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HYDRAULIC CENTER AND DRIVER

Filed Feb. 5, 1968

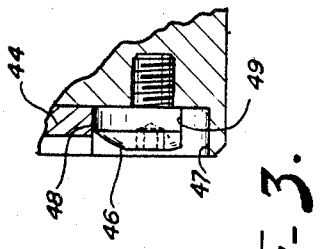

Fig. 3.

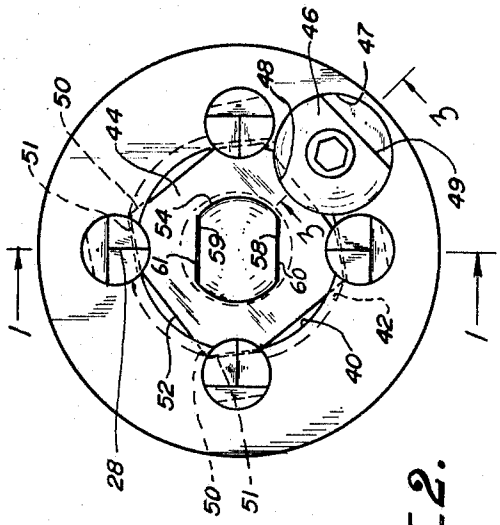

Fig. 2.

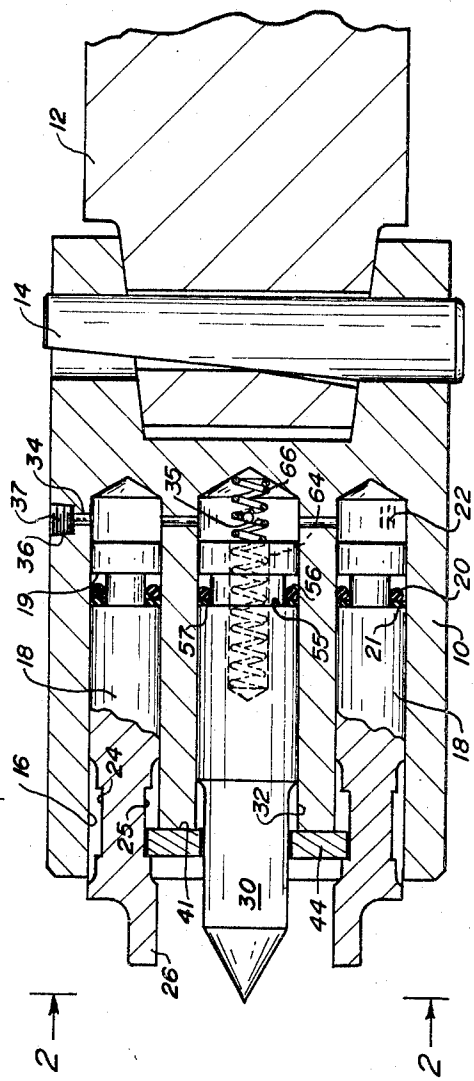

Fig. 1.

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HYDRAULIC CENTER AND DRIVER

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ABSTRACT OF THE DISCLOSURE

A work-driver having a hydraulic center and appropriately positioned driving dogs, said center and dogs being operatively and responsively interconnected by means of a common hydraulic reservoir. The common hydraulic reservoir provides means for equalizing the thrust forces on the center and driving dogs of the work-driver. This combination of dogs and center are uniquely retained within the body by means of a single retainer plate movable into the locking position from a loading position wherein the center and drivers may be readily inserted and removed from the body of the work-driving member.

BACKGROUND OF THE INVENTION

Field of the invention

The field of art to which this invention pertains is generally found in the class of Turning and more particularly in the subclasses of "Work-drivers," "Lathe dogs," "Cam grip," "Mandrels" and "Centerers."

Description of the prior art

Work-drivers and centers, of course, are well known in the art and the use of hydraulics as by pistons or plungers to equalize the thrust pressures on the various components of the work-drivers is also known in the art. It is to be noted that, in general, the complexity of assembly, maintenance and operation of these drivers leaves much to be desired.

Many of the drivers generally available and known in the art employ a hydraulic equalization of the driver dog members requiring an auxiliary supply or loading of the hydraulic fluid. This auxiliary connection oftentimes complicates the operation of the lathe and like apparatus. In the preferred embodiment of my invention to be hereinafter more fully described, it is contemplated that an integral self-contained hydraulic reservoir system is adapted to provide an equalization of thrust pressure on the inner ends of both a center member and four or more driving dog members. These center and driving dog members are reciprocal in bores connected at their inner ends to form a reservoir. The several hydraulic pistons are movably actuated and supported by a fluid contained in the common reservoir. The center and driving dogs are oriented and maintained within the common body of the work-driver by means of a novel retaining plate which is rotated to determined positions to permit a ready inserting or removal of the various components from the body. The plate in a determined position permits axial rotation of the dogs to either an inner or outer driving position.

