

Sept. 18, 1951

H. M. OLSON
STEEL PISTON RING

2,568,655

Original Filed Feb. 9, 1948

2 Sheets-Sheet 1

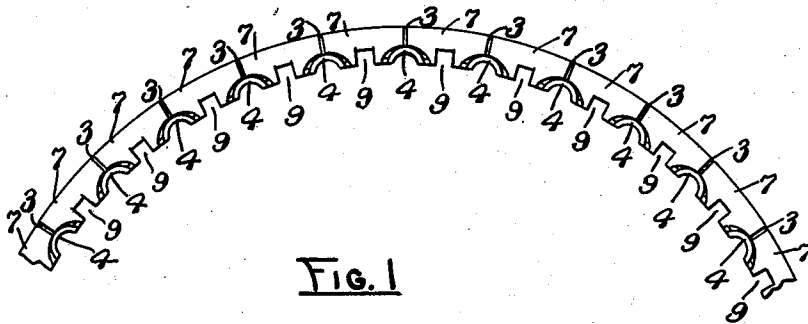


FIG. 1

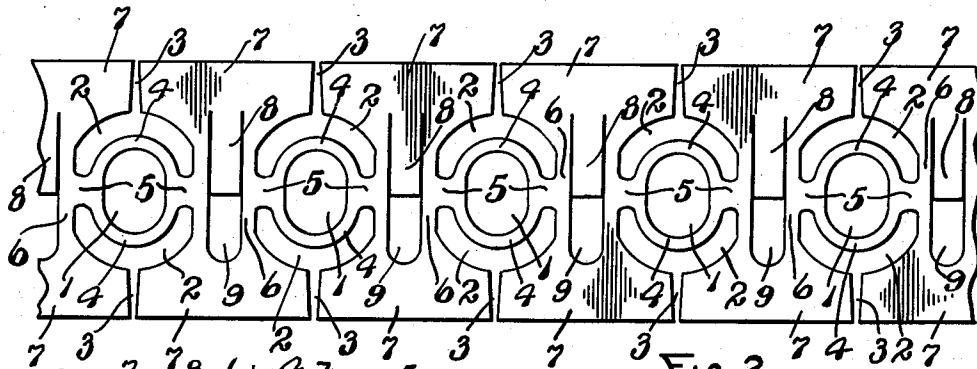


FIG. 2.

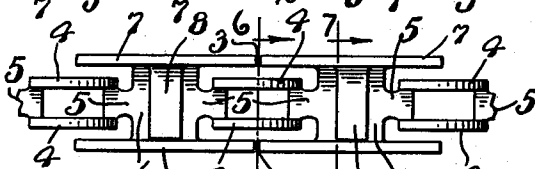


FIG. 3.

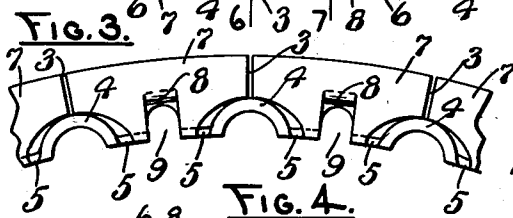


FIG. 4.

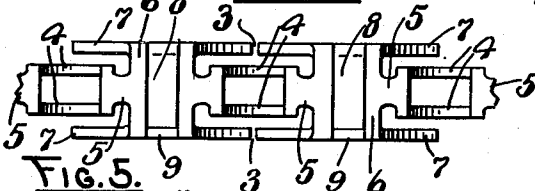


FIG. 5.

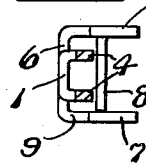


FIG. 6.

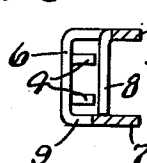


FIG. 7.

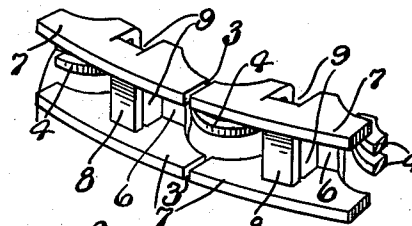


FIG. 8.

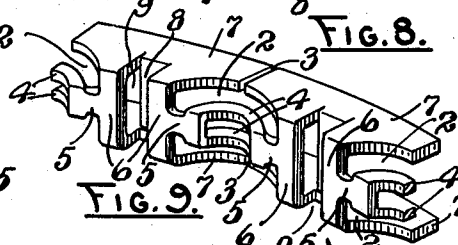


FIG. 9.

