Jan. 28, 1969 H. F. HOHLFELDER, JR., ET AL 3,424,319

HYDRAULIC INDEXING AND CLAMPING FIXTURES

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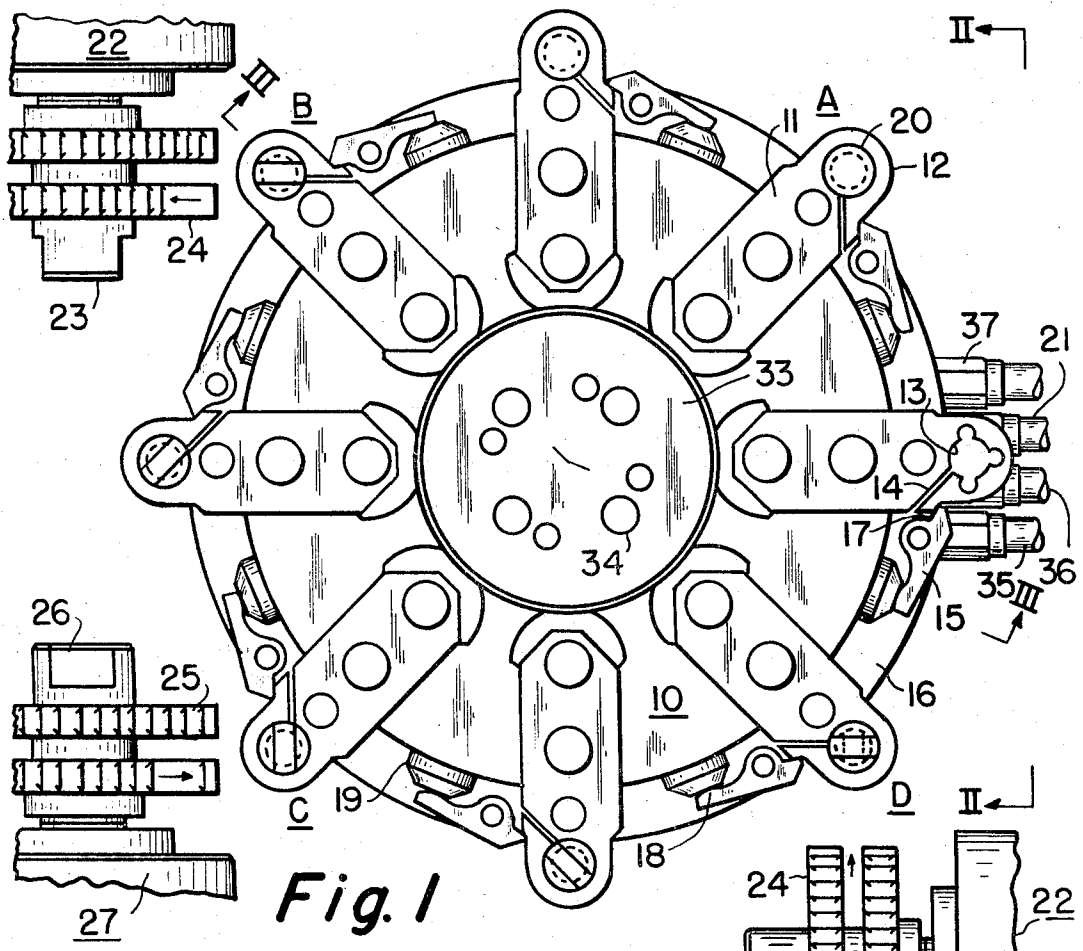

