

April 17, 1945.

H. M. OLSON

2,373,907

RING CASTING DIVIDING MACHINE

Filed Dec. 9, 1943

3 Sheets-Sheet 1

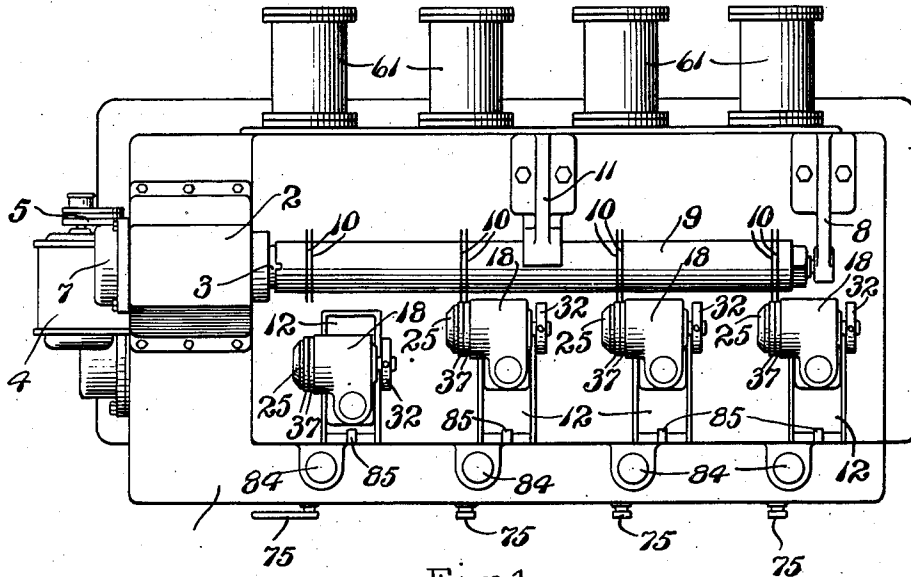


Fig. 1.

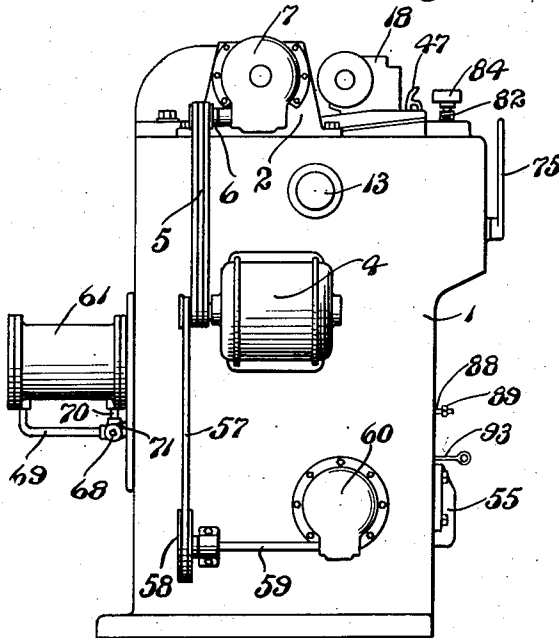


Fig. 2.

