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APPARATUS FOR EXPANDING PISTONS

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This invention pertains to an improved apparatus for expanding pistons.

The invention is primarily applicable to the expansion of skirts of pistons of the split skirt type which have collapsed in use, the apparatus being such that by its employment the skirt may be evenly and quickly brought to size in order to insure proper fit with the wall of its companion cylinder. In fact, the apparatus is such that the amount of expansion of the piston may be controlled with the highest degree of accuracy and can, moreover, be utilized to expand the piston at the lower end more than at the upper end, and vice versa, when necessary. It is, likewise, possible to expand the piston into an oval shape.

Stated in a broad sense, the apparatus is such as to project through the action of a blast, a plurality of bodies or particles simultaneously and directly against and over a substantial area of the inner face of the piston or the skirt thereof. In other words, the process involves the bombardment of the inner face of the piston or any predetermined area thereof with a mass of particles which act to equally expand the body, and at the same time, tend to remove any burned oil or the like which may be present if the piston which is undergoing treatment or expansion is a used one.

It has heretofore been proposed to enlarge "the diameter of a relatively small piston by percussion"; this is evidenced by U. S. Letters Patent to McCormack and Searle, No. 1,181,467, dated May 2, 1916, wherein the point of a hammer 47 is caused to deliver a blow upon the inner surface of a piston through the action of a spring 48, the piston being turned step-by-step with reference to the hammer.

Insofar as I am aware, the method which is effected by the apparatus of this invention has never been employed, and it is probably due to the fact that the peening action of the hammer is localized at a series of points extending circumferentially around the inner face of the piston. Moreover, the action of the hammer is dependent upon a spring, the force of which will gradually decrease during its life or, in other words, is not constant, and in the showing made in the patent referred to, no means is provided for adjusting the tension of the spring and, consequently, the force of the blow or impact of the hammer 47.

While the patent proposes through the peening action to enlarge the diameter uniformly, the operation at best is slow, if in fact any such uniform result may be had. Localizing the impact through the peening hammer tends to cause the metal to flow and this is not overcome by producing another blow immediately adjacent thereto, as the metal will tend to flow into the theretofore formed or produced pit or opening.

In the present case, there is no localization of a blow, but on the other hand, a multiplicity of blows is imparted over a substantial area and over the desired area simultaneously, with the result that any displacement of the metal of the piston is substantially uniform.

In the annexed drawings, several embodiments of apparatus are shown, whereby the inner surface of the skirt of the piston may be subjected to a bombardment of bodies or particles propelled and thrown against the skirt through the action of an air blast or other gaseous or fluid medium.

In the drawings:—

Figure 1 is a vertical sectional view, with parts in elevation, showing a piston mounted upon a stand in position to be subjected to the bombarding action;

Fig. 2, a perspective view of an adjustable encircling sleeve placed about the piston to prevent the particles or bodies employed to bombard the piston from passing outwardly through the openings commonly found in a piston;

Fig. 3, a view similar to Fig. 1, illustrating means for closing off the inner ends of the piston pin bosses and also for localizing the blast against the diametrically disposed portions of the skirt;

Fig. 4, a perspective view of one of the guards employed in the arrangement shown in Fig. 3;

Fig. 5, a side elevation of a modified form of blast nozzle which may be utilized;

Fig. 6, a face view thereof seen at right angles to that shown in Fig. 5;

Fig. 7, a sectional elevation of a further form of nozzle;

Fig. 8, an elevation with parts broken away, of a modified form of apparatus whereby the method may be carried out;

Fig. 9, a similar view as seen from the right hand side of Fig. 8;

Fig. 10, a transverse horizontal section taken on the line X—X of Fig. 8;

Fig. 11, a sectional elevation of the upper portion of the apparatus, the operating parts being shown in full; and

Fig. 12, a top plan view of a portion of the cover illustrative of the locking pawl for indexing the piston oscillating mechanism.

A description of the mechanism shown in Figs. 1 to 7, both inclusive, will first be given.

Referring first to Fig. 1, 10 denotes the base of the machine, which may be clamped upon a bench or the like denoted by 11. The base or stand 10 is provided in its upper face with a series of concentric stepped bearings or shouldered portions 12. These bearings or stepped portions preferably will be made to conform with the usual outside diameter of the lower end of the piston skirt which they are designed to receive, as best shown in Fig. 1, and are for the purpose of centralizing the same. It will be appreciated

that the degree of expansion required to make the skirt conform to a cylinder is, of course, relatively small.

A piston to be expanded is shown as seated upon one of these shouldered portions and is designated generally in said figure by 13. The piston pin bosses are shown as filled by plugs 14 of any suitable material, such, for instance, as steel, wood or cork, and surrounding the outside of the piston and covering the openings which extend through the walls thereof is a shield or sleeve 15. The ends of the sleeve overlap and the outer section is provided with a slot 16 through which extends a threaded stem 17 secured at its inner end to the inner overlapping portion of the member 15 and carying a wing nut 18 by which arrangement the sleeve may be held closely to the outside of the piston when once adjusted with reference thereto, but free to move by reason of the slotted connection under expansion of the piston.