Fig. 1

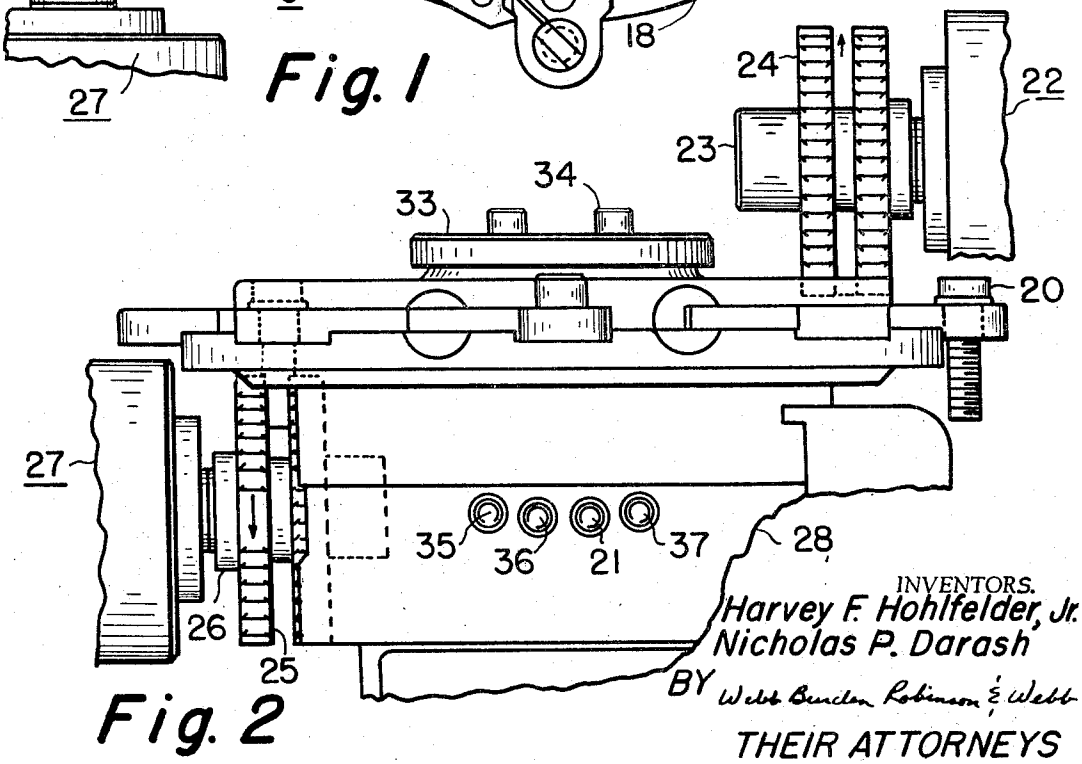

Fig. 2

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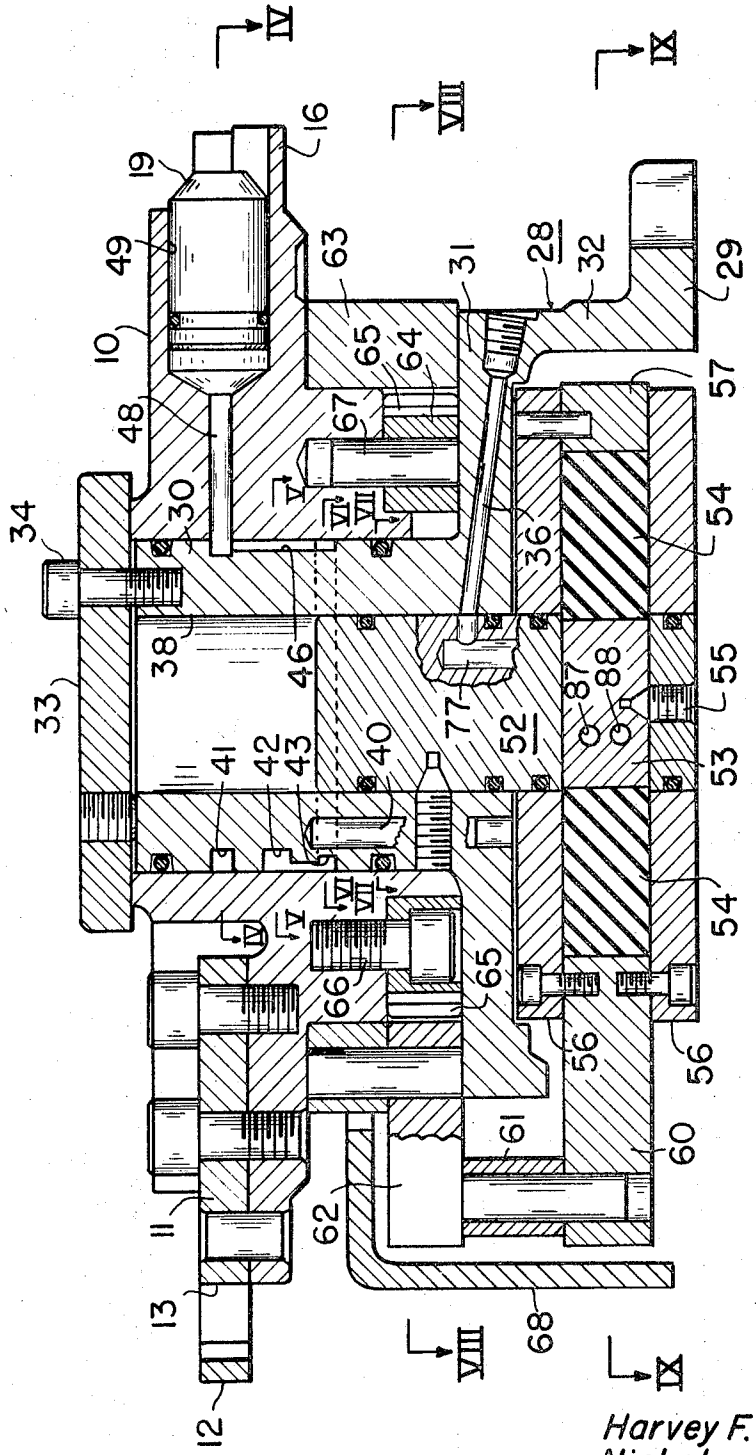

Fig. 3

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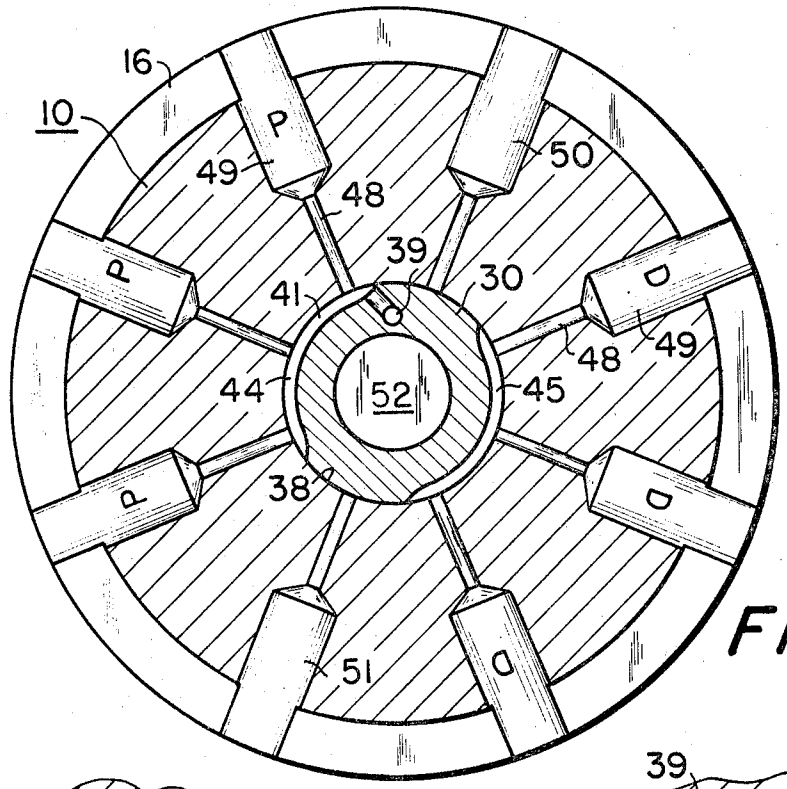

