Jan. 9, 1945. J. T. OBECNY 2,366,979

HYDRAULIC WORK HOLDER

Filed April 17, 1943 4 Sheets-Sheet 1

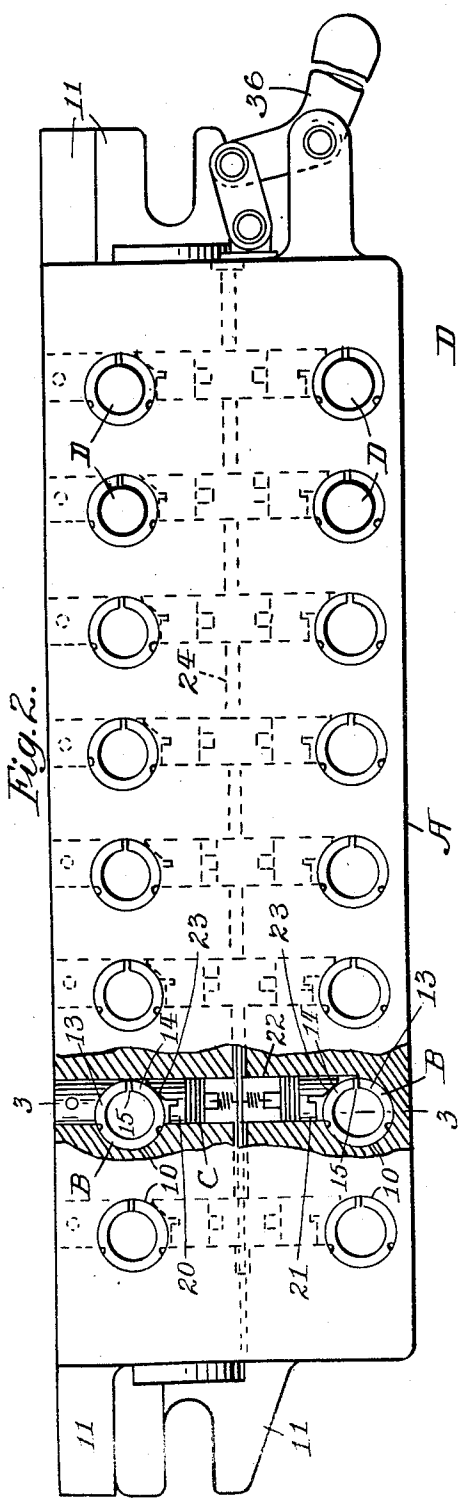


Fig. 2.

