Nov. 6, 1934. J. G. COLEMAN 1,979,959

PISTON BALANCING MACHINE

Filed Aug. 17, 1931 3 Sheets-Sheet 1

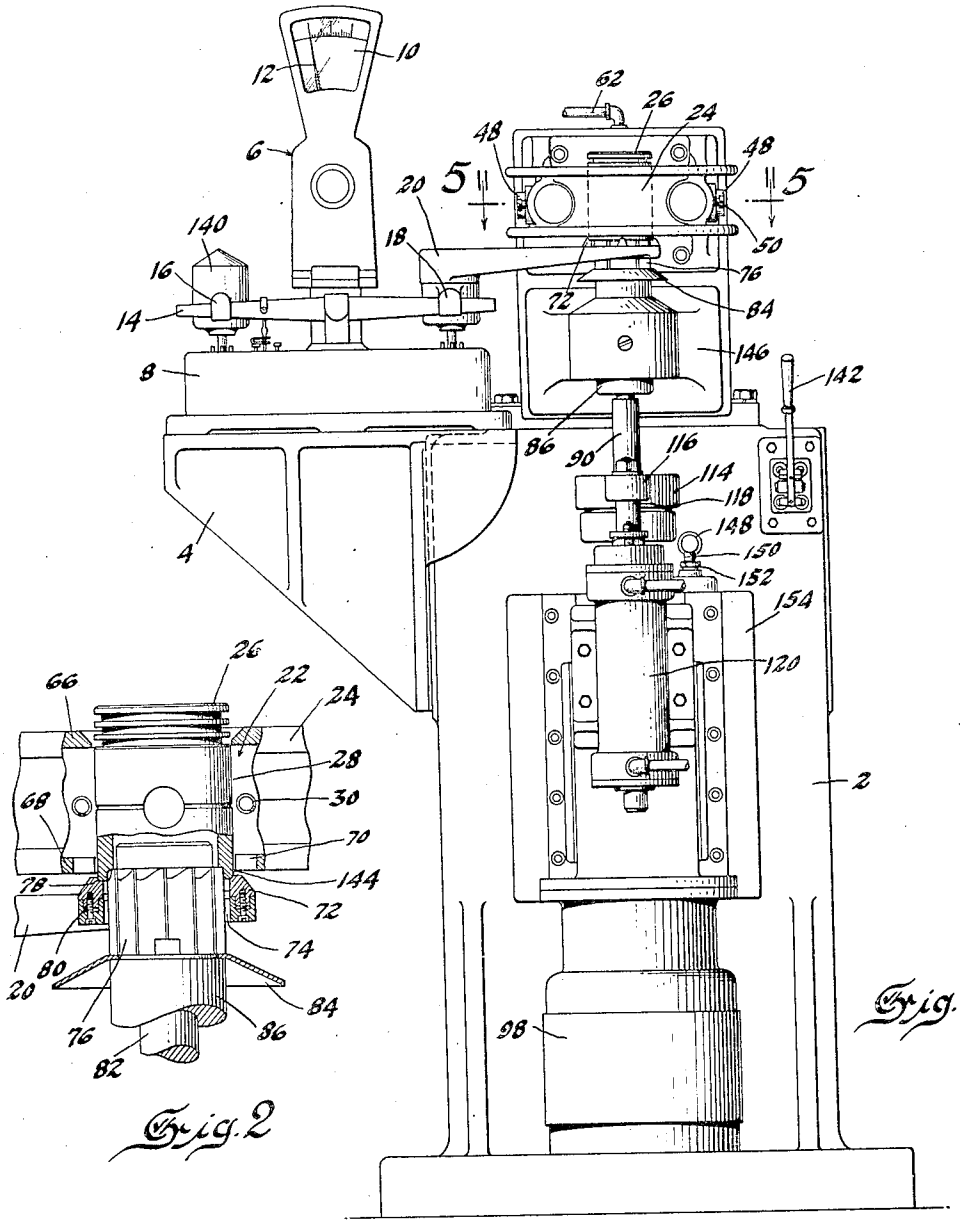


Fig. 1

Fig. 2

Inventor
John G. Coleman
By Blackmore, Spencer & Hurt