To hold the lower end of the piston in close contact with the stepped portion or element 12 upon which it is brought to rest, a bail 19 pivoted upon pins 21 carried by the base 10 is employed. The bail at its cross portion carries a threaded stem 22 having a knurled head 23, the stem at its lower end bearing upon the upper face of a plate or washer-like element 24, resting upon the upper end of the piston and exerting an endwise thrust thereon as the stem or screw is turned inwardly. The piston is thus maintained in position against displacement with reference to the stand, and through the utilization of the plugs 14 and the encircling band or shield 15, the passage of any particles to the bearing surfaces of the piston pin bosses or to the outside of the piston is prevented.

The bombarding material is, as above indicated, designed to be forcibly thrown against the interior surface of the piston, or more specifically the piston skirt, either in whole or in part. Such material or substance may be shot, crushed steel shot, or any material or substance having sufficient body to effect the desired action.

The material may be introduced through a nozzle and impelled therefrom through the action of fluid under pressure. As will be seen upon reference to Fig. 1, the base 10 is provided with a central opening through which there extends a pipe 25 surmounted by a nozzle 26 which, as shown in said figure, is open at opposite sides with a centrally disposed downwardly projecting deflector 27, which acts to guide the particles laterally through the oppositely disposed openings in the nozzle.

Pipe 25 is connected with any suitable source of fluid pressure, which pressure will depend upon the character of the material of which the piston is formed and also the nature of the impacting or bombarding material carried forward and projected by the fluid stream. Air under pressure varying anywhere from 40 to 90 pounds has been successfully employed, though higher or lower pressures may be utilized, depending upon the factors of time, piston material, character of bombarding or impacting material, and extent of expansion necessary or desired.

It may be desired to project the disconnected impacting particles or bodies against all portions of the skirt, and to this end the pipe 25 may be moved longitudinally and likewise rotated about its axis. With a view of rotating the same, a reciprocating rack as 28, cooperating with a pinion 29 secured to the pipe 25, may be employed. Motion may be imparted to the rack by any suitable means. Any suitable mechanism for moving the pipe endwise and rotating the same about its axis may, of course, be utilized.

In carrying out the method, the expansion of the piston takes place very quickly but in order to draw off any impacting material, pipes or conduits 31 and 32 may open into the lower portion of the stand 10 and lead off to the supply from which the shot or other impacting material is withdrawn for projection through the nozzle 26.

In actual practice, it has been found that a piston of 3⅞" diameter taken from a Ford machine, was expanded .011" and 40 seconds, with a blast of crushed shot at 90 pounds pressure. A strut type piston of 3⅛" diameter was likewise expanded in 40 seconds to .006" with similar material and like pressure. These are given merely by way of example.

It will thus be seen that the action is almost momentary and, in addition thereto, it is found to be uniform throughout the extent of impaction; in other words, there is no undue stretching of the metal at any one point over another.

By the utilization of the plugs 14 and the surrounding sleeve or shield 15, all contact surfaces of the piston are protected. The piston may be readily removed and the protecting elements as readily withdrawn, with a view of putting another piston in place with reference to the nozzle.

In Fig. 3, a slight modification is shown. In this instance, instead of using plugs as 14, guard plates of substantially L-shaped form are employed. The upright body portion of these plates is designated by 33 and from and at the upper end there extends at right angles a section 34. The base or lower end of the member 33 is turned outwardly to a slight extent and a slotted finger as 35 projects therefrom.

A pair of such guard plates is shown in position within the piston in Fig. 3, the upper ends overlapping and the lower sloted ends being attached to the base plate 10a by set screws 36. The upright portions 33 are of such extent as to entirely close off the piston pin bosses 37 and 38. By reason of the fact that the plates are adjustable toward and from each other, the structure may be adapted to pistons wherein the inner ends of the piston pin bosses are nearer to or further apart than the last one positioned upon the base 10a.

A surrounding shield or band 15 is also shown positioned about the piston in this figure.

Various forms of nozzles may be employed, and in Figs. 5 and 6 a nozzle having two oppositely disposed mouths 39 and 40, relatively narrow in cross section as compared to their height, is shown. The center of the upper portion of the nozzle, in line with the connection for the pipe or conduit to which the nozzle is attached, is depressed as at 41, so as to cause an equal deflection of the impacting material laterally and out through the mouths to the opposite sides of such deflector.

In Fig. 7, a further form of nozzle is shown wherein the body of the nozzle which is to be attached to the conduit is denoted by 42, and an adjustable baffle or deflector 43 is mounted above the upper open end thereof. The upper edge of the member 42 is preferably formed parallel with the under face of the cone-shaped baffle 43, to produce an even flow of the impacting material around the entire extent or mouth of the nozzle without any undue impedance.

The simple forms of nozzle are, however, preferred, and the same effect that is accomplished by the outflow of the material entirely around the upper end of the nozzle 42 and beneath the deflector 43 may be had by rotating the conduit as 25 with a nozzle having one or more openings therein.