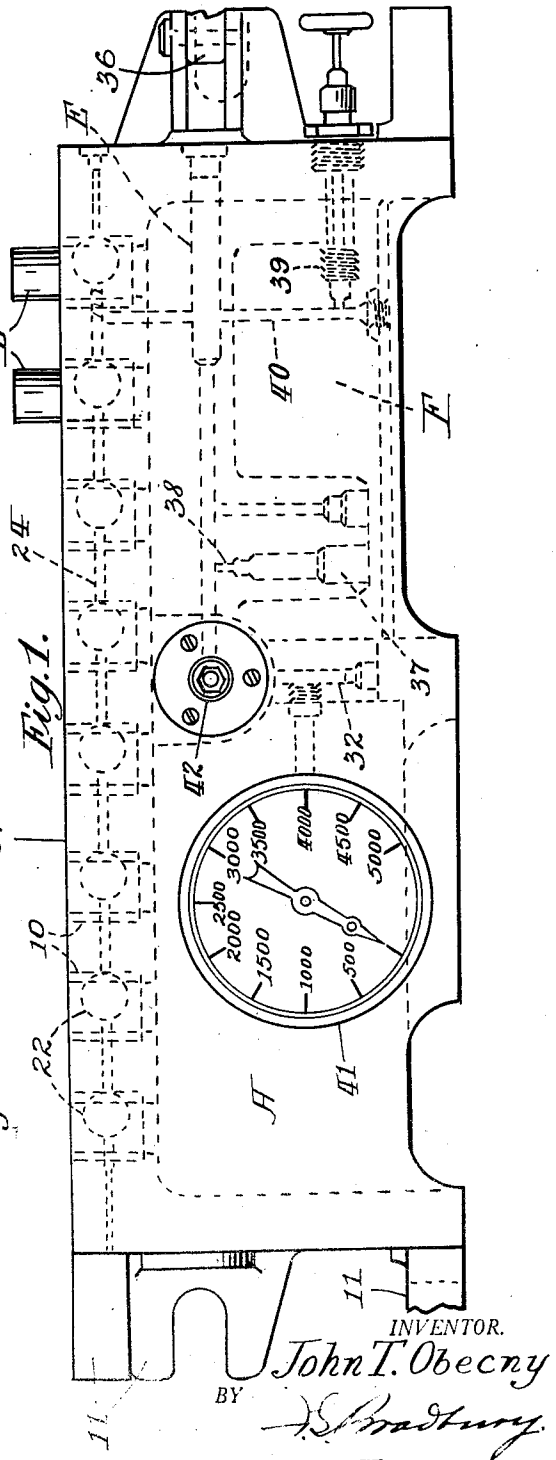


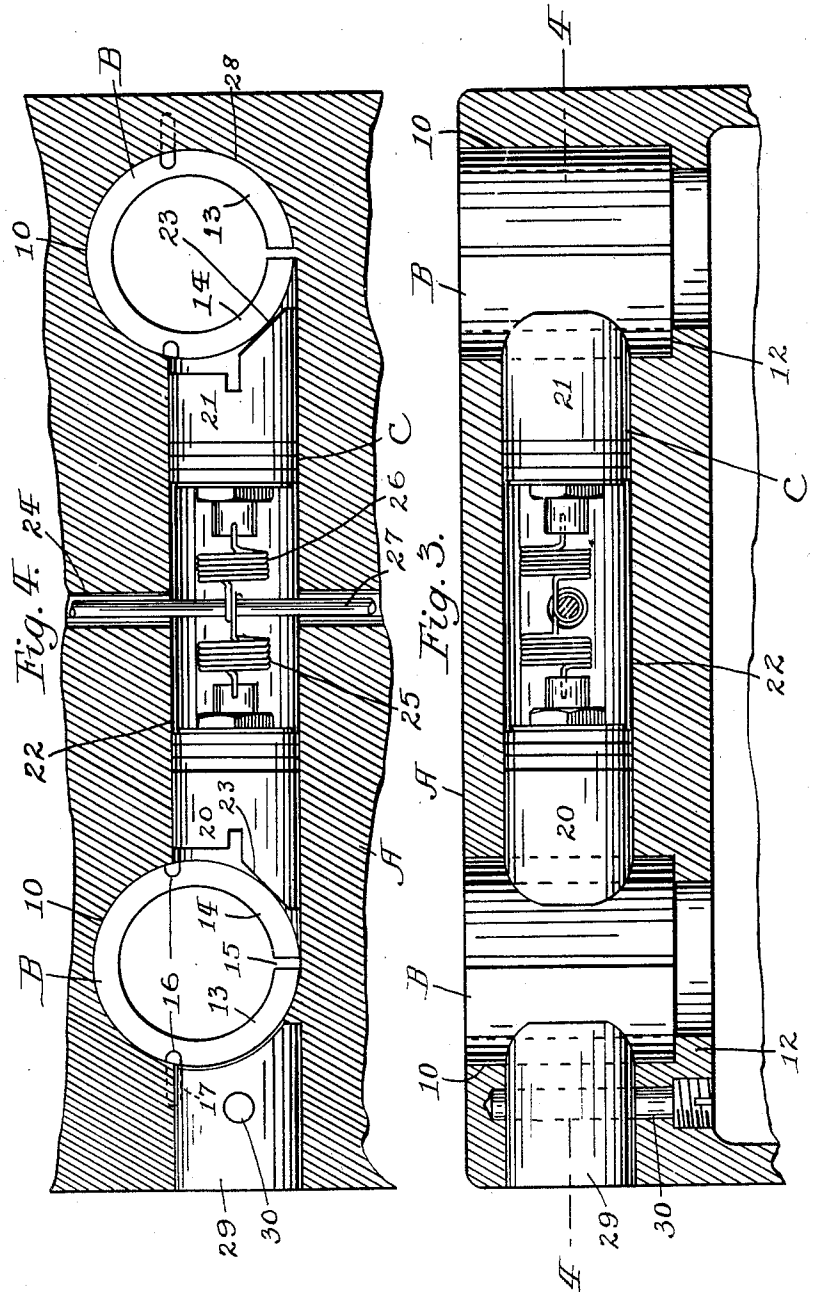
Fig. 1.

