April 2, 1940. A. M. ALEXANDRESCU 2,195,552

HEAVY DUTY PISTON

Original Filed July 23, 1937 3 Sheets-Sheet 1

Fig. 2.

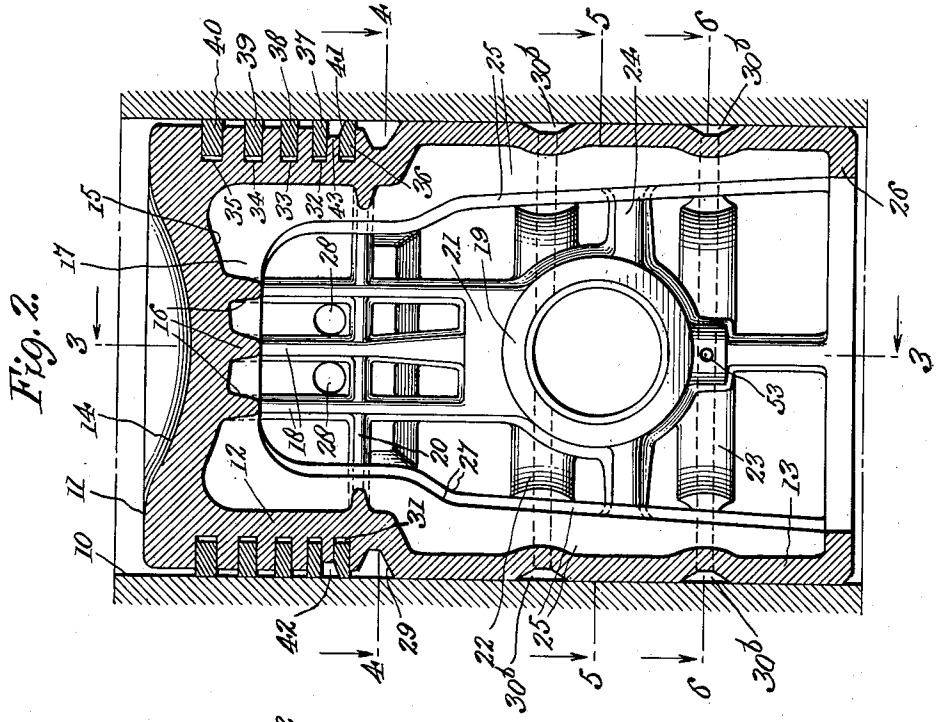
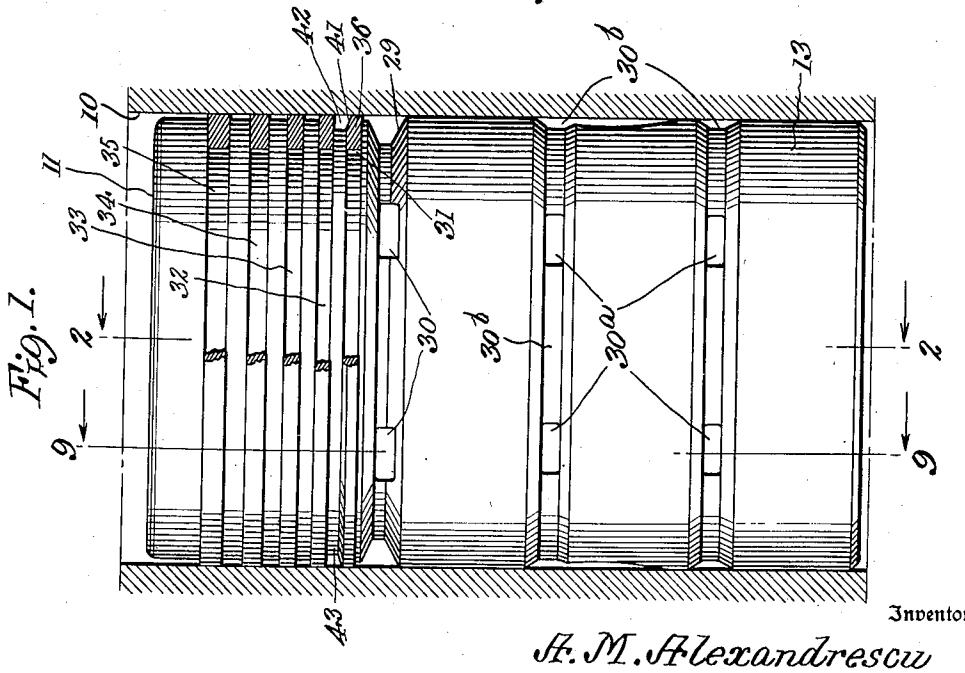


Fig. 1.