In the arrangement shown in Fig. 1, and the parts in the position as depicted therein, and with the understanding that the conduit 25 is held stationary, the blast or stream of impacting material is directed only on a diameter at right angles to the axis of the piston pin bosses, as will readily be appreciated.

Under this arrangement, assuming that the bombarding or expanding material has been forced outwardly under proper pressure and for the proper time interval through the nozzle, the piston is expanded only on this diameter and the result is the same as a cam ground piston.

The invention thus far described is a continuation of my application Serial No. 17,545, filed April 20, 1935, which application, in turn, is a division of my original application Serial No. 753,025, filed November 14, 1934, in which the method of expanding pistons was set forth and claimed, in addition to the apparatus as above set forth.

In Figs. 8 to 12, both inclusive, a modification or further development of the mechanism whereby the pistons may be expanded is disclosed. It involves the same general principle of employing shot thrown or forced against the inside of the piston skirt by fluid under pressure.

In said figures, 51 denotes a casing, preferably formed from sheet metal rolled into the form of a cylinder upon which (see more particularly Fig. 11) is mounted a transverse plate 52 and above the latter is a cover 53. The central portion of said cover protrudes upwardly as at 54 and inasmuch as most of the working parts lie above the plate 52 and are enclosed within the cover 53, 54, they are not subject to contact with the blast employed for expanding the piston, nor with any dirt which may be thrown off from the latter.

A door 55 is provided to normally close an opening formed in the upper part of the vertical face of the shell or casing 51, which opening affords access to the interior of the casing, or more particularly to the support or fixture upon which the piston to be expanded is placed.

A vent opening 56 is provided on the opposite side of the casing and a vertically disposed shield or plate 57 is associated therewith to prevent shot or the like from passing outwardly through said opening, while still permitting the air to pass freely from the casing. Below the plate just mentioned and spaced therefrom is an inclined plate 58, the plate inclining forwardly in the form shown and communicating with a downwardly extending channel 59 which terminates at its lower end in a trough 61 into which the shot, after it has impacted the inner face of the piston, passes.

As will be seen upon reference to Fig. 8, the trough-shaped member 61 is V-shaped in cross section and a hose or flexible pipe 62 having a ferrule 63 mounted on one end thereof, is associated therewith. In other words, the ferrule and pipe extend into the outer end of the trough-shaped member and a cross bar 64 is fastened at its ends to the trough and overlies the pipe and ferrule, a set screw 65 carried by the bar serving to hold the pipe and ferrule in place. The pipe extends through the inclined bottom 66 and at such point a guard 66 surrounds the same. At its upper end, said pipe communicates with an injector nozzle denoted generally by 67. Extending into the lower end of this nozzle is a blast pipe 68 connected with a suitable source or supply of air or other fluid under pressure through a line 69 which extends upwardly and outwardly of the casing 51. The nozzle is mounted upon an L-shaped arm, shown as formed of piping, which is designated by 71. At its lower end, it is connected by a T 72 with a pipe section 73, the ends of which are swiveled in oppositely disposed bearings 74, 75, secured to the inner face of the casing.

Through means shortly to be described, an oscillating movement is imparted to the shaft 73 and, consequently, to the nozzle support 71, the same swinging backward and forward through an arc of a circle. Air under pressure passing upwardly through the nozzle, draws the shot from the trough-shaped member 61 and projects the same forcibly into the interior of a piston designated generally by 76. The piston is placed on what may be termed a stand or fixture 77, which is mounted upon two horizontally extending arms 79, 79a, spread apart as they extend outwardly in diverging relationship. Said arms carry dowel pins or stakes 81 which extend upwardly into the under face of the fixture. Thus, the under face of the interior of the piston 76 which is mounted upon the fixture supported by the arms, is open to the blast of shot emanating from the nozzle. At their inner ends, the arms 79, 79a, are welded or otherwise secured to the lower end of a depending arm 82, the upper portion of which is bent laterally, producing a horizontally disposed arm 83 which is secured to the lower end of a shaft 84 mounted in a bearing 85 attached to the cross plate 52. Shaft 84, moreover, extends upwardly through the raised portion of cover 54 and has a wheel 86 attached thereto, the rim of the wheel having an index mark thereon, as indicated in Figs. 8 and 11.

As will be seen from the description heretofore given, it is preferable to treat first one side and then the other side of a piston, and in order that the fixture support may be properly positioned to insure the blast contacting that portion of the piston which it is designed to operate upon, means is provided for locking the shaft and fixture support to the driving mechanism.

Also secured to the shaft 84 is an indexing disc 87 which is provided with oppositely disposed notches 88 and 89 designed to coact with the nose of a spring pressed pawl 91 fulcrumed as at 92 on the outer end of an arm or lever 93 swiveled on the shaft 84. The pawl has an upwardly extending arm or finger 94 which passes upwardly and freely through an elongated slot 95 formed concentrically with the shaft 84. The slot is wide enough to permit the retraction of the nose of the pawl from either of the notches 88 or 89 to permit rotation of the wheel 86 by hand and shifting of the fixture support from one position to the other. The apparatus is designed to impart an oscillating movement to the piston or, in other words, to the piston support and the piston resting thereon, while the machine is in operation. To that end, a pitman 96 is pivotally attached to the arm 93 and likewise attached to the upper face of a gear 97 which in turn meshes with a driving pinion 98 which is actuated through a hand wheel 99 when the machine is in operation.