Fig. 4

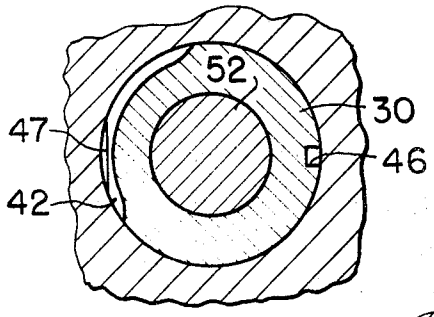

Fig. 5

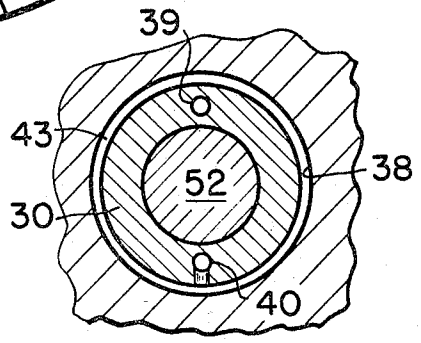

Fig. 6

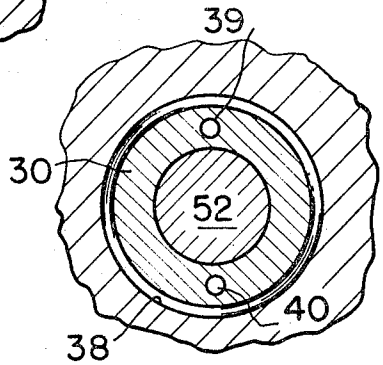

Fig. 7

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HYDRAULIC INDEXING AND CLAMPING FIXTURES

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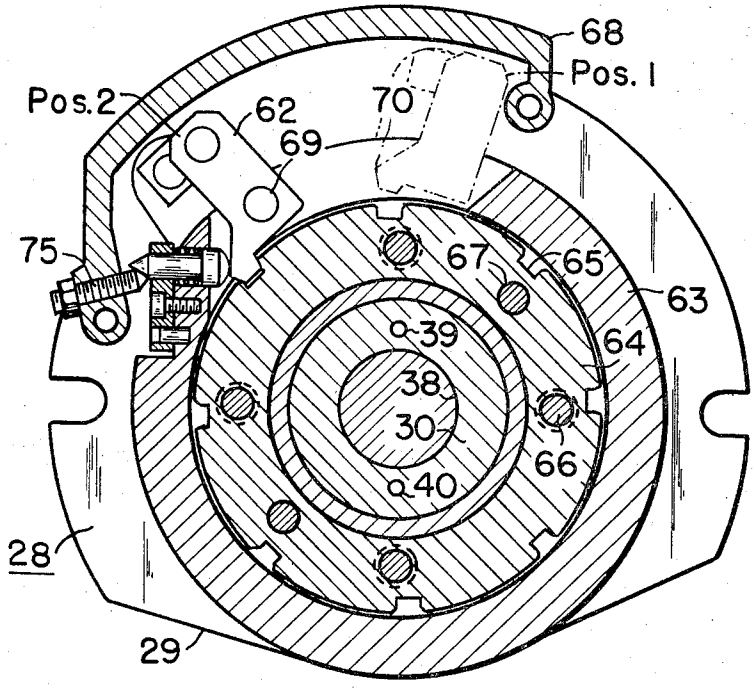

Fig. 8

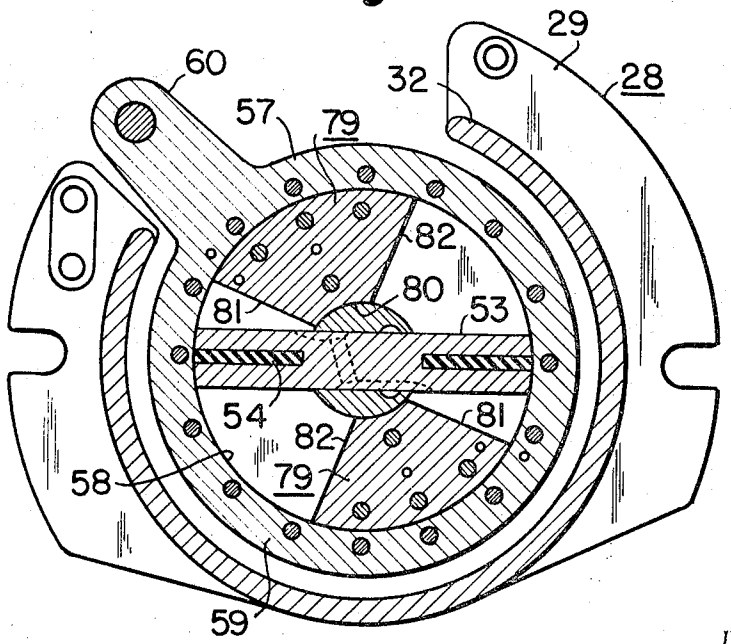

Fig. 9

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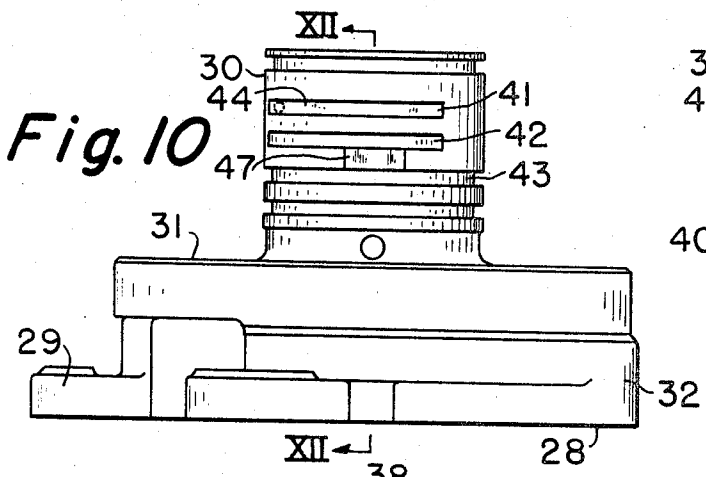

