Aug. 21, 1962 H. PALAZZOLO 3,050,301

DIFFERENTIAL GEARING-ACTUATED WORK HOLDER CLAMP

Filed Sept. 21, 1959 2 Sheets-Sheet 1

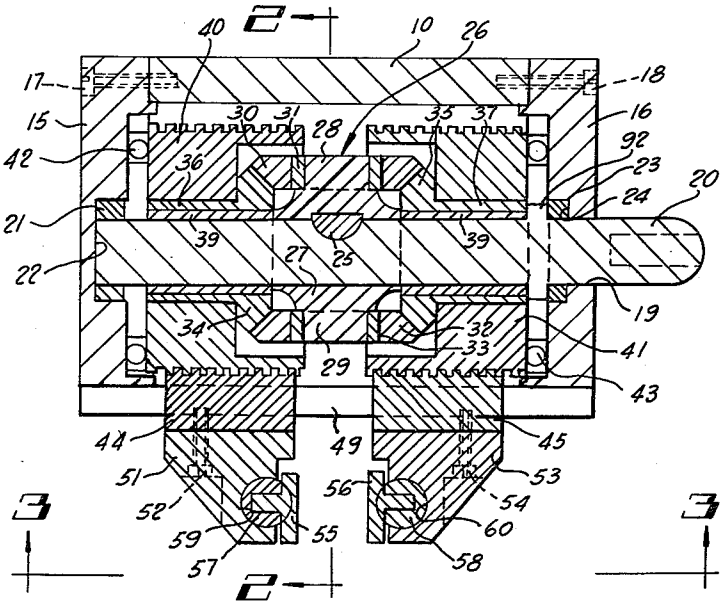


Fig. 1

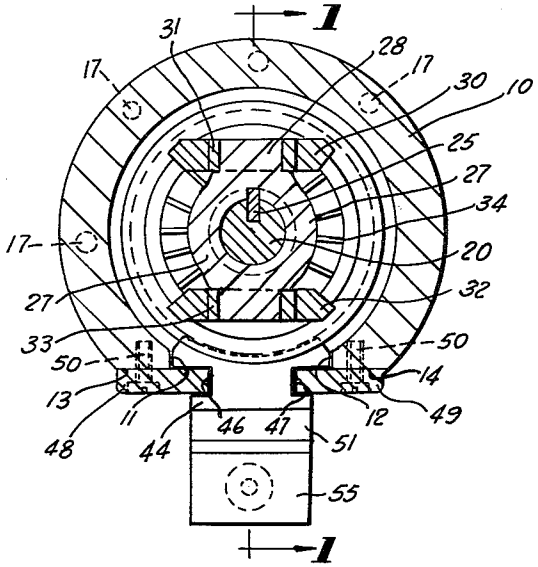


Fig. 2

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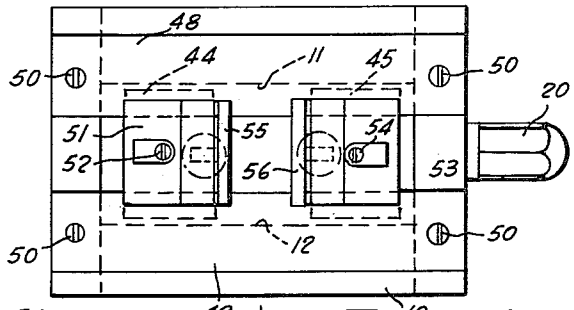