SUMMARY OF THE INVENTION

This invention provides a work-driver in which a center member and a plurality of driving dogs, generally four or more, are reciprocally mounted in a main body which may be mounted to a shank or mounted in a machine tool. The center and the driving dogs have their inner ends provided with sealing means so as to become hydraulic pistons actuated by a common hydraulic source. In the body of the driver there is provided four or more precisely positioned and sized bores, each bore adapted to reciprocally retain a driving dog. The inward ends of these bores are

interconnected to provide a common hydraulic system or reservoir with the fluid within the reservoir adapted to pass from one bore to the other interconnected bores. The center member is likewise mounted in a precisely sized and positioned bore formed in the body. The inner end of this bore is also fluid connected to the interconnected bores containing the driving dogs. The driving dogs and center are readily inserted and removed from the work-holder body of the manipulation and releasing of a retaining plate which is adapted to seat in a groove formed in the holder body. The retaining and releasing of the retaining plate requires only a small arc of movement. With the plate in the releasing position the center and dogs may be turned to other driving positions. The plate is then turned to the retaining position. The plate is then locked in position so as to positively retain the positioned driving dogs and center within the bores of the work-holder.

INTENT OF THE DISCLOSURE

Although the following disclosure offered for public dissemination is detailed to insure adequacy and aid in understanding of the invention, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how it may later be disguised by variations in form or additions of further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the parts, improvements and combinations in which the inventive concepts are found.

There has been chosen a specific embodiment of the hydraulic center and driver as adapted for use on lathes and the like in which is shown a preferred means for mounting the work-holder on a shank. This specific embodiment has been chosen for the purposes of illustration and description as shown in the accompanying drawing wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 represents a sectional view of the work-holder and showing particularly the driving dogs and center in a retained position within the body;

FIG. 2 represents an end view of the work-holder looking toward the center and driving dogs, the view being taken on the line 2—2 of FIG. 1, and

FIG. 3 represents a fragmentary sectional view showing the means of locking a retaining plate in a determined position in the work body, the view being taken on the line 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now particularly to the drawing wherein like numbers refer to like members throughout the figures and in particular to FIGS. 1 and 2 wherein there is shown a tool body **10** having one end recessed for mounting on a driving spindle or shank **12**. The body **10** may be retained on said spindle by means of a drive pin or key **14**. It is to be noted, of course, that body **10** is preferably provided with a conventionally tapered socket adapted to accurately seat upon the nose of spindle **12**. In the body **10**, as shown, there are provided four equally spaced and sized bores **16**, each adapted to slidably retain the cylindrical body of a driving dog **18**. The inner ends of these dogs are grooved at **19** to provide a retaining means for an O-ring **20**. Said O-ring is intended to act as a piston seal for the inner end of the body of the driving dog **18** as it is moved in bore **16**. Adjacent the O-ring and carried in the groove **19** is a wiper ring **21** which may be of nylon or the like. The use of a wiper ring is conventional and is merely a means of excluding dirt and the like to provide for an insur-

ance for good and trouble-free operation. The O-ring and wiper are the piston ring which retain the supply of hydraulic fluid 22 carried in the inner ends of bore 16.

Still referring to FIG. 1, the driving dogs 18 are shown as formed with oppositely disposed flats 24 and 25 which provide means for maintaining the attitude of the driving dog when engaged by a retaining means or guide. The dog is reciprocally movable in a determined oriented position in the bores 16 of the tool body. The outer ends of the driving dogs are formed with a reduced end portion 26 which, as seen in FIG. 2, may have a sharpened end to provide a chisel point 28. Centrally carried in the tool body 10 so as to be on the exact axis of rotation of said tool body is a center 30 which is reciprocally retained in a bore 32. This bore, at its inner end, is interconnected to the hydraulic supply 22 as provided by the reservoir formed by the inner ends of the bores 16. This interconnection is formed by means of cross-drilled passageways 34 and 35 which become hydraulic conduit means through which the hydraulic fluid 22 flows and/or transmits pressure from the end of each bore 16 to the inner end of the bore 32. The cross-drilled passageways 34 and 35 are shown as made by drilling a hole from one side of the body. The outer end of hole 36 in the body is threaded by tapping and by means of a plug 37 the passageway is made fluid tight. The hydraulic reservoir thus formed includes the inner ends of the several bores 16 and center bore 32 and the cross-drilled passageways 34 and 35.

