide member 48 also on the case of the hydraulic variable

speed gear 2 as shown best in Fig. 1. The projecting portion of the stem 47 is furnished with stops 49 and 50 which as shown may be adjustable and consist of nuts to alternately engage the guide member 48 and to therefore arrest the motion of the valve 45 at the limits of its respective movements. The stem 47 in addition is provided with a bearing 51 to which the lever 38 hereinbefore described, is fulcrumed between its ends. The case of the hydraulic variable speed gear 2 further supports a suitable accumulator such as that denoted by 52. From the tank of the accumulator the pipe 53 extends and opens into the valve casing 43 practically midway of the ends thereof as shown best in said Fig. 5. From the mid-plate 7 the pipes 54 and 55 extend, said pipes communicating respectively with the ports 8 and 9 in said mid-plate. They are connected together and are in communication by the branch 56 with the tank of the accumulator 52. Each of the pipes 54 and 55 is provided with a check valve as 57 to prevent back flow of the liquid although permitting free forward flow thereof which is alternately in a direction toward the tank of the accumulator 52.

The case of the hydraulic variable speed gear also supports the cylinder 58 in which is mounted for reciprocation the piston or plunger 59, the stem 60 of which extends outward through a stuffing box on one end of said cylinder and is rigidly connected with the rack bar 39. When the valve 44 is in the neutral position thereof as shown in Fig. 5, the heads or valve members 45 and 46 thereof cover the annular grooves 61 in the inner surface of the casing 43 and between the ends thereof. Extending from said annular grooves 61 are ducts or pipes 62 and 63 respectively leading into the ends of the cylinder 58 or disposed at opposite sides of the limits of movement of the piston 59 therein. From the storage tank 15 to which I have already referred the pipe 64 extends and it has branches 65 and 66 respectively opening into the casing 43 near the ends thereof or at opposite sides of the limit of movement of the duplex valve 44.

It will be assumed that the rocker 30, valve 44, piston 59 and control shaft 14 are in their neutral positions as shown best in Figs. 5 and 8, and that the shaft 10 is being rotated by the motor 12. At this time the shaft 11 is at rest as is also the reciprocatory bed 3. To start the bed the handle 35 is pulled either down or up and on such motion the rod 37 is either moved to the right or to the left in Fig. 5 so as to impart a swinging motion to the lever 38 about the pin 41 as a fulcrum or center. It will be assumed as shown in Fig. 7 that the rod 37 is moved to the right and that a corresponding movement follows with respect to the lever 38. On such motion of the lever the stem 47 is moved in a similar direction and a corresponding motion follows with respect to the two heads 45 and 46, thus moving the valve 44 of which said heads form a part, to one of the two extreme positions, one of which as will be understood is shown in said Fig. 7 and the other of which is of course exactly opposite to that shown in said view. On such motion of the duplex valve 44 liquid from the accumulator 52 under pressure can pass by way of the pipe 53 into the casing 43 and into the space between the two valve heads 45 and 46. When the said valve 44 is shifted to the position shown in said Fig. 7 liquid under pressure passing from the pipe 53 and entering the pipe 63 now in communication with the pipe 53 or other source of liquid pressure supply, will enter the cylinder 58 or its equivalent and acting against the piston 59 move said piston to the left from its neutral position. It is shown in the neutral position in Fig. 5 and in one of its two shifted positions (the left) in Fig. 7. On this particular motion of the said piston it acts through its stem 61 to impart a corresponding longitudinal movement to the rack bar 39 and the latter acting against the pinion 42 will rotate said pinion and as a consequence correspondingly turn the control shaft 14 so as to effect in the manner already described the rotation of the shaft 11 and through the connections between said shaft 11 and reciprocatory table or traveling bed 3, the movement of said part 3.

