Jan. 23, 1945. E. J. McILVRIED ET AL 2,367,793

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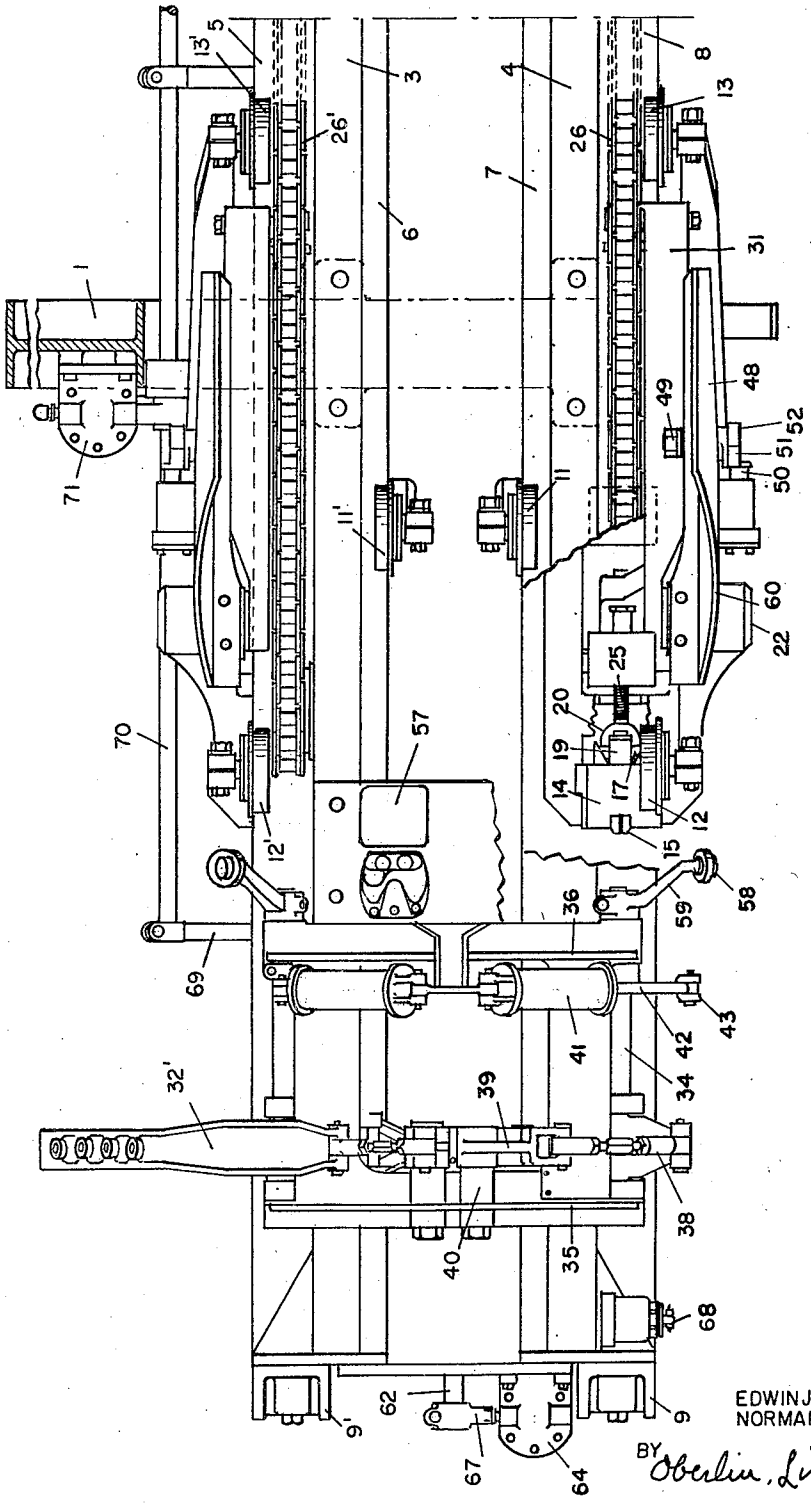

FIG. 1

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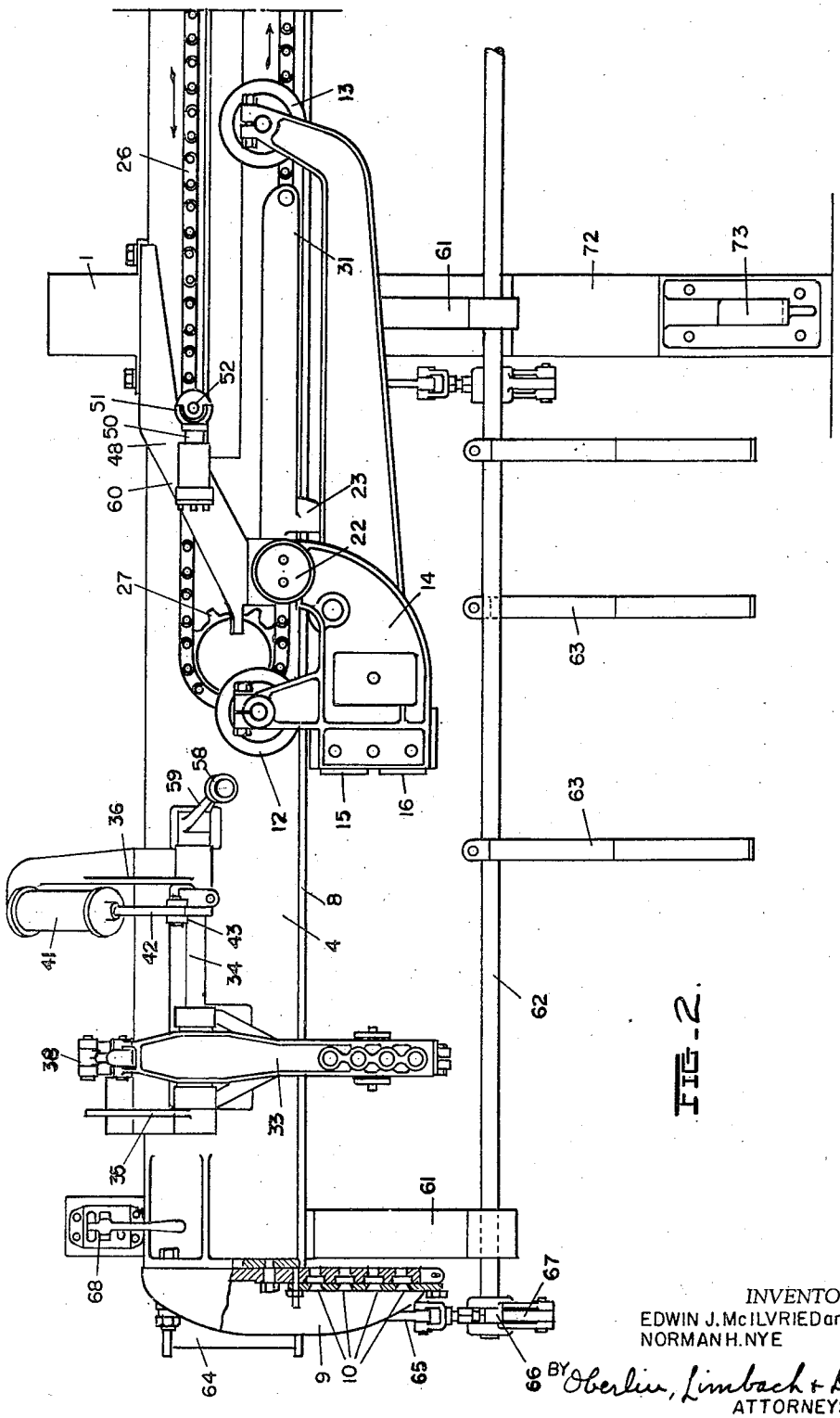

