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3,013,835

POWER OPERATED JAW ASSEMBLY

Filed April 1, 1959

2 Sheets-Sheet 1

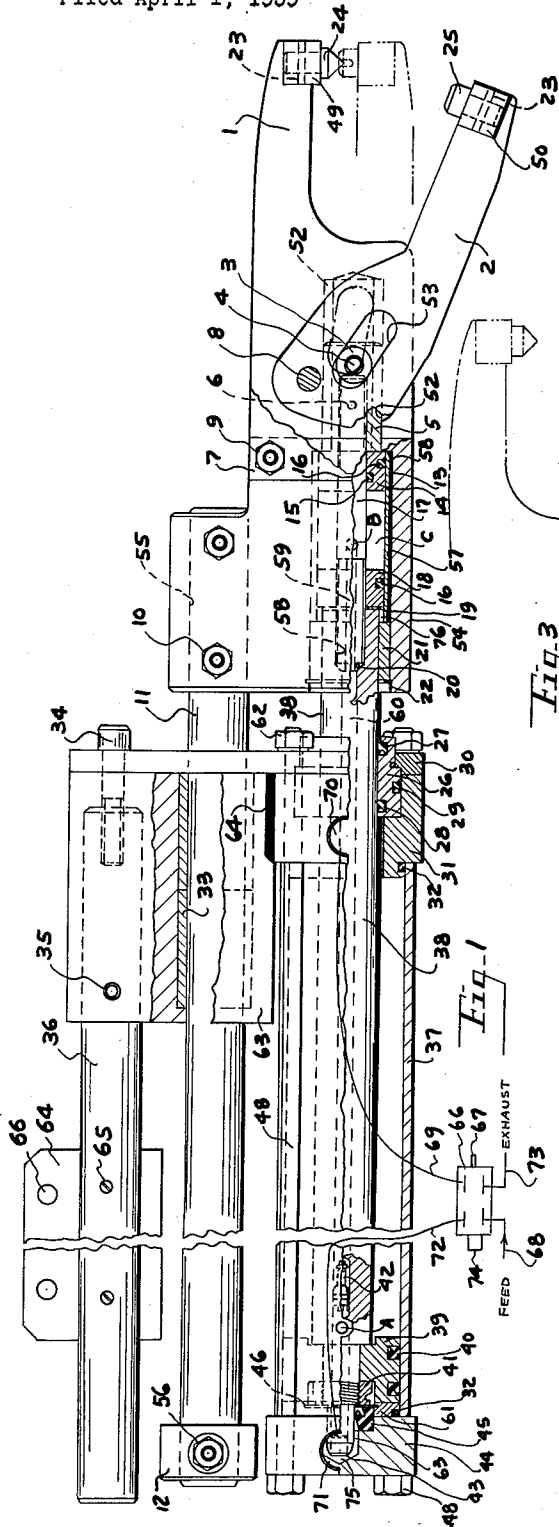


Fig. 1

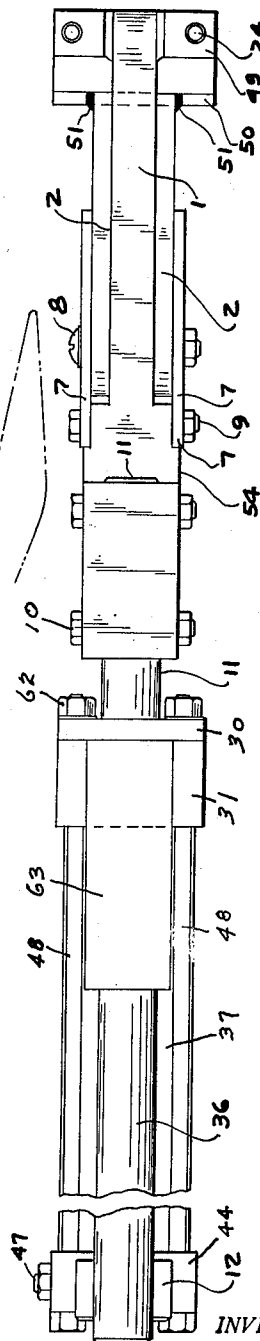


Fig. 2

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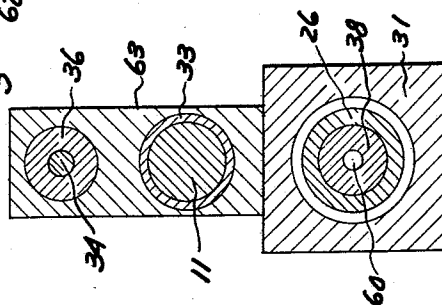
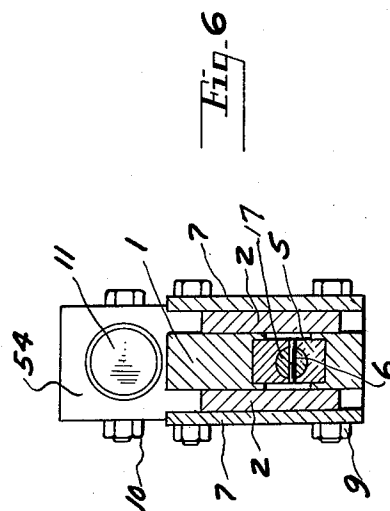
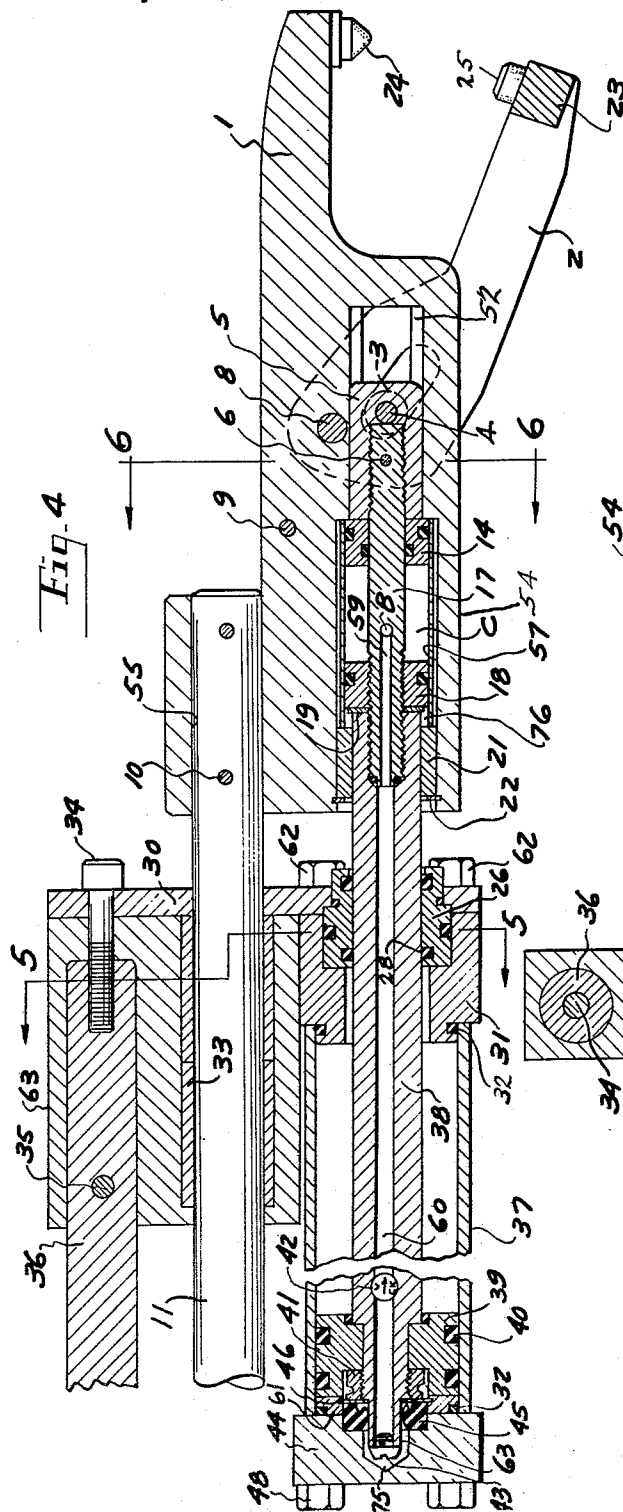
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POWER OPERATED JAW ASSEMBLY
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This invention relates to a jaw assembly and more particularly to a power operated jaw assembly primarily designed as an automatic gripping device for removing sheet metal parts from a draw, trim or other die operation or for other work moving operations.