As above indicated, it is desired to impart a swinging movement to the nozzle at the same time the fixture is oscillated, and to accomplish this, a pinion 101 also meshes with the gear 97, said pinion being mounted upon an upright bearing and having affixed to the upper face thereof a plate or the like carrying a pin 102 which extends into an elongated slot 103 formed in a plate 104, said plate being attached or carried by the upper end of a bar or rod 105 (see more particularly Fig. 8), which at its lower end is adjustably secured to the oscillating shaft element 73. By having the bar or rod adjustably connected at this point, the inclination of the nozzle may be varied as desired.

Line 69, through which the fluid under pressure passes to the nozzle, in addition to the ordinary stop valve 106 and pressure gauge 107, has a second valve 108 mounted therein. This valve is designed to be closed when the door 55, heretofore referred to, is opened, in order to cut off any blast from the nozzle. To this end, a valve handle 109 is fixed to the valve stem and extends outwardly through a slot in the side of the cover 53. At its inner end the lever carries a pin 110 which, when the door 55 is open and the valve 108 closed, is designed to enter a notch 111 in an arm 112 secured to the upper end of a shaft 113, which shaft at its lower end carries an arm 114. Said arm stands in line with an opening which is normally closed by the door 55. A spring 115 is attached to the lever 109 at one end and to the upper end of shaft 113 at its opposite end and tends to draw the valve to its closed position. A second spring 116 attached to the arm 112 and to a pin fixed to the plate 52 tends to draw the arm 112 into locking engagement with the pin 110. An adjusting screw 117 is mounted in a fixed stud 118, the inner end of the screw standing in alignment with the arm 112 and serving to limit its motion. In other words, by adjusting the screw, adjustment of the throw of the parts may be regulated.

In order to hold the piston in position when it is placed upon the fixture 77 and prevent its being displaced or moved by the shot blast, I employ a gravitating weight or hold-down element designated by 119 pivotally mounted in a ball-like member 121, which in turn is attached to the upright member 82 by transversely extending pins 122 and 123 (Fig. 9), which arrangement permits ball 121 to be moved upwardly or downwardly while at the same time allowing the weight to swivel or pivot and to take a fair bearing against the upper face of the piston which at that time is resting upon the fixture 77.

A vertically disposed guard plate 68 is secured within the casing to prevent the blasting material passing upwardly into the space between plate 52 and the cover by way of the opening through which arm 105 projects.

A stop member 124 is attached to the front face of the vertically disposed member 82 of the fixture support, which prevents the ball and the hold-down weight 119 from moving downwardly and contacting the fixture 77 should there be no piston thereon.

It is thought that this form of the apparatus will be understood from the foregoing description. It is to be noted, however, that in neither form of the apparatus is there anything placed outwardly of the piston to restrain its expansion, and the shield 15 (Figs. 1, 2 and 3) is merely to prevent contact of shot with the outer face of the piston. It is found, however, that this is not essential nor necessary, if the blast is accurately directed.

Assuming the door 55 has been opened, the air valve will be automatically closed through the operation of the mechanism above described. A piston is then placed upon the fixture and the hold-down weight 119 allowed to come to rest upon the upper end thereof. It will readily accommodate itself by reason of the arrangement above specified, and securely hold the piston in place. The wheel 86 is then rotated until the pawl 91 engages one or the other of the notches 88 or 89, at which time this fact will be indicated by an indicia upon the wheel 86. The door then being closed, the arm or lever 114 is swung inwardly and the valve lever 109 will be released. The operator will then open the valve and according to a predetermined table, allow the shot to blast against the inner face of the piston at one side thereof for a given period of time. This will be worked out in advance and tables supplied with each machine so that an unskilled operator can, by using the proper pressure and employing the proper time interval, expand a piston to the desired degree

When the blast is turned on, the operator by manipulating the wheel 99 causes the fixture support to oscillate and likewise causes the nozzle to swing back and forth toward and from the vertical, with the consequence that the inner face of the piston skirt will be subjected to the desired blast and equally over the area designed to be treated. When one half has been treated, the operator, by merely releasing the pawl 91 through operation of the finger 94, can rotate the fixture support through 180°, at which time the pawl will engage the oncoming notch 88, or 89, and lock the parts together. The blast will continue so long as the valve 108 is held open, but said valve may not be opened except when the door is closed.

The form of the apparatus last described is the preferred form, although as will be readily appreciated, both forms disclose features in common which have been found to be eminently successful in operation.

The fact that the method may be employed with either of the machines and with either a plain piston, a piston of the strut type, or to produce an expansion comparable to cam grinding, shows the adaptability of the method and the machines.

Moreover, the method may also be advantageously employed to reclaim pistons that have been ground or turned undersize as the skirt of the piston is free, diametrically considered, of any mechanical restraint or holding action, and the metal therein may be so worked as to expand the body of the skirt to increase the outside diameter thereof.