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HYDRAULIC WORK HOLDER

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HYDRAULIC WORK HOLDER

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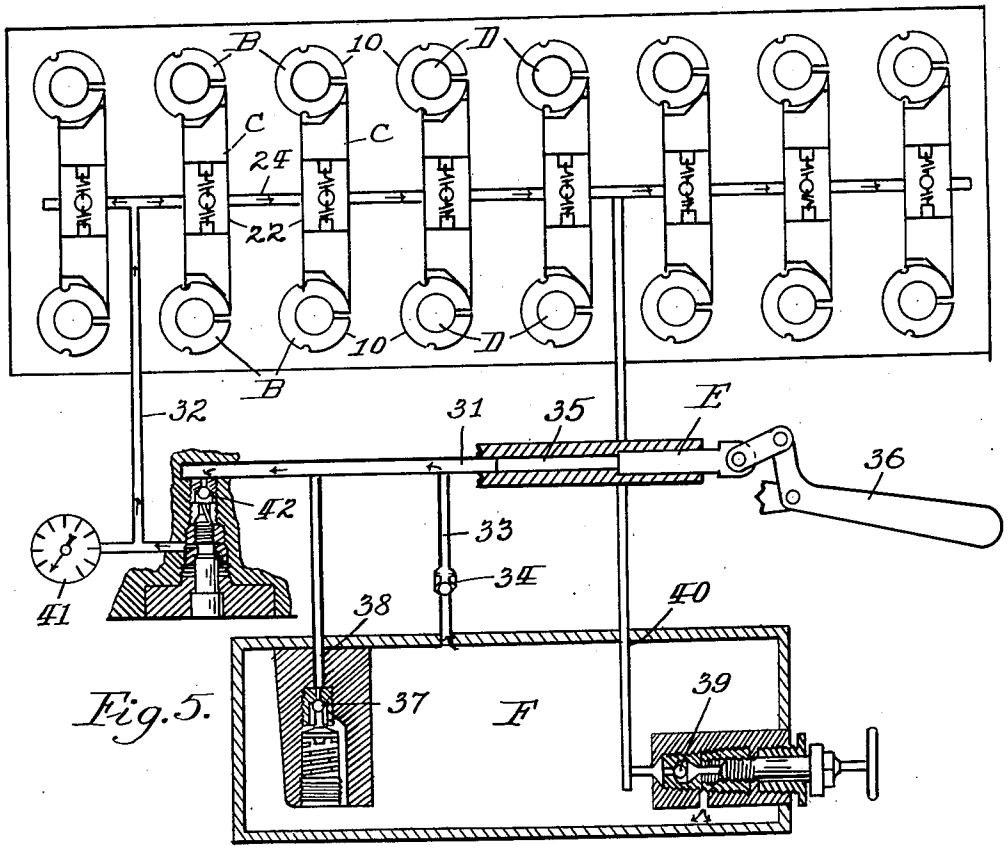


Fig. 5.

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Fig. 6.