Inventor

A. M. Alexandrescu

By

Wilkinson & Mawhinney

Attorneys.

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Fig. 3.

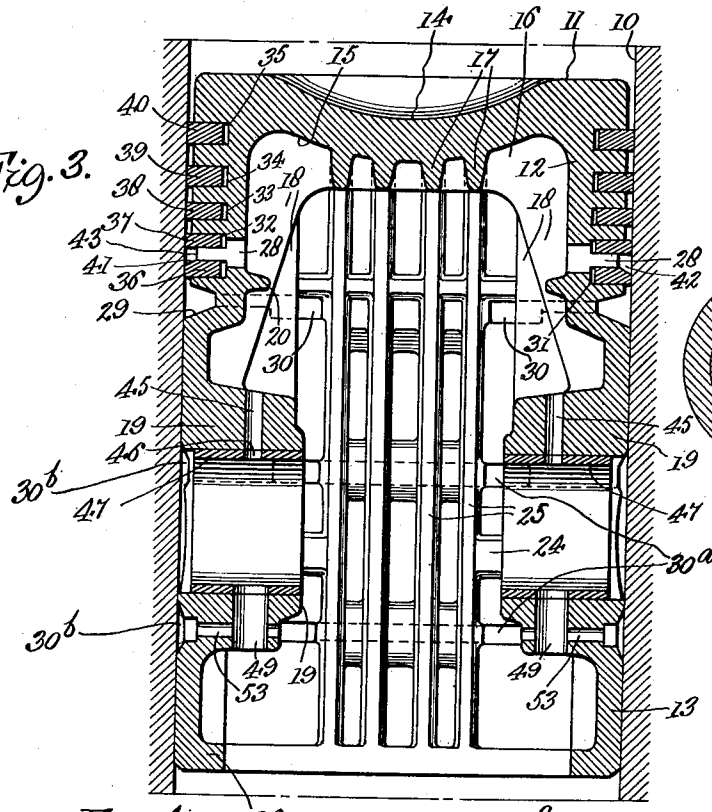


Fig. 8.

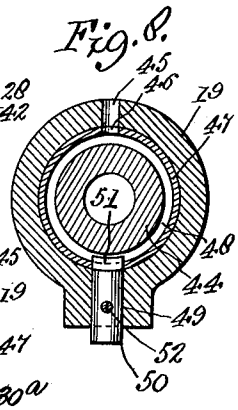


Fig. 4.

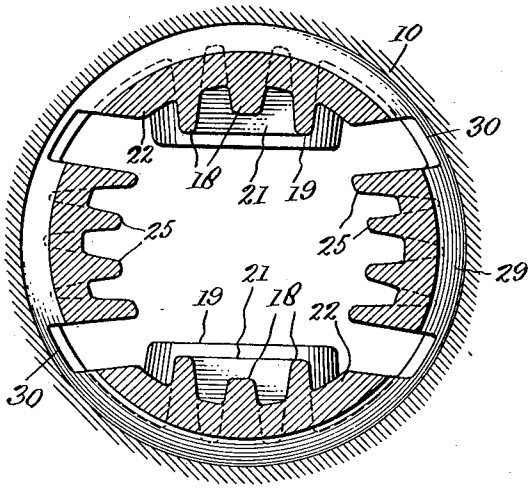
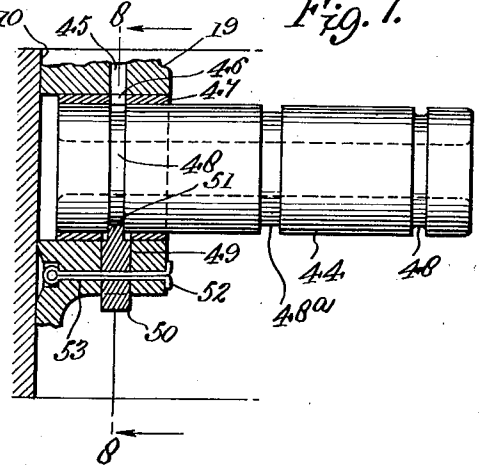


Fig. 7.



Inventor

A. M. Alexandrescu

By Wilkinson & Mawhinney

Attorneys.