It is an object of the present invention to provide a novel jaw assembly and power operating means therefor.

It is a further object to provide a novel jaw assembly operated by a positive acting hydraulic or pneumatic motor.

It is a further object to provide a novel jaw assembly incorporating fixed and pivotal jaw arms together with a slidable cross head operatively engageable with said pivotal arm for intermittently moving the same to and from a work gripping position.

These and other objects will be seen from the following specification and claims in conjunction with the appended drawing, in which:

FIG. 1 is a fragmentary side elevational view, partially broken away and sectioned, illustrating the present jaw assembly and control.

FIG. 2 is a fragmentary plan view thereof.

FIG. 3 is a fragmentary side elevational view of a different form of jaw assembly shown in phantom.

FIG. 4 is a fragmentary broken away longitudinal section of the jaw assembly of FIG. 1 on an enlarged scale.

FIG. 5 is a section taken on line 5—5 of FIG. 4.

FIG. 6 is a section taken on line 6—6 of FIG. 4.

It will be understood that the above drawing illustrates merely a preferred embodiment of the invention and that other embodiments are contemplated within the scope of the claims hereafter set forth.

Jaw assembly

The specific illustrative jaw assembly shown in the drawing includes an elongated jaw body 1 provided with a transverse longitudinal slot 52 intermediate its ends and a fixed transverse jaw 49 at one end carrying jaw inserts 24 anchored in place by pins 23.

The lower jaw assembly includes a pair of spaced jaw arms 2 arranged upon opposite sides of the jaw body and pivotally mounted thereon by bolt 8.

The forward ends of arms 2 have secured thereto the transverse jaw 50 as by welds 51 to which is removably secured jaw inserts 25 for cooperative registry with the respective jaw inserts 24 upon power operated closure of jaw 50.

The depending ends of inserts 24 are generally convex, whereas the registering opposed surfaces of inserts 25 are concave, for illustration. Other shapes may be employed as shown in FIG. 3.

To facilitate the handling of a particular part, said inserts may be redesigned for that application.

Pressure block 5 is reciprocally positioned within slot 52 in the jaw body and has a transverse pin 4 extending therethrough carrying at its outer ends rollers 3 slidably positioned within cam slots 53 formed through the respective arms 2.

The pivotal jaw in its normally open position is inclined at an acute angle to the axis of the jaw body 1. Cam slots 53 extend substantially longitudinally of jaw arms 2. Accordingly a power operated forward movement of pressure block 5 operatively and forcefully cams the arms 2 to the dotted line article securing position shown in FIG. 1. Alternately the rearward movement

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of pressure block 5 returns said arms to the position shown.

Upright retainer plates 7 are arranged upon opposite sides of jaw body 1, and are secured thereon by the bolt assembly 8 as shown in FIG. 2; and additionally by the bolt assembly 9 which extends through said jaw body.

Retainer plates 7, not only enclose the operating mechanism for the pivotal jaw but also retainingly engage the rollers 3 maintaining the same within arm slots 53.

The jaw body includes base 54 at the end opposite jaw 49. Longitudinal bore 55 in said base adjacent its upper end receives one end of the elongated carrier rod 11 fixedly secured thereto by bolt assemblies 10. The opposite end of rod 11 has a collar stop 12 secured thereon by fastener 56.