Inventor
Holly M. Olson
By *Liverance and*
Vaucentwerp
Attorneys

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H. M. OLSON

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3 Sheets-Sheet 2

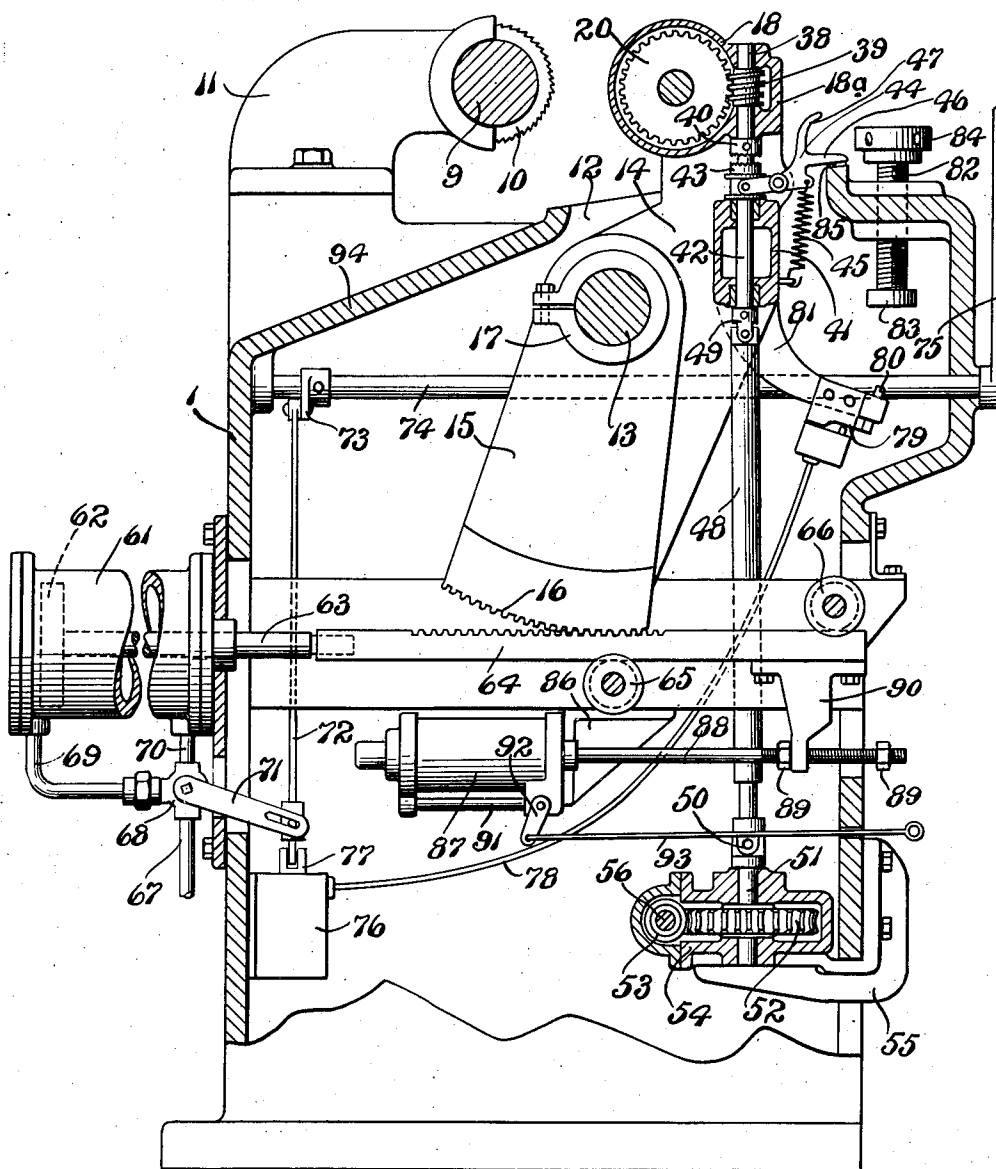


Fig. 3.

Inventor
Holly M. Olson
By *Leverance and*
Van Antwerp
Attorneys.