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HEAVY DUTY PISTON

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Fig. 5.

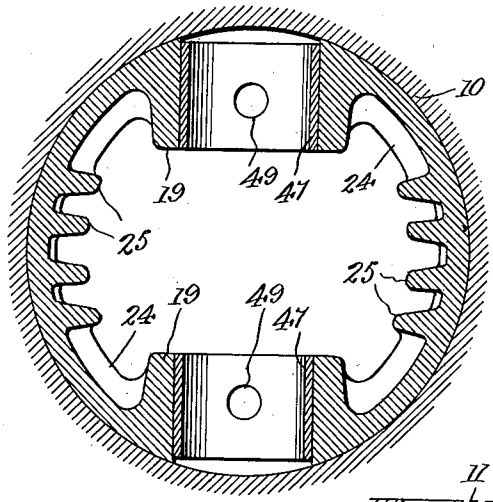


Fig. 6.

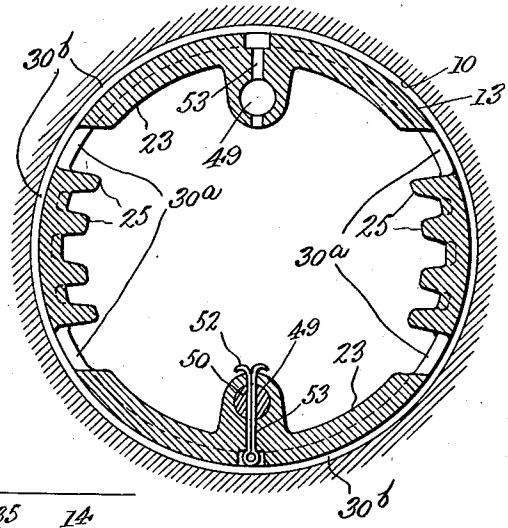
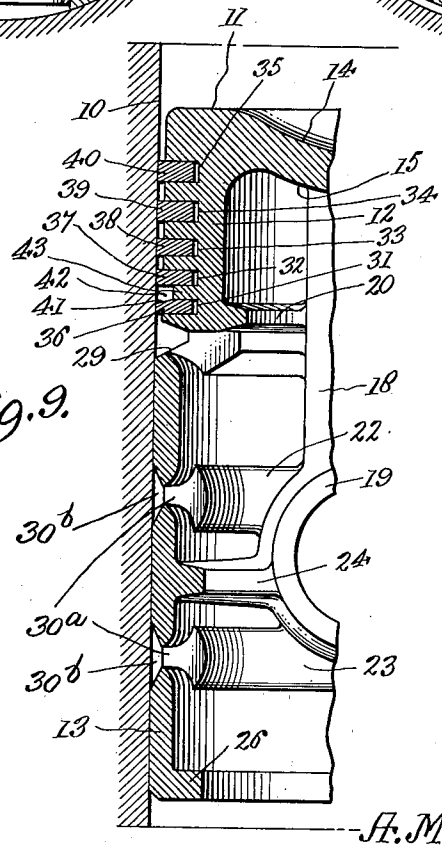


Fig. 9.



Inventor

A. M. Alexandrescu

By

Wilkinson & Mawhinney

Attorneys.

Patented Apr. 2, 1940 2,195,552

UNITED STATES PATENT OFFICE

2,195,552

HEAVY DUTY PISTON

Alexander M. Alexandrescu, Cleveland, Ohio

Application July 23, 1937, Serial No. 155,310
Renewed February 5, 1940

3 Claims. (Cl. 309—7)

The present invention relates to improvements in heavy duty pistons for internal combustion, Deisel and other engines, and is a continuation in part of my Patent No. 2,110,316, March 8, 1938, entitled "Pistons for internal combustion engines," and my copending application filed April 29, 1936, Serial No. 77,036, entitled "Piston and ring construction."

An object of the invention is to provide a piston having ribs therein subserving two functions: first, to reinforce and strengthen the piston, its ring column, head and skirt; and secondly, to transfer and dissipate the heat rapidly from the shell or wall and top of the piston, to the end that neither the piston, nor the engine generally, will become overheated or heated beyond desirable working temperature; thereby effecting economy in the operation of such engines accompanied by conservation of the life of the working parts of the engine.

Another object of the invention is to provide the ribs in continuity from the top of the piston down the side wall thereof and down to the bottom open portion of the piston whereby to carry off the heat as rapidly as possible and as uniformly as practicable, avoiding any sharp rises or declines in temperature in the piston wall or top.