His Attorneys

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PISTON BALANCING MACHINE

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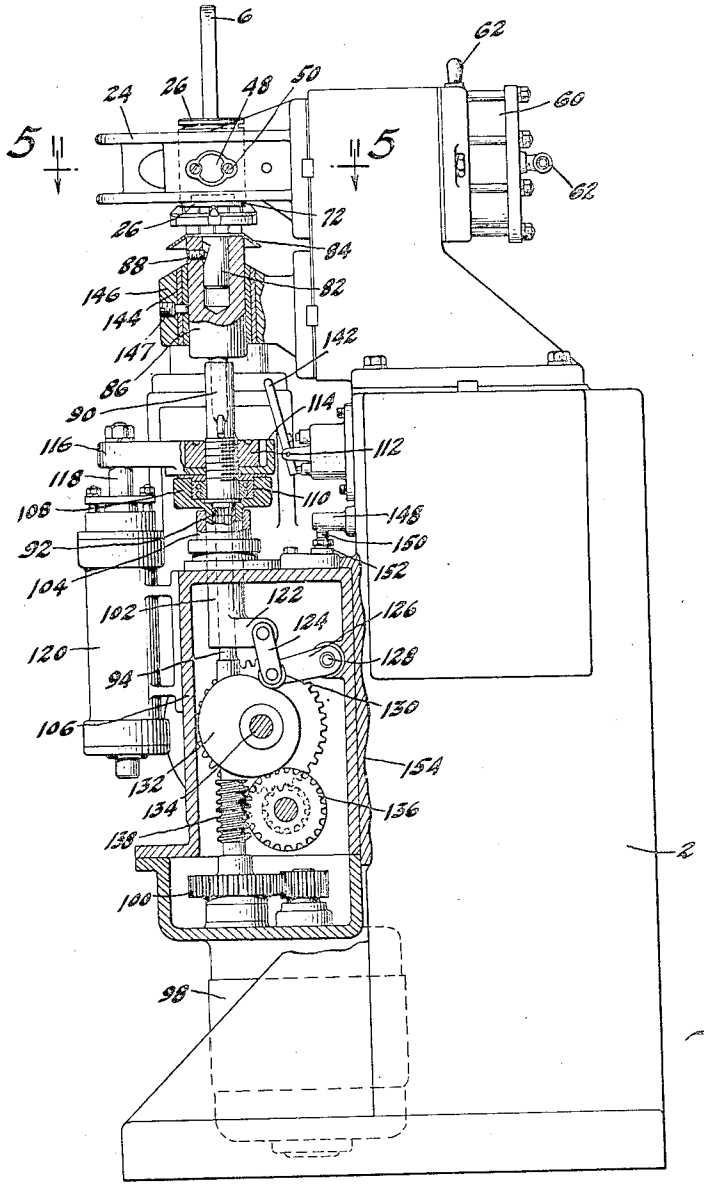