Base 54 has an elongated bore 57 through substantially the length thereof terminating in shoulder 58. An air spring tube 13 is loosely positioned within bore 57 and at one end bears against shoulder 58. Bushing 21 bears against the other end of tube 13 and is removably secured within bore 57 by snap ring 22. Air spring rod 17 extends axially through chamber C in tube 13 and threadedly into pressure block 5 and is fixedly joined thereto by transverse pin 6.

Floating piston 14 is slidably positioned within tube 13 and in one position, namely the inoperative position shown, bears against shoulder 58, there being a suitable seal 16 in piston 14 engaging said tube.

The air spring rod 17 is slidably positioned through floating piston 14, there being an additional seal 15 in said piston cooperatively engaging rod 17. The outer end of piston rod 38 slidably extends through bushing 21 in base 54 of the jaw body and partly into tube 13.

Lock piston 18 is slidably positionable within tube 13 and is threadedly mounted and secured upon rod 17 for movement therewith, said rod being fixedly threaded as at 58 into an enlarged bore at the end of rod 38 for movement therewith. A suitable seal 20 is interposed between rod 17 and rod 38 to prevent the passage of pressure fluid, such as compressed air, along threads 58.

Rod 17 has an elongated axial passage 59 from its inner end terminating in the radial passage B, communicating with chamber C, which defines an air spring as hereafter described in further detail.

The other end of passage 59 communicates with the longitudinal bore 60 which extends throughout the length of rod 38, being closed by the plug 43.

A suitable seal 16 is also mounted within lock piston 18 for engagement with the interior of tube 13 defining the present air spring. A suitable lock washer 19 is mounted on rod 17 and interposed between lock piston 18 and the outer end of rod 38.

Rod 38 as hereafter described is adapted for power operated reciprocal movement with respect to the cylinder assembly and the jaw body as shown, with relative outward movement of the jaw body limited by collar stop 12 on the end of carrier rod 11 engageable with block 63 mounted upon cylinder head 31 and secured thereto as by welds 64.

Cylinder assembly

The present cylinder assembly, providing a hydraulic or pneumatic power operation for the jaw assembly, includes cylinder 37, carrying at its outer end cylinder head 31 with seal 32 interposed. Said cylinder head has an intake port 70 therein adapted to receive pressure fluid, such as compressed air, through conduit 69 from fourway valve 66 including movable valve element 67.

Gland 26 carrying suitable seals 27, 28 and 29 slidably receives rod 38 which extends into cylinder 37 and has bolted thereto at its left end at 41 the piston 39 carrying conventional seals 40.

The upright retainer plate 30 is mounted upon the end

of cylinderhead 31 and is suitably apertured to receive gland 26 and rod 38.

The upper portion of the retainer plate bears against the forward edge of block 63 mounted upon cylinderhead 31. The elongated hanger rod 36 projects into block 63 and is secured therein by cap screw 34 on plate 30 and the transverse locking pin 35. Said hanger rod is adjustably attached to a suitable holding bracket 64 by set screws 65 for illustration.

Said bracket is somewhat shorter than said hanger rod in order to provide for jaw position adjustment. The holding bracket is adapted for attachment at 66 to a suitable conveying or shuttling device designed to produce a linear, angular or a compound type of transmitting motion necessary to load or unload a particular part or assembly in the process of manufacture.

The block 63 carries a pair of bushings 33 retained by plate 30 which slidably receive carrier rod 11. Said carrier rod is attached to the jaw body which is movable with respect to stationary cylinderhead 31 under the action of reciprocal piston rod 38.

In the inoperative position shown, piston 39 bears against gland 61 which is sealed at 32 within the end of cylinder 37 and projects from cylinderhead 44.

The respective cylinderheads are maintained in assembled relation with respect to opposite ends of cylinder 37 by a plurality of tie rods 48 and fastening nuts 62. Annular cushion seal 45 is nested within cylinderhead 44 and gland 61 and is secured therein by seal retainer 46. The cushion seal is apertured to loosely receive the reduced end 63 of rod 38, which in the return position is nested within chamber 75 of said cylinderhead.