Pressure of the fluid medium, hardness of the impacting material carried thereby, time of impaction of such material against the inner face of the piston, and the character of the material of which the piston is formed, are, of course, the factors which have to be taken into consideration. It has been found that #10 steel shot produced the desired effect and, likewise, gave a much smoother appearance to the inside of the piston than where the shot is broken up or impacting material having a broken surface presenting angles is employed; these latter have a tendency to cut.

The projection of a stream or streams of freely

movable disconnected bodies against the inner surface of a piston impacts or compresses the metal uniformly at those parts against which the stream is directed. Hence, a new piston may be treated by the present method and have the metal on the inside of the skirt worked to such an extent as to cause an outward expansion of the skirt, be the skirt thereof continuous or cut.

With an old piston, bodily expansion of the skirt is effected by working the metal therein as a result of the blast of impacting particles, which compresses the metal on the inside of the skirt and serves to lengthen the effective life of such treated piston by reason of the expansive action of the skirt as wear thereof takes place in use. Thus, a piston which has become worn may be re-sized and the metal on the inside worked to such an extent as to compensate for further wear over a considerable period of time, since the inside of the piston is not affected by wear on the outside and the compressed metal on the inner surface will tend to cause an outward movement of the piston skirt.

Where a new uncut piston with its outer surface unrestrained is treated and consequently expanded, it will, moreover, spring outwardly when the usual cut is made in the skirt thereof, and the outer surface of the skirt while expansion thereof is being effected, is free of any mechanical restraint or holding action. As above noted, by varying the time interval and the pressure employed in the blast, the degree of expansion may be regulated to a nicety.

No claim is made herein to the method set forth in this case as the same forms the subject matter of my application Serial No. 753,025, filed November 14, 1934, above referred to, said application having now eventuated in Patent No. 2,032,020, dated February 25, 1936.

What is claimed is:

1. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of any restraint against outward expansion of the skirt thereof; and means for subjecting the inner surface of the skirt in part at least to a bombardment of solid particles, said particles being free and unrestrained.

2. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of any restraint against outward expansion of the skirt thereof; means for subjecting the inner surface of the skirt in part at least to a bombardment of solid particles; and means for securing an oscillation of the piston about its axis.

3. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of any restraint against outward expansion of the skirt thereof; means for subjecting the inner surface of the skirt in part at least to a bombardment of solid particles; and means for moving the bombarding means back and forth axially of the piston.

4. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of any restraint against outward expansion of the skirt thereof; means for subjecting the inner surface of the skirt in part at least to a bombardment of solid particles; and means for effecting a relative movement between the piston and the bombarding means.

5. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of any restraint against outward expansion of the skirt thereof; means for subjecting the inner surface of the skirt in part at least to a bombardment of solid particles; means for oscillating the piston about its axis; and means for moving the bombarding means through a path intersecting the axial movement of the piston.

6. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston upon its open end; means acting to hold the same upon said supporting means; a nozzle for projecting a stream of particles against the inner face of the piston skirt; and means for moving said nozzle to direct the stream of particles toward that portion of the skirt which it is desired to expand.

7. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston upon its open end; means acting to hold the same upon the support; a nozzle for projecting a stream of particles against the inner face of the piston skirt; means for moving said nozzle to direct the stream of particles toward that portion of the skirt which it is desired to expand; and means for oscillating said piston about its axis.

8. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston free of restraint against outward expansion of the skirt thereof; means for subjecting the inner surface of the skirt in part at least to a bombardment of separate solid particles; and means for moving the piston about its axis and the bombarding means transversely of the piston.

9. A structure as set forth in claim 8, wherein the bombarding means partakes of a swinging movement.

10. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston upon its open end; means for maintaining it in such position; means for oscillating the piston about its axis; a nozzle located beneath the open end of the piston for projecting solid particles against the inner face of the piston; and means for swinging said nozzle.

11. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston upon its open end; means for maintaining it in such position; a nozzle for projecting solid particles against the inner face of the piston, said nozzle being mounted for swinging movement beneath the piston; and means for moving the piston about its axis and swinging the nozzle.

12. A structure as set forth in claim 11, wherein the piston is moved simultaneously with the swinging movement of the nozzle.

13. A structure as set forth in claim 11, wherein the means for moving the piston causes it to oscillate about its axis.

14. In a machine for expanding the skirt of a piston, the combination of a support adapted to hold a piston with its open end exposed in a downward direction; means for holding a piston upon said support; means for rotating said support; a nozzle adapted to project a stream of disconnected particles into the open end of the piston and into contact with the inner face thereof; and means for swinging said nozzle.

15. A structure as set forth in claim 14, wherein the actuating means for rotating the piston and for swinging the nozzle are interconnected and work in unison.

16. In a machine for expanding the skirt of a piston, the combination of a support adapted to hold a piston with its open end exposed in a downward direction; means for holding a piston

in position thereon; means for oscillating the piston support about its axis; means under the control of the operator for shifting said support and the piston carried thereby through an arc of 180°; means for maintaining the parts in the thus shifted position; and means for projecting a stream of particles against the inner face of the piston skirt.