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3 Sheets-Sheet 3

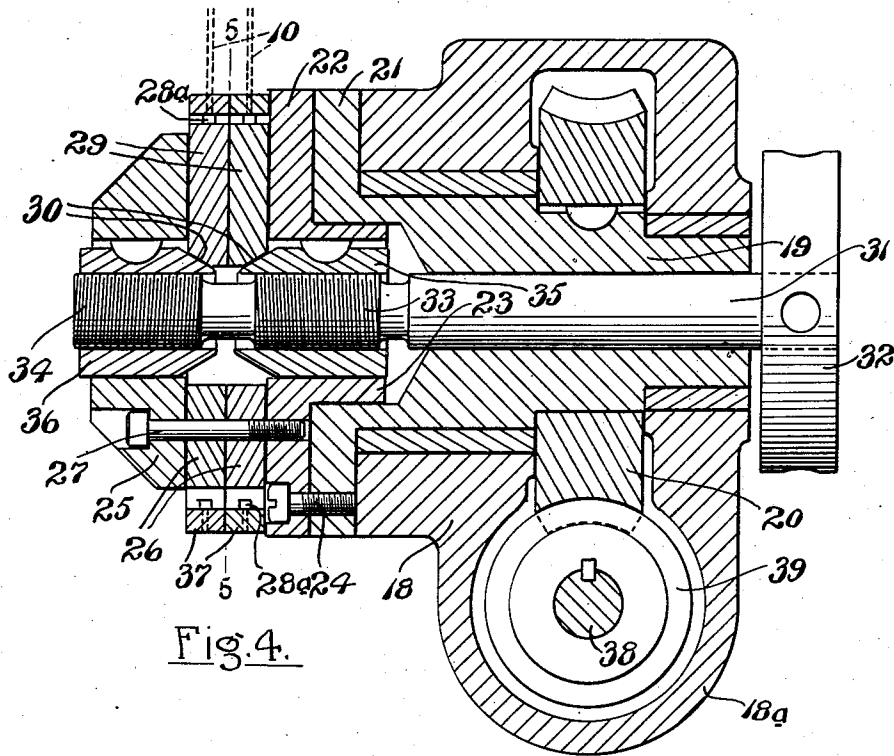


Fig. 4.

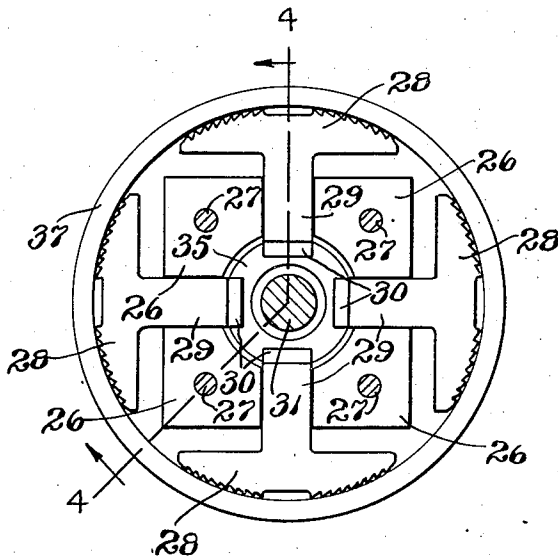


Fig. 5.

Inventor
Holly M. Olson
By *Liverance and*
Van Antwerp
Attorneys.

UNITED STATES PATENT OFFICE

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RING CASTING DIVIDING MACHINE

Holly M. Olson, Muskegon, Mich., assignor to
Sealed Power Corporation, Muskegon, Mich., a
corporation of Michigan

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6 Claims. (Cl. 29—70)

The present invention relates to a novel and practical machine for splitting or dividing double width ring castings to produce from each casting two individual ring castings from each of which a piston ring may be made.

The reduction in vertical dimension of piston rings, such as are used in the ordinary internal combustion engines in motor vehicles, involved problems in casting the piston ring castings which for more than thirty years had been largely produced from individual castings, that is, a single ring casting for each ring. The small cross section of individual ring castings resulted many times in defective castings which had to be rejected, while other castings had produced in the body thereof so-called "hard spots," that is, small portions of the castings were of a combined iron and carbon composition which when engaged by the tools used in finishing the castings to piston rings injured the tools and in most cases resulted in a destroying of the casting so far as its usefulness was concerned in getting a proper piston ring therefrom. By producing a ring casting of double width, that is, double the vertical dimension of a finished ring, plus allowances for shrinkage and machining, a heavier body of metal could be cast avoiding such defects in castings and by dividing such castings midway between their sides two uniform homogeneous ring castings were attained from each ring casting.

In the present invention it is a primary object and purpose to split or divide the double width ring castings in a very rapid and expeditious manner to obtain a high quantity production and correspondingly reduce the cost of piston ring manufacture. This primary object is attained by the machine apparatus illustrated in the accompanying drawings, in which,

Fig. 1 is a plan view of a machine embodying my invention.

Fig. 2 is an end elevation thereof.

Fig. 3 is a vertical transverse section through the machine, enlarged over the view shown in Fig. 2.

Fig. 4 is a horizontal section through the upper part of one of the ring casting holding units, a plurality of which are used, the section being substantially upon the broken plane 4—4 of Fig. 5 looking in the direction indicated, and

Fig. 5 is a vertical section substantially on the plane of line 5—5 of Fig. 4.

Like reference characters refer to like parts in the different figures of the drawings.