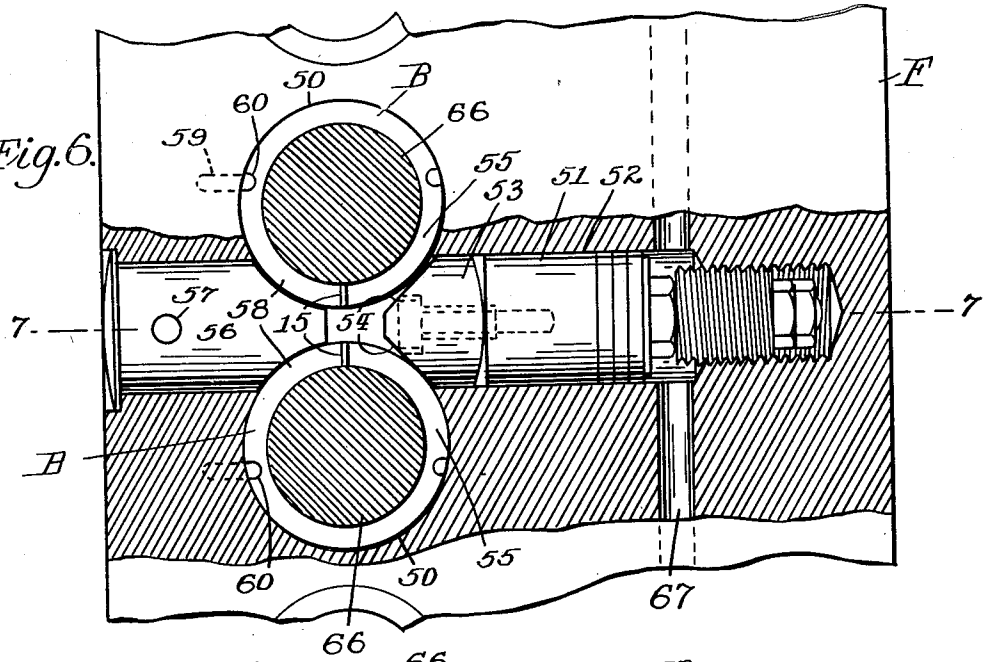


Fig. 7.

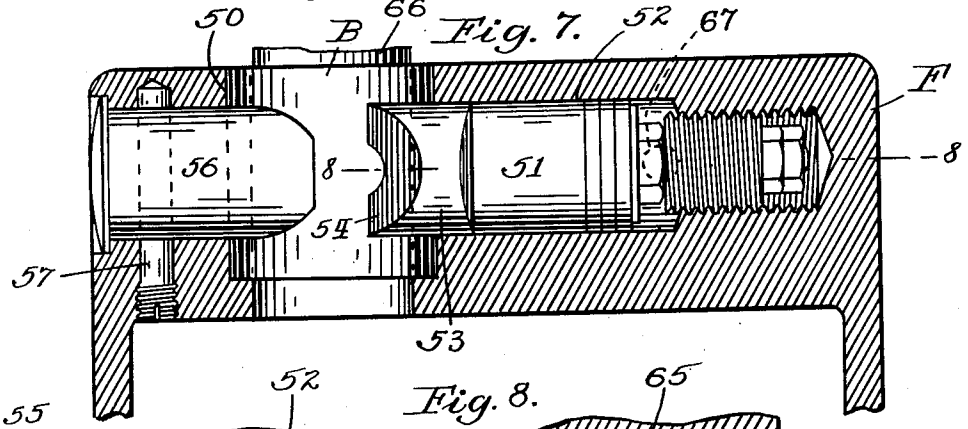
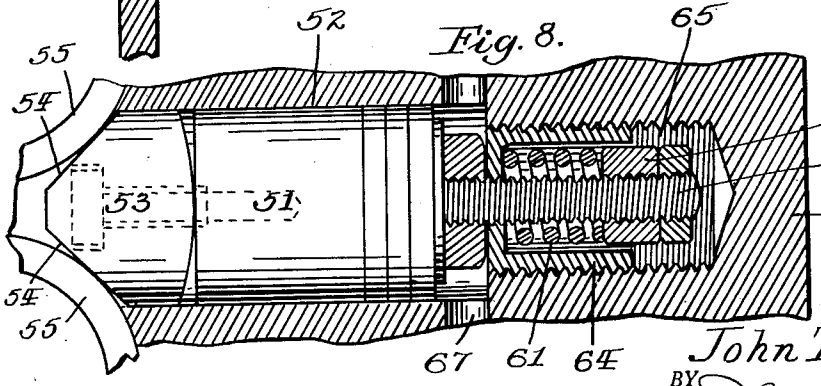


Fig. 8.