Fig. 3

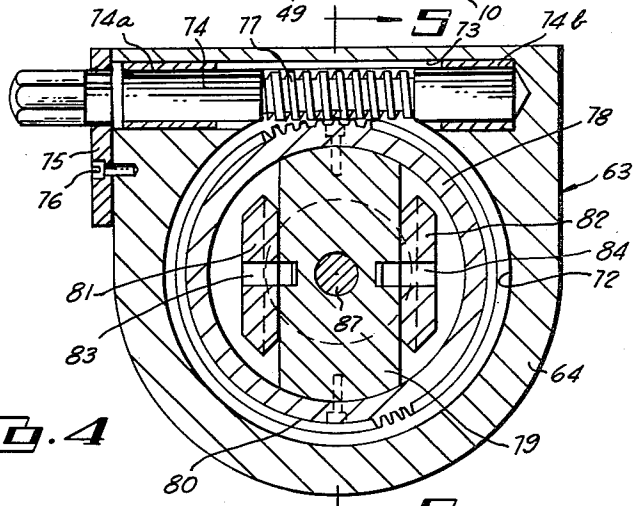


Fig. 4

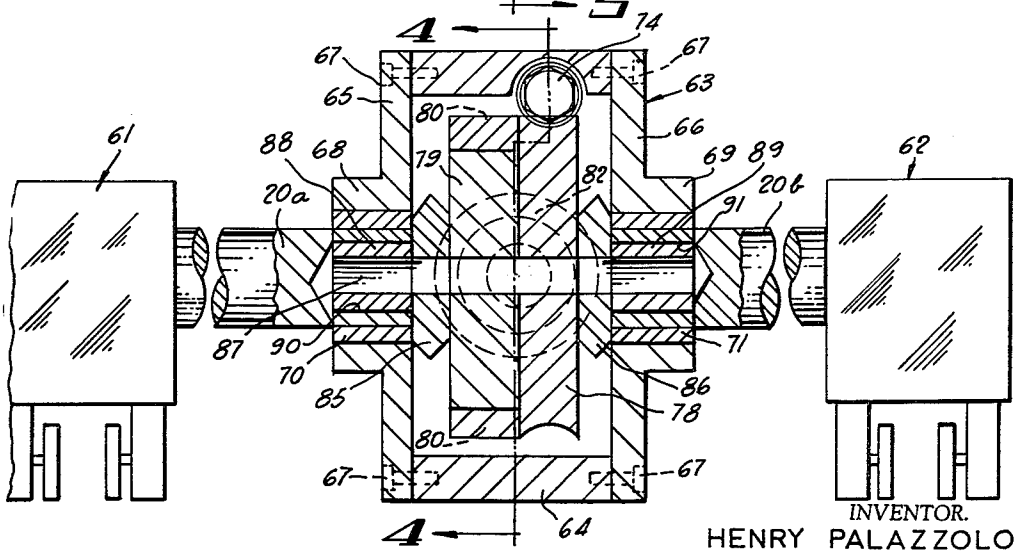


Fig. 5

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DIFFERENTIAL GEARING-ACTUATED WORK HOLDER CLAMP

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6 Claims. (Cl. 269—218)

This invention relates generally to the work holder art and more particularly to a novel and improved work holder which incorporates a differential gearing arrangement adapted to actuate a pair of work engaging jaws toward and away from each other so as to clamp a workpiece therebetween.

It is an important object of the present invention to provide a work holder which may be used as a separate unit or which may be used in sets or groups and operated by suitable interconnecting driving means.

It is another object of the present invention to provide a work holder having a pair of jaws which are movable by a differential gearing arrangement and wherein the jaws are each provided with a floating work engaging body.

It is still another object of the present invention to provide a work holder which is compact and rugged in construction, economical of manufacture and efficient in use and operation.

Other objects, features and advantages of this invention will be apparent from the following detailed description and appended claims, reference being had to the accompanying drawing forming a part of the specification wherein like reference numerals designate corresponding parts of the several views.

In the drawings:

FIG. 1 is a central, longitudinal, elevational, sectional view of a work holder made in accordance with the principles of the invention, taken along the line 1—1 of FIG. 2 and looking in the direction of the arrows;

FIG. 2 is an elevational, cross-sectional view of the structure illustrated in FIG. 1 taken along the line 2—2 thereof and looking in the direction of the arrows;

FIG. 3 is a bottom plan view of the structure illustrated in FIG. 1, taken along the line 3—3 thereof and looking in the direction of the arrows;

FIG. 4 is an elevational sectional view of the structure illustrated in FIG. 5 taken substantially along the line 4—4 thereof and showing an interconnecting driving structure for operating a plurality of the work holders; and,

FIG. 5 is a broken, longitudinal, elevational, sectional view of the structure illustrated in FIG. 4 taken along the line 5—5 thereof and looking in the direction of the arrows.