Upon the machine frame or housing 1 at one end and at its upper side a suitable head stock 2

is mounted, the end 3 of the shaft of which is adapted to engage with and drive one end of a saw carrying arbor. The shaft is driven from an electric motor 4, mounted at the end of the machine, by means of belts 5 which drive a short worm shaft 6, suitable reduction gearing being housed within the housing 7 between the shafts 6 and 3. Adjacent the opposite end of the machine is a bracket 8 which has similarity to a lathe tail stock in the manner of engaging one end of an arbor 9, the other end of which is detachably connected with the shaft 3 and is driven thereby. In the length of the arbor 9 a plurality of pairs of metal cutting saws 10 are mounted in any suitable manner, the pairs of saws being spaced short distances from each other, as indicated in Fig. 1. A back rest 11 may be used between the ends of the arbor 9 to bear against and hold the arbor from springing under pressure imparted through the saws 10 while engaged in their ring casting splitting operations.

Toward what may be termed the front side of a machine, the upper side of the housing 1 has a plurality of spaced openings 12 of rectangular form, through each of which a ring casting carrying unit extends, there being one of such units for each of the pairs of saws 10 on the arbor, four being shown in the drawings. The units are mounted upon a fixed horizontal cylindrical rod 13 mounted on and below the upper side of the housing 1 and are loose thereon for rocking movement about said rod, said units include each a generally vertical member 14, at a side of which a sector 15 is fastened or cast therewith extending downwardly from the rod 13 and at its lower edge carrying an arc shaped gear segment 16. The units may be mounted upon the rod 13 and held against sidewise movement thereon by suitable collars 17 clamped to said rod.

At the upper end of each part 14 of each unit, a ring casting carrying shaft is mounted. In a housing 18 integral with and at the upper end of the member 14 a horizontal shaft 19 is mounted for rotation in suitable bearings on which shaft a worm wheel 20 is keyed (Fig. 4). The shaft 19 at one end has a circular flanged face 21 coming against the adjacent vertical side of the housing 18. Against said face a disk 22 is located having a sleeve hub 23 centrally thereof which extends into a cylindrical recess in the shaft 19. The disk 22 is secured to the shaft 19 by screws 24. Spaced from the disk 22 an outer head 25 is located between which and the disk 22 a plurality of guide blocks 26 are placed and all are connected and held together by means

of screws 27 which pass through the parts 25 and 26 and screw into the disk 22.

A plurality of expanding jaws 28 having arcuate toothed outer faces, each of said faces being divided between opposite sides by groove 28a (Fig. 4), are mounted by means of inwardly extending stems 29 guided between the guide blocks 26 (Fig. 5). The jaws 28 and their stems 29 are located side by side in pairs and said stems of each pair at their inner ends are oppositely beveled as at 30, as shown in Fig. 4.

The shaft 19 is longitudinally bored and through it a shaft 31 is passed and mounted for rotation having a wheel 32 at one end with the usual radial openings bored in its periphery for the entrance of a rod or handle for turning the shaft 31. The shaft where it passes through the disk 22 and its hub 23 and the outer head 25 is provided with two spaced sections 33 and 34 which are oppositely threaded, on which interiorly threaded sleeves 35 and 36 are located, their adjacent inner ends having conical surfaces to engage against the beveled portions 30. The sleeves 35 and 36 are keyed, respectively, to the hub 23 and the member 25 and are thus held from rotation. It is evident that on turning the shaft 31 in one direction the members 35 and 36 are separated longitudinally from each other and when rotated in the opposite direction are brought toward each other, engaging the beveled surfaces 30 on the jaw members and forcing them simultaneously outward. The ring castings 37 two of which may be placed over the jaws when they are in retracted position, are engaged by the toothed outer arc shaped faces thereof on such outward movement and are firmly held in place thereon. Two of the double width ring castings 37 are thus securely held against each other at adjacent sides with the inner ring casting against the face of the disk 22.

The housing at 18 has a forward housing portion 18a in which a vertical shaft is mounted having a worm 39 thereon engaging with the worm wheel 20. Below said housing portion 18a a clutch member 40 is secured to the shaft 38. A vertical housing 41 is cast integral with the member 14, through which a vertical shaft 42 extends at its upper end carrying a cooperating clutch jaw 43, associated with which is a collar engaged by a yoke on a lever 44 pivotally mounted between its ends on member 14 and normally acted upon by a tension spring 45 to bring the two clutch members 43 and 40 into engagement with each other. From the lever 44 two fingers 46 and 47 extend, as shown in Fig. 3 for purposes which will be later described.