Fig. 10

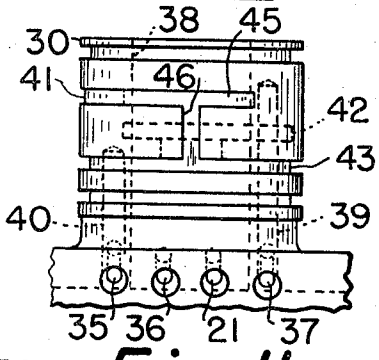

Fig. 11

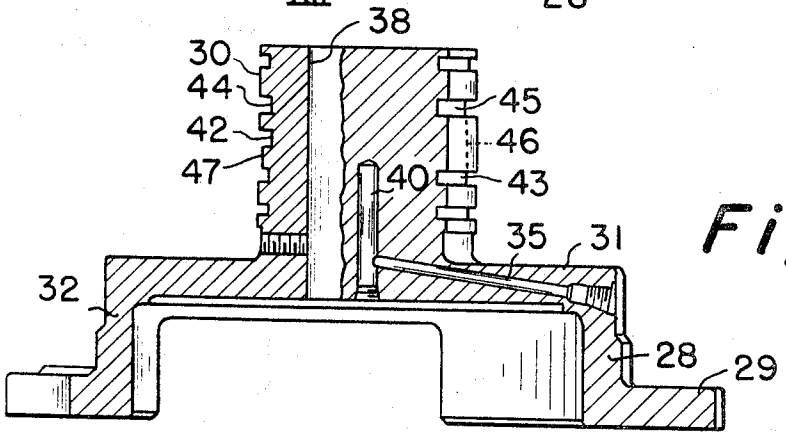

Fig. 12

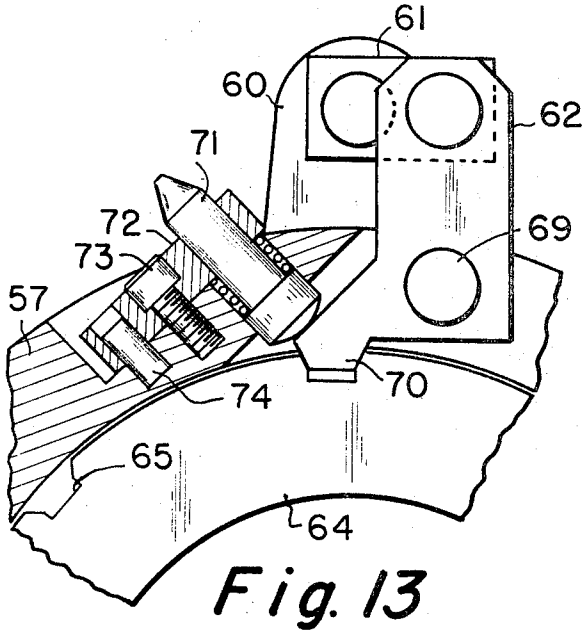

Fig. 13

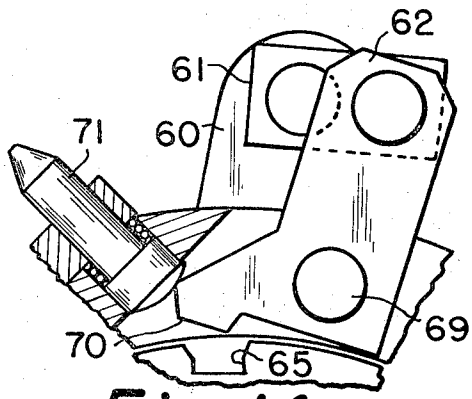

Fig. 14

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HYDRAULIC INDEXING AND CLAMPING FIXTURES
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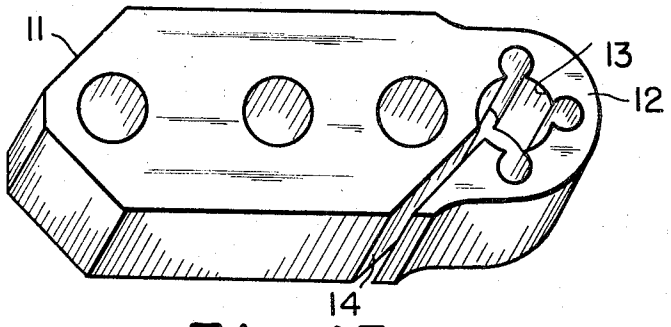

Fig. 15

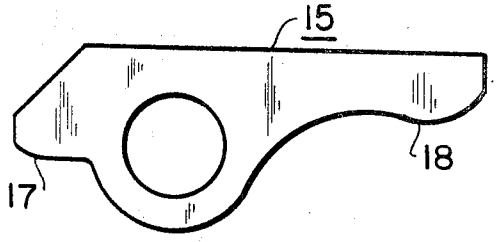

Fig. 16

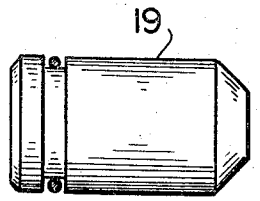

Fig. 17

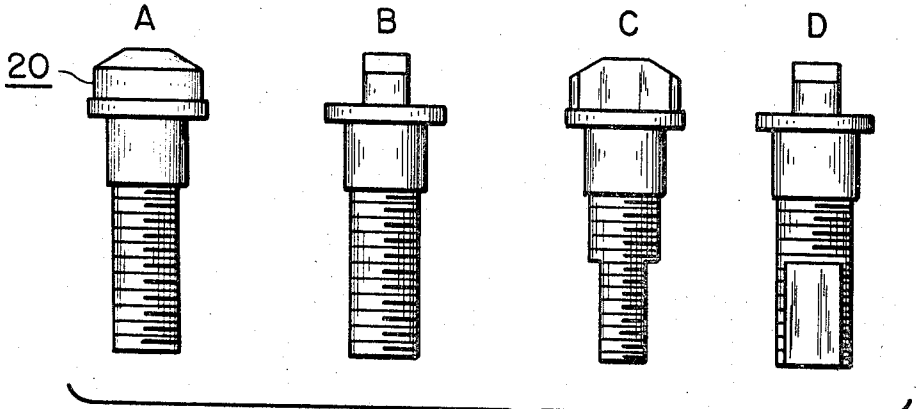

Fig. 18

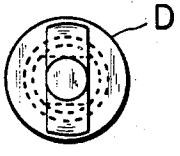

Fig. 19

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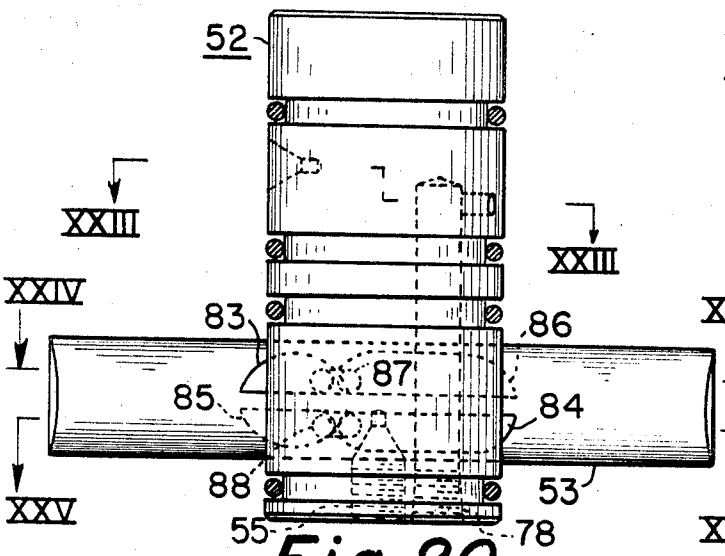

Fig. 20

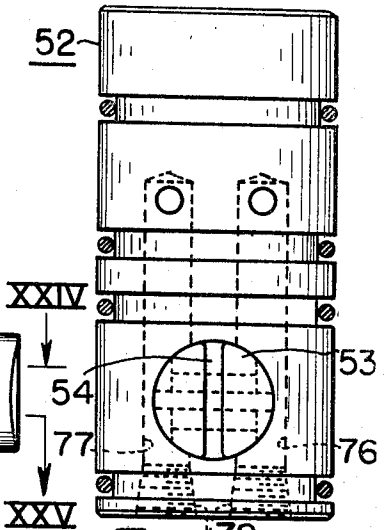

Fig. 21

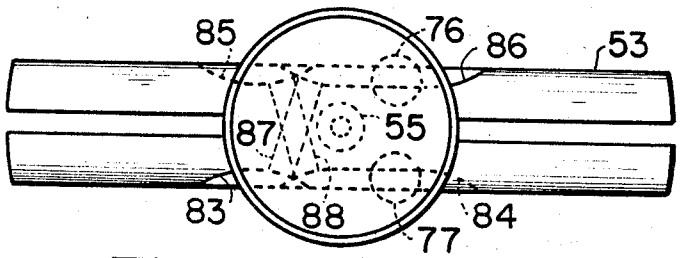

Fig. 22

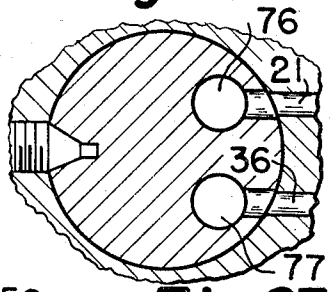

Fig. 23

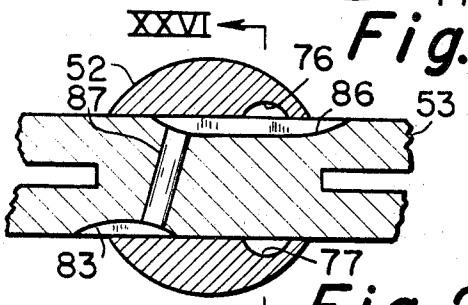

Fig. 24

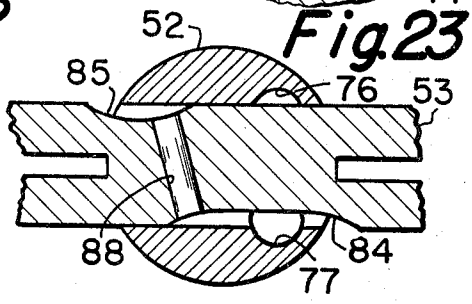

Fig. 25

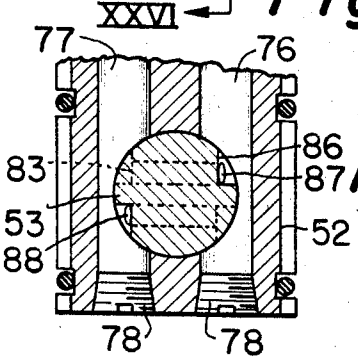

Fig. 26

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United States Patent Office 3,424,319
Patented Jan. 28, 1969