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UNITED STATES PATENT OFFICE

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HYDRAULIC WORK HOLDER

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Application April 17, 1943, Serial No. 483,501

10 Claims. (Cl. 90—59)

This invention relates to improvements in hydraulic work holders and more particularly to that type by which work pieces are effectively held in position for multiple chucking in milling machines, shapers, drill presses, grinding machines, etc. More particularly this invention relates to improvements upon the construction set forth in my companion applications, Serial Number 354,597, filed August 28, 1940, (Patent No. 2,339,799), and Serial Number 405,319, filed August 4, 1941, (Patent No. 2,339,800), of which the present application is a continuation in part. This invention like in the structure set forth in said applications is adapted for multiple production of fine precision work and a number of work pieces are held firmly and evenly by applied pressure regardless of inequalities, the controlled pressure elements being equalized to apply even pressure simultaneously upon a number of work pieces. The invention is further simplified and made more effective by the use of a single applicator or plunger unit for operating a plurality of work piece clamping collets in the holder, simultaneously. A series of said units is provided while the individual collets thereof are arranged in a plurality of rows and the pressure for actuating all of the collets is evenly distributed and equalized. One of the objects attained by the present improvement is the production of an apparatus by which no single work piece is permitted to move or slip while being machined or worked in any manner. Among further objects and advantages is the saving of time and expense in the multiple production of machined articles and the correct and accurate positioning of the work pieces for milling, grinding, cutting or other working.

With the above objects and advantages in view, in addition to and including the principal objects and advantages set forth in my companion applications, my invention comprises the features of construction and combination of parts hereinafter described and claimed.

In the accompanying drawings, forming part of this specification, Fig. 1 is a front elevational view of my improved work holder; Fig. 2 is a plan of the structure shown in Fig. 1, a portion of the body being broken away to illustrate more clearly, one tandem pair of collets and actuating unit; Fig. 3 is an enlarged vertical section of a detail, taken approximately on the line 3—3 of Fig. 2, the plungers 20 and 21, collet B and plug 29 being shown in full; Fig. 4 is a section taken on the line 4—4 of Fig. 3, the plunger mechanism, collets B and plug 29 being shown in full; Fig. 5 is a diagram or schematic view showing my improved work holder, and illustrating the operation of the work holding spring collets and the cooperating hydraulic actuators by which the collets are caused to function simultaneously, and particularly the tandem arrangement by which the construction is simplified and the propelling force is distributed evenly to all of the collets; Fig. 6 is a plan of a detail of my improved work holder showing an alternative construction, a portion of the body being broken away and in section and disclosing two of the work piece holding collets and a single laterally disposed plunger unit for hydraulically actuating a pair of the collets simultaneously; Fig. 7 is a section taken on the line 7—7 of Fig. 6, the collet B and plunger unit being shown in full, and Fig. 8 is a section of a detail taken on the line 8—8 of Fig. 7, the plunger 51 and equalizing head 53 being shown in full.

My improvement relates more particularly to the use of a single actuating unit C for simultaneously operating a plurality or pair of work piece holding collets B, thereby simplifying the construction and reducing the cost of production while improving the operation. This improvement is used in a work holding body A and with a suitable source of hydraulic compression means such as is disclosed in my companion applications above identified. The body and hydraulic actuating means will therefore be described only briefly. For more specific description reference is made to said applications.

A is a suitable body or housing in which collets B are held in corresponding chucks or chuck openings 10. These chucks and collets are arranged in two or more parallel rows with each pair of collets and chucks co-axial and substantially vertical when the body assumes upright position. The collets are supported with their upper ends in substantially a horizontal plane. As shown their upper ends are flush with the surface of the body. The collets in the chucks are arranged closely in each row, thus locating the work in the correct position for double milling or other operation, and with a minimum of loss of milling or other work. The body A is substantially rectangular or oblong and is provided with suitable horizontal and vertical bosses 11 by which it may be bolted or clamped in correct position on a machine or other support, with the work pieces such as D (Fig. 5), held securely and in substantial alignment, whereby a number of the work pieces can be machined or worked simultaneously with maximum precision. Each collet

is supported on an annular shoulder 12 in the lower end of each chuck 10. Various types of collets may be employed in the body, that shown consisting of a resilient hollow cylindrical sleeve which is split longitudinally and transversely to provide a pair of arcuate arms 13 and 14 which are separated by a gap 15 so that the sleeve can be contracted and wrapped tightly around the body or stem of the work piece in the collet. A pair of vertical channels 16 weaken the collet body so as to assist in permitting free wrapping action thereof. Each collet is prevented from rotating in its chuck by a key 17, which is seated in the body and engages in one of the channels 16. By the wrapping action described the work piece is held more securely by the collet.