FIG-2.

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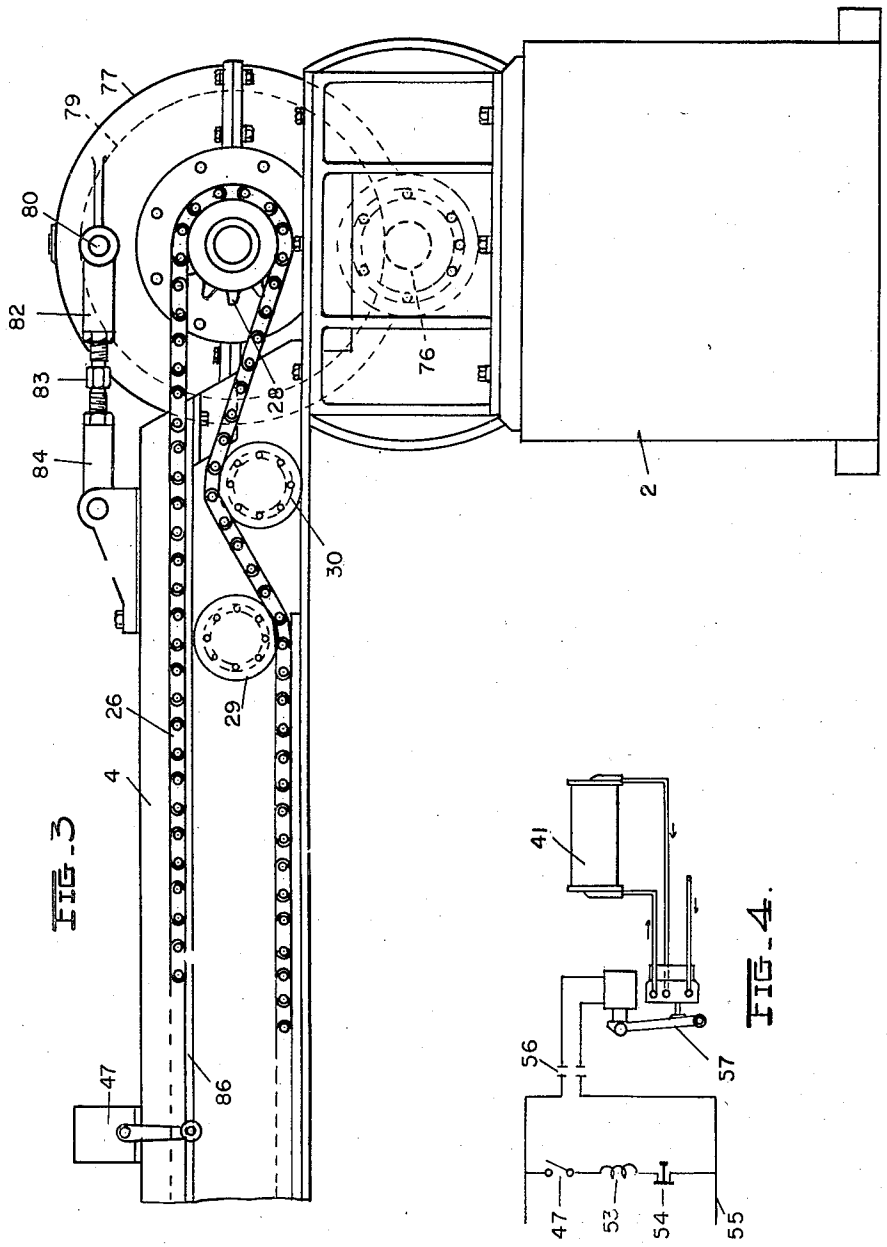

FIG. 3

FIG. 4.