A further object of the invention is to provide, by the use of the ribs, for additional strength within the hollow piston at the diametrically opposite points requiring such strength, namely at right angles to the axis of the wrist pin. It is understood that there is a tendency of the piston to slap in a plane at substantially right angles to the wrist pin owing to the action of the connecting rod upon the wrist pin. This portion of the piston tends to greatest wear and to greatest distortion and it is a purpose of the invention to reinforce and strengthen the piston particularly and peculiarly at these points in order that such distortion may be minimized.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views.

Figure 1 is a front elevation of an improved heavy duty piston constructed in accordance with the present invention and with parts shown broken away and in section.

Figure 2 is a vertical section taken on the line 2—2 in Figure 1.

Figure 3 is a vertical section taken at right angles to Figure 2 on the line 3—3 thereof.

Figure 4 is a horizontal section taken on the line 4—4 in Figure 2.

Figure 5 is a similar section taken on the line 5—5 in Figure 2.

Figure 6 is also a horizontal section taken on the line 6—6, likewise in Figure 2.

Figure 7 is a fragmentary enlarged vertical section taken through one boss of the piston and showing the wrist pin and its method of connection to the boss.

Figure 8 is a vertical section taken on the line 8—8 in Figure 7, and

Figure 9 is a vertical section taken on the line 9—9 in Figure 1.

Referring more particularly to the drawings, 10 designates generally a cylinder in which the improved heavy duty piston reciprocates. The top of the piston is designated generally at 11, the ring column at 12 and the piston skirt at 13. In the top of the piston there may be a cavity 14 exposed on its upper side for two purposes. This cavity increases the size of the compression and combustion chambers. It also increases the length of the top wall 11 of the piston owing to the fact that, in the production of this cavity 14, the top wall 11 is made partly spherical with its underside 15 presenting a convex surface. The greater the length, or the greater the area or the greater the amount of material in the top wall 11, the greater will be the capacity of this top wall to absorb and carry off heat unit from the piston and from the engine generally. While the invention derives great benefit from the use of such a spherical or curved piston wall 11, particularly in combination with the ribs as hereinafter described, this particular form of top wall is not essential to the invention.

The convex lower side 15 of the top wall is intersected by groups of ribs 16 and 17. In Figure 2 the group 16 of ribs is shown to comprise three such ribs spaced apart from one another an appreciable distance and spaced appreciably from the side walls of the ring column 12 at right angles to the axis of the wrist pin.

Looking at Figure 3 it will be seen that these ribs 16 extend from one side of the piston to the other and that at their ends they join with substantially vertical ribs 18. These vertical ribs have their outer edges preferably cast in one piece with the ring column. At their lower ends these vertical ribs 18 merge with bosses 19 in which the wrist pin is journaled.

Returning to Figure 2 it will be seen that

these vertical ribs 18 are intersected by a horizontal annular rib 20. At the points of intersection the vertical ribs 18 are joined with the horizontal annular rib 20 thus making for a strong construction and also adding considerable densities of metal which will absorb the heat and transmit the same both downwardly through the vertical ribs 18 and about the piston through the horizontal annular rib 20. At their lower portions the vertical ribs 18 are all merged with solid blocks 21, which in turn are directly merged with the bosses 19. As shown in Figure 2 the blocks 21 and the bosses 19 are both merged with conduction bands 22 extending horizontally for distances around the circumference of the skirt 13.

Similar bands 23 extend about the lower portion of the skirt 13. These bands 23 like the bands 22 may be two in number as shown in Figure 6 and they extend part-way around the piston at the end portions of the wrist pin. The bands 23 are at the lower side of the bosses 19; whereas the bands 22 are at the upper side of such bosses.

As shown in Figures 2 and 5 there are intermediate fins 24 extending in opposite circumferential directions from middle portions of the bosses 19. These fins, as shown in Figure 2, are spaced below the bands 22 and spaced above the bands 23. Thus there is ample space between the various conducting parts to permit of the rapid conductivity of the heat from off the metal into the surrounding atmosphere.