The members of each pair of collets in the two rows shown are compressed simultaneously by an interposed compression unit C, comprising a pair of hydraulically operable coaxially disposed plungers 20 and 21. These plungers in tandem formation are freely reciprocable in a corresponding cylindrical bore 22 in the body, their line of travel being substantially transverse to the vertical axes of the work piece holding collets. The forward end of each plunger has a beveled face 23 which bears against the outer surface of one of the arms 14 of the companion collet so as to compress and wrap the collet around the work piece therein by the forward movement of the plunger when applied under hydraulic pressure. Hydraulic fluid under pressure is admitted into the space in the cylindrical bore 22 between the plungers 20 and 21 by a manifold duct 24 in the body, leading from a suitable source as will be hereinafter described. Thus both plungers of each transverse pair or operated to and from each other to compress two collets, and the series of pairs are operated simultaneously, which materially simplifies the structure and reduces the space required. When fluid pressure is released the collets are sprung into open retracted normal position by the retractile springs 25 and 26. The springs of all of the compression units are anchored to a single intermediate shaft 27, which passes through duct 24 and across the bores of the several units between the plungers, said shaft being thrust through and sealed in body A.

Each collet near the inner end of each cylindrical bore 22, of the series of units is seated with its arm 13 held rigidly in a seat 28, which is provided by the wall of the chuck in the body A so that when the plunger 21 is urged forwardly by hydraulic pressure the flexible arm 14 is wrapped firmly around the body or stem of the work piece and holds the latter securely in the collet. In a similar manner the companion collet of each transverse pair has its arm 13 seated firmly, partly in the wall of the chuck and partly adjacent to the end of a corresponding plug 29, which latter is held in the bore 22 by the key pin 30. The companion flexible arm 14 is simultaneously wrapped tightly around the body or stem of the work piece therein by the compression movement of plunger 20. By arranging the applicator units with their plungers in tandem formation between a pair of transversely disposed contractible collets and applying fluid under pressure between them to contract the collets simultaneously, the compression force urged by the plungers against the collets is equalized, thereby reducing to a minimum any tendency of the work pieces slipping or working loose. The outer end of each bore of each actuating unit is thus closed and sealed by the plug 29. By removing the pin 30, the plug and parts of the accompanying actuating unit can be removed or replaced in the body. Repairing or adjusting of the parts is thus facilitated.

The fluid medium which is distributed evenly through the manifold duct 24 to all of the collet actuating units C is shown compressed by the reciprocable hand operable pump E, (see Fig. 5), in a similar manner to that set forth in my companion applications above identified. The circuit of the propelling fluid is illustrated diagrammatically and provides one form of actuating means for propelling the pump plunger forwardly and causing the compression and holding tendency of the collets for a period sufficient to machine or otherwise work the articles which are held by the device, and for releasing the collets from gripping the work pieces when desired. In the system thus provided the cylindrical bores 22 are connected by the manifold supply duct 24, which in turn is connected to the pump chamber 31 by a duct 32. F indicates a fluid reservoir which is contained in the body A and is connected by duct 33 with the pump compression chamber, a suitable compression check valve 34 being interposed, whereby during the suction stroke of the pump piston 35, fluid is drawn into the pump chamber. Immediately upon compression by the piston, valve 34 closes automatically and the fluid thus admitted is forced into the actuating unit bores 22 back of each pair of plungers 20 and 21. These plungers thus compress and hold the collets and the work pieces therein. Continued operation of pump E by reciprocating the pump handle 36, increases the hydraulic pressure of the operating fluid and establishes the desired holding pressure of the collets. Any excessive pressure of the fluid is released by valve 37, which by-passes the compression medium back into the reservoir through the by-pass duct 38. The release valve 37 thus functions as a safety valve to prevent danger and damage to the equipment from excessive pressure and also undesirable pressure upon the work pieces which are held by the collets. To release the sets of actuating plungers, a hand operable release valve 39 is provided in a return duct 40, which latter is connected with the manifold duct 24 and the reservoir F. By opening this valve the fluid under pressure in the plunger bores 22 is allowed to return to the reservoir. The collets thereupon expand, thus releasing the work pieces and permitting all of the plungers 20 and 21 to be returned into normal inactive position by their retractile springs 25 and 26. During the operation of the actuating means a pressure indicator 41 displays the pressure exerted by the actuating fluid in the entire system. The check valve 42 prevents the pressure fluid returning into the pressure chamber of the pump. This valve is also manually operable to close and prevent use of the pump. The positions of the assembled valves and ducts in the body A, referred to above are further indicated in Fig. 2.