Referring now to the drawings, in particular to FIGS. 1, 2 and 3, wherein is shown an illustrative embodiment of the invention, the numeral 10 indicates a tubular body or housing which is open at the ends thereof and which is substantially circular in cross section. The housing 10 is open along one side thereof as indicated in FIGS. 2 and 3 by the numerals 11 and 12. The housing 10 is provided with the flat surfaces 13 and 14 adjacent the opening edges 11 and 12 respectively, as shown in FIG. 2. The open ends of the housing 10 are enclosed by the end plate retainer caps 15 and 16 which are releasably secured to the housing by any suitable means as by means of the Allen screws 17 and 18, respectively.

As shown in FIG. 1, the work holder is provided with a longitudinally extended shaft 20 which extends into the housing 10 through the opening 19 formed through the retainer cap 16. The inner end of the shaft 20 is rotatably journalled in the bearing 21 which may be of any suitable type and which is operatively mounted in the recess 22 which is formed in the inner surface of the retainer cap 15. The outer end of the shaft 20 extends outwardly of the retainer cap 16 for operative engagement with any suitable tool for turning the shaft, as more fully explained hereinafter. The shaft 20 is further journalled on the right side thereof as viewed in FIG. 1, by means of the bearing 23 which may be of any suitable type, and which is operatively mounted in the recess 24 which is formed on the inner side of the retainer cap 16.

Centrally disposed on the shaft 20 and fixedly mounted thereon by means of the Woodruff key 25 is a differential driver means generally indicated by the numeral 26. The differential driver means 26 includes the hub portion 27 which is provided with the pair of integral outwardly extended stub shafts 28 and 29. Rotatably mounted on the stub shafts 28 and 29 are the bevel gears 30 and 32, respectively. The gear 30 is rotatably mounted on the stub shaft 28 by means of any suitable type of bearing 31 and the gear 32 is similarly mounted by means of the bearing 33 on the stub shaft 29. The driving bevel gears 30 and 32 are meshably and drivingly engaged with the pair of oppositely disposed driven bevel gears 34 and 35 which are integral with and carried by the sleeve shafts 36 and 37, respectively. The sleeve shafts 36 and 37 are rotatably journalled on the shaft 20 by means of any suitable bearing means as by the sleeve bearings 39.

A first externally threaded sleeve 40 is fixedly connected by any suitable means to the sleeve shaft 36 whereby the externally threaded sleeve 40 will be rotated when the bevel gear 34 is rotated, and the externally threaded sleeve 41 is fixedly connected to the sleeve shaft 37 whereby the externally threaded sleeve 41 will be rotated when the bevel gear 35 is rotated. The externally threaded sleeve 40 is provided with a right hand thread on the periphery thereof and the externally threaded sleeve 41 is provided with a left hand thread on the periphery thereof. As shown in FIG. 1, the inner ends of the externally threaded sleeves 40 and 41 are adapted to abut against the back sides of the bevel gears 34 and 35, respectively. The externally threaded sleeves 40 and 41 are retained in place against the aforementioned gears, to prevent shifting relative to the housing 10, by any suitable bearing means as by means of the roller bearing means 42 and 43, respectively.

As shown in FIGS. 1 and 2, a pair of nuts 44 and 45 are disposed in the open side of the housing. These nuts 44 and 45 are provided with threaded lower surfaces which are meshably engaged with the externally threaded sleeves 40 and 41, respectively. As shown in FIG. 2, the nut 44 has the recesses 46 and 47 formed on the opposite sides thereof for the reception of the guide plates 48 and 49, respectively. The other nut 45 is provided with similar recesses. The guide or retainer plates 48 and 49 are releasably secured to the housing 10 by means of the screws 50. It will be seen that the retainer plates 48 and 49 function to maintain the nuts 44 and 45 in engagement with the worm gears 40 and 41 when the externally threaded sleeves are rotated.

