May 8, 1934. W. J. SIX 1,958,154

PISTON EXPANSION MEANS

Filed Feb. 17, 1932

FIG. 1

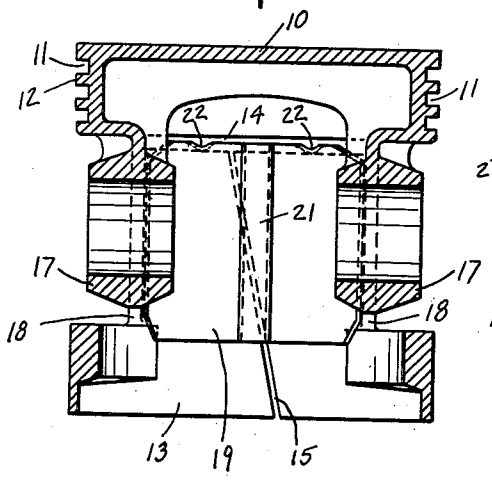


FIG. 2

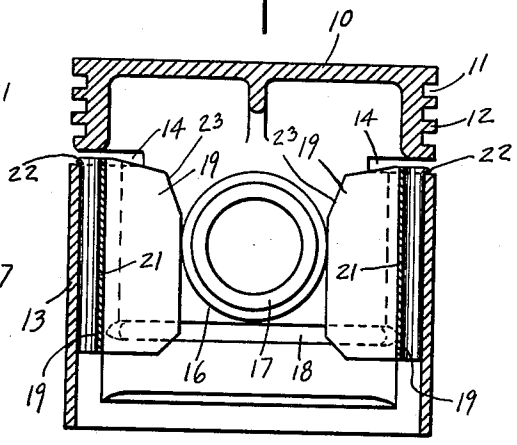


FIG. 3

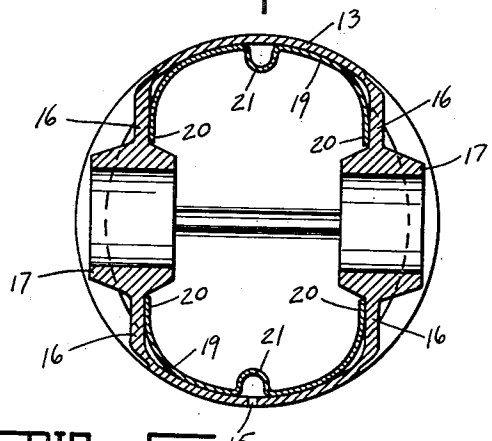


FIG. 4

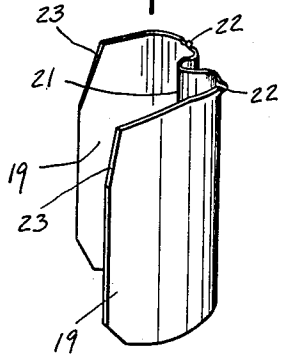
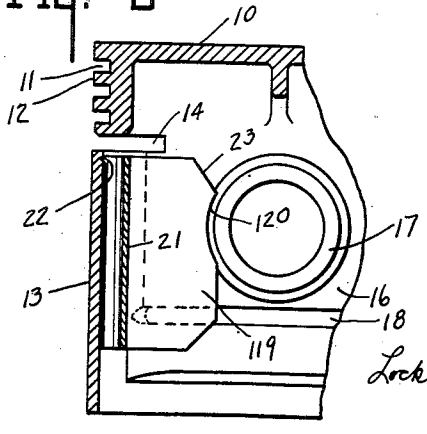


FIG. 5



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PISTON EXPANSION MEANS

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27 Claims. (Cl. 309—12)

This invention relates to expanding means for skirts of pistons adapted for use in engines, such as internal combustion engines, compression engines, steam engines and the like.

It is usual to provide such pistons with a head and a skirt which is partially or wholly separated from the head by a circumferential opening or openings. The lands between the ring grooves on the head are usually made slightly smaller in diameter than the diameter of the skirt which is formed initially to closely fit the interior of the cylinder. The skirt, particularly when formed of aluminum or smilar metal, is usually slotted longitudinally to permit the skirt to expand and contract so that it will closely follow the cylinder wall. However, due to wear of the cylinder and the piston this closeness of fit between the skirt and the cylinder wall is soon destroyed with the attendant results of "piston slap", undue leakage of the oil past the piston rings, and decreased efficiency of the engine. In order to overcome these defects without reboring the cylinders or replacing the pistons, it has been heretofore suggested that spring means of some sort within the skirt be provided to expand the skirt. So far as I am aware the various schemes heretofore suggested for expanding piston skirts have not proven practical or commercially successful.