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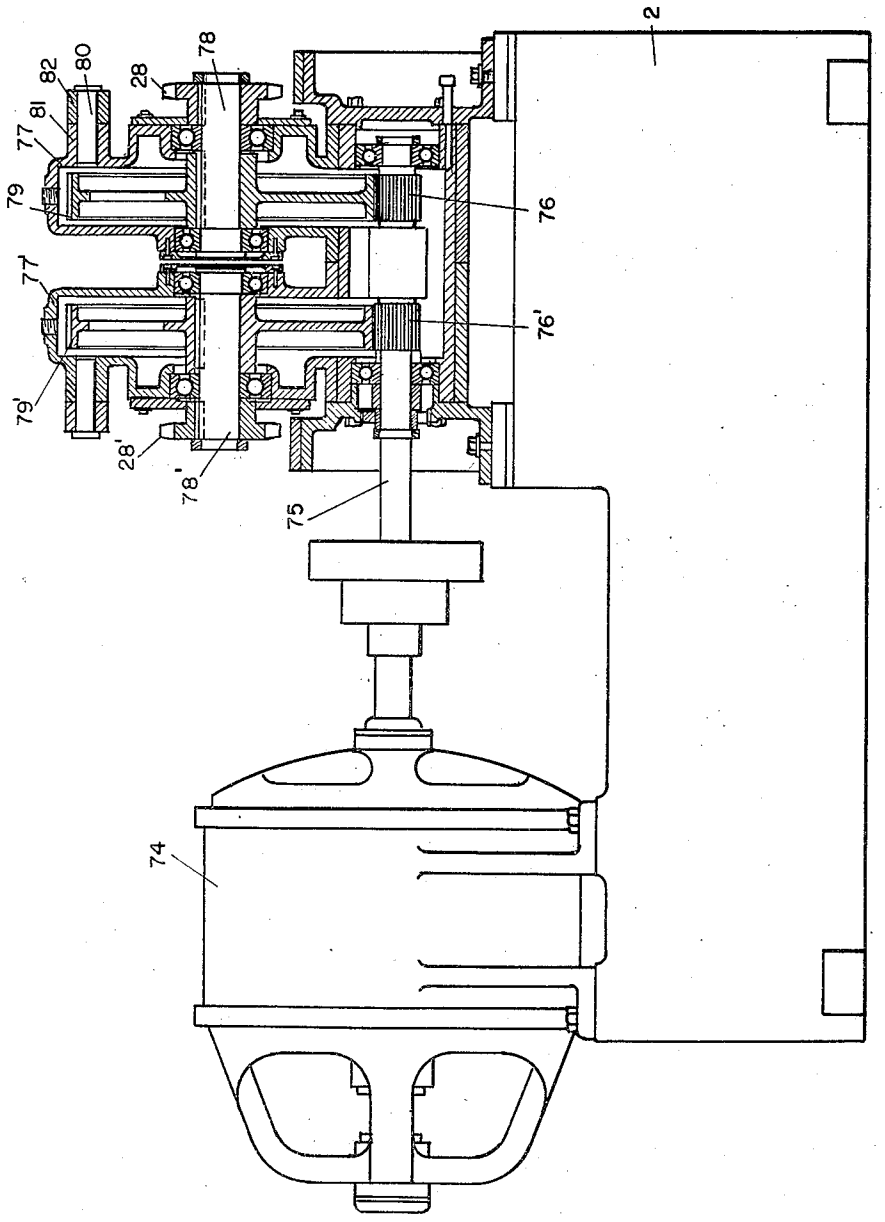

FIG. 5.

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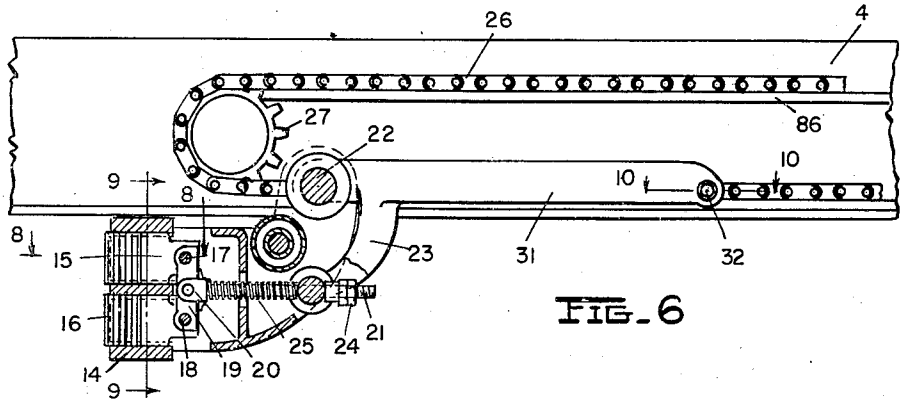