Upon return movement of piston 39 to the position shown air is trapped behind said piston in chamber 75, and is metered through a small orifice controlled by a cushion adjustment assembly 47 generally indicated in FIG. 2. This provides for a cushioning of the jaw assembly to the open position shown.

Port 71 provides compressed air communication to chamber 75 and to interior of cylinder 37, and is connected by conduit 72 to fourway valve 66.

The transverse aperture A formed through an end portion of rod 38 adjacent piston 39 establishes communication between the interior of said cylinder and the elongated bore 60 of said piston rod adapted for transmitting compressed air to the air spring chamber C. A suitable check valve assembly 42 is interposed in bore 60 adjacent passage A for preventing the return or escape of air through passage A.

In the position of the piston 39 shown in FIG. 1, which is the normally inoperative position, valve element 67 in fourway valve 66 is spring or otherwise biased to such position that the power source such as compressed air at 68 to said valve travels via conduit 69 to intake port 70 normally causing and/or maintaining piston 39 in the inoperative position shown. Exhaust from the far side of piston 39 escapes via conduit 72 and in the position of the valve shown exhausts as at 73.

The operation of the fourway valve 66 can be piloted, solenoid or any other type, as indicated at 74, adapted to receive a controlled signal from the conveying mechanism.

Operation

In the inoperative or waiting position, port 71 is connected with exhaust whereas port 70 is connected to the pressurized port 68 of valve 66. Air pressure entering port 70 forces piston 39 to rest at the end 61 of the air cylinder 37.

Air enters opening A in piston rod 38, passes through check valve assembly 42, and flows the length of said rod and into passage 59 and through port B in air spring rod 17 for pressurizing chamber C defining the air spring.

An appreciable clearance is provided between tube 13 and bore 57 in base 54 of the jaw body. This allows tube C to float should there be any misalignment present

in the air spring assembly. Air in chamber C under pressure is retained by seals 16 in lock piston 18 and in floating piston 14 respectively as well as by the wiping seal 15.

The pressurized chamber C forces floating piston 14 against shoulder 58 of base 54. At the same time lock piston 18 actuates the pivotal jaw assembly to the release position shown, limited by the rod end of pressure block 5 bearing against floating piston 14. Accordingly pressure block 5 is retained in body slot 52 by floating piston 14.

The above assembly is maintained in alignment with cylinder 37 by its carrier rod 11 which is fitted and secured within the jaw body at 55. Said carrier is free to slide in bushings 33 in block 63 on cylinder head 31. Hanger rod 36 is the sole means of support for the complete jaw assembly in operation.

Upon actuation of the fourway valve, as by solenoid 74 for illustration, port 70 is open to exhaust and port 71 as pressured. The air spring chamber C remains pressurized due to the action check valve 42. The pressure at port 71 causes longitudinal movement of piston 39 and attached rod 38. There is a differential between the effective piston area, between the main air piston 39 and the air spring lock piston 18. As the main piston rod assembly moves the jaw assembly forwardly, it is working against the sealed pressurized air spring including chamber C, which holds the lower jaw 50 in the open position shown.

As the jaw assembly slides forwardly, it carries rod 11 until stopped by collar 12 operatively engaging block 63. Jaw forward motion then stops. However, the main cylinder rod 38 carrying the air spring lock piston 18 and pressure block assembly 5, 4 and 3 continues to travel compressing the air in chamber C and forcefully closing lower jaw 50 with inserts 25 gripping the part to be moved.

The complete assembly may then be mechanically transported as desired by the hold bracket 64 on hanger rod 36. When the fourway valve element is returned to its normal position, port 71 is connected to exhaust and the jaw 50 opens instantly due to the compressed air spring pressure acting on piston 18, dropping the part.

A clearance 76 is provided between the lock washer side of lock piston 18 and guide bushing 21. When the jaw starts a fast return to normal open position, pressure block 5 contacts the air spring floating piston 14, which is yieldingly retained by the compressed air in chamber C. This clearance 76 allows the reverse inertia to be absorbed against the air spring by floating piston 14 without lock piston 14 forcefully jamming against the shoulder of guide bushing 21. As the main piston 39 returns to the normal position shown, the end 43 of the piston rod enters cushion seal 45.