Fig. 3

Inventor

John G. Coleman

By Blackmore Spencer & Flint

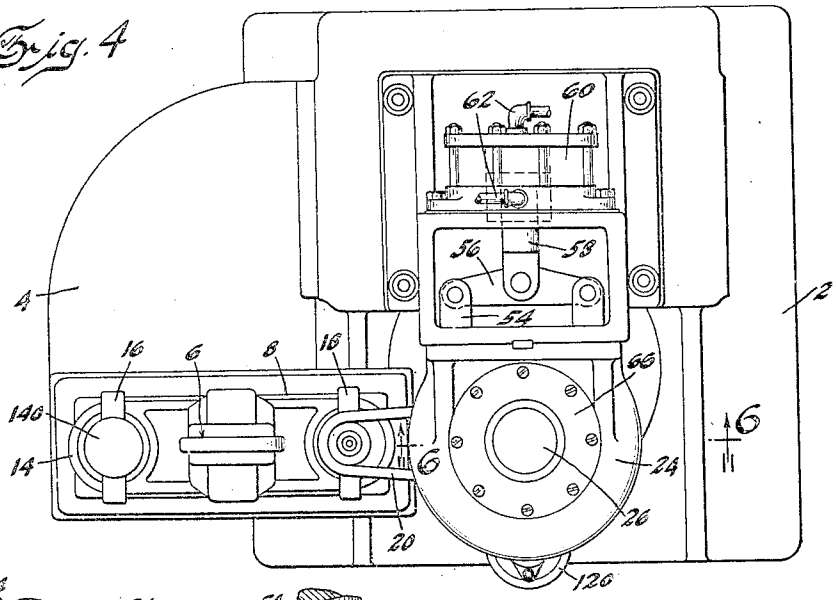
his Attorneys

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PISTON BALANCING MACHINE

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Fig. 4



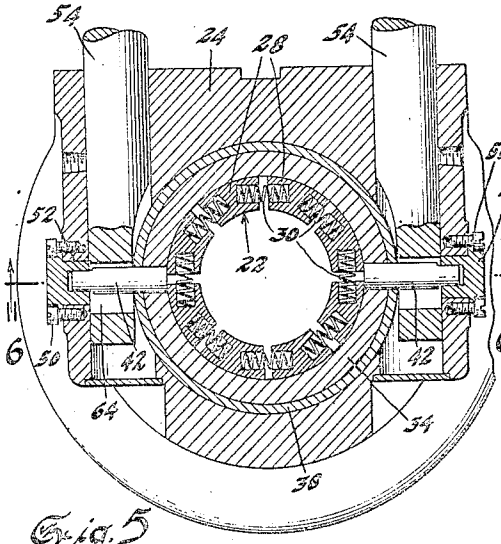


Fig. 5

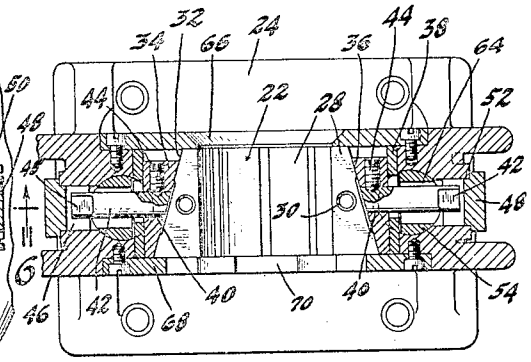


Fig. 6

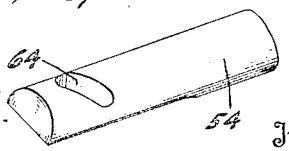


Fig. 8

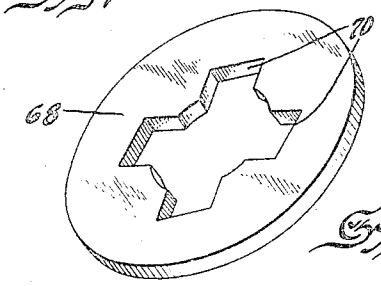


Fig. 7

Inventor
John G. Coleman
By Blackmore, Spencer & Elliott
His Attorneys

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UNITED STATES PATENT OFFICE

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PISTON BALANCING MACHINE

John G. Coleman, Lansing, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application August 17, 1931, Serial No. 557,550

13 Claims. (Cl. 77—1)

This invention relates to pistons and particularly to a machine for balancing pistons or making pistons of uniform weight.

In the past, it has been found somewhat slow, inconvenient and expensive to make pistons for the internal combustion engines of automotive vehicles of a uniform weight and the difficulties and objections encountered in obtaining uniform weight pistons led to the experiments which resulted in the present invention.

In casting pistons of cast iron, it is not a practical matter to cast them such that the amount of metal in the pistons will weigh the same. It is accordingly necessary and desirable to cast them with an excess of metal and to remove a sufficient amount to make the weight of the pistons uniform. The machine of the present invention takes from the cast iron piston as it comes from the mold enough metal so that all the pistons, after they leave the machine, will have substantially the same weight.

The machine of the invention includes a balance (the details of which form no part of the invention) having an arm adapted to receive the piston. The piston fits into the opening of a chuck which is positioned over the arm. The excess weight of the piston will depress the arm of the balance an amount proportionate to the excess over the desired uniform weight, the greater the excess weight, the greater the depression of the arm. The chuck engages the piston rigidly to hold it when the piston is balanced on the scale. A reciprocable and rotatable milling cutter having a definite and constant reciprocable movement turns from the piston an amount of metal proportionate to its excess weight. After the cutter has turned the metal from the piston, the chuck is released and the piston removed and a new piston inserted.

The chuck used is particularly adapted to the machine and for the holding of pistons and comprises a plurality of arcuate shaped members having one or more coil springs between each pair of members to urge them apart. The exterior portion of the arcuate members is inclined and receives thereover an oppositely inclined ring. By causing the ring to slide up or down, the arcuate members are released or engaged as the case may be, to release or engage the piston.