Fixedly secured to the nut 44 is the jaw 51. The jaw 51 may be fixedly secured to the nut 44 by any suitable means as by screws as 52. The jaw 53 is similarly secured to the nut 45 by means of the screw 54. The jaws 51 and 53 carry the floating work engaging pads 55 and 56, respectively, and these pads are fixed to pivot ball members 57 and 58 which are pivotally mounted in the mating recesses 59 and 60, respectively, in the jaws. As shown in FIG. 1, the shaft 20 is provided with the flange 92 to prevent the shaft from sliding to the right thereof as viewed in FIG. 1. The flange 92 may be integrally formed on the shaft 20 if desired.

In the use of the work holder of the present invention

it will be understood that the housing **10** may be mounted in any desired position and on any desired machine tool by any suitable means. It will be understood that the work holder may be made to any desired size. With the jaws **51** and **53** moved apart, a workpiece may be positioned between the work engaging pads **55** and **56** and the shaft **20** is then turned clockwise, as viewed from the right side of the structure shown in FIG. 1. The shaft **20** rotates the bevel gears **30** and **32** clockwise and these gears lock with the bevel gears **34** and **35** and carry them along in the clockwise direction as long as the pads **55** and **56** do not engage the workpiece. As soon as one or the other of the pads engages the workpiece it stops and the respective bevel gear **34** or **35** will be stationary, as for example, gear **35**. The bevel gears **30** and **32** will then continue to drive the bevel gear **34** by differential action whereby the externally threaded sleeve **40** will continue to rotate and move the nut **44** inwardly towards the workpiece. When the pad **55** engages the workpiece the differential gearing means will serve as a locking means against the pads **55** and **56** to prevent them from moving backwards to release the workpiece. In order to release the workpiece the shaft **20** is merely rotated in the reverse direction. It will be understood that the shaft **20** may be hand or power operated.

The work holder of the present invention is adapted for single or plural use. That is, it may be used in sets or groups or gangs and be operated by a driving means as illustrated in FIGS. 4 and 5. FIGS. 4 and 5 illustrate the use of a pair of work holders generally indicated by the numerals **61** and **62**. The drive shafts **20***a* and **20***b* of the work holders **61** and **62** are adapted to be driven by means of the driving means **63**. The driving means **63** includes a differential gearing arrangement as more fully described hereinafter. The driving means **63** includes the housing **64** which is enclosed at the ends thereof by means of the end plates **65** and **66** which are secured in place by means of the Allen screws **67**. The end plates **65** and **66** are provided with the hubs **68** and **69**, respectively, which are adapted to carry the bearing members **70** and **71** for journalling the ends of the shafts **20***a* and **20***b*, respectively.

The housing **64** is provided with the hollow inside **72** which communicates at one end thereof with the shaft bore **73** in which is rotatably mounted the screw shaft **74** by means of the bearing members **74***a* and **74***b*. The shaft **74** is retained in the bore **73** by means of the retainer plate **75** which is secured to the housing **64** by means of the screw **76**. The shaft **74** is provided with the worm threads **77** which meshably engage the ring gear **78** which carries the cage or plate **79** which is secured thereto by means of the screws **80**. The plate **79** carries the two planetary bevel gears **81** and **82** which are rotatably mounted on the shafts **83** and **84**, respectively, which are fixed to the plate **79**. The gears **81** and **82** meshably engage the bevel gears **85** and **86** which are fixedly mounted on the outer ends of the work holder shafts **20***a* and **20***b*, respectively. The plate **79** is rotatably mounted on the shaft **87** which has its ends rotatably mounted in the bearings **88** and **89** which are mounted in the recesses **90** and **91** in the ends of the shafts **20***a* and **20***b*, respectively. It will be seen that when the shaft **74** is rotated, the work holder shafts **20***a* and **20***b* will be rotated in accordance with the direction of rotation of shaft **74**. The differential gearing arrangement of the driving means **63** permits the driving of one of the shafts **20***a* or **20***b* when the other has stopped due to the fact that the work pads of the respective work holder have made contact with the workpiece. The other shaft will continue to drive until the work pads of the respective work holder have made contact, then they will both drive with equal pressure until the workpiece is securely clamped.