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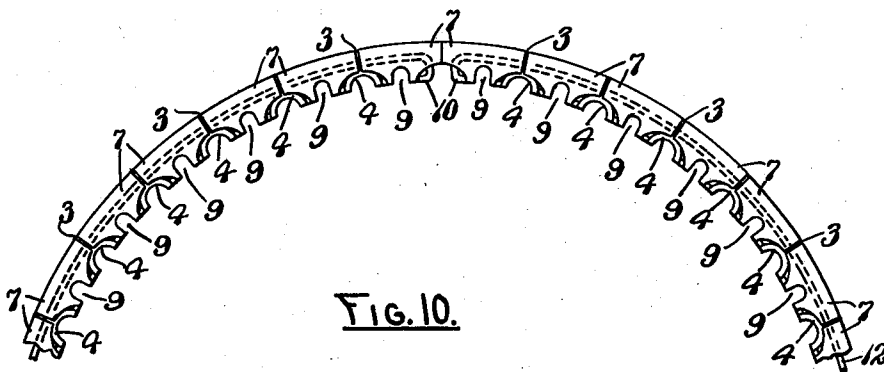


FIG. 10.

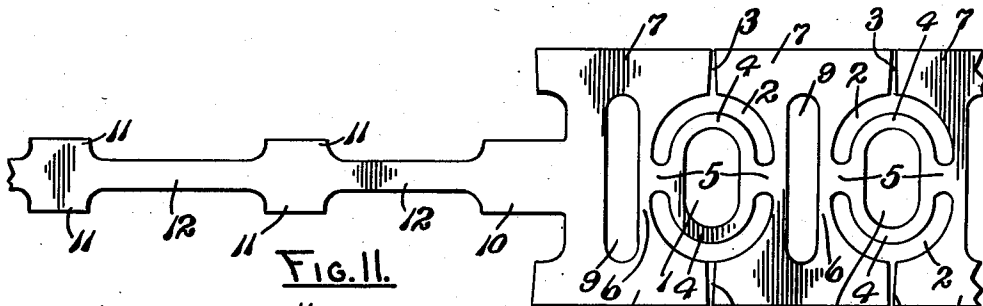


FIG. 11.

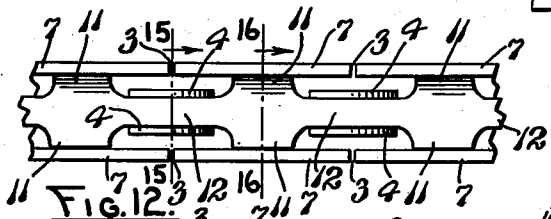


FIG. 12.

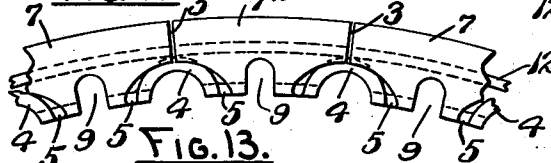


FIG. 13.

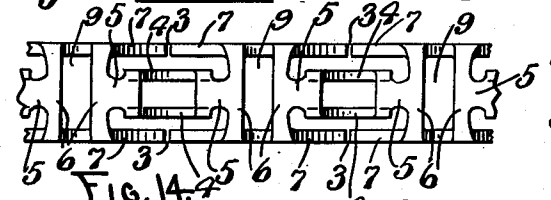


FIG. 14.

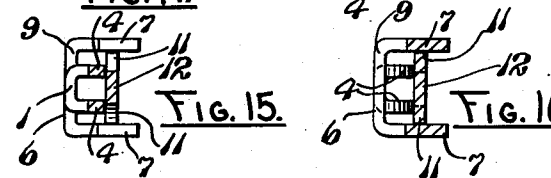


FIG. 15.

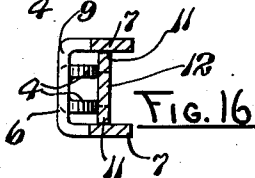


FIG. 16.

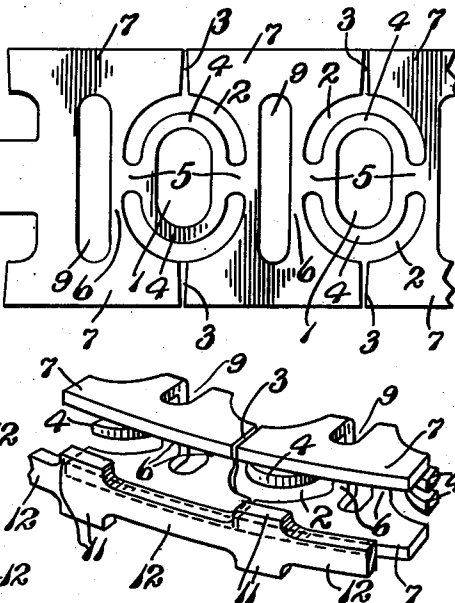


FIG. 17.

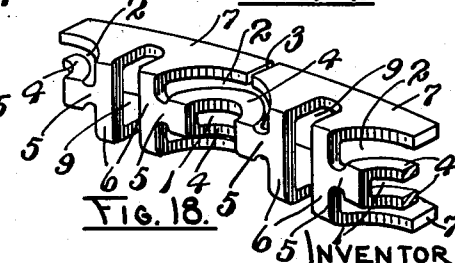


FIG. 18.