On the drawings:

Figure 1 is a front elevation of the machine.

Figure 2 is a sectional detail view through the chuck showing the cutting tool operating on the piston to turn a portion of the metal therefrom.

Figure 3 is a side view of the structure of Figure 1 with parts shown in section.

Figure 4 is a plan view of the structure of Figures 1 and 2.

Figure 5 is a section on the lines 5—5 of Figures 1 and 3.

Figure 6 is a section on the lines 6—6 of Figures 4 and 5.

Figures 7 and 8 are perspective views of details of the chuck.

Referring to the drawings, the numeral 2 indicates the frame of the machine. Secured to the side of the frame 2 is the shelf or bracket 4 on which there is supported the balance indicated as a whole at 6. The balance has the usual base 8 and the scale 10 over which the pointer 12 operates. The balance per se forms no part of the invention, and all the weight on either end of the balance arm 14 is concentrated at the knife edge sections 16 and 18. The balance includes the arm 20 which projects to the right in Figure 1 and extends beneath the opening in the chuck 22. The chuck is mounted in the frame portion 24 at the upper part of the machine and the opening therein is for the purpose of receiving the piston 26.

The chuck comprises the plurality of segmental members 28 which are urged apart by means of the coil springs 30 positioned between each pair of arcuate members 28 in mating recesses therein. The inner portion of the chuck 22 surrounding the central opening is cylindrical to accommodate it to the cylindrical outer surface of the piston 26 but the outer portion of each member 28 is inclined as shown at 32 in Figure 6 to give a frustro-conical outer periphery to the chuck members 28. The chuck members are surrounded by a reciprocable ring 34 which is tapered as shown at 36 in a direction opposite to the taper 32 of the members 28. The ring is held and positioned around the chuck by means of the stationary band 38 permanently mounted in the frame 24. The ring 34 has the lateral openings 40 in which there are received the ends of the studs or bolts 42. The ends are rigidly secured in the ring by means of the set screws 44. The outer ends of the studs 42 are flattened as at 45 and are adapted to slide in the slots 46 in the blocks 48 secured by the machine screws 50 in openings 52 in the side of the frame 24. About the intermediary portion of each bolt 42, there is received the slotted end of the operating rod 54 which extends rearwardly of the machine and terminates in eyes and is connected by means of equalizing link 56 with the stem 58 of a piston op-

erating in the cylinder 60. The piston is operated by air from the piping 62. The forward end of the rods 54 is slotted as at 64, the slot being inclined as is best shown in the perspective view in Figure 8. The operation of the rods 54 either forward or backward will cause the slot 64 to engage the shank portion of the bolts 42 to cause the bolts to ride either up or down in the slot and thereby move the ring 34 either up or down to release or engage respectively the segmental members 28 of the chuck 22 thereby causing them to either release or engage the piston. The segmental members 28 are held in position by means of the upper plate 66 and the lower plate 68 shown in perspective in Figure 7. The plate 68 has the squared notches 70 to accommodate the prongs 72 of the arm 20.

Referring to Figure 2, it will be seen that the end of the arm 20 projects beneath the opening in the chuck 22. The end of the arm has an opening 74 to accommodate the milling cutter 76. Around the periphery of the opening, there are positioned the four prongs 72, each of which is provided with a shoulder 78 having a short knife-edge on which the piston rests. The prongs 72 are secured to the arm by means of the machine screws 80.

The milling cutter 76 is rigidly mounted on a reciprocable and rotatable shaft 82. A deflector 84 is secured to the shaft immediately below the milling cutter to deflect the chips as they are turned from the piston.

The shaft 82 is mounted in a suitable holder 86 and is secured therein by means of the set screw 88. The holder 86 is driven from the shaft 90, the lower end of which is hollow and splined as indicated at 92 and receives the feathered end of a shaft 94 driven from a motor 98 through the gearing 100. The reciprocatory movement of the holder 86 is guided by a bearing 144 held in an arm 146 by means of the set screws 147.