A substantially vertical telescoping shaft 48 is connected at its upper end by a universal joint 49 with the lower end of the shaft 42. At its lower end it is connected by a universal joint 50 with a short shaft 51 on which a worm gear 52 is secured in engagement with a worm 53 which is mounted on a shaft 56 which extends the length of the housing 1 of the machine, there being four of the worms 53 and worm gears 52 in the machine, one for each of the ring casting holding units, four in number in the machine. Shaft 56 may be driven by means of a belt 57 from the motor 4 which goes around a driven pulley 58 on a shaft 59, said shaft 59 through suitable reduction gearing such as a worm and a worm gear, housed within the the housing at 60 (Fig. 2) driving the shaft 56. With this double reduction it is evident that

the shafts 19 of the ring casting holding units are driven at a low speed.

Cylinders 61, one for each of the four units are secured at the rear side of the machine. In each a piston 62 is mounted for reciprocation and is connected with a piston rod 63 which extends into the housing of the machine. At its outer end the piston rod 63 is connected with a rack bar 64 mounted for reciprocating movement between guide rollers 65 and 66 and provided with rack teeth at its upper edge in engagement with the teeth 16.

Each of the cylinders 61 is supplied with compressed air alternately at opposite ends thereof. The air is carried from a reservoir or other source of compressed air by a pipe 67 to a valve housing 68 in which a valve is located, the movement of which will control the passage of air through the branch pipes 69 and 70 to the opposite ends of the cylinders 61. The valve in the housing 68 is operated by an arm 71 connected at one end thereto and at its opposite end being slotted for a distance and having a pin and slot connection with the lower end portion of a vertical bar or rod 72, the upper end of which is pivotally connected to an arm 73 extending from a horizontal rock shaft 74 mounted on the housing 1 of the machine and at its forward end in front of the housing being equipped with a hand lever 75 for manual operation. It is evident that on turning the handle 75 in one direction the arm 71 may be turned upwardly from the position which it occupies in Fig. 3, thereupon directing the air to the cylinder 61 through the branch pipe 69, the arm 71 in its lower position as shown positioning the air control valve for air to pass through the pipe 70 to the front end of the cylinder.

Directly below the lower end of the bar or rod 72 a solenoid 76 is mounted on the housing support of the machine and an armature 77 therefor is connected to the lower end of the rod 72. The passing of current through the solenoid winding causes the armature to be moved in a downward direction and swing the valve controlling arm 77 to its down position, as in Fig. 3. Wires of the solenoid circuit are indicated as carried in a cable 78 leading from the solenoid 76 to a switch 79 having an operating presser member 80 which switch is mounted on a curved arm 81 fastened to or integral with the member 14. Therefore, when a ring casting carrying unit swings about the axis of the rod at 3, the switch is moved upwardly or downwardly dependent upon the direction of movement of the unit, being carried upwardly when the unit is swung so as to move ring castings 37 toward the saws 10.

In the upper side of the housing support 1 and at the front of each of the ring casting carrying units, a vertical screw 82 is mounted having a head 83 at its lower end and a wheel 84 at its upper end for manual operation. On the swing of a ring carrying casting unit far enough in a counter-clockwise direction (Fig. 3) the member 80 comes against the head 83, closing the switch of the solenoid circuit and thereby energizing the solenoid and pulling the armature 77 to its lower position. It is also evident that on the return movement of a ring carrying casting unit and a swing thereof in a clockwise direction, the finger at 46 on the lever 44 engages against a projection 85 at the front of the opening 12 through which the unit extends, disconnecting the clutch member 43 from the member 40 where-

upon shafts 38 and 19 stop in movement. But as soon as the movement of the ring casting carrying unit is in the opposite direction, moving finger 46 away from the projection 85, spring 45 will bring the two clutch members 40 and 43 into engagement.

A bracket 86 is secured to a fixed portion of the supporting frame of the machine to which a cylinder 87 is permanently connected (Fig. 3). Said cylinder has a piston therein (not shown) and a piston rod 88 extending forwardly out of the cylinder, the free end of which is threaded to receive spaced nuts 89. An arm 90 is connected to the rack bar 64, extending downwardly to said rod 88, and has an opening through which the rod passes, one of said nuts 89 being at one side of the arm 90 and the other at its other side. A pipe 91 connects opposite ends of the cylinder 87 for a flow of oil or other hydraulic liquid from one end of the cylinder to the other. The flow of the oil may be controlled, that is, restricted to a desired degree by a valve, the position of which is changed by moving an operating arm 92 to which a rod 93 is connected and extends to and in front of the machine for access for manual operation.