3,424,319

HYDRAULIC INDEXING AND CLAMPING FIXTURES

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Filed Nov. 9, 1966, Ser. No. 593,030
U.S. Cl. 214—1 8 Claims
Int. Cl. B25j 3/00; B23q 3/08; B23f 23/08

This invention relates to automatic indexing devices of the type normally associated with metal working machines, such as milling machines, turret lathes, and the like. In particular, the invention relates to a novel hydraulically actuated indexing and clamping fixture useful for locating and holding a workpiece for machining by automatic equipment.

To reduce production time on small items, such as bolts, it has become common practice to provide multi-workholder locating and positioning means on the table of a metal working machine, and adjacent the cutting tool of the machine. The piece to be machined is inserted into a workholder or locating means and indexed or moved to a position suitable for cutting. A second piece to be machined can be inserted in a second workholder during the machining operation on the first piece. Hence, essentially continuous machining operation can be achieved.

From the foregoing, it is apparent that it is necessary to properly locate the workpiece with respect to the cutting tool and also to clamp it tightly in the workholder to prevent movement of the workpiece during machining. Many present devices use complicated mechanical linkages to do this, which linkages are subject to wear, breakage and which often require physical adjustment by the machine operator.

It is quite difficult to accurately locate a workpiece for machining, since required tolerances are often measured in tenths of thousands of inches. Bevel or spur gear driven indexing devices simply cannot hold such tolerances, due to inherent play in a gear train. Nor have we found a Geneva device entirely suitable for continuous indexing. Air operated piston devices, using rack and pinion principles, are subject to mechanical losses and breakdowns which lead to interruption of operation, machining inaccuracies, and production inefficiency.

An important feature of our invention is that it can be modified easily to clamp and hold a single workpiece in position at a single work station, or it can be used with multi-tool equipment to machine a number of workpieces simultaneously at a number of independent work stations. Similarly, a mere reversal of the flow of hydraulic fluid in our novel fixtures automatically releases clamping of finished workpieces and indexes material to be worked into proper position for machining. In the figures:

FIG. 1 is a plan view of our novel fixture showing the fixture adjacent the cutters of a dual head milling machine;

FIG. 2 is a side view taken along line II—II of FIG. 1;

FIG. 3 is a section taken along line III—III of FIG. 1 showing our fixture in an enlarged scale;

FIG. 4 is a section taken along line IV—IV of FIG. 3, but with the plungers omitted;

FIG. 5 is a section taken along line V—V of FIG. 3;

FIG. 6 is a section taken along line VI—VI of FIG. 3;

FIG. 7 is a section taken along line VII—VII of FIG. 3;

FIG. 8 is a section taken along line VIII—VIII of FIG. 3;

FIG. 9 is a section taken along line IX—IX of FIG. 3;

FIG. 10 is a left side view of the base showing the grooved annulus;

FIG. 11 is a partial right side view of the annulus shown in FIG. 10;

FIG. 12 is a section taken along the line XII—XII of FIG. 10;

FIG. 13 is an enlarged partial section showing the latching means for indexing our fixture;

FIG. 14 is a partial section showing the indexing latch having overtraveled clockwise 5° from the position of FIG. 13;

FIG. 15 is an isometric detail view of a clamp of a type useful in our fixture for holding a workpiece;

FIG. 16 is a plan view of a clamp lock engageable with the clamp of FIG. 15 for locking a workpiece in the clamp;

FIG. 17 is an elevation view of a plunger used to actuate the clamp lock;

FIG. 18 comprises four views of a workpiece machined in the machine of FIG. 1 showing in

A—an unfinished workpiece as inserted in a workholder at position A of FIG. 1;

B—a workpiece after the head is milled at position B of FIG. 1;

C—a workpiece after the bottom is milled at position C of FIG. 1; and

D—a side elevation of the workpiece shown in C

FIG. 19 is a plan view of FIG. 18D;

FIG. 20 is a front elevation view of the assembly of impeller shaft and impeller bar;

FIG. 21 is a side elevation of FIG. 20;

FIG. 22 is a top view of FIG. 20;

FIG. 23 is a section taken along line XXIII—XXIII of FIG. 20;

FIG. 24 is a section taken along line on XXIV—XXIV of FIG. 20;

FIG. 25 is a section taken along line XXV—XXV of FIG. 20; and

FIG. 26 is a section taken along line XXVI—XXVI of FIG. 24.

The fixture

In FIG. 1, we have shown our novel clamping and indexing fixture positioned on the table of a standard dual-head milling machine. In plan view, the fixture comprises a circular indexing plate **10** to which are secured a plurality of radially extending clamps **11** (also shown in isometric in FIG. 20). A workholder portion **12** is included at the outboard end of each clamp **11**. For clarity, we have illustrated a simple drilled aperture **13** which is adapted to hold a workpiece during machining. Of course, other workholders, such as internal and external collet type holders can be utilized for certain types of workpieces.

A diagonal slot **14** is cut through each clamp **11** in the workholder portion to provide means for closing the aperture **13**. A clamp lock **15** (enlarged in FIG. 16) engageable with the workholder portion **12** is pivotally mounted on the outwardly extending flange **16** of the indexing plate. A lip **17** formed on the clamp lock is adapted to engage the clamp to close it. A leg **18** of the clamp lock is engageable with a plunger **19** (only a portion of which is shown in FIG. 1 and which is shown in its entirety in FIG. 17) mounted in the indexing plate, which plunger is actuated by hydraulic fluid pressure, as will be described hereinafter.

In operation, a workpiece, such as bolt **20**, is inserted at position A into the aperture **13** of a clamp **11**. The unfinished piece, which is shown enlarged in FIG. 18A, is only representative of a great number of different types and classes of workpieces which can be machined using our fixture. Fluid under pressure is then introduced at inlet passageway **21** causing the indexing plate **10** to move counterclockwise (as viewed in FIG. 1). The mechanism

for producing this rotational movement will be described later in reference to the "Indexing Feature."

