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P. L. SPINK

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FLUID OPERATED CHUCK

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FIG. 1.

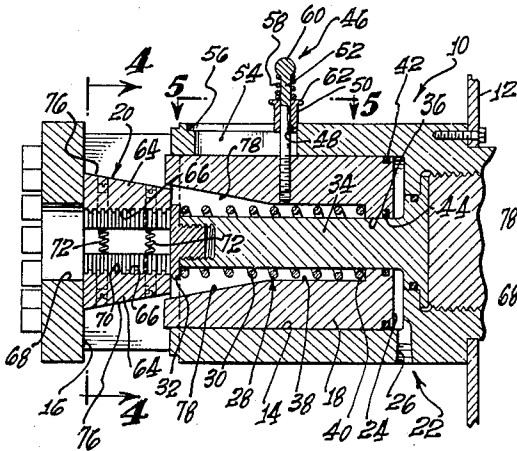


FIG. 2.

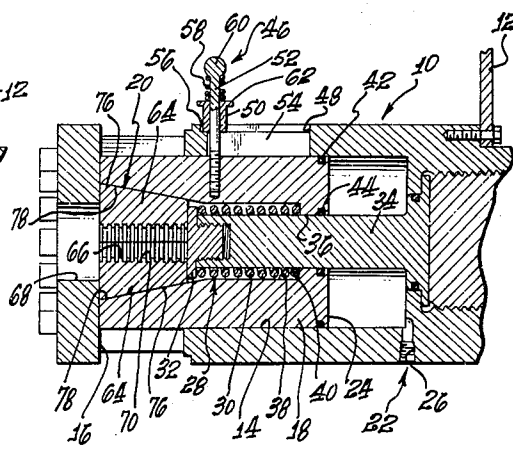


FIG. 3.

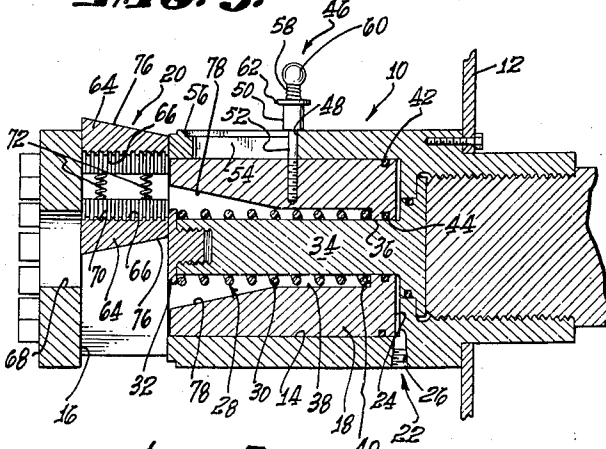


FIG. 4.

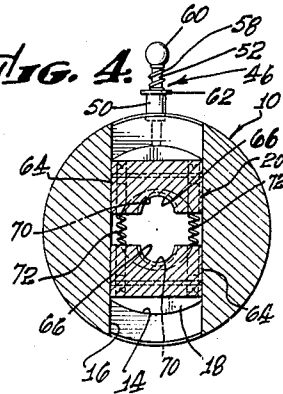
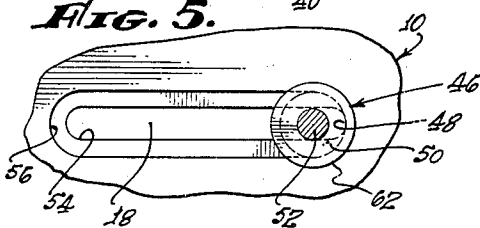


FIG. 5.



PAUL L. SPINK,
INVENTOR.

By HIS ATTORNEYS.

HARRIS, KIECH, HOSTER & HARRIS.