It is contemplated that the fluid actuating means can be motor driven or any suitable type desired or that it can be controlled by hand or automatically, within the spirit of the invention. In use any number of units, as described, can be provided in a single holder, the invention contemplating a single opposite transverse pair of collets and their actuating unit or as many pairs and accompanied operating units in a double row as may be accommodated in any desired structure.

By arranging the collets in a double row with a single hydraulic actuating unit for each transverse pair of collets, the construction is simplified and its relative cost of production reduced to a minimum. The output of work is increased and the device otherwise materially improved in efficiency and effectiveness. Equalization of the hydraulically driven pressure elements applied to the collets also serves to hold all of the work pieces evenly and rigidly so as to overcome all inequalities while being machined or worked. Also by arranging the collets in two parallel rows, double milling, machining or other work operations can be performed, thus reducing time, expense and effort of production.

In the alternative construction illustrated in Figs. 6 to 8 inclusive, two adjacent collets are shown operated by a single actuator instead of a tandem arrangement of plungers as above described. The construction however is equally applicable for use with a multiple tandem arrangement when desired. The improvement provides the compressible collets B whose axes are parallel and whose longitudinal gaps 15 of each pair face each other. These collets are held in a corresponding pair of chucks 50, in a suitable body F. A single cylindrical plunger 51 is reciprocable in a cylindrical bore 52, said parts being disposed in the body F in a line substantially transverse to the axes of the collets. The plunger element carries an equalizing head 53 which has a pair of forwardly converging faces 54, said faces being adapted to bear with a guiding movement against the sides of the resilient arms 55 and compress the collets by wrapping the bodies or stems of the work pieces 66 and holding them firmly. The equalizing head is slightly less in diameter than the diameter of the bore 52 to allow free movement of the head and permit even application of the operating force against the collets during the advancing movement of the plunger. A single plug 56 is inserted and held in the bore 52 ahead of the collets by the pin 57. This plug functions to close the bore 52 and may when desired be used as a seat for the arms 58 of the collet. Keys 59 seated in the body F and engaging the collets in weakening slots 60, as in the preferred construction, serve to prevent rotary movement of the collets in their seats. The return movement of the plunger 51 into normal releasing position of the collets is produced by the helical expansion spring 61 (Fig. 8), which bears against lock nuts 62 which are threaded upon the stem 63 of the plunger, at one end and against the inner shoulder of a cupped nut 64, at its opposite end. The cupped nut is threadedly engaged in a suitable recess 65 in the body F.

When fluid in the bore 52 back of the plunger is compressed, the plunger is urged forwardly and compresses the pair of collets simultaneously, the collets in turn engaging the body or shank of the work piece 66 by wrapping. As many of these units, each composed of a pair of collets and a single actuating plunger are incorporated into a single body F, as desired, the several units being connected by a manifold passage 67 with a suitably controlled source of hydraulic pressure for equalizing the distribution of the compressed fluid medium to all of the actuating elements. The construction permits of assembling all of the collets in a single or multiple rows or in any other convenient position desired.

In accordance with the patent statutes, I have described the principles of operation of my invention, together with the construction thereof which I now consider to represent the best embodiment thereof, but I desire to have it understood that the construction shown is only illustrative and that the invention can be carried out by other means and applied to uses other than those above set forth without departing from the spirit of the invention and within the scope of the following claims.

I claim:

1. In a holder for a plurality of work pieces, the combination of a body having a pair of collet seats therein, a contractible collet mounted in each seat having a socket for receiving a work piece, a pressure element guided toward and simultaneously against the walls of both collets, said pressure element and said collets having engaging faces cooperating to contract both collets simultaneously and clamp their corresponding work pieces, and means for actuating the pressure element against said collets.