The shafts 90 and 94 are rotatable in a reciprocable slide 102 journalled in a bearing 104 mounted on a housing 106 secured to the frame 2. The upper portion of the slide 102 is enlarged as at 108 and has the ball bearing 110 for the lower portion of the shaft 90. The shaft 90 has secured thereto the member 112 which seats in a cup-shaped portion 114 of an arm 116 secured to the connecting rod 118 of a pneumatically operated piston working in a cylinder 120 secured to the housing 106.

The slide 102 has the ear 122 to which there is pivoted a link 124 pivoted at its end to a second link 126, pivoted at 128 to the interior of the housing 106. The pivotal pin interconnecting the links 124 and 126 has a roller 130 mounted thereon which engages a cam 132 rigidly secured to a shaft 134 operated by suitable gearing 136 driven from the worm 138 secured to the shaft 94.

From time to time, the milling cutter 72 must be sharpened which will shorten it somewhat and slightly change its limits of travel. To take care of the change due to the sharpening of the cutter, the adjustment shown in Figures 1 and 3 is provided. A bracket 148 is rigidly secured to the frame 2 and has a stud 150 screwthreaded therein. The stud projects downwardly and screws into a threaded opening in the housing 106. The stud is polygonal in shape intermediate its ends, as at 152, to permit the application of a tool to turn it. The housing 106 and motor 98 slide as a unit in the ways 154 and may be adjusted by rotating the stud 148.

The operation of the device is as follows. The electric motor 98 is started by closing the usual switch (not shown), the operator immediately placing a piston in the opening of the chuck and causing it to rest on the prongs 72 at the end of the arm 20. The balance 6 has a weight 140 on its left side (Figure 1) which exactly balances a piston of the weight desired. If a 14 ounce piston is used, the weight 140 will weigh exactly 14 ounces. The piston 26 will be slightly over-weight and will depress the arm beyond the balanced position by an amount depending upon its weight in excess of the 14 ounces, or the weight of the weight 140. In the machine in question, this amount of depression will be .176" for each ounce of weight in excess of the desired amount. When the pointer of the balance 6 is stationary, it will indicate that the scale has reached equilibrium and the operator then seizes the handle 142 which controls the air for the piston in the cylinder 60 to cause the chuck rigidly to engage and hold the piston. The operation of the gearing 100 will rotate the shafts 94 and 90 and cause the milling cutter 76 to rotate. The gearing 136 and worm 138 will rotate the cam 132 and at a given period after the chuck holds the piston, will cause the roller 130 to ride up and through the link 124 and slide 102 will push the shaft 90 upwardly to cause the cutter to cut or turn a quantity of metal from the lower inside portion of the piston, as shown by the numeral 144 in Figure 2. In the upward movement of the slide 102, the arm 116 is carried along therewith which will compress the air in the cylinder 120 above the piston and when the cam 132 again reaches a point where it will allow the roller 130 and link 124 to descend, the compressed air will force the shaft 90 and holder 86, together with the milling cutter 76, downwardly to remove it from the piston. The upward stroke or distance of travel of the cutter is the same at all times owing to the constancy of the cam 132. The cutter will turn from the piston more or less metal depending upon the piston's weight, or upon the amount which it has depressed the arm 20 of the scale 6 beyond the balanced position.

I claim:

1. In a machine for balancing pistons, a chuck, means in the machine for weighing and positioning the pistons in the chuck in different positions according to the weight of the piston, said chuck adapted to grip and hold the piston in said position dictated by the weighing means, and means in the machine having a fixed path of movement for turning off a portion of the metal from the interior of the piston while the piston is being held in the chuck in said position to diminish the piston's weight to a substantially predetermined amount.

2. In a machine for balancing pistons, means therein for seizing and holding the piston, means in the machine for positioning the piston in different positions in said means according to its weight in excess of predetermined weight for the piston, said first-named means seizing and holding the piston in a definite position and means in the machine having a fixed path of movement with relation to said holding means for turning off a portion of the metal of the piston while the piston is being held in said definite position to decrease its weight until the piston substantially reaches the predetermined weight.

3. In a machine for balancing pistons, means therein for seating the piston in different positions according to its weight in excess of a predetermined weight for the piston, reciprocable

means in the machine for seizing and holding a piston in said position and a second reciprocable means having a fixed path in respect to the holding means operative when the piston is held for turning off the portion of the metal of the piston to decrease its weight until the piston substantially reaches the predetermined weight.