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FLUID OPERATED CHUCK

Paul L. Spink, Altadena, Calif., assignor to Claude C. Slate Company, Glendale, Calif., a corporation of California

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7 Claims. (Cl. 279-4)

The present invention relates in general to chucks and a primary object of the invention is to provide a chuck which includes radially expansible and contractible jaw means adapted to be contracted onto a tool, or other device to be gripped thereby, by means of an actuator having the form of a piston, fluid pressure being applied directly to one end of such piston to move it into contracting engagement with the jaw means. With this construction, a very simple and compact fluid operated chuck results, which is an important feature of the invention.

An important object of the invention is to provide a chuck having removable jaw means and having means whereby the actuator prevents removal of the jaw means until the actuator is displaced into an inoperative position, the actuator normally being movable between an operative position, wherein it contracts the jaw means, and an intermediate position, wherein it provides for expansion of the jaw means to release a tool or other device gripped thereby.

More particularly, an important object of the invention is to provide a chuck which includes some or all of the following: a supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of the axis; jaw means movable along said lateral guideway into a position coaxial with the longitudinal guideway, the jaw means being transversely expansible and contractible and having axially divergent, external cam surfaces; an actuator movable along the longitudinal guideway and having axially divergent, internal cam surfaces engageable with the cam surfaces of the jaw means to contract the jaw means in response to movement of the actuator along the longitudinal guideway, in the direction of the jaw means and in the direction of axial divergence of the cam surfaces on the jaw means and the actuator, into an operative position relative to the jaw means, the actuator being movable along the longitudinal guideway, in a direction away from the jaw means, from its operative position through an intermediate position into an inoperative position, the cam surfaces on the actuator disengaging cam surfaces of the jaw means when the actuator is in its intermediate position to provide for expansion of the jaw means, the actuator blocking the lateral guideway when it is in its intermediate position to prevent removal of the jaw means from the supporting structure along the lateral guideway; and releasable means for preventing movement of the actuator from its intermediate position to its inoperative position, such releasable means including interengageable stops on the supporting structure and the actuator, one of these stops being movable to a position wherein it is out of engagement with the other.

With the foregoing construction, the actuator, which, as hereinbefore indicated, is preferably a piston and is adapted to be moved from its inoperative position through

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its intermediate position to its operative position by fluid pressure applied to one end thereof, prevents the removal of the jaw means until such time as the stops mentioned are disengaged to permit movement of the actuator into its inoperative position. Thereupon, the jaw means may be removed from the supporting structure through the lateral guideway to permit the substitution of another, similar jaw means of a different size, or for other reasons.

Another object is to provide an actuator having the form of a piston which is movable along the longitudinal guideway from its inoperative position through its intermediate position into its operative position by fluid pressure applied directly to one end thereof, and which is biased in the opposite direction by spring means acting thereon.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the chuck art in the light of this disclosure, may be attained with the exemplary embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of the chuck of the invention with an actuator of the chuck in an intermediate position and with a jaw means of the chuck in an operative position and in an expanded state;

Fig. 2 is a view similar to Fig. 1, but showing the actuator in an operative position with the jaw means in its operative position and in a contracted state;

Fig. 3 is a view similar to Figs. 1 and 2, but showing the actuator in an inoperative position and showing the jaw means in a partially removed, expanded condition;

Fig. 4 is a transverse sectional view taken along the arrowed line 4-4 of Fig. 1; and

Fig. 5 is an enlarged, fragmentary view, partially in section and partially in elevation, taken along the arrowed line 5-5 of Fig. 1 of the drawing.

In the drawing, the numeral 10 designates a supporting structure or housing connected to a suitable mount 12. The housing 10 is provided with mutually perpendicular, intersecting longitudinal and lateral guideways 14 and 16 respectively receiving an actuator 18 and a radially or transversely expansible and contractible jaw means 20 adapted to be contracted by the actuator.