Accordingly a certain amount of air trapped within chamber 75 serves to cushion the return movement of the piston 39. The entrapped air in chamber 75 is eventually metered through a small orifice controlled by cushion adjustment assembly 47.

The main pressure supply is now at port 70. If the air pressure in the air spring chamber C has been reduced by a minor leak, said air pressure is now replenished by compressed air transmitted through port A, check valve 42, bore 60 passage 59 and port B.

Having described my invention, reference should now be had to the following claims.

I claim:

1. In combination, an elongated jaw body having a fixed jaw at one end, a jaw arm pivotally mounted at one end upon said body and carrying a cooperating jaw at its other end, said pivoted jaw being normally open with said jaw arm extending at an acute angle to the longitudinal axis of said jaw body, a pressure block reciprocally mounted and retained within said body, there being an elongated slot formed through said arm extend-

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ing axially thereof, a pin projecting laterally from said block operably positioned within said slot, and a motor including reciprocal means axially joined to said pressure block, longitudinal movement of said pin in one direction relative to said body adapted to cam said jaw arm from inoperative to work securing position, and in the opposite direction adapted to cam said jaw arm from work securing position to inoperative position.

2. The combination of claim 1, said jaw arm being on one side of the body, there being a second jaw arm pivotally mounted on the opposite side of the body extending at a similar angle to the body axis and joined to said cooperating jaw, there being a similar slot in said second jaw arm, said pin operably extending into said latter slot.

3. The combination of claim 1, carrier means joined to said jaw body slidably supported on said motor, movement in one direction of said reciprocal means initially advancing said jaw body relative to said motor, stop means on said carrier means limiting longitudinal movement of said jaw body relative to said motor, further movement of said reciprocal means in the same direction effecting movement of said pressure block relative to said jaw body.

4. The combination of claim 1, said jaw arm being on one side of the body, there being a second jaw arm pivotally mounted on the opposite side of the body extending at a similar angle to the body axis and joined to said cooperating jaw, there being a similar slot in said second jaw arm, said pin operably extending into said latter slot, and rollers retained on the ends of said pin movably positioned in said slots.

5. The combination of claim 1, a carrier rod joined at one end to the jaw body slidably supported on said motor, movement in one direction of said reciprocal means initially advancing said body relative to said motor, stop means on the other end of said carrier rod engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means in the same direction providing movement of said pressure block relative to said jaw body.

6. The combination of claim 1, there being a longitudinal bore in said jaw body, a lock piston in said bore joined to said reciprocal means and defining a sealed air chamber adjacent said piston, said chamber serving as an air spring, initial longitudinal movement of said reciprocal means and lock piston acting on the confined air in said chamber effecting corresponding movement of said jaw body relative to said motor, means on said jaw body engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means effecting an air compressing longitudinal movement of said lock piston in said bore.

7. A combination of claim 1, there being a longitudinal bore in said jaw body, a lock piston in said bore joined to said reciprocal means and defining a sealed air chamber adjacent said piston, said chamber serving as an air spring, initial longitudinal movement of said reciprocal means and lock piston acting on the confined air in said chamber effecting corresponding movement of said jaw body relative to said motor, means on said jaw body engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means effecting an air compressing longitudinal movement of said lock piston in said bore, the compressed air in said air chamber on release of said reciprocal means effecting an instantaneous return movement of said lock piston returning said jaw to open inoperative position.

8. The combination of claim 1, said motor and reciprocal means including a cylinder with a reciprocal rod movably projected into said jaw body, there being a bore in said body axially of said rod, an air spring rod longitudinally movable through said bore joined at one end to said rod axially thereof and at its other end

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joined to said pressure block, a lock piston at one end of said bore secured to said air spring rod, a floating piston at the opposite end of said bore, loosely mounted on said air spring rod, said pistons defining a sealed air spring chamber therebetween adapted for connection to a source of compressed air, means slidably mounting said body on said cylinder for movement longitudinally thereof, longitudinal movement of said air spring rod and said lock piston acting on said air chamber effecting corresponding longitudinal movement of said jaw body, means limiting movement on said jaw body relative to said cylinder, further movement of said air spring rod effecting relative movement of said lock piston in said air chamber compressing the air therein and closing said jaw, the compressed air in said air chamber on release of said reciprocal means moving said lock piston in the opposite direction forcefully camming said pivotal jaw arm to open position.