2. In a holder for a plurality of work pieces, the combination of a body having a pair of closely associated collet seats, a contractible collet mounted in each seat having a socket for receiving a work piece, a pressure element corresponding with said collets and guided to move toward and simultaneously against the walls of both collets along a line substantially transverse to the longitudinal axes of the collets, said pressure element and said collets having engaging faces cooperating to compress the collets simultaneously and clamp their corresponding work pieces, and hydraulic means for advancing the pressure element.

3. In a hydraulic work holder, a body having aligned chucks to receive collets, corresponding collets seated in said chucks for holding work pieces, pressure units corresponding with and hydraulically operable between the members of each pair of said collets for compressing the collets upon work pieces therein, the members of each pair of collets and their corresponding compression unit having engaging faces cooperating to contract the collets and engage their companion work pieces, hydraulic means for operating said pressure units upon the members of each pair of collets simultaneously, said hydraulic means being common to all of the collets, and manually operable means for controlling said hydraulic means, whereby the pressure is equalized on all of the collets.

4. In a hydraulic work holder, a body having a pair of chucks, corresponding contractible collets seated in said chucks for holding work pieces, a pressure unit freely operable between said collets for compressing the same upon work pieces therein, means for operating said pressure unit upon both of said collets simultaneously, said operating means being common to both of said collets, and means for controlling said operating means, whereby the pressure is equalized on both of said collets.

5. In a holder for a plurality of work pieces, the combination of a body having a plurality of collet seats, arranged in a plurality of rows, the collet seats of companion rows being arranged in transverse pairs, a contractible collet mounted in each set and having a socket for receiving a work piece, a pressure unit guided to move simultaneously toward and against the walls of the collets of each pair along a line substantially transverse to the longitudinal axes of the collets, the collets of each pair and their corresponding

pressure unit having engaging faces cooperating to compress the collets and grip work pieces therein, and means for actuating the pressure units in unison to contract the collets.

6. A hydraulic work holder including in combination, a body having a plurality of substantially parallel rows of collet seats arranged in transverse pairs between said rows, a corresponding series of collets held in said seats for holding work pieces, a pressure element for each transverse pair of collets hydraulically operable for simultaneously compressing the members of each pair upon work pieces, hydraulic means for simultaneously operating said pressure elements in cooperation with said collets, said hydraulic means being common to all of said pressure elements, whereby pressure is equalized on all of said collets, and manually operable means for controlling said hydraulic means.

7. A hydraulic work holder including in combination, a body having a series of transverse pairs of chucks for seating collets, contractible work piece receiving collets seated in said chucks, corresponding pressure units simultaneously cooperating to operate the collet members of each of said pairs, hydraulic means for actuating said pressure units to compress each pair of collets simultaneously, said hydraulic means being common to all of said pressure units whereby pressure is equalized on all of said collets, and means for controlling said hydraulic means.

8. A hydraulic work holder including in combination, a body having a series of chucks arranged in pairs for seating collets, contractible work piece receiving collets seated in said chucks, corresponding pressure units equalized between the collet members of each pair, hydraulic means for actuating said pressure units to compress each pair of collets simultaneously, said hydraulic means being common to all of said pressure units, whereby pressure is equalized on all of said collets, and means for controlling said hydraulic means.

9. A hydraulic work holder including in combination, a body having a series of chucks arranged in pairs for seating collets, contractible work piece engaging collets seated in said chucks, a pressure unit cooperating with each pair of collet members, means by which the pressure imparted by the pressure unit is equalized against the members of the companion pair of collets, hydraulic means for actuating said pressure units to compress all of the pairs of collets simultaneously, said hydraulic means being common to all of said pressure units, whereby pressure is equalized on all of said collets, and means for controlling said hydraulic means.

10. In a work holder, a body having a pair of contractible chuck elements, a pressure unit freely operable between said chuck elements for compressing the same upon work pieces therein, means for operating said pressure unit upon both of said chuck elements simultaneously, said operating means being common to both of said chuck elements, and means for controlling said operating means whereby the pressure is equalized on both of said chuck elements.

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