In the construction illustrated, the longitudinal guideway 14 is a cylinder and the actuator 18 is a piston movable in such cylinder between an operative position, Fig. 2, and an inoperative position, Fig. 3, through an intermediate position, Fig. 1. The chuck includes means for moving the piston 18 between its operative and inoperative positions, such means including means 22 for applying fluid pressure to one end 24 of the piston to move it into its operative position, the means 22 being shown as including a pressure port 26 adapted to be connected to a suitable fluid pressure source, not shown. The means for moving the piston 18 longitudinally of the cylinder 14 also includes spring means 28 for biasing the piston toward its inoperative position. In the particular construction illustrated, the spring means 28 includes a compression spring 30 seated at one end against an annular flange 32 on a central stem 34 which forms part of the housing 10 and which extends through a central bore 36 in the end 24 of the piston into a counterbore 38 therein, the spring 30 encircling the stem 34 and the other end thereof being seated against an annular shoulder 40 at the junction of the bore 36 and the counterbore 38. Fluid-tight seals between the piston 18 and the housing 10 are provided by O-rings 42 and 44 disposed in annular grooves in the piston and respectively engaging the peripheral wall of the cylinder 14 and the periphery of the stem 34.

The piston 18 is freely movable between its operative

position and its intermediate position, manually releasable means 46 being provided, however, to normally prevent movement of the piston from its intermediate position into its inoperative position. The manually releasable means 46 comprises interengageable stops 48 and 50 on the housing 10 and the piston 18, respectively, the stop 50 being movable out of engagement with the stop 48 to permit movement of the piston from its intermediate position into its inoperative position, as shown in Fig. 3. In the construction illustrated, the stop 50 takes the form of a sleeve slidable on a pin 52 which extends through a longitudinal slot 54 in the housing 10 into threaded engagement with the piston. The stop 48 is formed by one end of a longitudinal external groove 56 in the housing 10 and registering with the slot 54. Normally, the stop 50 is maintained in the groove 56 by a compression spring 58 disposed between this stop and a head 60 on the pin 52, the stop 50 being provided with an annular flange 62 which may be gripped by the thumb and forefinger of the operator to withdraw it from the groove 56. As will be apparent, the end of the groove 56 which forms the stop 48 registers with the corresponding end of the slot 54. Consequently, when the stop 50 is in the groove 56, it engages the end of the groove forming the stop 48 before the pin 52 can engage the corresponding end of the slot 54, thereby maintaining the piston 18 in its intermediate position. In order to permit movement of the piston 18 into its inoperative position under the influence of the spring means 28, it is merely necessary to pull the stop 50 out of the groove 56 in opposition to the action of the spring 58 by gripping the annular flange 62 thereon, thereby disengaging the stop 50 from the stop 48 to permit movement of the piston into its inoperative position.

Considering the jaw means 20, it includes two jaws 64 provided with hemicylindrical recesses 66 adapted to receive a tool shank, or the like, inserted between the jaws through an aperture 68 in the corresponding end of the housing 10. The surfaces of the recesses 66 are provided with semiannular grooves 70 adapted to receive complementary projections on the tool shank, or other device to be gripped.

As will be apparent, the jaws 64 are movable toward each other in the lateral guideway 16 to contract the jaw means 20 on the tool shank, or other device to be gripped. The jaws 64 are biased apart to expand the jaw means 20 by compression springs 72 seated in aligned bores in the jaws.

The jaws 64 are respectively provided with oppositely facing, external, axially divergent cam surfaces 76 which are engageable by oppositely facing, internal, axially divergent cam surfaces 78 on the piston 18 to contract the jaw means 20 onto a tool shank, or the like, inserted between the jaws 64, in response to movement of the piston into its operative position upon application of fluid pressure to the end 24 thereof through the pressure port 26. It will be understood that when the cam surfaces 76 and the cam surfaces 78 are herein referred to as "axially divergent," this is with reference to the direction of movement of the piston 18 toward its operative position.