Operation

Assuming a ring carrying casting unit to be in the position shown in Fig. 3, that is, with the upper casting carrying arbor of the unit at its farthest position away from the splitting saws 10, the shaft 19 and the parts connected therewith are at rest. Two of the ring castings 37 are placed over the retracted jaws 28 against each other and one against the face of the disk 22 (Fig. 4). The shaft 31 is turned to move the sleeves 35 and 36 toward each other to engage with and expand the jaws outwardly against the inner curved sides of the ring castings 37. After this is done the operator swings the handle 75 directly in front of the ring casting carrying unit to vertical position moving the arm 71 for passage of compressed air through the pipe 69 to the cylinder 61. Compressed air engaging against the piston 62 moves the piston rod 63 and rack bar 64 in a forward direction, that is, to the right in Fig. 3, rocking the unit and moving the ring castings 37 rapidly toward the pair of splitting saws 10 which are directly back of the castings. Before the castings come to said splitting saws the arm 90 will come against the outermost nut 89 on the rod 88, whereupon the compressed air will be required to move said piston rod 88 and the piston connected thereto which is within the cylinder 87. Such movement will be controlled by the passage of the oil from the front end of the cylinder 87 to its rear end through the pipe 90 and past the control valve governed by the arm 92. Such control valve is initially set at a desired position. Therefore, shortly before the saws engage with the castings the movement of the castings toward said saws will be reduced to the slow movement desired and the continued movement of the castings toward and into engagement with the saws will be at such slow speed and until the castings have been sawed through and divided into the two parts desired.

When the castings have been completely divided and the edges of the saws are received in the grooves 28a (Fig. 4) of the jaws 28, arm 81 will have been elevated to bring the switch operating member 80 against the under side of the head 83. It is evident that the head 83 will have been adjusted to the desired position to cause such switch

closing when the ring castings have been sawed entirely through. Closure of the switch energizes the solenoid at 76 and a movement of the armature 77 to its lower position as in Fig. 3 with a corresponding movement of the valve control arm 71, compressed air thereupon being carried through the pipe 70 into the forward end of cylinder 61. This causes a return movement of piston 62 and the rack bar 64 with an accompanying clockwise movement of the ring casting carrying unit to the position shown in Fig. 3. The movement from a position in which the ring castings have been split or divided to the position shown in Fig. 3 is initially rapid or while the arm 90 is moving away from the outer nut at 89 until it engages the inner nut 89, whereupon there is the same checking and thereafter slow movement as occurred when the ring castings were moved toward and closely adjacent to the splitting saws. Such return movement continues until the piston 62 reaches the outer end of the cylinder 61. When this has happened the finger 46 will have engaged its associated projection 85 and disconnected the clutch members 40 and 43, stopping rotation of the shaft 19 and the parts associated therewith including the split or divided castings. The operator thereupon releases the holding jaws 28, the divided castings are moved laterally over the head at 25 and allowed to roll down the incline at 94 (Fig. 3) to any suitable receptacle. Such unit is thereupon ready to receive another pair of ring castings to be split or divided with a repetition of the cycle of operations described.

If at any time it is desired to stop the rotation of said shaft 19 and the parts associated therewith finger 47 may be manually engaged to separate the clutch members 40 and 43.

It is evident from the construction and operation described that the worker attending the machine will release the split castings from a unit which is in the position shown in Fig. 3 or at the left in Fig. 1, move the split castings off from the unit and replace them by two ring castings to be split, swing the arm 75 associated with such unit to a vertical position and move on to the next unit which has completed its ring casting splitting cycle to do the same things there. The operation of the machine otherwise is automatic.

With the machine as described a very rapid splitting or dividing of the ring castings is attained with high quantity production. In practice one attendant can readily take care of two of the machines, each of which has four of the ring casting splitting units thereon, so that fourteen castings are being simultaneously split or divided at various stages of splitting, that is, seven of the units are working while one is being unloaded and reloaded.