17. A structure as set forth in claim 16, wherein the means for maintaining the parts in their shifted position is provided with a finger piece whereby said means may be released by the operator.

18. A structure as set forth in claim 16, wherein the mechanism is enclosed within a casing, and the means for maintaining the parts is provided with a finger piece which extends outwardly of the casing through a slot or opening formed therein.

19. A structure as set forth in claim 16, wherein the means for projecting a stream of particles against the inner face of the piston skirt comprises a nozzle mounted for swinging movement in line with the open end of the piston skirt, together with interconnections between said nozzle and the oscillating means for the piston support.

20. In a machine for expanding the skirt of a piston, the combination of a support adapted to hold a piston with its open end exposed in a downward direction; means for maintaining a piston upon such support; means for oscillating said support and the piston carried thereby about their common axis; a nozzle mounted for swinging movement below the open end of the piston, said nozzle being adapted to project a stream of particles into the piston and against the inner face thereof; and means cooperating with the oscillating means aforesaid for rocking said nozzle.

21. A structure as set forth in claim 20, wherein the means for oscillating the piston comprises a driven gear; a pitman extending therefrom and connected to the piston supporting means at its opposite end; and means also cooperating with the gear aforesaid for swinging the nozzle.

22. In a machine for expanding the skirt of a piston, the combination of a support adapted to hold a piston with its open end exposed in a downward direction; manually controlled means for shifting said support through 180°; means for locking said support in one or another of such positions; means for oscillating said support and the piston mounted thereon about their common axis; a nozzle mounted below the open end of the piston and adapted to project a stream of particles against the inner face of the piston skirt to expand the same; and means for swinging said nozzle back and forth to vary the direction of the stream of particles up and down within the skirt.

23. In a machine for expanding the skirt of a piston, the combination of means for supporting a piston; a nozzle adapted to project a stream of particles under the action of fluid pressure into said skirt; a valve controlling the flow of said fluid pressure to the nozzle; an enclosing casing; a handle for opening the valve, said handle extending outwardly of the casing; a door for closing an opening in the casing through which a piston may be introduced; means cooperative with the door to lock the valve in its closed position when the door is open and to permit the valve to be actuated by the handle aforesaid when the door is closed; and means for normally urging the valve to its closed and locked position.

24. In a machine for expanding the skirt of a piston, the combination of a support adapted to hold a piston with its open end exposed in a downward direction, said support including in its structure a vertically disposed bar; and means for maintaining a piston upon the support, said means comprising a weighted lever, one end of which is loosely interrelated with the bar aforesaid, whereby the weight may accommodate itself to pistons of different height.

25. A structure as set forth in claim 24, wherein the weight is pivoted to the lever and may, by reason of such pivotal connection, find a fair bearing upon the upper face of the piston.

26. In an apparatus for expanding pistons, the combination of a base upon which the piston to be treated is supported; means for maintaining the piston in place thereon; and means for projecting solid disconnected loose particles under pressure against the inner face of the piston through the open end thereof.

27. A structure as set forth in claim 26, wherein means is provided for protecting the bearing or working faces of the piston against the impact of the projected particles.

28. In an apparatus for expanding pistons, the combination of a base having a series of annular seats formed upon the upper face thereof adapted to receive the edge of a piston skirt; means to hold a piston thereon; and a blast pipe extending through the base and into the piston, said pipe serving by the action of the blast therein to project solid particles fed thereto against the inner face of the piston.

29. A structure as set forth in claim 28, wherein guard plates extend upwardly from the base and close the inner ends of the piston pin bosses of the piston.

30. In an apparatus for expanding pistons, the combination of a base upon which the piston to be treated is supported; means for maintaining a piston in place thereon; a pair of guard plates supported upon the base and movable toward and from each other, said plates extending upwardly within a piston secured upon the base and closing the inner ends of the piston pin bosses of the piston; and means located between said plates for projecting solid particles against the inner face of the piston.

31. In an apparatus for expanding pistons, the combination of a base upon which the piston to be treated is supported; a swinging bail connected thereto; means carried by the bail and coacting therewith and with the piston mounted upon the base for holding such piston upon the base; means for projecting solid particles against the inner face of the piston so supported; and means for protecting the bearing or working faces of the piston against the impact of the projected particles.

32. In an apparatus for expanding pistons, the combination of a base upon which the piston to be treated is supported; means for maintaining the same thereon; means for projecting solid particles against the inner face of the piston; and a sleeve loosely surrounding the piston and serving to prevent the outward passage of the projected particles through openings which may be present in the body of the piston.

EMIL A. KOETHER.