Considering the operation of the chuck of the invention, it will be assumed that it is desired to insert the jaw means 20 into or remove it from the housing 10. To accomplish this, the operator merely grips the flange 62 on the stop 50 with his thumb and forefinger and withdraws this stop from the groove 56, whereupon, in the absence of pressure application to the end 24 of the piston 18, the spring means 28 moves the piston into its inoperative position. Under such conditions, as shown in Fig. 3 of the drawing, the piston clears the lateral guideway 16 so that the jaw means 20 may be installed in or removed from the housing 10 through the lateral guideway.

With the jaw means 20 installed in the lateral guideway 16 in a position substantially coaxial with the cylinder 14, the piston 18 may be moved into its intermediate position by application of fluid pressure to the end 24 thereof, whereupon the stop 50 is urged into the groove 56 by the spring 58 so that the stop 50 is engageable with the stop 48 defined by the end of the groove 56 to prevent the return of the piston to its inoperative position, the stops 48 and 50 maintaining the piston in its intermediate position. Under these conditions, it will be noted that the piston 18 blocks the lateral guideway 16 with the jaw means 20 between the cam surfaces 78 on the piston so that the jaw means cannot be removed from the lateral guideway 16, inadvertently or otherwise.

With the piston 18 in its intermediate position and the jaw means 20 in its operative position and in an expanded state, as shown in Fig. 1 of the drawing, the jaw means may be contracted onto a tool shank, or the like, inserted between the jaws 64 through the aperture 68, merely by applying fluid pressure to the end 24 of the piston through the pressure port 26. This results in axial or longitudinal movement of the piston 18 from its intermediate position into its operative position, whereupon the cam surfaces 78 on the piston engage the complementary cam surfaces 76 on the jaws 64 to close the jaw means 20 on the tool shank, or the like, this state of affairs being illustrated in Fig. 2 of the drawing.

It will be noted that the piston 18 thus performs the dual function of contracting the jaw means 20 and of retaining the jaw means in its operative position in the lateral guideway 16, it being impossible to remove the jaw means until such time as the stops 48 and 50 are disengaged to permit movement of the piston to its inoperative position, which is an important feature of the invention.

As will be apparent, the spring means 28 moves the piston 18 from its operative position to its intermediate position upon relaxation of the fluid pressure applied to the end 24 of the piston, the springs 72 automatically expanding the jaw means 20 as this occurs. When it is desired to remove the jaw means 20 from the housing 10, it is merely necessary to disengage the stop 50 from the stop 48, whereupon the spring means 28 moves the piston to its inoperative position to permit removal of the jaw means.

Although I have disclosed an exemplary embodiment of the present invention herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims hereinafter appearing.

I claim as my invention:

1. In a chuck, the combination of: supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of said axis; jaw means movable along said lateral guideway into alignment with said longitudinal guideway, said jaw means being transversely expansible and contractible and having axially divergent cam surfaces; an actuator movable along said longitudinal guideway and having axially divergent cam surfaces engageable with said cam surfaces of said jaw means to contract said jaw means in response to movement of said actuator along said longitudinal guideway in one direction into an operative position relative to said jaw means, said actuator being movable along said longitudinal guideway in the opposite direction from said operative position through an intermediate position into an inoperative position to provide for expansion of said jaw means, and said actuator blocking said lateral guideway when in said operative position and said intermediate position to prevent removal of said jaw means from said supporting structure along said lateral guideway, said actuator clearing said lateral guideway in said inoperative position of said actuator; means for moving said actuator along said longitudinal guideway; and re-

leasable means for preventing movement of said actuator into said inoperative position.