While it will be apparent that the preferred embodiments of the invention herein disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What I claim is:

1. A work holder of the class described, comprising: a housing; a drive shaft rotatably mounted in said housing and provided with a differential driver means; a differential gearing means having a first pair of gears rotatably connected to said differential driver means on said shaft; said differential gearing means having a second pair of gears driven by said first pair of gears; a pair of externally threaded sleeves fixedly connected to said second pair of gears in said differential gearing means for rotation therewith; a pair of work engaging members slidably mounted on said housing for clamping a workpiece therebetween; and, each of said externally threaded sleeves being threadably connected to one of said pair of work engaging members for moving the same.

2. A work holder of the class described, comprising: a housing; a drive shaft rotatably mounted in said housing and provided with a differential driver means; a differential gearing means having a first pair of gears rotatably connected to said differential driver means on said shaft; said differential gearing means having a second pair of gears driven by said first pair of gears; a pair of externally threaded sleeves fixedly connected to said second pair of gears in said differential gearing means for rotation therewith; a pair of work engaging members slidably mounted on said housing for clamping a workpiece therebetween; each of said externally threaded sleeves being threadably connected to one of said pair of work engaging members for moving the same; and, each of said work engaging members being provided with a pivotally mounted work engaging pad.

3. A work holder means of the class described, comprising: a housing; a differential gearing means mounted in said housing; a drive shaft mounted in said housing and connected to said differential gearing means for driving the same; a plurality of driven shafts connected to said differential gearing means; each of said driven shafts being rotatably mounted in a housing of a work holder and provided with a differential driver means; a differential gearing means in each housing provided with a first pair of gears rotatably connected to each of said respective differential driver means on said driven shafts; each of said differential gearing means having a second pair of gears driven by said first pair of gears; a pair of work engaging members being slidably mounted on each of the work holder housings; and, a pair of externally threaded sleeves fixedly connected to said second pair of gears for rotation therewith in each of the work holder housings and threadably connected with the work engaging members mounted on each work holder housing.

4. A work holder of the class described, comprising: a housing having a longitudinally disposed opening along one side thereof; a pair of work engaging members slidably mounted on said housing on the outer side thereof for movement along said opening toward and away from each other for clamping a workpiece therebetween; each of said work engaging members being provided with a threaded end extended into said housing through said opening; a longitudinally disposed drive shaft rotatably mounted in said housing and having one end thereof extended outwardly of said housing; a differential gearing means in said housing having a pair of driving bevel gears and a pair of driven bevel gears meshing with said pair of driving bevel gears and driven thereby; said drive shaft being drivingly connected to said pair of driving bevel gears; an externally threaded sleeve fixedly connected to each of said driven bevel gears; and, the threaded end of each of said work engaging members meshing with and being driven by one of said externally threaded sleeves for moving the work engaging mem-

bers toward and away from each other for clamping engagement with a workpiece.

5. A work holder as defined in claim 4, wherein: each of said work engaging members is provided with a work engaging pad which is carried on a pivot ball member pivotally mounted in a mating recess in each jaw.

6. A work holder of the class described, comprising: a first housing; a first differential gearing means mounted in said first housing; a primary drive shaft mounted in said first housing and being drivingly connected to said first differential gearing means for driving the same; a plurality of secondary drive shafts connected to said first differential gearing means for driving the same; each of said secondary drive shafts being rotatably mounted in a separate second housing having a longitudinally disposed opening along one side thereof; a pair of work engaging members slidably mounted on each of said second housings on the outer side thereof for movement along said opening toward and away from each other for clamping a workpiece therebetween; each of said work engaging members being provided with a threaded end extended into their respective housing through said opening; a second differential gearing means in each of said second housings having a pair of driving bevel gears

and a pair of driven bevel gears meshing with said pair of driving bevel gears and driven thereby; each of said secondary drive shafts being drivingly connected to a respective pair of driving bevel gears; an externally threaded sleeve fixedly connected to each of said driven bevel gears; and, the threaded end of each of said work engaging members meshing with and being driven by one of said externally threaded sleeves for moving the work engaging members on each second housing toward and away from each other for clamping engagement with a workpiece.

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