FIG. 6

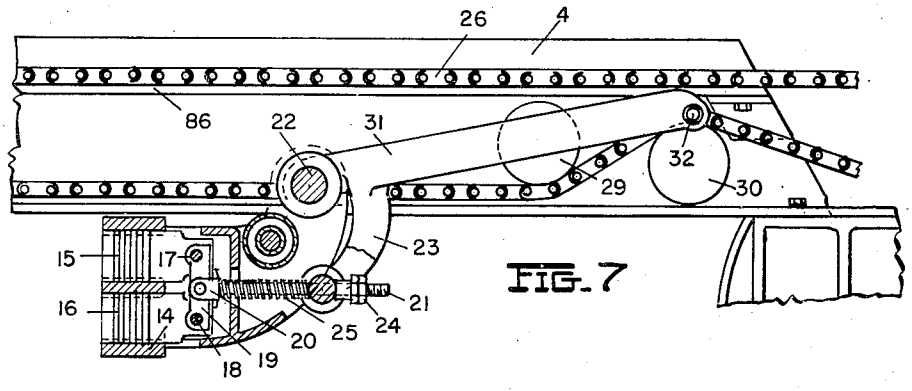

FIG. 7

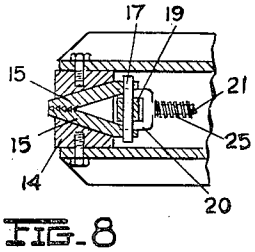

FIG. 8

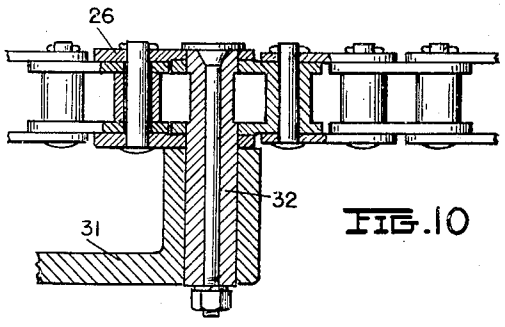

FIG. 10

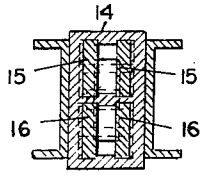

FIG. 9

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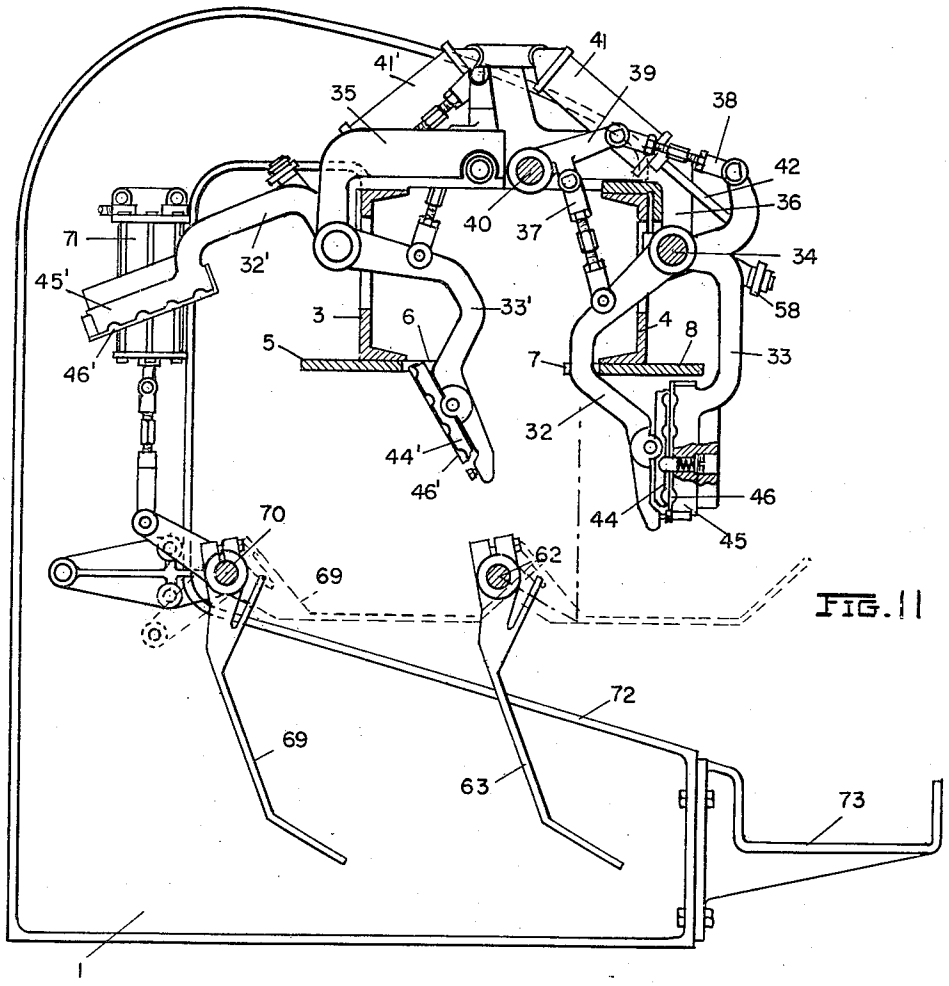
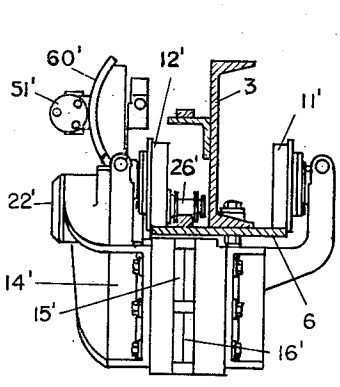


FIG. 11



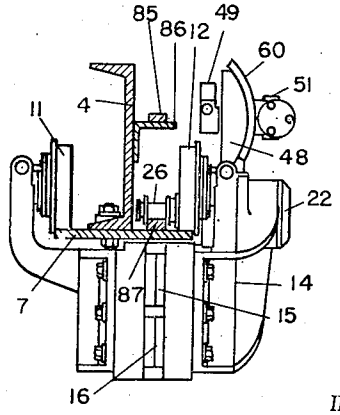


FIG. 12

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Patented Jan. 23, 1945 2,367,793

UNITED STATES PATENT OFFICE

2,367,793

DRAWBENCH

Edwin J. McIlvried, Akron, and Norman H. Nye, Cuyahoga Falls, Ohio, assignors to The Vaughn Machinery Company, Cuyahoga Falls, Ohio, a corporation of Ohio

Application January 1, 1942, Serial No. 425,356

29 Claims. (Cl. 205—3)

This invention relates as indicated to draw benches, and more particularly to drawing mechanism especially adapted to the drawing of tubes and the like.

In the past, drawing mechanism of this type has been relatively slow in operation and particularly in the steps of removing the work pieces from the bench after completion of the drawing operation and the return of the work gripping means to the die end of the bench to seize and draw further work. In one type of draw bench commonly employed, such work gripping means is connected to an endless chain and such means is reciprocated along the bench by reversing the direction of movement of such chain as by the employment of a reversing motor or the like. Or the work gripping means may be releasably attached to the endless chain and additional means provided for returning the work gripping means to the die end of the bench. The work in process of being drawn has generally been supported upon subjacent means from which the work must be lifted subsequent to the drawing operation. As the latter end of such work passes through and is released from the die, there has been a strong tendency for such work to whip or snap with possible resultant injury to the work, operator or machine.

It is therefore a primary object of this invention to provide an improved drawing mechanism in which the work gripping means is automatically closed to seize the work and automatically opened to release the work.

Another object of this invention is to provide means connecting such gripper means to the usual endless chain or cable whereby such gripper means may be reciprocated in a rectilinear path without the necessity of reversing the direction of movement of such endless chain.

A further object is to provide supporting means for the drawing mechanism which will permit discharge of the work pieces to one side of the draw bench upon completion of the drawing operation, even when two or more draw benches are in operation side-by-side and supported by the same supporting means.

A further object is to provide means automatically operative to frictionally grasp the work pieces shortly prior to passage of the latter ends thereof through the dies to prevent whipping of such ends upon release from the dies.

A further object is to provide means associated with the driving means for ensuring tight engagement of such driving means with the endless chain to which the work gripping means is attached.

Other objects of this invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a top plan view of the die end of a double draw bench constructed in accordance with our invention;

Fig. 2 is a side elevational view of the die end of such draw bench;

Fig. 3 is a side elevational view of the drive end of such draw bench;

Fig. 4 is a diagrammatic lay-out of the electric control and valve means for operating the double acting cylinders which close and open the tube clamping means;

Fig. 5 is a sectional view in elevation of the drive end of the draw bench;

Fig. 6 is a side elevational view of the work gripping means with a portion broken away to show the inner mechanism;

Fig. 7 is a view similar to Fig. 6 but showing the jaws in open position;

Fig. 8 is a top detail view of the jaw mechanism with the upper portion of the enclosing carriage broken away;

Fig. 9 is a sectional view taken along the line 9—9 on Fig. 6;

Fig. 10 is a detail view showing the manner in which the gripper means is attached to the endless chain;

Fig. 11 is a sectional view taken transversely of the draw bench adjacent the die end of the machine; and

Fig. 12 is a transverse sectional view of the draw bench showing the work gripping means mounted thereon.