9. The combination of claim 1, said motor and reciprocal means including a cylinder with a reciprocal rod movably projected into said jaw body, there being a bore in said body axially of said rod, an air spring rod longitudinally movable through said bore joined at one end to said rod axially thereof and at its other end joined to said pressure block, a lock piston at one end of said bore secured to said air spring rod, a floating piston at the opposite end of said bore, loosely mounted on said air spring rod, said pistons defining a sealed air spring chamber therebetween, a piston in said cylinder secured to said reciprocal rod, means applying air pressure to said piston maintaining said piston in retracted position, said reciprocal rod having a longitudinal bore communicating at one end with said air chamber and at its other end communicating with the interior of said cylinder, and a check valve in said bore for maintaining air pressure in said air chamber.

10. The combination of claim 1, said motor being a cylinder, said reciprocal means including a piston and connected piston rod extending from said cylinder into said jaw body, a support block secured on one end of said cylinder, a carrier rod slidably extending through said block and secured at one end to said jaw body for guiding longitudinal movements of said body relative to said cylinder, a stop at the other end of said carrier rod operatively engageable with said block limiting movements of said jaw body relative to said cylinder, and a horizontally disposed hangar rod parallel to said carrier rod, secured at one end to said block and adapted for suspension from a movable conveying means.

11. The combination of claim 1, said motor and reciprocal means including a cylinder with a reciprocal rod movably projected into said jaw body, there being a bore in said body axially of said rod, an air spring rod longitudinally movable through said bore joined at one end to said rod axially thereof and at its other end secured to said pressure block, a self aligning air spring tube loosely and floatingly mounted in said bore, a lock piston at one end of said tube secured to said air spring rod, and a floating piston at the opposite end of said tube loosely mounted on said air spring rod, said pistons defining an air spring chamber therebetween adapted for connection to a source of compressed air.

12. A jaw assembly comprising an elongated jaw body, having a fixed jaw at one end, a jaw arm pivotally mounted at one end upon said body and carrying a cooperating jaw at its other end, said pivoted jaw being normally open with said jaw arm extending at an acute angle to the longitudinal axis of said jaw body, a pressure block reciprocally mounted and retained within said body, there being an elongated slot formed through said arm extending axially thereof, a pin projecting laterally from said block operably positioned within said slot, there being a longitudinal bore in said jaw body axially of said pressure block, a reciprocal air spring rod in said bore joined at one end to said pressure block, a reciprocal rod project-

ing into said bore axially of said air spring rod and secured thereto, a lock piston secured upon said air spring rod adjacent one end of said bore and movable therein, a floating piston loosely mounted on said air spring rod adjacent the opposite end of said bore sealing off said bore and defining an air spring chamber between said pistons, and means providing a continuous compressed air supply within said chamber.

13. A jaw assembly comprising an elongated jaw body having a fixed jaw at one end, a jaw arm pivotally mounted at one end upon said body and carrying a cooperating jaw at its other end, said pivoted jaw being normally open with said jaw arm extending at an acute angle to the longitudinal axis of said jaw body, a pressure block reciprocally mounted and retained within said body, there being an elongated slot formed through said arm extending axially thereof, a pin projecting laterally from said block operably positioned within said slot, there being a longitudinal bore in said jaw body axially of said pressure block, a reciprocal air spring rod in said bore joined at one end to said pressure block, a reciprocal rod projecting into said bore axially of said air spring rod and secured thereto, a lock piston secured on said air spring rod adjacent one end of said bore and movable therein, a floating piston loosely mounted on said air spring rod at the opposite end of said bore sealing off said bore and defining an air spring chamber between said pistons, means providing a continuous compressed air supply within said chamber, and a self aligning air spring tube loosely and floatingly positioned in said bore slidably receiving said pistons.