Referring particularly to FIG. 2, it is to be noted that a recess of minimum diameter 40 is formed in the body. This recess extends to an internal face surface 41 shown in FIG. 1. Face 41 extends outwardly to a retaining groove of determined maximum diameter 42. The groove is a determined width sized so as to slidably engage the corner portions of a retaining plate 44. As seen in FIG. 2, this retaining plate is depicted as having a nearly square configuration whose corners are of a sufficient extent and thickness so as to engage and mate in groove 42 in the body. The plate 44 simultaneously retains the driving dogs 18 and center 30 when the plate 44 is moved to the position of FIG. 2.

Shown particularly in FIGS. 2 and 3 is a lock screw 46 whose outer diameter is sized so as to enter a counterbore 47 in the body 10 and an arcuate scallop 48 in the edge portion of the plate 44. The scallop 48 as formed in the plate 44 is sized so as to be snugly engaged by the lock screw 46 to retain the plate in a determined position to which the plate is rotated. A flat 49 is formed on one side of the head of the lock screw. This flat, when the screw is rotated about one hundred and eighty degrees, permits the retaining plate to be moved in groove 42 or removed therefrom without the removal of the lock screw from the body 10.

The four corner or point portions 50 of the plate 44 are disposed so as to enter and engage the retaining groove 42 to longitudinally maintain the plate in the body. Adjacent each corner 50 is a beveled portion 51 which, when in the retaining position of FIG. 2, slidably engages either flat 24 or 25 of the driving dog 18. The sides 52 of the plate 44 are sized so that with the midposition of the side 52 turned to the driving dog 18, any or all of the driving dogs may be removed from the body 10 or the dogs may be turned so that the ends 26 are either in or out. In this manner the driving dogs are positioned so as to engage larger or smaller workpieces.

A center retaining aperture 54 is precisely located and shaped in the plate 44. This aperture 54 slidably retains the outer portion of the center and its reduced diameter while the larger inner diameter of the center 30 is sized to slide in bore 32 in the body 10. The inner end of the center is locally grooved at 55 so as to retain an O-ring 56 and a wiper 57 providing a piston ring or hydraulic seal of the center 30 in the bore 32. A pair of flats 58 and 59 are provided on the center so that the center is prevented from rotating in its bore. The flats 58 and 59 are slidably engaged by chords 60 and 61 which are provided in the shaping of the aperture. The chords provide the means to prevent the center from turning in the body. The tapered outer end of the center is conventional and usually is of sixty degrees included angle.

The rear portion of center 30 is counterbored at 64 to receive and retain a compression spring 66 which is disposed so as to urge the center 30 outwardly. The spring urged center is initially thus the most outwardly disposed hydraulically movable member of the center and driver. This extending of the center enables a workpiece to be positioned on the center before the driving dogs are brought into engagement with the workpiece which is to be centered and driven.

USE AND OPERATION

The mounting of the tool body 10 to the spindle 12 utilizes the tapered socket of the body 10 which is slid upon a like tapered portion of the spindle. The tapered drive pin 14 is driven into retaining position so as to urge the body 10 into a lock condition upon the spindle 12. Conventionally the tool body 10 may be removed from the spindle by simply removing the pin 14 from its lock position and rapping the body with a hammer or the like to loosen the body 10 from the spindle 12. The mounting and locking of the tool body to the spindle may be before or after the assembly of the work-holder components into the body. The replacement or positioning of the hydraulically actuated members may be before or after the assembly of the body to the spindle. It is further contemplated that several sizes of bodies 10, having appropriate centers and dogs, may have like sized sockets for selective mounting on the spindle 12.