Referring now more particularly to said drawings, the mechanism of this invention is supported by a series of substantially C-shaped base members 1 with the exception of the drive end of the machine which is supported on a box frame 2. Suspended from the upper or bracket portions of such C-shaped members are two par-

allel longitudinal guideways 3 and 4 bearing trackways 5, 6, 7 and 8.

Since the mechanism supported by and associated with each of said guideways is substantially identical, the one being the mirror image of the other, only the mechanism associated with outer guideway 4 will be described in detail, the parts associated with guideway 3 being given prime numbers corresponding to the numbers accorded the parts associated with guideway 4. At one end of the guideways are die mounts 9 bearing four dies 10 in vertical alignment therein. Slung from trolleys 11, 12 and 13, running on trackways 7 and 8 (or trackways 5 and 6 in the case of the mechanism associated with guideway 3), is a carriage 14 containing upper and lower pairs of jaws 15 and 16 respectively slidably mounted in angularly related camways in such carriage. (See Figs. 6 to 9 inclusive.) Pins 17 and 18 pass transversely through the back portions of such jaw members and are centrally held by an upright member 19 itself pivotally held within yoke member 20. Such yoke member is mounted on the end of rod 21 adapted to be reciprocated back and forth in the casing. Pivotally mounted on the casing at 22 is a bell-crank lever in the end of one arm 23 of which rod 21 is slidably mounted, lock nuts 24 preventing such rod from escaping from the arm. A coil spring 25 is interposed between the end of such arm and yoke 20 so that when the arm is moved forwardly to advance the jaw members in their angularly related cam slots to close the jaws, the tubing or other work pieces seized by the jaws will be firmly but resiliently held. An endless chain 26 is mounted on sprocket 27 adjacent the die end of the bench and on sprocket 28 at the drive end of the bench, the lower course of such chain passing between idlers 29 and 30 shortly before reaching such drive sprocket. An arm 31 of said lever is pivotally attached to said chain, as best shown in Fig. 10, by means of a special bushing 32 so formed that the chain may pass over the sprockets without interference from the lever arm or attaching means. When such lever arm 31 is attached to the lower course of the chain, as shown in Fig. 6, arm 23 will be bearing on spring 25 to effect closure of the gripper jaws. On the other hand, when the point of attachment of lever arm 31 to the chain has been elevated by idler 30 or has passed around sprocket 28 and is therefore on the upper course of the chain, lever arm 23 will have been drawn back, thus opening the gripper jaws, as shown in Fig. 7. It will therefore be seen that as chain 26 moves in the direction indicated by the arrows on Fig. 2, the gripper mechanism will be drawn along the guideway with the jaws in closed position until the point of attachment of lever arm 31 to the chain passes over idler 30, at which point the gripper jaws will be opened. As such point of attachment passes around drive sprocket 28 from the lower to the upper course of the chain, carriage 14 will be reciprocated along its supporting guideway toward the die end of the bench. When such point of attachment passes about sprocket 27 from the upper to the lower course of the chain, the gripper jaws will of course again be closed. The upper course of the chain is supported on a track carried by bracket 86 on the side of guideway 4, the lower course being supported on a similar track 87 on trolley trackway 8.

Clamping means are provided adjacent the die end of the bench to frictionally grasp the tubing shortly prior to the passage of the latter end thereof through the dies. Such clamping means comprises a pair of arms 32 and 33, the former pivotally and the latter tightly mounted on a shaft 34 journalled in ends of cross members 35 and 36. Toggle links 37 and 38 pivotally link said arms to T-arm 39 pivotally mounted at 40, said toggle arms being adjustable by turnbuckle means to provide for proper adjustment of the clamp. It is apparent, therefore, that outward movement of clamping arm 33 will cause arm 32 to swing in an opposite direction through the action of such toggle means. A double acting air cylinder 41 is carried by an upward extension of cross member 36 and is provided with a piston, an extension 42 of which is pivotally attached to the end of rocker arm 43 which is tightly mounted on shaft 34. It will thus be seen that when fluid pressure, such as air pressure, is admitted to cylinder 41 to move rod 42 outwardly the clamp will be closed, as shown in the right hand clamp in Fig. 11. The clamp proper comprises a shoe 44 pivotally mounted on arm 32 and another shoe 45 mounted on arm 33 with spring backed plates 46 mounted therein to ensure that the tubing is frictionally held in the four cooperating cut-away portions of the respective shoes adapted to receive the tubing. As also shown in the left hand clamp in Fig. 11, when air pressure is admitted to the opposite end of the double acting cylinder the clamp arms are swung apart to permit the gripper carriage 14 to advance therebetween toward the dies to seize new work pieces as the point of attachment of lever arm 31 to the chain passes around sprocket 27.

To close such clamp at the proper time a limit switch 47 is mounted on guideway 4 adjacent the drive end of the bench in proper position to be tripped shortly prior to the passage of the latter ends of the work pieces through the dies. Tripping means for such switch is mounted on an upward extension 48 of gripper carriage 14, such means comprising an upstanding arm 49 journalled in said member 48 for pivotal movement in a vertical plane. On the opposite side of member 48 is mounted a spring backed plunger 50 bearing a yoke member 51, the ends of which are adapted to engage the bevelled shoulders of an extension 52 of said arm 49. Thus when arm 49 engages and trips limit switch 47 such arm will be tipped back against the resilient pressure of plunger 50 and thus enabled to clear the switch as well as being returned to an upright position thereafter.

Upon reciprocation of gripper carriage 14, arm 49 will engage switch 47 on the return journey to open the switch and thereby cause the opening of the clamping means. The limit switch 47 is in an electric circuit including a relay coil 53 and an on-and-off button 54 of the maintaining type provided for manual control of the clamping means, if such should be desired. Line 55 is connected to a 220 volt 60 cycle current source. When limit switch 47 is closed during the drawing operation, relay contacts 56 are thereby likewise closed, causing solenoid valve 57 to be operated to admit compressed air to an end of cylinder 41 whereby rod 42 is extended and the clamping means closed. Of course when the limit switch is open the solenoid valve will act to admit compressed air to the other end of the cylinder and the clamp will likewise be open. (See Fig. 4.)