2. In a chuck, the combination of: supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of said axis; jaw means movable along said lateral guideway into a position coaxial with said longitudinal guideway, said jaw means being transversely expansible and contractible and having axially divergent, external cam surfaces; an actuator movable along said longitudinal guideway and having axially divergent, internal cam surfaces engageable with said cam surfaces of said jaw means to contract said jaw means in response to movement of said actuator along said longitudinal guideway, in a direction toward said jaw means, into an operative position relative to said jaw means, said actuator being movable along said longitudinal guideway, in a direction away from said jaw means, from said operative position through an intermediate position into an inoperative position to provide for expansion of said jaw means, and said actuator blocking said lateral guideway when in said operative position and said intermediate position to prevent removal of said jaw means from said supporting structure along said lateral guideway, said actuator clearing said lateral guideway in said inoperative position of said actuator; means for moving said actuator along said longitudinal guideway; and releasable means for preventing movement of said actuator from said intermediate position to said inoperative position.

3. In a chuck, the combination of: supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of said axis; jaw means movable along said lateral guideway into a position coaxial with said longitudinal guideway, said jaw means being transversely expansible and contractible and having axially divergent, external cam surfaces; an actuator movable along said longitudinal guideway and having axially divergent, internal cam surfaces engageable with said cam surfaces of said jaw means to contract said jaw means in response to movement of said actuator along said longitudinal guideway, in a direction toward said jaw means, into an operative position relative to said jaw means, said actuator being movable along said longitudinal guideway, in a direction away from said jaw means, from said operative position through an intermediate position into an inoperative position to provide for expansion of said jaw means, and said actuator blocking said lateral guideway when in said operative position and said intermediate position to prevent removal of said jaw means from said supporting structure along said lateral guideway, said actuator clearing said lateral guideway in said inoperative position of said actuator; means for moving said actuator along said longitudinal guideway; and releasable means for preventing movement of said actuator from said intermediate position to said inoperative position, including interengageable stops on said actuator and said supporting structure, one of said stops being movable to a position to disengage the other.

4. A chuck as defined in claim 3 wherein said means for moving said actuator along said longitudinal guideway includes spring means for biasing said actuator toward said inoperative position.

5. A chuck as defined in claim 4 wherein said longi-

tudinal guideway is a cylinder and wherein said actuator is a piston, said means for moving said actuator along said longitudinal guideway including means for applying fluid pressure to one end of said piston to move it toward said operative position in opposition to the action of said spring means.

6. In a chuck, the combination of: supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of said axis; jaw means movable along said lateral guideway into alignment with said longitudinal guideway, said jaw means being transversely expansible and contractible to vary a lateral dimension thereof and having axially divergent cam surfaces; an actuator having axially divergent cam surfaces complementary to and engageable with said cam surfaces of said jaw means to control said lateral dimension thereof, said actuator being movable along said longitudinal guideway from a first position through an intermediate position into a second position, said cam surfaces of said actuator and said cam surfaces of said jaw means cooperating to vary said lateral dimension of said jaw means when said actuator is moved between first position and said intermediate position, and said actuator blocking said lateral guideway when in said first position and said intermediate position to prevent removal of said jaw means from said supporting structure along said lateral guideway, said actuator clearing said lateral guideway in said second position of said actuator; means for moving said actuator along said longitudinal guideway; and releasable means for preventing movement of said actuator from said intermediate position to said second position.

7. In a chuck, the combination of: supporting structure providing a longitudinal guideway having an axis and providing a lateral guideway extending transversely of said axis; jaw means movable along said lateral guideway into alignment with said longitudinal guideway, said jaw means being transversely expansible and contractible to vary a lateral dimension thereof; an actuator movable along said longitudinal guideway from a first position through an intermediate position into a second position, said actuator blocking said lateral guideway in said first position and said intermediate position to prevent removal of said jaw means from said supporting structure along said lateral guideway, and said actuator clearing said lateral guideway in said second position of said actuator; interengageable means on said actuator and said jaw means for varying said lateral dimension of said jaw means in response to movement of said actuator between said first position and said intermediate position; means for moving said actuator along said longitudinal guideway; and releasable means for preventing movement of said actuator from said intermediate position to said second position.

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