The fins 24 give reinforcement and strength to the skirt and they connect the bosses 19 with the ribs 25 as shown in Figure 5. The vertical ribs 25 extend the full height of the piston and skirt and are cast in one with such piston parts. The bands 22 and 23 end in spaced relation from the vertical ribs 25 leaving a hollow space, which, when machined creates oil channels opening through the piston permitting the passage of lubricant to the walls of the cylinder and skirt. (See Figures 6 and 9.) These vertical ribs 25 merge at their upper ends with the end portions of the group 17 of horizontal ribs which pass across beneath the piston top 11. If at this point attention is directed to Figure 3, it will be seen that the group of four ribs 17 which pass across horizontally beneath the piston top are in alignment with the group of four vertical ribs 25, and that these four vertical ribs 25 pass downwardly all the way from the top 11 of the piston to the very bottom thereof. The lower ends of the vertical ribs 25 merge with the inturned flange 26 at the bottom of the skirt and thus the lower ends of such vertical ribs 25 are reinforced horizontally, kept from spreading and united in a manner which will add desirable rigidity to the lower portion of the piston skirt; while at the same time providing adequate areas for the conduction of the heat away into the crank case space.

By an examination of Figure 2 the vertical ribs 25 will be seen to preferably taper from relatively great width at the top corner portions of the piston down to the lower inturned flange 26, there being preferably stepped portions 27 in the vertical ribs 25 to accord with the differential thickness of the ring column and skirt, the ribs being of greater radial width above the skirt than below same.

As shown in Figure 3 the horizontal annular rib 20 also intersects the vertical ribs 25. This horizontal annular rib 20 is placed at a favorable point in the height of the piston to subserve two functions, beside the normal function of reinforcing and strengthening the piston and acting to carry away the heat units therefrom. By an examination of Figure 3 it is seen that the horizontal annular rib 20 is disposed just below the pairs of diametrically opposite openings 28 made through the ring column and opening through the inner and outer walls of such ring column. The horizontal annular rib 20 is also spaced directly above the external annular groove 29 which acts as a reservoir for the oil scraped from the cylinder wall by the action of the rings. As shown in Figures 1, 3 and 4 particularly, the annular groove 29 communicates with the interior space of the piston through a number of ports 30. Such ports 30 are shown to be four in number in Figure 4 and to be located at the sides of the groups of four vertical ribs 25. The ports 30 are for the purpose of allowing excess quantities of oil in the groove 29 to escape into the interior of the piston and to drop down into the crank case without any interference from the internal horizontal annular rib 20. However, this internal annular horizontal rib 20 will prevent the splash from the cranks operating in the crank case below from working abnormal quantities of oil through the openings 28.

The openings 28 communicate with the inner or base portions of the oil ring groove 31 and with the first ring groove 32 above it. The other ring grooves are shown to be three in number and are designated 33, 34 and 35 from bottom to top in the order named. The oil ring is designated at 36, the first compression ring at 37 and the remaining compression rings at 38, 39 and 40.

As shown more particularly in Figures 2, 3 and 9, the upper outer corner portion of the oil ring 36 is beveled as indicated at 41 in order to diminish the bearing surface of the outer edge of the ring upon the cylinder wall whereby to avoid the effect of the rocking of this ring upon such cylinder wall. The beveled part 41 also increases the annular chamber 42 formed between the oil ring 36 and the first compression ring 37. This chamber 42 has considerable radial extent by reason of the fact that the segment 43 of the ring column between the oil ring 36 and the first compression ring 37 is undercut, or cut back from the vertical line of the outer wall of the ring column. This annular chamber 42 receives oil splashed through the openings 28. Fumes, gases and products of combustion escaping downwardly through the upper compression rings will be received into the annular chamber 42 and will thence find diametrically disposed exit through the openings 28 into the internal space of the piston and thence downwardly into the crank case.

Referring more particularly to Figures 7 and 8, and also to Figure 6, the bosses 19 which receive the wrist pin 44 are formed with vertical oil receiving openings 45 in their upper sides through which oil may be splashed. In line with these openngs 45 are openings 46 in the bearing sleeves 47. Openings 45 and 46 aline with annular grooves 48 in the ends of the wrist pin 44. At the lower sides of the bosses 19 are sockets 49 into which are removably introduced locking pins 50. Such pins are provided with reduced noses 51 for engaging into the annular grooves 48 of the wrist pins 44. Thus the wrist pins may rotate in the bosses and at the same time be lubricated. Cotter pins 52 may be employed to hold the locking pins 50 in place. The cotter pins 52 lie in keyways 53 intersecting the sockets 49. The locking pins may be perforated in alignment with the keyways 53 to permit passage of the cotter pins therethrough. It will be noted that the vertical

thickness of the piston and oil rings is graduated, the same increasing from the oil ring up to the top compression ring.