In order to obviate any chance of damage to the mechanism due to failure of the electric circuit or for other reason, positive means are pro-

vided adapted to open the clamp as the gripper carriage approaches the same so that collision therebetween may be avoided. Such means comprises a cam roller 58 mounted on the end of arm 59 locked to shaft 34. A cam track 60 is provided on member 48 adapted to engage said cam roller 58 and raise the same to rock shaft 34 and thus open the clamp. Of course if such clamp has already been opened as will have been the case in normal operation, cam roller 58 will have been raised to a position where it will not engage camway 60.

Journalled in depending arms 61 is a shaft 62 carrying a plurality of rack members 63. At the die end of the bench is a double acting cylinder 64 with a plunger 65 extending from the lower end thereof. Such plunger is connected by means of a link 66 to lever arm 67 locked to the end of shaft 62 so that upon admission of compressed air to respective ends of cylinder 64 shaft 62 may be rocked to elevate or depress rack members 63. Control valve means 68 are provided for manual operation of the rack. As best shown in Fig. 11, similar rack members 69 are mounted on shaft 70 below guideway 3 and adapted to be operated by similar link and lever means connected to the plunger of double acting cylinder 71 mounted on C-frame member 1. Such last named cylinder is also provided with manual control means, not shown. It will thus be seen that when such cylinders are operated to depress rack members 69 and 63 containing the work pieces dropped thereon by the gripper jaws at the conclusion of the drawing operation, such work pieces will roll down the inclined guideway 72 comprised by the upper surfaces of the base portions of members 1 and be laterally discharged into the receiving rack 73. It will be noted that this construction provides for all of the work pieces from both of the guideways being discharged laterally at the same side of the draw bench. This facilitates removal of the completed work and permits a greater degree of access to the bench.

As best shown in Figs. 3 and 5, the driving mechanism comprises an electric motor 74 operative to turn a drive shaft 75 to which gears 76 and 76' are keyed. Mounted for pivotal movement about the axis of such drive shaft are two housings or casings 77 and 77' in which are journalled shafts 78 and 78' respectively. Keyed to the outer end of shaft 78 is drive sprocket 28 and keyed to such shaft within housing 77 is gear 79 in driven engagement with said gear 76. It is at once apparent that gears 76 and 79 will maintain proper engagement when housing 77 is rotated about the axis of drive shaft 75. Pivotally mounted on stub shaft 80 in boss 81 of casing 77 is an arm 82 joined by means of a turnbuckle 83 to arm 84 pivotally mounted on guideway 4. It will be seen that by means of turnbuckle 83 housing 77 may be tipped about the axis of drive shaft 75 to ensure tight engagement of sprocket 28 and chain 26, the turnbuckle acting as a jack. Similar means is provided to tighten the chain travelling along guideway 3 on drive sprocket 28', it being noted that gears 79 and 79' each have their respective separately adjustable housings.

While the operation of the drawing mechanism of this invention is more or less obvious from the foregoing description, such operation will nevertheless be briefly explained. The ends of the work pieces are inserted in the dies in position to be seized by the jaws of the gripper mechanism, the feeding or loading means being no part of this invention. Carriage 14 is then advanced between clamping arms 32 and 33 and as the point of attachment of lever arm 31 to the chain passes around sprocket 27 from the upper to the lower course of the chain the pairs of jaws 15 and 16 are automatically closed to seize the ends of the work pieces to be drawn. As carriage 14 moves along guideway 4 the work is drawn through the dies. Shortly prior to the passage of the latter ends of the work pieces through the dies, the upstanding arm 49 engages limit switch 47 to cause arms 32 and 33 to swing their respective clamping shoes into cooperative frictional clamping engagement with the work pieces. Buckling and whipping of the work caused by jumping forward as it is released from the die is thus avoided. Otherwise the tubing may be bent into a sinuous configuration seriously interfering with further handling. The work gripping means continues to move along the guideway until the ends of the work pieces clear the aforesaid clamp. Shortly thereafter the point of attachment of lever arm 31 passes over idler 30 operating to open the work gripping jaws and permit such work to be deposited on rack members 63. Sufficient time is thus afforded for the carriage 14 to get out of the way of the tube before the point of attachment of lever arm 31 of the chain passes about sprocket 28 causing reciprocation of gripper carriage 14 in the opposite direction toward the die end of the machine, where the procedure is repeated. Of course the gripper mechanism carried by guideway 3 operates in a similar manner in conjunction with its respective clamping mechanism, likewise operated by a solenoid valve controlled by a limit switch. The limit switches may be adjustably located on the guideways to adapt the operation of the clamping means to different lengths of tubing.

Although in Figs. 1 and 12 the gripper means of the two guideways are shown side by side, such gripper means may be oppositely located on their respective guideways so that one will just be seizing work to be drawn when the other has released the completed work and is about to return to the die end. In this way, work will be drawn on only one bench at a time and a less powerful driving means will be required than when both benches are engaged in drawing work simultaneously.

It will be seen from the foregoing that drawing mechanism has been provided affording a great economy in the use of power and the operator's time. The underslung work gripping means permits the completed work to be deposited on the subjacent racks for lateral discharge, thus avoiding heavy manual labor and speeding operations.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In drawing mechanism, a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain, gripper means supported by said guideway for reciprocating movement therealong, means including lever means connecting said gripper means to said chain operative to reciprocate said gripper means along said guideway upon movement

of said endless chain in a single direction, said lever means being operative to maintain said gripper means in open position when the point of attachment of said lever means to said chain is travelling with the upper course of said chain and to maintain said gripper means in closed position when such point of attachment is travelling with the lower course of said chain.

2. In drawing mechanism, a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain, gripper means supported by said guideway for reciprocating movement therealong, means including lever means connecting said gripper means to said chain operative to reciprocate said gripper means along said guideway upon movement of said endless chain in a single direction, said lever means attached to said chain being operative to close said gripper means when the point of attachment of said lever means to said chain is on the lower course of said chain and to open said gripper means when such point of attachment is raised above such lower course, and means adjacent an end of such lower course adapted to raise said chain to cause opening of said gripper means shortly before reaching the end of such lower course.