The principal object of my invention is to provide an improved and simple expander which exerts an expansive action substantially throughout the length of the skirt while permitting the skirt to contract when necessary in operation, and thereby attain a more perfect fit between the worn skirt and the cylinder wall than has been possible heretofore.

Another object of the invention is to provide an expander which exerts an expanding force in all four cardinal directions.

One feature of my invention resides in providing a leaf spring expander adapted to be compressed in a worn piston to exert lateral forces in the direction of the axis of the piston pin and also substantially at right angles thereto. More particularly, the expander has a curved expansion portion or fold forming an intermediate recess or groove lying adjacent the longitudinal slot in the piston skirt.

Another feature of the invention resides in interlocking the expander with a suitable projection carried within the piston such as the bosses. One arrangement consists primarily in providing a semi-cylindrical or arcuate shell having its free ends so arranged as to engage with the sides of the piston pin bosses extending within the skirt of the piston, while the intermediate structure engages and presses against that portion of the piston skirt intermediate the bosses, and preferably adjacent its split side. Thus, the expander is firmly wedged and held in place between the bosses and intermediate portion of the skirt whereby it will not only be supported or locked in place but will exert a yielding pressure between the bosses and skirt tending to expand the latter. In another form, the opposing ends of the shell may be formed with a concave recess partially embracing the bosses for positioning and holding it in place.

Other objects and the full nature of the invention will be understood from the accompanying drawing and the following description and claims:

Fig. 1 is a vertical central sectional view through a piston having inserted therein an expander according to the present invention. The said view is taken on the center line of the piston pin bosses. Fig. 2 is a vertical central sectional view through the piston and expander taken at right angles to Fig. 1. Fig. 3 is a horizontal sectional view taken through the piston and expander on the center line of the piston pin bosses. Fig. 4 is a perspective view of one of the expanders removed from the piston. Fig. 5 is a partial view of that shown in Fig. 2 disclosing a modified form.

In the drawing, a piston is shown having the usual piston head 10, ring grooves 11, lands 12 and skirt 13. Immediately beneath the piston ring grooves there are cut a pair of slotted openings 14 which extend partly around the circumference of the piston and serve to increase the flexibility of the skirt. The skirt 13 is split by a slightly diagonal, but substantially vertical cut 15 extending from the bottom of the piston into one of the slotted openings 14. If desired, the skirt may be similarly split at both sides. However, a single split is usually found sufficient. The skirt 13 carries webs 16 which support the projections formed by the piston pin bosses 17. A slotted opening 18 beneath each of the webs separates the same from the lower portion of the skirt.

The expander in its preferred embodiment of the invention is in the form of a pair of substantially semi-cylindrical shells 19 formed of spring steel or other suitable resilient material. The expander shells 19 are inserted in the piston in opposed relation to each other, as best shown in Figure 3. The initial shape of the expander shells is such that when inserted with their edges 20 abutting against the piston pin bosses 17, the said

shells exert an outward pressure against the web 16 in a direction substantially parallel to the axes of the piston pin bosses and exert an outward pressure at right angles to this direction at a point intermediate the said edges. By this means, the expander shells together exert their outward pressure in each of the four cardinal directions and they, therefore, provide a uniform expansion of the skirt of the piston by means of which the piston conforms closely to the interior of the cylinder.

Each of the expander shells 19 is provided with a vertical expansion structure or formation as in the fold 21 at a point intermediate its edges, the fold forming a longitudinal recess or groove which partially spans the longitudinal slot in the skirt. The said fold serves to increase the resiliency of the expander. Each expander shell is also provided with small lugs 22 which engage the slotted opening 14 to prevent longitudinal movement of the expander in the piston. The upper corners of each shell are beveled as shown at 23 to facilitate entrance of the expander into the piston.

From the foregoing description, it will be seen that the expander exerts its outward pressure in a plane through the piston pin bosses and for a substantial distance either side of said plane. Thus substantially the entire skirt is expanded to fit the cylinder. Since the pressure is exerted in all four of the cardinal directions, the piston skirt will also fit cylinders which are slightly out of round. It will also be seen that an expanding force is exerted immediately beneath the slotted opening 14. This is particularly important since the upper part of a cylinder is usually worn to a larger diameter than the lower part and since a loose fit at this point produces a greater tendency to slap than at any other point in the piston.

While the foregoing description represents a preferred form of the invention, minor variations in the structure may be made without departing from the scope of the invention as defined by the appended claims. For example, it is not necessary that the ends abut against the piston pin bosses. While it is preferred that the expander be compressed between the bosses or associated portion of the skirt, yet the ends of the shells may abut against any other suitable projection carried within the skirt of the piston. It is understood, of course, that I have shown the expander adapted for use in a particular form of piston for illustration purposes only, the invention being equally susceptible of use in any other type of split-skirt piston.