When the workpiece **20** reaches position B, it is adjacent one head of a dual head milling machine, shown partially at **22**. The head carries a spindle **23** on which are mounted a pair of spaced cutters **24**, so located that upon advance of the cutters toward the workpiece at B, the head of the workpiece will be milled as shown in FIG. 18B. Upon continued clockwise rotation of the workpiece to a position C, a cut is made on the foot of the workpiece by a second pair of spaced cutters **25** located on a spindle **26** of a second head **27** of the machine. This second cut, made transversely of the cut taken at position B, is clearly shown in FIG. 18C. The finished workpiece is removed from the workholder at position D, and appears as shown in FIG. 18D. Hence, a finished workpiece is obtained with each complete cycle of operation. Depending upon the number of available workholder portions, it is apparent that production of completely machined pieces can be stepped up considerably by using our fixture.

During intermittent indexing of the fixture from position A to position D, each clamp **11** is adapted to be actuated hydraulically to hold a workpiece for machining. At positions where no cutting operation is programmed, the clamps may be either in a "free" or "neutral" condition. This will be described in further detail below under the paragraphs titled "Clamping Feature."

Referring to FIGS. 1–3, the fixture of our invention is supported by a base **28** having an outwardly extending flanged foot portion **29** by which it can be secured to the table of a metal-working machine. The upper portion of the base defines an annulus **30**. A horizontally extending wall portion **31** joins the annulus to the lower portion of the base and a vertical wall portion **32** forms the lower portion of the base between the portion **31** and the foot portion **29**.

A cap member **33** is secured to the top of the annulus by a plurality of vertical bolts **34**. Four parallel inclined passageways **35**, **36**, **21** and **37** extend through the wall portion **31** from the vertical wall portion **32** toward a central aperture **38** of the annulus **30**. Each of the passageways is adapted to be connected to lines for carrying hydraulic fluid into and out of the fixture to a source of hydraulic fluid power (not shown).

A pair of vertical channels **39** and **40** extend upwardly within the wall of the annulus **30** within the bottom of the horizontal wall portion, as shown in FIGURES 4–9. The lower portion of each channel **39** and **40** communicates with the inner end of one of the inclined passageways **37** and **35**, respectively.

The outer surface of the annulus has a plurality of vertically spaced circumferential grooves **41**, **42** and **43**. Grooves **41** is shown to have two oppositely disposed unconnected portions **44** and **45**. Groove **42** is a groove portion spaced below the groove portion **44**. Groove **43** extends entirely around the circumference of the outer surface of the annulus.

The upper end of the vertical channel **39** is adapted for communication with a portion of groove **41**, such that hydraulic fluid under pressure introduced into inlet passageway **37** is forced into and upwardly through channel **39** and into a groove portion **44**; hereinafter this enter fluid flow path is called the "pressure side."

Vertical slot **46** along the outer surface of the annulus connects groove portion **45** with groove **43** and vertical flat **47** connects groove **42** with groove **43**, more particularly shown in FIGS. 10–12. The purpose of the groove **42** and the flat **47** which connects it to the groove **43** is to equalize the pressure of the fluid in the groove **43** so that during draining of the hydraulic fluid it does not back up in the fixture.

The upper end of the vertical passageway **40** is in communication with a portion of groove **43**, such that hydraulic fluid under pressure which enters groove **43** can flow around groove **43** and exit through vertical channel **40** and passageway **35**; hereinafter this exhaust fluid flow path is called the "drain side."

As shown in FIG. 4, circumferential groove **41** comprises a noncontinuous passage having groove portions **44** and **45**. A plurality of radial channels **48** drilled in the indexing plate **10** extend outwardly from the outer wall of the annulus. Enlarged cylindrical openings **49** at the outer end of the channels **48** are adapted to envelope a plunger **19** (not illustrated in FIG. 4) which is movable axially under the influence of hydraulic pressure. The figure shows eight such channels **48**, only six of which are in communication with a portion of groove **41**. Since no hydraulic fluid can flow in the two channels not in communication, the plungers positioned in the openings **50** and **51** are inoperative and the position is called "neutral." Plunger channels P are in channels **48** in communication with a groove **44** on the pressure side; plunger channels D are in channels **48** in communication with a groove **45** on the drain side.

Clamping feature

Each of the clamps **11** can be hydraulically actuated to engage a workpiece **20** at a particular station merely by changing the extent of the grooves **44**, **45** such that more or less of the number of available channels **48** are in communication with a portion of the groove **44** at any time. This versatility makes our fixture useful for a large number of applications.

The clamping fixture will best be understood by referring to FIGS. 1, 3, 4, 10, 11 and 12 of the drawings. To clamp a workpiece in a workholder, hydraulic fluid under pressure is forced into into inlet **21** on the pressure side of the fixture and into groove portion **44** of the annulus. Groove portion **44** will be in engagement with some of the available channels **48**. Under fluid pressure, those plungers in the channels P in communication with groove portion **44** will move outwardly to engage leg **18** of a clamp lock **15** causing the lock to pivot and force lip **17** tightly against the end of a clamp **11**. The force of the lip **17** tends to close the slot **14**, decreasing the size of the aperture **13** and squeezing a workpiece **20** therein.

As pointed out before, the indexing plate **10** rotates with respect to the fixed base **28**. As it rotates, certain of the channels **48** move out of communication with groove portion **44** on the pressure side and into communication with groove portion **45** on the opposite side of the annulus, whereupon the hydraulic fluid drains from the channel **48** to the groove portion **45**, down through slot **46** to groove **43**, then to channel **40**, into passageway **35** and passes out of the fixture. The clamping feature thus described is dependent for operation upon the position of the indexing plate **10** with respect to the stationary annulus. Rotational movement of the indexing plate causes a corresponding activation and deactivation of various clamps, the extent of the grooves in the annulus being determined by the positions of the operative work stations. In other words, clamps holding workpieces and positioned adjacent a cutting tool of a metal-working machine will be actuated by hydraulic fluid to effect a clamping action on such workpieces; clamps having workpieces which are not adjacent cutting tools will be held in a neutrial or free condition.

Indexing feature

FIGS. 3, 8, and 9 illustrate the mechanism of our invention which comprises our novel means for indexing a workholder from one work station to another. Referring to FIG. 3, a cylindrical impeller shaft **52** extends upwardly into the center of the aperture **38** of the annulus **30** of the fixture. A cylindrical impeller bar **53** extends transversely through a horizontal opening in the foot of the impeller shaft and carries resilient impeller blades **54**. A threaded plug **55** closes a vertical bore in the center of

the foot of the shaft **52**. A pair of circular drive ring covers **56** are disposed about shaft **52**, one of the covers being above the impeller blades and one being below the blades. A drive ring **57**, to which the covers are secured, spaces the covers from each other and forms a cylindrical opening **58** at the foot of the shaft **52**. The ends of the blades **54** abuts walls **59** of the opening **58** to form a seal therebetween during operation of the indexing means as shown in FIG. 9; the edges of the blades abut the inner surfaces of the covers **56** during activation of the impeller to seal against fluid leakage. A handle **60** integral with the drive ring extends radially from a portion of the drive ring and into a space formed by cutting out a section of the base wall portion **32** and its foot portion **29**. A link **61** joins the handle of the drive ring to an indexing latch **62**.