3. In drawing mechanism, a guideway, sprockets adjacent each end of said guideway, an endless chain mounted on said sprockets comprising an upper and a lower course, means for driving one of said sprockets to drive said chain, gripper means supported by said guideway for reciprocating movement therealong, means connecting said gripper means to said chain operative to reciprocate said gripper means along said guideway upon movement of said endless chain in a single direction, said connecting means comprising lever means pivotally attached to said chain and operative to close said gripper means when the point of attachment of said lever means to said chain in on the lower course of said chain and to open said gripper means when such point of attachment is raised above such lower course, and means adjacent said driven sprocket over which said lower course of chain is adapted to pass prior to reaching said driven sprocket operative to raise said chain to open said gripper means upon passing of such point of attachment thereover before reaching the end of such lower course.

4. In drawing mechanism, a guideway, a die through which work is drawn located adjacent one end of said guideway, an endless chain supported adjacent said guideway and having upper and lower courses arranged substantially parallel thereto, means for driving said chain with such lower course moving away from said die, gripper means supported by said guideway for movement therealong and operative to seize the work and draw such work through said die, means connecting said gripper means to said chain operative to reciprocate said gripper means from and toward said die upon movement of said endless chain in a single direction, said connecting means comprising lever means pivotally attached to said chain and operative to close said gripper means when the point of attachment of said lever means to said chain is on the lower course of said chain and to open said gripper means when such point of attachment is on the upper course of said chain, clamping means located adjacent said die operative to frictionally grasp such work to prevent jumping of the latter end thereof upon sudden release from said die, air pressure means operative to open and close said clamping means, an electric circuit including a limit switch to control the operation of said air pressure means, and means travelling with said gripper means operative to engage said limit switch shortly prior to passage of the work through said die to cause closing of said clamping means and to engage said limit switch upon reciprocation of said gripper means toward said die to cause opening of said clamping means.

5. In drawing mechanism, a die through which work is drawn, gripper means operative to seize the work and draw such work through said die, clamping means located adjacent said die operative to frictionally grasp such work to prevent jumping of the latter end thereof upon sudden release from said die, fluid pressure means operative to open and close said clamping means, a solenoid valve to control said pressure means, an electric circuit including a limit switch to control the action of said valve, and means automatically operative to engage said limit switch to cause closing of said clamping means shortly prior to passage of the latter end of such work through said die.

6. In drawing mechanism, a guideway, a die through which work is drawn located adjacent one end of said guideway, an endless chain supported adjacent said guideway and having upper and lower courses arranged substantially parallel thereto, means for driving said chain with such lower course moving away from said die, gripper means supported by said guideway for movement therealong and operative to seize the work and draw such work through said die, means connecting said gripper means to said chain operative to reciprocate said gripper means from and toward said die upon movement of said endless chain in a single direction, said connecting means comprising lever means pivotally attached to said chain and operative to close said gripper means when the point of attachment of said lever means to said chain is on the lower course of said chain and to open said gripper means when such point of attachment is on the upper course of such chain, clamping means located adjacent said die operative to frictionally grasp such work to prevent jumping of the latter end thereof upon sudden release from said die, air pressure means operative to open and close said clamping means, a solenoid valve to control said pressure means, an electric circuit including a limit switch to control the action of said valve, means travelling with said gripper means operative to engage said limit switch shortly prior to passage of the work through said die to cause closing of said clamping means and to engage said limit switch upon reciprocation of said gripper means toward said die to cause opening of said clamping means, and cam means automatically operative to open said clamping means when said gripper means approaches said die to seize and draw further work, should said pressure means have failed to open said clamping means.

7. In drawing mechanism, a die through which work is drawn, gripper means operative to seize the work and draw such work through said die, clamping means located adjacent said die operative to frictionally grasp such work to prevent jumping of the latter end thereof upon sudden release from said die, fluid pressure means operative to open and close said clamping means, a solenoid valve to control said pressure means, and electric circuit including a limit switch to con-

trol the action of said valve, means automatically operative to engage said limit switch to cause closing of said clamping means shortly prior to passage of the latter end of such work through said die, and cam means carried by said gripper means automatically operative to open said clamping means when said gripper means approaches said die to seize further work, should said fluid pressure means have failed to open said clamping means.

8. In tube drawing mechanism, a pair of longitudinal guideways disposed parallel to one another, C-shaped frame members to one side of said guideways and supporting said guideways from above to permit lateral removal of work pieces from the outer sides of said guideways, dies at ends of said guideways, gripper means operable to travel along each of said guideways to draw work through said dies, and a set of tiltable rack members below each of said guideways whereon the work pieces are adapted to be deposited subsequent to the drawing operation, both sets of said rack members being inclinable to the side unobstructed by said frame members to discharge such work pieces.

9. In tube drawing mechanism, a pair of longitudinal guideways disposed parallel to one another, C-shaped frame members to one side of said guideways and supporting said guideways from above to permit lateral removal of work pieces from the outer sides of said guideways, dies at ends of said guideways, gripper means operable to travel along each of said guideways to draw work through said dies, a set of tiltable rack members below each of said guideways whereon the work pieces are adapted to be deposited subsequent to the drawing operation, and means operative to incline either of said sets of rack members, as desired, to the side unobstructed by said frame members to discharge such work pieces.

10. In drawing mechanism, a guideway, an endless chain having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, and gripper means supported by said guideway for movement therealong and adapted to seize the work to be drawn, said gripper means comprising a carriage having trolley wheels by which said carriage is suspended from said guideway, jaws carried by said carriage, and means connecting said carriage to said chain and operative to open said jaws when such point of attachment to said chain is raised and to close said jaws when such point is lowered.

11. In drawing mechanism, a guideway, an endless chain disposed adjacent said guideway, means for driving said chain continuously in the same direction, and gripper means supported by said guideway for movement therealong and adapted to seize the work to be drawn, said gripper means comprising a carriage, paired jaw members slidably mounted in angularly related cam ways in said carriage, and lever means connecting said carriage to said chain and operative to open and close said gripper jaws as the point of attachment of said means passes from one course of said chain to the other.

12. In drawing mechanism, a guideway, an endless chain disposed adjacent said guideway, means for driving said chain, and gripper means supported by said guideway for movement therealong and adapted to seize the work to be drawn, said gripper means comprising a carriage, paired jaw members slidably mounted in angularly related cam ways in said carriage, lever means pivotally mounted on said carriage, one end of said lever means being pivotally attached to said chain and the other end connected with said jaw members, and means operative to raise and lower said chain in its course of travel to open and close the gripper jaws.