Figure 9 is a section taken on the line 9—9 in Figure 1. This Figure 9 shows the lubricating openings 30ª discharging into the channel 30ᵇ.

The ribs 25 are very important as they carry the heat down the skirt. The oil splashes from the connecting rods and enters the openings 30 and 30ª. These openings are in line with the ends of the connecting rod bearings. The oil which issues out of the openings 30 and 30ª encircles the piston in the channels 29 and 30ᵇ, lubricating the walls of the cylinder and skirt, and also connecting the skirt to the cylinder wall by film of oil. The heat running down the ribs 25 is easily absorbed by the water or air that surrounds the cylinder because of the oil film above referred to which makes transference of the heat by conduction easy and rapid.

The durability of the piston and all other parts is dependent upon lubrication. Hence the improved piston is of durable and long life due to the lubricating properties of the same. The durability is also dependent on the cooling of the piston and the maintaining of the same in a cool condition, preventing scoring of the cylinder and skirt walls. This cooling is accomplished by the ribs 25 and the other interior rib and fin construction of the piston.

The improved piston will function better due to the fact that it is well lubricated. For this reason the engine produces greater power and is more economic in the matter of fuel.

The invention is well adapted, not only for Diesel engines, but also for such large engines as U. S. submarine engines having a 12 inch bore and employing gasoline for fuel. The invention is also applicable to airplane engines and all types of engines having large bore. In such large bore engines it is common to maintain a compression of 400 pounds and an explosion value of 4,000 pounds. Therefore, the rib reinforcement in the piston is useful in such engines in order to maintain the piston against distortion and in its true original condition. The improved lubricating arrangement also helps to this end and to reduce the great friction against the cylinder wall in engines of this character. Referring to Figure 7, the groove 48ª is disposed in approximately the center of the connecting rod when assembled. The groove is an oil groove maintaining lubrication to the connecting rod bearing; the lubricant being admitted from the top or through the connecting rod.

The improved piston is cast in one solid mass. It can be made of case iron, steel, aluminum, alloy or other desired material.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of this invention without departing from the spirit thereof, such changes and modifications being restricted only by the scope of the following claims.

What is claimed is:

1. An improved piston comprising a top wall, ring column, skirt, and bosses extending inwardly from said skirt and leaving free wall portions of the skirt therebetween, said ring column and skirt having vertical groups of spaced apart ribs, said groups being mounted in diametrically opposite pairs, one pair of ribs having its lower end portions merging with said bosses, the other pair of groups of vertical ribs lying in the free sides of said piston and extending from end to end of the piston, said ring column having an internal substantially horizontal annular rib at its lower portion intersecting said vertical ribs, said ring column having an external oil groove lying below said annular rib, said ring column having therein oil openings above said annular rib, oil and compression rings carried by said ring column, said ring column having a radially reduced portion between the oil ring and the next compression ring and with an undercut portion therein to form an annular chamber between said rings in communication with said openings.

2. An improved piston comprising a top wall, ring column, skirt, and bosses extending inwardly from the skirt at opposite sides and leaving free sides of the piston between said bosses, horizontal intersecting groups of ribs extending downwardly from said top wall, groups of vertical ribs extending down the sides of said ring column and skirt, the groups at the boss sides of tne piston merging with said bosses, the groups of vertical ribs at the free sides of the piston extending from end to end of said piston, a horizontal annular rib extending from the lower portion of the ring column and intersecting said groups of vertical ribs, conducting bands extending partly around the skirt from the upper and lower portions of said bosses, and fins extending partly around the skirt from the intermediate portions of said bosses, said bands and fins extending to the sides of the groups of vertical ribs at the free sides of the piston.

3. An improved piston comprising a top wall, ring column, skirt and bosses extending inwardly from the skirt and leaving free side portions between said bosses, groups of intersecting horizontal ribs on the top wall extending downward therefrom, groups of vertical ribs extending downwardly from the top wall along the ring column and skirt, blocks merging with the upper portions of the bosses and with the lower portions of the groups of vertical ribs at the boss sides of the pistons, the vertical ribs at the free sides of the piston having stepped inner edges opposite the step between the ring column and skirt, said last mentioned ribs tapering in width from top to bottom and extending substantially the full length of the piston.

ALEXANDER M. ALEXANDRESCU.