It is also conceived that this machine may be used for splitting so-called "sleeve castings" which are ring shaped castings of sufficient length from which to cut several piston rings. When so used the sleeve casting is clamped upon the jaws 28 and against the disk 22 with its surplus length projecting away from the disk 22 and the saws 10 will cut a pair of rings from the casting near one end. Then those rings which have been cut off are removed and the remainder of the ring casting is moved up against the disk 22 and clamped by the jaws 28 and the process repeated.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. In a construction of the character described,

a horizontal arbor having a plurality of saws thereon spaced short distances from each other, means for continuously driving said arbor, a ring casting carrying unit comprising, a substantially vertical support mounted between its ends below said arbor to turn about a horizontal axis whereby said unit may be swung at its upper portion toward said saws and away therefrom, means engaging with the lower end of said unit for rocking the unit about said horizontal axis a predetermined distance toward said saws and thereafter reverse the movement and carry the unit away from the saws, ring casting carrying means at the upper end of said vertical support including a plurality of series of outwardly and inwardly movable jaws around each of which series of jaws a ring casting is adapted to be placed, manually operable means for moving said jaws outwardly to engage against the inner sides of said ring castings to hold them in firm connection with said shaft to turn therewith, means for driving said ring casting carrying means to rotate the castings, and means for automatically disconnecting the driving means therefrom upon swinging movement of the unit to carry the ring castings away, said disconnection occurring at a predetermined distance away of said unit from said saws.

2. In a ring casting holding mechanism, a movably mounted support adapted to move toward and away from ring casting dividing cutters, said support including a housing, a rotatably mounted shaft extending through said housing and at one end having an annular flange bearing against an adjacent side of the housing, said shaft at said end thereof having a cylindrical recess at its central portion, a disk secured to said flange and provided with a central hub extending into said recess, guide blocks spaced from each other located against the disk, an outer head located against the outer guide blocks, means passing through said head and guide blocks and connecting with the disks for securing said disks, guide blocks and head together, said outer head having a central cylindrical opening therethrough, arc shaped jaws each having a radially inwardly extending stem located around said jaws, said stems extending between adjacent blocks, a rotatable rod passing axially through said shaft, said rod within said hub and within the opening of said outer head having oppositely threaded sections, interiorly threaded sleeves provided at their adjacent ends with annular conical surfaces mounted on said threaded sections, said sleeves being keyed respectively to said hub and said head and said stems at their inner ends having beveled portions bearing against the conical surfaces of the sleeves.

3. In a machine of the class described, a support, a horizontal supporting rod extending therethrough, a ring carrying casting unit mounted for rocking movement on said rod and having parts extending above and below the rod,

a horizontal shaft mounted at the upper end of the unit, means carried by said shaft for the releasable mounting thereon of a plurality of piston ring castings, an arbor located to one side of said shaft, means for driving the arbor, saws on said arbor to which the ring castings are brought upon swinging movement about said supporting rod of said unit in one direction and away therefrom when swung in the opposite direction, a reciprocating rack bar located below the lower end of said unit, gear teeth at the lower end of said unit engaging said rack bar, means for moving said rack bar in opposite directions, manually operable means for causing said means to move the rack bar to carry ring castings toward and into engagement with said saws and means for automatically reversing the movement of said rack bar moving means when the saws have cut through said castings, as specified.

4. A construction containing the elements in combination defined in claim 3, combined with means for driving the ring casting carrying shaft and means for automatically disconnecting said driving means therefrom on movement of the unit to carry the ring castings which have been divided by said saws away therefrom a predetermined distance.

5. In a construction of the class described, a support, a horizontal rod fixed on said support, a ring casting carrying unit mounted on said rod for rocking movement, a part of said unit extending below and a part above the rod, ring casting carrying means at the upper end of said unit including a rotatable shaft, means for releasably securing a plurality of ring castings on said shaft to turn therewith, means for driving the shaft, means for rocking said unit a predetermined distance about the axis of said rod, rotating saws to which the ring castings are brought and with which they engage on the movement thereof in said direction, means for automatically reversing said movement when the ring castings have been sawed into parts to carry the upper part of said unit and the divided castings away from the saws, means for driving the shaft of said unit, and means for disconnecting the driving means therefrom on movement of the upper part of the unit a predetermined distance away from said saws.

6. A construction containing the elements in combination defined in claim 5, said shaft and said unit normally being at rest when located substantially at said predetermined distance away from said saws, means for manually controlling and starting in operation the means for moving the unit to carry ring castings toward and into engagement with said saws, and means for automatically reversing said movement after the saws have cut through the ring castings to thereby move the upper part of the unit and the divided ring castings carried thereby away from the saws.

HOLLY M. OLSON.