4. In a machine for balancing pistons, means therein for seating a piston in different positions according to its excess of weight over a predetermined weight for the piston, reciprocable means for seizing and holding the piston in said position, a tool therein adapted to operate on the piston, means for rotating the tool and means having a fixed path with respect to the holding means to reciprocate the tool to and from the piston to cause it to turn off a given weight of metal to bring the piston down to a predetermined weight depending upon the position of the piston in the holding means.

5. In a machine for balancing pistons, a chuck therein having a central opening adapted to receive the piston, means for closing and opening the chuck to seize or release the piston, a balance in the machine having an arm extending under the chuck opening, said arm receiving the piston placed in the chuck opening and seating said piston in different positions according to its weight in excess of a predetermined weight for a piston, said chuck holding said piston in said position, a tool therein for operating on the piston, means for rotating and reciprocating said tool in a given path in respect to the holding means, the operation of said tool removing from said piston an amount of metal having a weight to reduce the weight of the piston to substantially predetermined weight.

6. In a machine for balancing pistons, a gripping member therein having an opening to receive the piston, a balance therein having a piston supporting arm extending under the opening of the gripping member, said arm having an opening beneath said piston, said arm balancing or supporting said piston in the opening of the gripping member in different positions according to the weight of the piston, said gripping member adapted to seize and hold said piston in a given position, a rotatable tool adapted to work on said piston and means for reciprocating said tool through the arm opening in a predetermined path to engage the piston and cause the tool to turn off a portion of the metal of the piston dependent upon the position of the piston in the gripping member.

7. In a machine for balancing pistons, means therein for weighing and positioning the piston in different positions, means operative after the piston has been weighed for seizing and rigidly holding the piston in the weighed position, and means in the machine having a fixed path of movement with respect to said holding means, operative while the piston is being held, for turning off a portion of the piston to diminish its weight to substantially a predetermined amount.

8. In combination, a chuck, means to position a piston in said chuck in accordance with the weight of the piston, varying weights thereof causing said piston to project different distances from the face of the chuck, means to operate the chuck to cause it to hold the piston in a given position and means operative along a fixed path of movement with respect to said chuck while the chuck is holding the piston in said position for removing a portion of the piston to diminish its weight to substantially a predetermined amount.

9. In combination, a chuck adapted to grip and hold a metallic piece of work, means for positioning said piece of work in said chuck in accordance with the weight of the piece of work, the varying weights causing the piece of work to project different distances from the face of the chuck and means operative along a fixed path of movement with respect to the chuck, while the chuck is holding the piece of work for removing a portion of the metal to diminish the weight of the piece of work to substantially a predetermined amount.

10. In combination, means for holding a metallic piece of work, means to position said piece of work and holding means relative to each other depending on the weight of the piece of work, means to operate the holding means to cause it to seize and rigidly hold said piece of work in said relative position and means operative along a fixed path with respect to the holding means while the piece of work is being held by the holding means for removing a portion of the metal from the piece of work to diminish its weight to a substantially predetermined amount dependent upon the relative position of the piece in the holding means.

11. In a machine for balancing pistons, means for weighing and positioning the piston with respect to its weight in different positions in relation to the remainder of the machine, a fixed chuck having radially movable jaws that surround the piston and hold the same in the position dictated by the weighing means and means having a fixed path of movement for turning off a portion of the metal from the interior of the piston while it is being held in the chuck in said position to diminish the piston's weight to a predetermined amount.

12. In a machine for balancing pistons, a fixed chuck having radially movable jaws, a balancing arm initially supporting the piston between the jaws, the distance which the piston projects into the jaws depending upon the weight thereof as it forces down the balancing arm, means to cause the jaws to grip the piston after it has balanced, and means having a fixed path of movement with respect to the chuck for turning off a portion of the metal from the interior of the piston while it is held in the chuck, the amount depending upon its position therein as determined by the position of the balancing arm as affected by the weight of the piston.

13. In a machine for balancing pistons, a chuck, a balancing arm initially supporting the piston within the chuck, the distance which the piston projects from the chuck being dictated by the weight thereof on the balance arm, means to cause the chuck to grip the piston after it has balanced and means having a fixed path of movement with respect to the chuck for turning off a portion of the metal from the interior of the piston while it is held in the chuck, the amount depending upon its position therein as determined by the balance arm as affected by the weight of the piston.

JOHN G. COLEMAN.