By limiting the movement of the control shaft 14 or its equivalent in opposite directions from the neutral position I can as will be clear govern the speed of movement of the traveling table or reciprocatory bed 3 on opposite movements thereof, and this particular result I obtain in the present case by adjusting or obtaining predetermined opposite movements of the rack bar 39 or its equivalent, and I will now set forth suitable means by which this particular result can be accomplished. On the case of the hydraulic variable speed gear 2 I mount a bracket 70 which has the lugs 71 which support between them the rod 72 screw-threaded (Fig. 5) to receive the blocks 73 and 74 constituting suitable adjustable stops, these blocks being, as will be clear, in the nature of nuts and being coöperative with a lateral projection as 75 on the rack 39. As I have already stated the control shaft 14 and other parts are in the neutral positions in Fig. 5, the adjustable stops 73 and 74 being shown in their maximum outward adjustments. Either or both of them may be moved inwardly. In said maximum adjustments the bed 3 through the intermediate parts is given its highest speed on both strokes. It will be assumed

that the rack bar 39 is moved until the projection 75 strikes the stop or nut 74. When this occurs the tilting box of the hydraulic variable speed gear is given its greatest movement in one direction from the neutral so as to effect the rapid movement of the bed. On opposite movement of the rack bar and as soon as the rack bar passes the neutral, the direction of movement of the bed 3 will be reversed, and when the projection 75 strikes the stop 73 the opposite movement of the bed will be at the greatest velocity. By adjusting either or both stops 73 or 74 inward, the velocities of the bed 3 on opposite movements thereof can be regulated. The bed can as a consequence be moved slowly on the advance stroke during which the tool (not shown) is cutting the stock on the bed. The return or backward stroke can be a rapid one. Either these or other desirable speed conditions can be easily accomplished through the proper adjustment of the two stops 73 and 74.

I have described the fact that the machine is thrown into action in the organization shown through the operation of the handle 35 which can be swung either downwardly or upwardly. After the machine has commenced its action it stays in action until said handle is brought to the neutral by hand or otherwise. During the normal operation of the machine the dogs 25 and 26 alternately strike the rocker 34 so as to effect through the intermediate parts movements alternately in opposite directions of the rod 37. In consequence of this condition the valve 44 is alternately moved to its extreme positions, being shown in one of said positions in Fig. 7, having been operative after being moved to such position to effect the movement of the piston 59 to the left to effect a predetermined movement of the bed 3. It will be assumed that the duplex valve 44 is moved to its extreme left position, and in this event liquid will be caused to pass from the casing 43 by way of the pipe 62 to the cylinder 58 and thereby move the piston 59 to the opposite extreme position to effect movement of the rack bar 39 to the right and therefore in the manner set forth the action of the control shaft to automatically reverse the machine and on its said reverse movement which may be either forward or backward the desired speed of the table.

As I have already noted the machine is thrown into action initially by hand, and I have described one of several ways in which this particular result can be obtained. Obviously I am in no sense restricted thereto, nor to other points, in that the invention resides in certain broad relations and in any detailed construction. After the machine is thrown into action by hand it becomes wholly automatic, the necessary liquid to the casing 43 not being supplied by the accumulator 52 but from the variable speed gear 2 itself. This liquid circulates, and it passes in alternation into the pipes 54 and 55 and from one of them to the branch 56, passing into the pipe 53 and then into the casing 43 by way of the accumulator 52 where it functions in the manner already set forth to effect alternately opposite movements of the piston 59 through the shifting of the duplex valve 44. In this manner the control shaft 14 through the described parts is oscillated to effect reversals in the direction of movement of the bed 3. The bed, as will be understood, is reversed, thus automatically, when it has concluded each of its strokes.

As will be inferred I do not restrict myself to the use of any particular device for effecting the reciprocation of the table, although the hydraulic variable speed gear described somewhat fully in this particular connection is a preferable device for obtaining the desired opposite movements of a work table or bed or equivalent part. In some cases I can employ merely what I have considered the A-end and can connect this A-end to the reciprocatory bed or it might be to any other suitable part.