An indexing ring **63** is rotatably supported on the horizontal portion **31** of the base for rotation about the annulus. An index plate **64** is positioned between the inner periphery of the indexing ring and the outer surface of the annulus. Slots **65** are spaced circumferentially around the outer periphery of the index plate. The index plate **64** is secured to the indexing plate **10** by means of bolts **66** and dowels **67**. Hence, any rotation of the index plate will produce a corresponding rotation of the indexing plate.

Motion is transferred from the indexing ring **63** to the indexing plate by a latching means shown in FIG. 8 in alternate positions within a chip guard **68** which is secured to the base at the foot portion **29**. The latching means, as more clearly shown in FIGS. 13 and 14, includes the indexing latch **62** which is pivotally mounted on the indexing ring at **69**. A projection **70** of the latch **62** is adapted to engage a slot **65** of the index plate to prevent further rotation in a clockwise direction and to couple the index plate with the indexing ring for rotation in a counterclockwise direction. A spring loaded latch plunger **71** mounted in plunger block **72** on the indexing ring by a bolt **73** and dowel **74** forces against and maintains engagement of the projection **70** of the latch and a slot **65** during counterclockwise rotation from a position **1** in FIGURE 8 to a position **2** where the outer end of the plunger **71** strikes a stop bolt **75**.

Rotation of the indexing ring **63** by which motion is transferred to the index plate and thus to the indexing plate is accomplished hydraulically through cooperation of a stationary impeller and the drive ring to which the indexing ring is linked. The impeller bar **53**, its blades **54** and the impeller shaft **52** are shown in FIG. 3; however, reference to FIGS. 9 and 20–26 is necessary for a complete understanding of its structure and operation.

A pair of vertical channels **76** and **77**, extend into the impeller shaft **52**, the channels being on opposite sides of the blades **54**. Inclined passageway **21** communicates with the upper portion of channel **76** and inclined passageway **36** communicates with the upper portion of channel **77**. The bottom of each channel is closed with a threaded plug **78**. Passageways **21** and **36** are connected to a source of hydraulic fluid under pressure (not shown).

The shaft **52** extends into the annulus such that the one of the vertical channels is on each side of the stationary impeller blades **54**. The lower end of each of the vertical channels thus communicates with a portion of the cylindrical opening **58** in which the impeller bar **53** is disposed.

A pair of wedge-shaped drive segments **79** (shown in FIG. 9) are secured to opposite sides of the inner wall of the drive ring **57**. A circular wall **80** on the narrow edge of each segment is free to sweep around the shaft **52** in response to fluid pressure introduced against sides **81** or **82** of each drive segment.

On each side of the impeller bar are a pair of grooves **83**, **84**, and **85**, **86** respectively. The grooves **83** and **86** are connected by a bore **87** and the grooves **84** and **85** by a bore **88**. The bores **87** and **88** lie in spaced horizontal planes through the impeller bar. The grooves **84** and **86** are sufficiently long to extend beyond the wall **80** of each segment so that fluid introduced into the opening **58** through one of the vertical channels on a side of the impeller bar will be directed under pressure against one of the sides **81** or **82** of a drive segment.

Operationally, hydraulic fluid under pressure is introduced through passageway **21** and into channel **76** in communication with a groove, for example **85**, in the impeller bar. The fluid flows therefrom into the opening **58** and against side **81** of the drive segment on the same side of the impeller blades as grooves **85** and also through the bore **88** into groove **84** in communication with opening **58** on the opposite side of the impeller bar and against side **81** of the other segment. This pressure on the drive segments **79** causes the drive ring to which they are secured to rotate in a clockwise direction carrying with it the indexing ring to which the drive ring is linked. The indexing latch slides freely out of the slot **65** in the index plate **64** and is also rotated clockwise.

FIG. 13 illustrates the indexing latch in locked position. The indexing latch **62** slides freely out of slot **65** since movement of the drive ring clockwise causes latch **62** to pivot about point **69** thereby lifting projection **70** out of slot **65**. FIG. 14 illustrates the position of the latch after the drive ring and handle **60** have moved about 5° clockwise from the locked position.

In the illustrated embodiment the drive ring and latch, which is linked to the drive ring, rotate clockwise approximately 50° under the pressure of the hydraulic fluid introduced in passageway **21** so that the drive ring and latch again move into a position relative to the index plate **64** as shown in FIG. 14, approximately 5° past the slot **65** in the index plate **64** with which it is to engage for indexing movement. At this point, there is a buildup in hydraulic pressure which triggers a microswitch to reverse the flow of hydraulic fluid. The indexing ring reverses under the pressure of the hydraulic fluid which now is introduced against the side **82** of the drive segments and the latch projection **70** is forced into the slot **65** by the latch plunger **71** to secure the indexing ring to the index plate, which in turn is secured to the indexing plate **10** which carries the workholders. Reversal of the drive segments forces the fluid which had been introduced earlier to empty back through the vertical channel **76** to passageway **21** and return to the hydraulic fluid source.

The reversal of the fluid flow causes movement of a workholder carrying a workpiece to be machined from latch position **1**, shown in FIG. 8, to a position **2** adjacent a cutting tool. In this operation, the fluid enters passageway **36**, travels through channels **77** and enters groove **84** on side **82** of the drive segment **79** causing the segment to be moved in a counterclockwise direction, as viewed in FIG. 9. Fluid also passes out through bore **87** into groove **86** and forces the opposite drive segment to rotate counterclockwise, causing the drive ring, the indexing ring, the index plate and the indexing plate all to rotate in a counterclockwise direction. When the indexing plate, carrying a workholder, reaches the work position **2**, the outer end of the plunger abuts the plunger stop holding the workpiece carried in a workholder in a fixed position relative to the cutting tool. Hydraulic fluid under pressure is maintained during machining of the workpiece to keep the workpiece accurately positioned. When the machine operation is completed, the hydraulic fluid flow through the impeller bar is again reversed, the drive segments being driven in the opposite direction (as earlier described) to engage the indexing latch in the next removed clockwise slot **65** for indexing the next succeeding workpiece to a cutting position. This indexing operation continues through a full revolution of the indexing plate to machine a workpiece at each station and can be repeated to provide continuous production.

As pointed out hereinbefore, as a plunger carrying channel **48** on the indexing plate is brought into communication with a portion of groove **44** on the pressure side of the annulus, the clamp operated by that plunger is actuated to secure a workpiece held in the workholder firmly in position for machining. When the indexing plate rotates

further to carry the same channel **48** out of communication with the groove portion **44**, the hydraulic pressure will be relieved, the clamp loosened and the workpiece free to be removed from the clamp. Thus, we have invented a hydraulically actuated indexing and clamping fixture which can be modified from that shown in the drawings to include either more or less workholders and to include means for actuating a selected number of the available workholders for clamping a workpiece to be machined. Our novel fixture combines a means for accurately positioning and holding a workpiee for machining and a quick and easy release clamping mechanism for facilitating removal of a completed piece after cutting. A series of production operations can be performed on a single workpiece held in a single workholder or on a number of pieces in a multi-holder device incorporated in our fixture saving labor, changeover time, and without the possibility that tolerances of the finished piece will be exceeded through mistake in locating the workpiece in the holder or with respect to the cutting tool.