The driving dogs and center are assembled in the body 10 by the following procedure: the O-ring 56 and wiper 57 is mounted in the groove 55 of the center 30; the spring 66 is mounted in counterbore 64 and the center is then inserted in bore 32; retaining plate 44 is now mounted on the center and with the corners 50 disposed to coincide with the bores 16, the plate is moved inwardly to the face surface 41 and the ends 50 are moved into groove 42; the O-rings 20 and wipers 21 are mounted in each of the grooves 19 of the dogs 18; plate 44 is turned about forty-five degrees in the groove to bring the midportions of side 52 adjacent bore 16 so as to allow the dogs 18 to slide by the midportions of the sides 52 of the plate; with the tool body 10 disposed in a vertical attitude a determined amount of hydraulic fluid 22 is poured into one of the bores; with the desired quantity of fluid now in the reservoir, the dogs 18 are inserted in their respective bores with the ends 26 either in or out as desired; the retaining plate 44 is now turned counterclockwise until the beveled portions 51 engage a flat 24 or 25 of the driving dog 18; the lock screw 46 is turned to enter scallop 48 and lock plate 44 in the position shown in FIG. 2; and the work-holder is now ready for mounting or use on spindle 12 or the like.

It is of particular note that the aperture 54 in plate 44 is sized and shaped so that the center 30 is oriented and maintained in a fixed relationship to the plate. The center is slidably retained so as to limit its forward or outward motion as urged by the spring 66. The flats 58 and 59 and/or the reduced diameter of the forward portion of the center may separtely or coincidently provide a shoulder means for engaging the plate 44 to limit the outward travel of the center 30. With the plate 44 in the secured position of FIG. 2, the driving dogs 18 and center 18 are limited as to their maximum outward movement and are maintained in their selected keyed or oriented position. The inward limit of movement of the driving dogs and center is determined by the degree of exerted pressure pushing inwardly against the reservoir of hydraulic fluid 22. The common source of hydraulic fluid insures an equal or like pressure exerted on the inner

ends of the several driving dogs and the inner end of the center.

When it is desired to change the position of the chisel driving ends **26** of the driving dogs **18**, as for example, from the position shown in FIG. 1 to an opposite or outer driving position, this adjusting procedure is followed: the lock screw **46** is turned about one hundred eighty degrees until flat **49** is next to plate **44**; plate **44** is rotated clockwise about forty-five degrees or until the midportion of sides **52** are next to a driving dog **18**; the dogs are then turned to the desired orientation; with the dogs in the desired position, the plate **44** is once again rotated counterclockwise into the retaining attitude of FIG. 2 with the beveled edge **51** slidably adjacent one of the flats either **24** or **25**, and with the plate **44** now once again in retaining position, the screw **46** is turned and tightened to the position of FIG. 2 whereby plate **44** is now in a locked position and the work-holder is in operating condition.

The center and driver above-shown and described has four driving dogs **18**. It is, of course, to be noted that as few as two driving dogs may be provided and that any number such as two, three, five or more could be provided if desired.

It is to be further noted that although the retaining plate **44** is shown as having four corners **50**, this is a matter of selection. The number of corners on the plate are sized and positioned to coincide with the number and position of the bores of the driving dogs. For example, if there are two bores then there are two precisely positioned corners. When there are three bores then there are three corners, and for five bores, five corners, etc. The inner diameter **40** of groove **42** has its maximum diameter of at least sufficient extent so as to intersect each of the bores **16** to provide a passageway for a corner **50** of the retaining plate. The corners **50** are shaped so as to engage both the groove **42** to retain the plate **44** while at the same time a portion of the plate corner will enter a flat **24** or **25** to slidably engage and retain a driving dog **18**.

It is, of course, noted that air or fluid can be added or removed from the reservoir by removing the plug **37** from one of the cross-drilled passageways. It is also noted that plate **44**, if desired, may be turned over, whereupon the rotation of the orienting procedure above is reversed and the position and provision for lock screw **46** in plate **44** is reoriented.

In operation, a workpiece (not shown) having a center-drilled end may be mounted in loose engagement on the extending center **30**. The workpiece and center is then moved towards the chisel ends **26** of the driving dogs **18** until the workpiece engages the chisel ends to provide the desired driving engagement. The hydraulic fluid **22** insures that an equal or substantially equal thrust pressure is exerted against the inner end of each driving dog and the end of the center **30**. In this manner any irregularities on the end of or engaging face of the workpiece is accommodated. The outward movement of the driving dogs and center is limited by the shoulder means on the members and the retaining plate **44**. The inward movement of the movable members is limited by the amount of fluid in the reservoir.

Terms such as "in," "out," "up," "down," "right," "left," "near," "far," "clockwise," "counterclockwise" and the like are applied to the hydraulic center and driver as shown and described in conjunction with the drawing. These terms are used merely for the purposes of description and do not necessarily apply to a particular position in which the apparatus may be constructed or used.

The conception of the hydraulic center and driver and its novel retaining means is not limited to the example above-described but departures therefrom may be made within the scope of the accompanying claims and protection is sought to the broadest extent the prior art allows.