In conclusion I wish to call attention to the fact of the advantage of the accumulator 52. In this accumulator is a piston 52′ backed by the spring 52″. It is conceivable that the apparatus might work without this hydraulic accumulator, or its equivalent. Its use is, however, highly advantageous. It or its equivalent serves to store oil or other substance under pressure, the consequence being that the reversing mechanism when at or near neutral will be positively reversed as under ordinary and usual circumstances it cannot supply any oil or equivalent for motive purposes. If it were not for this accumulator or an analogous device, the mechanism would not reverse itself certainly under ordinary circumstances. When in the latter event the control shaft is brought to the zero or neutral position the mechanism would ordinarily stop. The use of this accumulator, therefore, is highly advantageous, although as I have already observed, it might in some cases be dispensed with or an equivalent put in its stead. Ordinarily it or something of a similar nature is an essential element of the organization. An accumulator which meets my conditions is that denoted by 52. This accumulator incloses the piston 52′ backed up by the spring 52″ which exerts a constant pressure against the piston and tends to advance it to effect the supply of oil or equivalent to the reversing mechanism at the proper point.

What I claim is:

1. The combination of a movable member, a transmitting device operatively connected with the movable member, for actuating the

same, and fluid actuated means set in action by the movable member for governing the action of said transmiting device.

2. The combination of a movable member, a transmitting device operatively connected with the movable member for actuating the same, and fluid actuated means set in action by the movable member for governing the action of said transmitting device and for also reversing the same.

3. The combination of a movable member, a transmitting device operatively connected with the movable member, for reciprocating the same, hydraulically operated means for governing the action of said transmitting device and for also effecting reversal thereof, and means to be set at will for governing the amounts of opposite movements of said movable member.

4. The combination of a hydraulic transmitting device, automatically operable fluid actuated means receiving fluid from the transmitting device, for effecting reversals thereof, and manually adjustable means for governing opposite movements of said transmitting device.

5. The combination of a hydraulic transmitting device, automatically operable fluid actuated means receiving fluid from the transmitting device, for effecting reversals thereof, and means to be set at will for adjusting opposite movements of said hydraulic transmitting device.

6. The combination of a movable member, a transmitting device operatively connected with the movable member for actuating the same, and automatic fluid operated means for effecting reversals in movement of said transmitting device.

7. The combination of a movable member, a transmitting device operatively connected with said member, and hydraulically operated means set in action by said transmitting device for automatically reversing said transmitting device.

8. The combination of a hydraulic transmitting device, and automatically actuated fluid operable means for effecting reversals in direction of movement of said transmitting device.

9. The combination of a hydraulic variable speed gear, and means actuated by the liquid received from said gear, for automatically reversing the same.

10. The combination of a hydraulic variable speed gear having a regulator, and hydraulic means operated by said speed gear for automatically operating the regulator to change the direction of movement of the speed gear.

11. The combination of a reciprocatory member, a transmitting device operatively connected with said reciprocatory member for actuating the same, and fluid actuated means operable by said reciprocatory member for reversing said transmitting device.

12. The combination of a reciprocatory member, a hydraulic power transmitting device operatively connected with the reciprocatory member and having a regulator, a casing, a double piston in said casing, said transmitting device being in communication with and adapted to supply liquid between the pistons in said casing, a second casing having a piston operatively connected with the regulator, means actuated by the reciprocatory member for effecting the action of the double piston, and means to alternately supply liquid to opposite sides of the piston in the second casing on opposite motions of the reciprocatory member.

13. The combination of a reciprocatory member, a hydraulic power transmitting device operatively connected with the reciprocatory member and having a regulator, a casing, a double piston in said casing, said transmitting device being in communication with and adapted to supply liquid between the pistons in said casing, means for conveying liquid from the casing, to the transmitting device, a second casing having a piston operatively connected with the regulator, means actuated by the reciprocatory member for effecting the action of the double piston, and means to alternately supply liquid to opposite sides of the piston in the second casing on opposite motions of the reciprocatory member.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN J. CRAIN.

Witnesses:

CHAS. P. HAIGHT,

C. E. HUMPHREY.