As shown in the modified form, the expander 119 is provided with concave edges 120 so formed as to partially embrace the inner surface of the wrist pin boss, fit snugly into place with respect thereto and provide an interlocking connection with the piston.

The invention claimed is:

1. In combination with a piston having a split skirt carrying interior projections, an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston with the edges thereof engaging said projections and the outer surface thereof engaging the interior of the piston for exerting an outward pressure to expand said skirt, and an expansion fold intermediate its lateral edges.

2. In combination with a piston having a split skirt and piston pin bosses carried thereby, of an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston with the edges thereof engaging said bosses and the outer surface thereof engaging the interior of the piston for exerting an outward pressure to expand said skirt, and an expansion fold intermediate its lateral edges.

3. In combination with a piston having a split skirt and piston pin bosses carried thereby, of an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston with the edges thereof engaging said bosses and the outer surfaces thereof engaging the interior of the piston for exerting an outward pressure to expand said skirt, the engagement of the outer surface of the expander shell and the interior of the piston occurring adjacent the edges of said shell, and an expansion fold intermediate its lateral edges extending inwardly throughout the entire width thereof.

4. In combination with a piston having a split skirt carrying interior projections, an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston with the edges thereof engaging said projections and the outer surface thereof engaging the interior of the piston for exerting an outward pressure to expand said skirt, and an expansion fold intermediate its lateral edges extending inwardly throughout the entire width thereof.

5. In combination with a piston having ring grooves, a split skirt beneath said grooves and a slotted opening between said grooves and skirt extending part way around the circumference of said piston, said skirt carrying interior projections, an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston with the edges thereof engaging said projections and the outer surface thereof engaging the interior of the piston for exerting an outward pressure to expand said skirt, and lugs formed thereon engaging in said slotted opening to prevent longitudinal movement of said expander in said piston.

6. In combination with a piston having ring grooves, and a split skirt beneath said grooves carrying interior projections, an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston, and concave portions formed on the opposite edges thereof for partially embracing said projections for interlocking the expander with the piston, the intermediate surface of said expander bearing against the adjacent portion of the skirt under spring tension for causing expansion thereof.

7. In combination with a piston having ring grooves, and a split skirt beneath said grooves carrying interior projections, an expander in the form of a substantially semi-cylindrical shell of resilient metal inserted in said piston, and concave portions formed on the opposite edges thereof for partially embracing said projections for interlocking the expander with the piston, and an expansion fold formed in the said expander and extending from the bottom to the top thereof, the intermediate surface of said expander bearing against the adjacent portion of the skirt under spring tension for causing expansion thereof.

8. In combination with a piston having a head, and a skirt provided with a substantially longitudinal slot, of a leaf spring expander mounted within said skirt, the said expander having an expansion formation embodying a closed longitudinal recess with portions on either side thereof engaging the piston skirt adjacent and longitudinally of the slot for yieldingly exerting an expanding pressure thereon.

9. In combination with a piston having a head, and a skirt provided with a substantially longitudinal slot, of a spring expander sprung into position within said skirt and bearing against the inner surface thereof under spring tension, and a substantially longitudinal inwardly extending expansion formation formed in said expander embracing a portion of said slot to permit said expander to automatically yield under pressure.

10. In combination with a piston having a head, a skirt provided with a substantially longitudinal slot and piston pin boss portions, of a leaf spring expander sprung into position in said skirt, the said expander having portions pressing firmly against the boss portions and having intermediate portions engaging the skirt, and an expansion formation in the expander comprising a substantially transverse trough whereby said expander may yield under pressure.

11. In combination with a piston having a head, a skirt provided with a substantially longitudinal slot and piston pin boss portions, of a spring expander sprung into position in said skirt, the said expander abutting the boss portions and having portions intermediate said boss portions engaging the skirt, and an expansion formation embodying a closed recess whereby said expander is rendered yielding under pressure.

12. In combination with a piston having a head, a skirt provided with a substantially longitudinal slot and piston pin boss portions, of a spring expander sprung into position in said skirt, the said expander having portions pressing firmly against the boss portions and an intermediate portion engaging the skirt, said expander being provided with an expansion formation whereby said expander may yield under pressure.

13. A piston comprising wrist pin bosses, a split skirt, and a readily detachable expander, said expander being provided with resilient portions and being held in position within said skirt on one side of a vertical plane passing through the centers of said bosses by simultaneously exerting pressure on exterior surfaces of said bosses and the interior surfaces of said skirt, and having formations contacting said skirt on each side of and adjacent said slot for radially expanding said skirt.