14. A jaw assembly comprising an elongated jaw body having a fixed jaw at one end, a jaw arm pivotally mounted at one end upon said body and carrying a cooperating jaw at its other end, said pivoted jaw being normally open with said jaw arm extending at an acute angle to the longitudinal axis of said jaw body, a pressure block reciprocally mounted and retained within said body, there being an elongated slot formed through said arm extending axially thereof, a pin projecting laterally from said block operably positioned within said slot, there being a longitudinal bore in said jaw body axially of said pressure block, a reciprocal air spring rod in said bore joined at one end to said pressure block, a reciprocal rod projecting into said bore axially of said air spring rod and secured thereto, a lock piston secured on said air spring rod adjacent one end of said bore and movable therein, a floating piston loosely mounted on said air spring rod at the opposite end of said bore sealing off said bore and defining an air spring chamber between said pistons, means providing a continuous compressed air supply within said chamber, and a self aligning air spring tube loosely positioned in said bore slidably receiving said pistons, movement in one direction of said rod under application of an external force causing an air compressive movement on said lock piston towards said floating piston, said compressed air on release of said external force effecting a simultaneous expansive return movement of said lock piston to inoperative position.

15. A jaw assembly comprising an elongated jaw body having a fixed jaw at one end, a jaw arm pivotally mounted at one end upon said body and carrying a cooperating jaw at its other end, said pivoted jaw being normally open with said jaw arm extending at an acute angle to the longitudinal axis of said jaw body, a pressure block reciprocally mounted and retained within said body, there being an elongated slot formed through said arm extending axially thereof, a pin projecting laterally from said block operably positioned within said slot, there being a longitudinal bore in said jaw body axially of said pressure block, a reciprocal air spring rod in said bore joined at one end to

said pressure block, a reciprocal rod projecting into said bore axially of said air spring rod and secured thereto, a lock piston secured on said air spring rod adjacent one end of said bore and movable therein, a floating piston loosely mounted on said air spring rod at the opposite end of said bore sealing off said bore and defining an air spring chamber between said pistons, said reciprocal rod having a bore adapted to deliver air under pressure in one direction, there being a communicating bore in said air spring rod extending into said air spring chamber, and means providing a continuous compressed air supply to the bore of said rod.

16. The combination of claim 1, there being a longitudinal bore in said jaw body, a lock piston in said bore joined to said reciprocal means and defining a chamber adjacent said piston, initially compressed means in said chamber normally resisting forward movement of said lock piston within said chamber, initial longitudinal movement of said reciprocal means and lock piston acting on said compressible means in said chamber effecting corresponding movement of said jaw body relative to said motor, means on said jaw body engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means effecting compressing longitudinal movement of said block piston in said bore on said compressible means.

17. The combination of claim 1, there being a longitudinal bore in said jaw body, a lock piston in said bore joined to said reciprocal means and defining a chamber adjacent said piston, initially compressed means in said chamber normally resisting forward movement of said lock piston within said chamber, initial longitudinal movement of said reciprocal means and lock piston acting on said compressible means in said chamber effecting corresponding movement of said jaw body relative to said motor, means on said jaw body engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means effecting compressing longitudinal movement of said block piston in said bore on said compressible means, the compressed means in said chamber on release of said reciprocal means effecting an instantaneous return movement of said lock piston returning said jaw to open inoperative position.

18. The combination of claim 1, there being a longitudinal bore in said jaw body, a lock piston in said bore joined to said reciprocal means and defining a chamber adjacent said piston, initially compressed spring means in said chamber normally resisting forward movement of said lock piston therein, initial longitudinal movement of said reciprocal means and lock piston acting on said spring means effecting corresponding movement of said jaw body relative to said motor, means on said jaw body engageable with said motor limiting relative movement of said jaw body, further movement of said reciprocal means effecting a compressing longitudinal movement of said lock piston in said bore upon said compressible spring means.

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