While we have described and shown a preferred embodiment of our invention, it is to be understood that it may otherwise be embodied within the scope of the appended claims.

We claim:

1. A fixture for indexing and holding workpieces to be machined by a tool of a metal-working machine, said machine having a fixed table for mounting the fixture, the fixture being connected to a source of hydraulic fluid under pressure, said fixture comprising:

(A) a base member having an upstanding annulus at its upper portion and a lower portion extending from the annulus for securing to the table and including a pair of inlets and outlets for connection to said source;

(B) indexing means having at least one workholder rotatably mounted on said annulus for positioning said workholder adjacent a tool;

(C) driving means connected to an inlet and an outlet and within the lower portion of the base member, said driving means being engageable with said indexing means, and driving the indexing means in response to the magnitude and direction of fluid of pressure introduced to the driving means at the inlet; and

(D) means for clamping a workpiece in said workholder, said clamping means being connected to a second inlet and outlet and operable in response to the position of the driving means relative to the position of the indexing means such that when a workholder carrying a workpiece is adjacent a tool, said clamping means operates to engage the workpiece.

2. The fixture as set forth in claim **1** wherein said indexing means comprises:

(A) an indexing ring supported by the lower portion of said base member and rotatable about said annulus;

(B) a index plate supported by the lower portion of said base member and rotatable about said annulus and within said indexing ring, said index plate having a plurality of circumferentially spaced slots;

(C) latching means pivotally mounted on said indexing ring for engagement with one of said slots of said index plate; and

(D) an indexing plate secured to said index plate and carrying at least one workholder thereon, said indexing ring being rotatable in one direction independent of said index plate by said driving means operating in said one direction, and rotating in engagement with said index plate in the opposite direction when said driving means rotates in said opposite direction.

3. A fixture as set forth in claim **2** wherein said driving means comprises:

(A) a stationary vertical shaft extending upwardly into said annulus and having a pair of spaced vertical channels, one channel being in communication with said first mentioned inlet and one being in communication with said first mentioned outlet;

(B) a circular drive ring having a central aperture therein and within the lower portion of the base member, said drive ring being linked along its periphery to the indexing ring and suspended therefrom for rotation about said vertical shaft;

(C) a cylindrical chamber formed by the aperture in said drive ring and into which said vertical shaft extends, said chamber being connected to said pair of spaced vertical channels;

(D) an impeller bar secured to the shaft and in said chamber, said bar having blades which contact the walls, top, and bottom of the chambers;

(E) a pair of drive ring segments secured to said drive ring and in said chamber, one of said segments being on each side of said blades, whereby upon introduction of fluid under pressure in said chamber on one side of said bar, the drive ring segments rotate within said chamber rotating said drive ring and said indexing ring around said index plate to engage with one of said slots in said index plate, and upon reversal of direction the fluid into said chamber, the drive ring segments rotate in the opposite direction carrying the drive ring, indexing ring, index plate and indexing plate a corresponding distance in said opposite direction.

4. A fixture as set forth in claim **2** wherein the clamping means comprises:

(A) at least one planer non-continuous circumferential channel having two spaced grooves extending around the periphery of said annulus;

(B) a pair of vertical channels on opposite sides of the wall of said annulus

(1) a portion of one of said vertical channels connected the second inlet to the source of supply of hydraulic fluid;

(2) a second portion of said channel in communication with a groove portion;

(3) a portion of the second vertical channel being in communication with said other groove portion; and

(4) a second portion of the second vertical channel being connected to said second outlet of said source of supply of hydraulic fluid; and

(C) means in communication with said groove portion connected to said inlet to fluid pressure for holding a workpiece to be machined.

5. The fixture as set forth in claim **4** wherein said workpiece holding means comprises:

(A) a clamp secured to the extending outwardly from and beyond said indexing plate;

(B) at least one plunger responsive to fluid pressure and being radially mounted on the indexing plate;

(C) a radial passageway in the indexing plate in communication with the plunger on one end thereof and adapted for communication with a portion of at least one circumferential groove portion of the annulus on the other end; and

(D) locking means pivotally mounted on said indexing plate, one end thereof being adjacent an end of the plunger, the other end thereof being adjacent the clamp, such that when the plunger is actuated by pressure of the fluid entering said radial passageway, the locking means engages the clamp to tighten the workpiece in the workholder, and when said indexing plate rotates to take said radial passageway out of communication with said fluid-carrying circumferential groove portion, said plunger disengages from said clamp and releases said workpiece.

6. A hydraulically operated clamping device having means for selectively clamping one or more workpieces on a rotating plate having a plurality of workholders comprising:

(A) an annulus about which the plate rotates;

(B) a pair of vertical channels in the annulus, one

channel being adapted to be connected to an inlet of hydraulic fluid and the second channel being adapted to be connected to an outlet of hydraulic fluid;

(C) a plurality of horizontally disposed grooves on the outer periphery of the annulus, at least two of said grooves being positioned in the same horizontal plane forming a non-continuous passage about the outer periphery of the annulus, one of said grooves being connected to the channel connected to the inlet of hydraulic fluid and another of said grooves being connected to the channel connetced to the outlet of hydraulic fluid;

(D) a plurality of radial passageways in the plate, said passageways being positioned to periodically connect with the two horizontal grooves;

(E) means in each passageway for actuating a clamp whereby hydraulic fluid may be forced into the inlet channel to the groove on the annulus connected with the inlet channel and to the radial passageways in the rotating plate to actuate the clamp associated with the passage way and when the rotating plate has moved so that the radial passage way is connected to the horizontal groove which is connected to the channel connected to the outlet of hydraulic fluid, the fluid flows out releasing the clamp.

7. The clamping device set forth in claim 6 having a third horizontally disposed groove on the outer periphery of the annulus, said groove being positioned in a different horizontal plane from the first two grooves forming the non-continuous passage and a vertical channel connecting the third groove with the horizontal groove connected to the channel connected to the outlet of hydraulic fluid.

8. A hydraulically operated driving means for a fixture in which and indexing plate carrying a plurality of workholders is driven about a central annulus by rotatable movement of an indexing ring linked to a drive ring having a cylindrical chamber, comprising:

(A) a stationary impeller bar positioned in said cylindrical chamber and dividing said chamber into two separate cavities;

(B) a pair of drive ring segments secured to the drive ring, one of said segments being positioned in each of said cavities;

(C) means for introducing hydraulic fluid into said cavities and against the sides of the drive segements whereby the drive ring is rotated causing the indexing plate to rotate.

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