What is claimed is:

1. A hydraulic center and work-driving tool in combination and for use in lathes and the like, the tool in use providing a positioner and supporter of a workpiece on the center and by means of the work-drivers engaging the workpiece to retain and move the workpiece as the tool is moved as by rotating; said tool including: (a) a body member; (b) a center bore formed in the body and extending from one end inwardly into the body; (c) a center mountable in and reciprocally movable in said center bore; (d) at least two driving dog bores formed in the same end of the body and extending inwardly, the bores disposed at a selected distance from the center bore; (e) a driving dog mountable in and reciprocally movable in each of the driving bores; (f) a fluid passageway interconnecting the inner portions of the driving dog bores and the center bore so as to provide a reservoir for a determined supply of hydraulic fluid and the like; (g) a retaining groove of determined diameter and width and formed in the body so as to be disposed a short distance from the body end containing the open ends of the center and driving dog bores, the outer diameter of the groove sized so as to intersect at least somewhat each of the driving dog bores; (h) a retaining plate having corners sized to slidably engage the outer diameter of the retaining groove and spaced so as to be brought into a coinciding attitude with the driving dog bores for movement into the body when the corners are disposed in said bores, the retaining plate at those portions which are disposed to enter and be retained in the groove having a thickness adapted to slide in the width of the groove; (i) a center receiving aperture formed in the retaining plate, the aperture shaped to provide cooperative engaging means with said center for limiting the outward movement of the center; (j) means formed on the driving dogs for engagement of the dogs by portions of the retaining plate so as to retain and limit the reciprocal movement of the driving dogs, and (k) fluid retaining means cooperating with the center and driving dogs and their bores for retaining fluid in the reservoir and to cause movement of the center and dogs in response to displacement of the fluid which may be provided in the reservoir.

2. A hydraulic center and work-driving tool as in claim **1** in which fluid retaining means for the center and driving dogs, each include cylindrical shaped body portions with each having a groove formed therein, and a fluid retaining ring carried in each of the grooves.

3. A hydraulic center and work-driving tool as in claim **2** in which the fluid retaining ring of the center and driving dog members include an O-ring and a wiper ring.

4. A hydraulic center and work-driving tool as in claim **1** in which the fluid passageway is formed of a hole drilled from one side of the body, said hole interconnecting the inner ends of the driving dog bores and the center bore.

5. A hydraulic center and work-driving tool as in claim **2** in which the center is formed with at least one longitudinally extending flat portion and the center receiving aperture in the retaining plate is formed with a chord portion sized to slidably engage and orient the center for a fixed axial attitude in the body.

6. A hydraulic center and work-driving tool as in claim **5** in which the center member has its inner end counterbored and in which there is provided a compression spring carried in the counterbore of the center, said spring disposed so as to engage the end of the counterbore and the center bore to urge the center to its outer limit of movement.

7. A hydraulic center and work-driving tool as in claim **2** in which each of the body portions of the driving dogs is provided with at least two longitudinally extensive flat portions, each flat disposed so as to be engaged by a corner portion of the retaining plate to slidably engage said flat to reciprocally retain the driving dog in a preselected oriented position.

8. A hydraulic center and work-driving tool as in claim 7 in which the outer end of each of the driving dogs is formed with an offset chisel end; and the flat portions formed in the body of the driving dogs are disposed in relation to the chisel end so that as selectively engaged by a corner portion of the retaining plate the driving dog and its chisel end is maintained in the selected oriented position.

9. A hydraulic center and work-driving tool as in claim 2 in which the retaining plate when mounted in the retaining groove has its outer sides sized so that midportions of said sides are absent engagement of the driving dog bores and the driving dogs therein when said midportions of the sides are moved to a position adjacent said driving dog bores.

10. A hydraulic center and work-driving tool as in claim 2 in which a counterbore is formed in an end of the body, the configuration of the counterbore disposed to substantially intersect the retaining plate groove in the body; and in which a scallop is formed in the retaining

plate, the scallop sized to mate with the counterbore to provide a determined diameter recess when the retaining plate is in a preselected position; and in which a lock screw is mountable in the body with the head of the screw sized to enter the counterbore and scallop to engage the sides thereof to maintain the retaining plate in said preselected position.

11. A hydraulic center and work-driving tool as in claim 10 in which the lock screw has a flat formed on its head, said flat being of sufficient extent to permit the turning of and removal of the retaining plate when the flat of the lock screw head is brought in way of the retaining plate.

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