14. In combination, a piston comprising a head, a skirt a longitudinally extending slot in said skirt, and pin bosses projecting inwardly from said skirt; and an expander for said piston, said expander being provided with resilient portions and being held in position by pressurally engaging the side surfaces of said bosses and engaging said skirt at spaced points on opposite sides of and adjacent said split for expanding said skirt.

15. In combination with a piston having a head, and a skirt provided with a substantially longitudinal slot, of a spring expander sprung into position within said skirt and bearing against the inner surface thereof under spring tension, and an inwardly extending expansion formation in said expander extending throughout the width thereof to permit said expander to automatically yield under pressure.

16. In combination with a piston having a head, piston pin boss portions, and a split skirt, of a spring expander sprung into position within said skirt and bearing firmly against said boss portions, and an expansion formation in the intermediate portions of said expander, the outer surfaces of said expander adjacent said formation engaging the inside surface of said skirt for exerting an outwardly expanding pressure.

17. The combination with a piston having a head, a skirt provided with a substantially longitudinal slot, and piston pin boss portions, of a leaf spring expander sprung within said skirt, a portion of said expander engaging the boss portions of the piston for exerting pressure thereagainst, and an intermediate portion of said expander engaging said skirt intermediate the boss portions, said expander having an expansion formation in said intermediate portion extending transversely of said expander.

18. The combination with a piston having a head, a skirt with a substantially longitudinal slot, and piston pin boss portions, of an expander for said piston including a pair of oppositely disposed arcuate shells sprung into said skirt, portions of said shells engaging the boss portions, and an intermediate portion in each of said shells engaging said skirt, each of said shells having an inwardly extending expansion formation in said skirt engaging portion for expanding said skirt.

19. In combination with a piston having a head, a skirt with a substantially longitudinal slot, and piston pin bosses, of an expander for said piston including an arcuate shell disposed between the bosses and intermediate portion of the skirt with its ends abutting and pressing firmly against the sides of said bosses, said shell having an inwardly extending expansion formation intermediate the ends thereof for causing a yielding expanding pressure to be exerted by the expander on said skirt.

20. In combination with a piston having a head, a skirt with a substantially longitudinal slot, and piston pin bosses, of an expander for said piston including an arcuate shell disposed between the bosses and intermediate portions of the skirt, said shell having its end edges provided with curved recesses partially embracing and abutting against the side walls of the piston pin bosses, said shell having an expansion formation intermediate the ends thereof.

21. In combination with a piston having a head, a skirt provided with a slot and piston pin bosses, of an expander formed of a leaf spring wider than the diameter of the bosses and sprung into position therebetween, said expander being in contact with the skirt adjacent the slot with such contact extending both above and below said bosses.

22. In combination with a piston having a head, a skirt provided with a substantially longitudinal slot and piston pin bosses, of an expander formed of a leaf spring wider than the diameter of the bosses and sprung into position therebetween, said expander being in contact with the skirt adjacent the slot, and means whereby said expander is rendered yielding under pressure.

23. A piston comprising wrist pin bosses, a split skirt, and a resilient detachable expander, said expander having portions engaging exterior side surfaces of said bosses and other portions contacting interior surfaces of said skirt on each side of said slot, and said expander being provided with means causing pressure to be simultaneously exerted on said surfaces of said bosses and skirt.

24. As an article of manufacture, an expander for expanding a slotted piston skirt, said expander being resilient and provided with end

portions adapted to be positioned between the bosses of a piston with its end portions contacting the external side surfaces of said bosses, and being provided with other portions adapted to span said slot and contact the interior walls of said skirt, and also being provided with means to cause the same to remain in position of use solely by spring tension.

25. The combination of an expansible piston comprising a head, oppositely disposed wrist pin bosses, and a skirt partially severed from said head having a longitudinal split intermediate said bosses; and a resilient detachable piston skirt expander, said expander being disposed in said piston intermediate said bosses on the split side of said skirt and having portions engaging the exterior side surfaces of said bosses and other portions engaging the interior surface of said skirt on opposite sides of and adjacent said split to expand said skirt.

26. As an article of manufacture, an expander for expanding a piston having a skirt provided with a pair of pin bosses and a longitudinal slot intermediate said bosses, said expander being resilient and adapted to be positioned between said bosses on the slotted side of said piston, and said expander having portions adapted to engage the external side surfaces of said bosses, and being provided with other portions adapted to contact the interior walls of said skirt adjacent said slot.

27. As an article of manufacture, a one-piece expander, for expanding a piston having a skirt provided with a pair of pin bosses and a longitudinal slot intermediate said bosses, said expander being inherently resilient and adapted to be sprung into position intermediate said bosses on the slotted side of said piston, and said expander having portions adapted to engage the side surfaces of said bosses and other portions for engaging the interior surface of said skirt adjacent said slot.

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