May 19, 1936. E. A. KOETHER 2,041,355

APPARATUS FOR EXPANDING PISTONS

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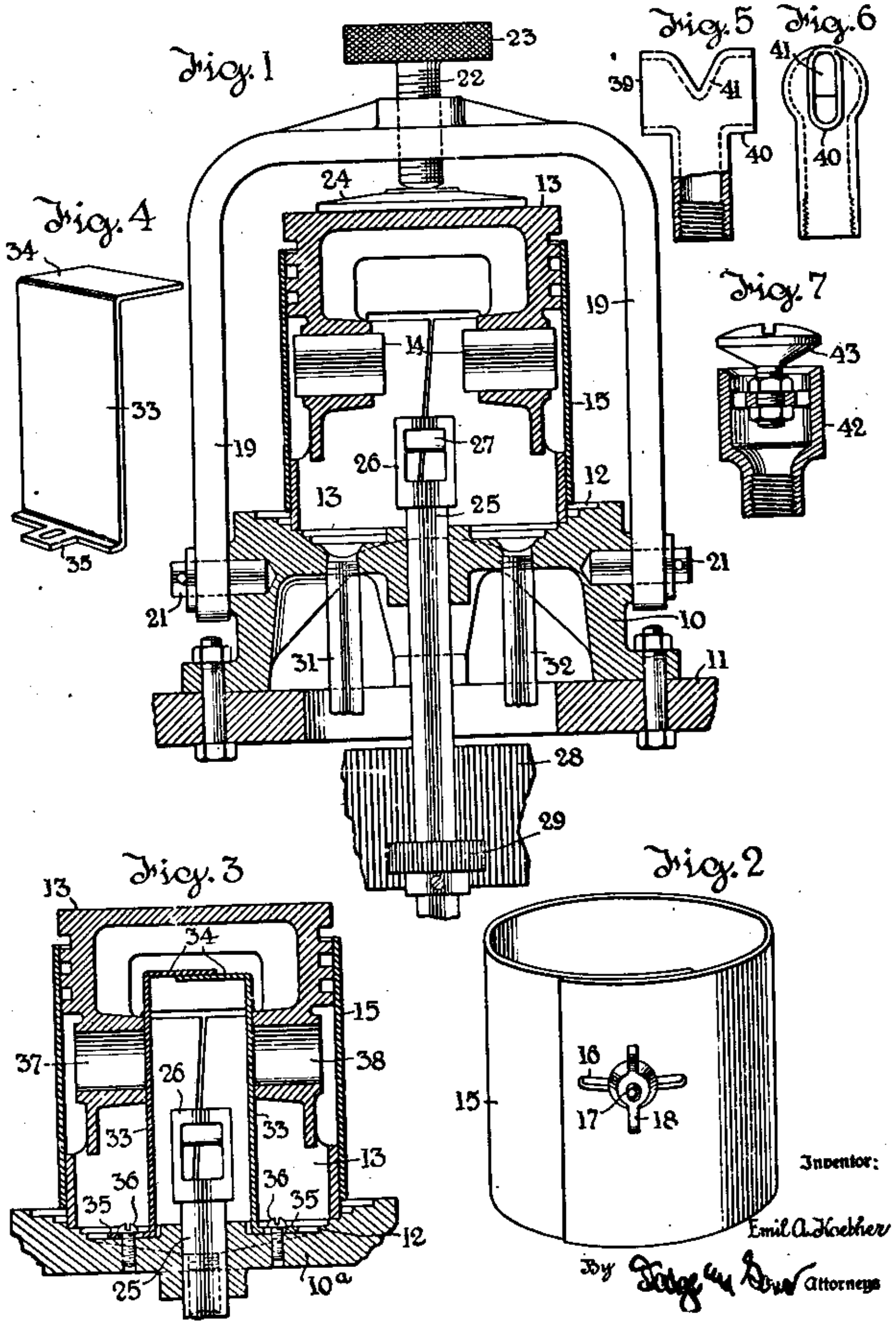