13. In tube drawing mechanism, a pair of longitudinal guideways disposed parallel to one another, substantially C-shaped frame members to one side of said guideways and supporting said guideways from above to facilitate lateral removal of work pieces at the other side of said guideways, dies at ends of said guideways, sprockets adjacent each end of each of said guideways, endless chains mounted on said respective sprockets and comprising upper and lower courses substantially parallel to said respective guideways, means for driving said sprockets adjacent the ends of said guideways farthest removed from said dies, gripper means supported by each of said guideways for movement therealong, means connecting said gripper means to said respective chains operative to reciprocate said gripper means along said respective guideways upon movement of said chains in a single direction, said connecting means comprising lever means pivotally attached to said chains and operative to close said gripper means when the points of attachment of said lever means to said chains are on the lower courses of said chains and to open said gripper means when such points of attachment are raised above such lower courses, and means located adjacent said dies operative to grasp the work pieces shortly before such work pieces pass through said dies and support such work pieces to prevent whipping upon release from the die.

14. In drawing mechanism, a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain, gripper means supported by said guideway for reciprocating movement therealong, means including lever means connecting said gripper means to said chain operative to reciprocate said gripper means along said guideway upon movement of said endless chain in a single direction, said lever means being operative to maintain said gripper means in open position when the point of attachment of said lever means is travelling with one such course of said chain and to maintain said gripper means in closed position when such point of attachment is travelling with the other such course of said chain.

15. In drawing mechanism, a die through which work is drawn, gripper means operative to seize the work and draw such work through said die, clamping means located adjacent said die operative to frictionally grasp such work to prevent whipping of the latter end thereof upon sudden release from said die, means operative to close said clamping means shortly prior to passage of the latter end of such work through said die, and cam means associated with said gripper means adapted to open said clamping means when said gripper means approaches said die to seize further work.

16. In drawing mechanism, a die through which work is drawn, gripper means operative to seize the work and draw such work through said die, clamping means located adjacent said die operative to frictionally grasp such work to prevent whipping of the latter end thereof upon sudden release from said die, and cam means associated with said gripper means adapted to open said

clamping means when said gripper means approaches said die to seize further work.

17. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having a course substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means in said carriage, and means connecting said chain to said carriage, whereby the latter is reciprocated in opposite directions as the point of such connection passes from the one course to the other of said chain.

18. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having a course substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means in said carriage, means connecting said chain to said carriage, whereby the latter is reciprocated in opposite directions as the point of such connection passes from the one course to the other of said chain, and means adapted to operate said gripper means incidentally to movement of said carriage.

19. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having a course substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means in said carriage, and means connecting said chain to said carriage, whereby the latter is reciprocated in opposite directions as the point of such connection passes from the one course to the other of said chain, said connecting means being also operatively connected to said gripper means.

20. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having a course substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means in said carriage, means connecting said chain to said carriage, whereby the latter is reciprocated in opposite directions as the point of such connection passes from the one course to the other of said chain, said connecting means being also operatively connected to said gripper means, and independent means adapted to operate said gripper means.

21. In drawing mechanism, the combination of an approximately horizontal guideway, an endless chain supported adjacent said guideway in a substantially vertical plane and having upper and lower courses substantially parallel to said guideway, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means on said carriage, and an arm attached at one end to said chain and at the other end to said carriage, whereby the latter is reciprocated in opposite directions as the point of attachment of said arm to said chain passes from the one course thereof to the other.

22. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means on said carriage, and an arm attached at one end to said chain and at the other end to said carriage, whereby the latter is reciprocated in opposite directions as the point of attachment of said arm to said chain passes from the one course thereof to the other, said arm being connected with said gripper means to operate the same incidentally to the swinging movement of said arm thus produced.

23. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means on said carriage, an arm attached at one end to said chain and at the other end to said carriage, whereby the latter is reciprocated in opposite directions as the point of attachment of said arm to said chain passes from the one course thereof to the other, and means adapted to operate said gripper means incidentally to movement of said carriage.

24. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means on said carriage, and an arm attached at one end to said chain and at the other end to said carriage, whereby the latter is reciprocated in opposite directions as the point of attachment of said arm to said chain passes from the one course thereof to the other, said arm being connected with said gripper means to operate the same incidentally to the swinging movement of said arm thus produced, and independent means adapted to swing said arm to operate said gripper means.

25. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, gripper means on said carriage, and a bell-crank lever pivotally mounted on said carriage, one arm of said lever being permanently pivotally attached to said chain so as to be carried by the latter through both of its courses and the other arm of said lever being operatively connected with said gripper means.

26. In drawing mechanism, the combination of a guideway, an endless chain supported adjacent said guideway and having upper and lower courses substantially parallel thereto, means for driving said chain continuously in the same direction, a carriage supported by said guideway for reciprocating movement therealong, paired gripper jaws on said carriage, and a bell-crank lever pivotally mounted on said carriage, one arm of said lever being permanently pivotally attached to said chain so as to be carried by the latter through both of its courses and the other arm of said lever having resilient connection with said gripper jaws.

27. In drawing mechanism, the combination of a guideway, a chain supported in said guideway and having a course substantially parallel

thereto, a carriage supported by said guideway for movement therealong, gripper means on said carriage, and an arm attached at one end to said chain and at the other to said carriage, said arm controlling said gripper means and the points of such attachment during the drawing operation being in line with such course of the chain.

28. In drawing mechanism, the combination of a guideway, a chain supported in said guideway and having a course substantially parallel thereto, a carriage supported in underslung relation to said guideway for reciprocating movement therealong, gripper means on said carriage, and an arm attached at one end to said chain and at the other to said carriage, said arm controlling said gripper means and the points of such attachment during the drawing operation being in line with such course of the chain.

29. In drawing mechanism, paired draw benches positioned in parallel, dies located at adjacent ends of said benches, work gripping means on said respective benches mounted for reciprocable movement therealong, endless chains for moving said gripping means respectively, and driving means for said chains adapted to drive both thereof continuously in the same direction, said chains being connected to said gripping means at points such that when one gripping means is adjacent the corresponding die the other gripping means will be at the opposite end of the corresponding bench.

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