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Fig. 8

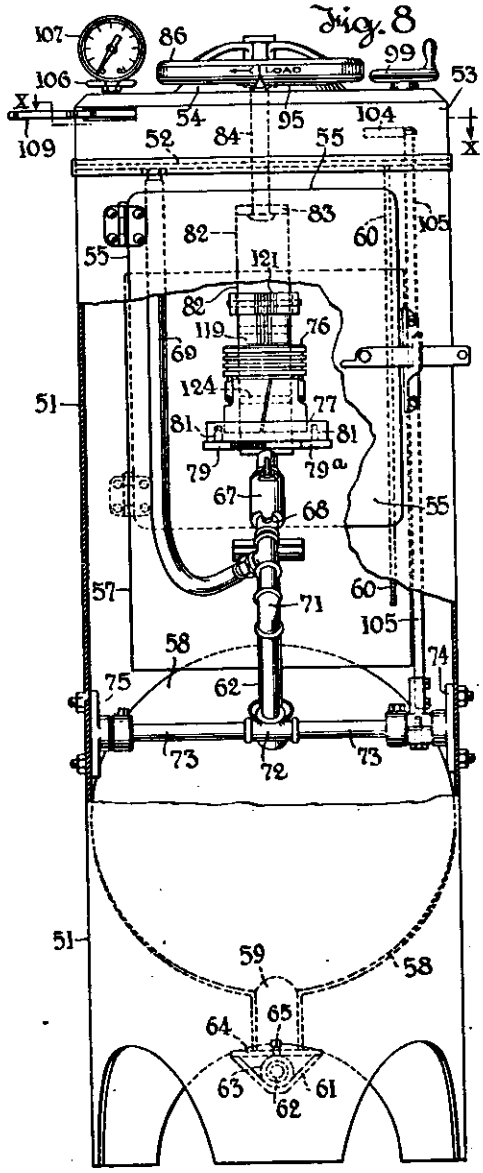

Fig. 9

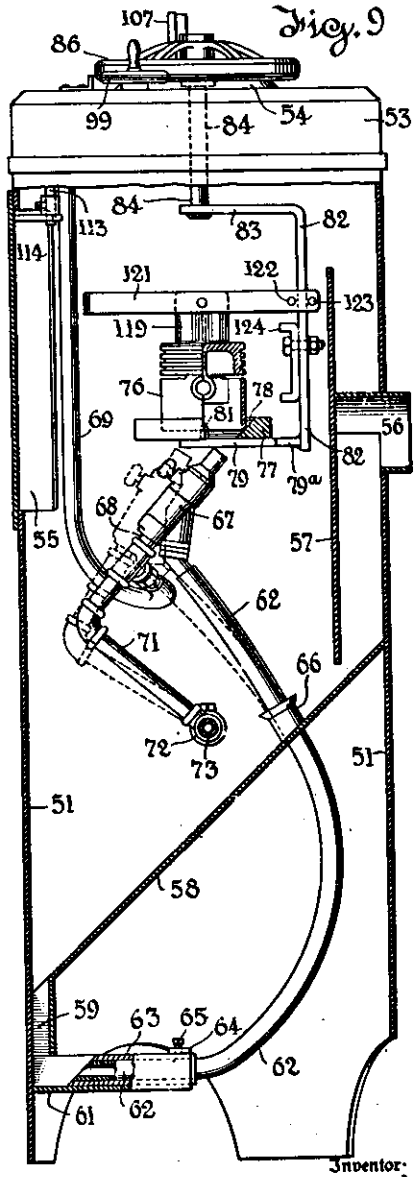

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Fig. 10

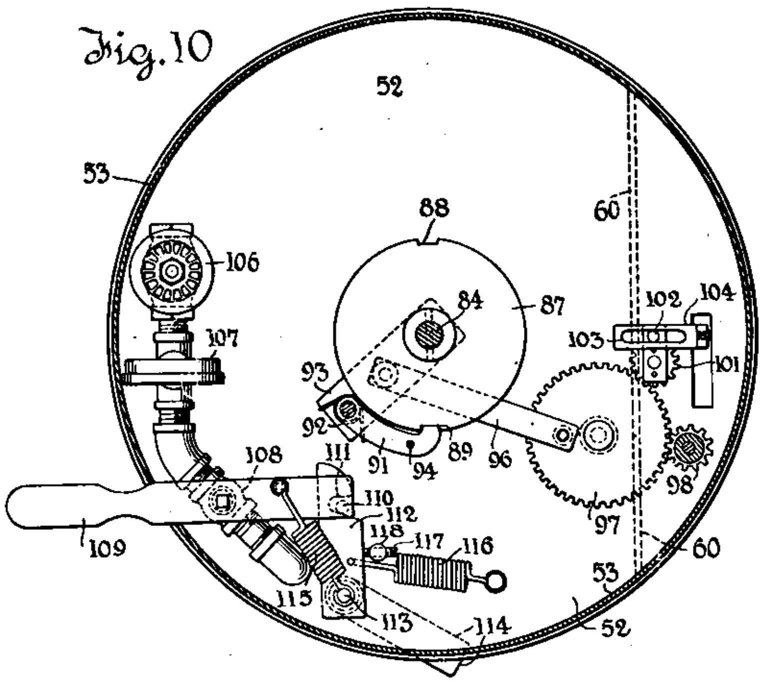
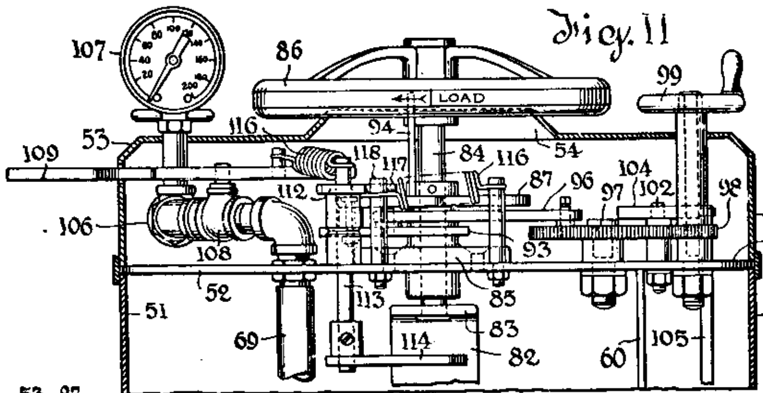


Fig. 11



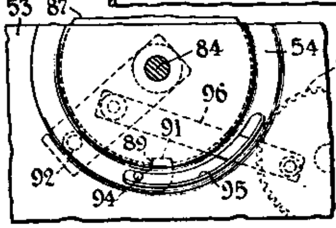


Fig. 12

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