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UNITED STATES PATENT OFFICE

2,568,655

STEEL PISTON RING

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Original application February 9, 1948, Serial No.
7,093, now Patent No. 2,482,990, dated Septem-
ber 27, 1949. Divided and this application Au-
gust 8, 1949, Serial No. 109,175

4 Claims. (Cl. 309—44)

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This application is a division from application
Ser. No. 7,093, filed February 9, 1948, now Patent
Number 2,482,990, issued September 27, 1949.

The present invention pertains to and is con-
cerned with a self-expanding piston ring, made
from one length of sheet metal with substantially
no waste of material in a preferred form thereof,
and having positive features for the control of oil
in internal combustion engines when the ring is
assembled in the lower groove of a piston or
pistons therein. Such ring is circumferentially
contracted when installed in the ring groove of
a piston and placed within a cylinder in which
the piston reciprocates, thereby producing a re-
quired pressure of the ring against a cylinder
wall; and such ring is very flexible and conforms
to the cylinder wall when such wall has become
worn and out of round or tapered. With the
ring the holding of the oil against passage beyond
a piston into the combustion chamber at the
outer end of the piston is substantially perfectly
attained and oil saved. The smoke, carbon and
other dirt which comes from excessive use and
burning of oil is substantially eliminated.

It is an object and purpose of the present in-
vention to provide a piston ring of the character
outlined which, when completed, has a multiple
number of sector-shaped units which conform
at their outer bearing edges to the inner curved
wall of a cylinder. Between each sector of the
ring, the material thereof is punched and cut
therefrom and removed, and the material shaped
to provide flexibility in a tangential direction
whereby, with the ends of a ring at the gap or
parting therein abutting against each other and
contracted within a cylinder wall, the ring is
circumferentially compressed with the sectors at
their ends in close proximity to each other, but
slightly spaced to permit freedom of movement.
Such ring in a short time in the operation of an
engine takes a position in which the spaces be-
tween the ends of the sectors become established
at a predetermined amount. Flexibility between
the several sectors, or numbers of said sectors,
allows free movement for the ring to conform to
irregularities of the inner wall of the cylinder,
thereby resulting in sealing against oil pumping
and eventual passage to the engine combustion
chamber at the outer end of the piston.

Furthermore, with my invention the length of
flat steel or ribbon material from which a ring is
made may be substantially the circumferential
length of the ring, and a minimum of material
for a ring used. The novel ring structure, fur-
thermore, is of a sturdy and durable character

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such that it gives a long time service. The
drainage of oil through the ring to the bottom of
the ring groove in which installed, and from
which groove it is carried to the interior of the
piston and back to the engine crankcase, is
ample so that closing or stopping such drainage
by carbon accumulation does not occur. In ad-
dition the ring segments are individually held
from axial collapse toward each other or from
vibrating or fluttering during the operation.

An understanding of the invention may be had
from the following description, taken in connec-
tion with the accompanying drawings, in which:

Fig. 1 is a fragmentary plan view of a steel
piston ring made in accordance with my inven-
tion,

Fig. 2 is a fragmentary enlarged plan of the
blank as it is cut and punched before forming
into the completed ring,

Fig. 3 is a fragmentary edge view of the com-
pleted ring, looking against its outer side,

Fig. 4 is a fragmentary plan thereof,

Fig. 5 is a fragmentary inner elevation of the
ring,

Figs. 6 and 7 are transverse sections substan-
tially on the planes of lines 6—6 and 7—7 of
Fig. 3, looking in the directions indicated,

Fig. 8 is a fragmentary perspective view of the
ring look at it against its outer edges or side,

Fig. 9 is a similar fragmentary perspective view
looking at the inner side of the ring,

Fig. 10 is a plan view, similar to Fig. 1, of a
modified form of structure of the invention,

Fig. 11 is a plan, similar to Fig. 2, of a frag-
mentary portion of a ring blank,

Fig. 12 is a fragmentary elevation of the ring
looking against its outer edges,

Fig. 13 is a fragmentary plan view thereof,

Fig. 14 is a fragmentary inner elevation of the
ring,

Figs. 15 and 16 are transverse sections through
the ring substantially on the planes of lines
15—15 and 16—16 of Fig. 12, looking in the di-
rections indicated,

Fig. 17 is a fragmentary perspective view of
the ring, looking at its outer edges or side, and
with the strut flange supporting means separated
outwardly therefrom, and

Fig. 18 is a fragmentary perspective view, sim-
ilar to Fig. 9, of the piston ring, looking at the
inner side thereof, the flange's supporting mem-
ber being removed.

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

In the production of a piston ring in accord-

ance with my invention, a length of flat thin steel, that is a band or ribbon of the proper width is subjected to die operations to provide, in the length thereof, a plurality of openings 1, having rounded ends and which may be somewhat oblong in shape, outwardly from each end of each of which an arcuate slot 2 is cut, the ends of each pair of slots, one at each end of the opening 1, approaching each other but not meeting. From each of the arc-shaped slots 2, and midway between the ends thereof, slots 3 are cut outwardly to the outer longitudinal edges of the strip or band of flat metal used. There is thus provided between each opening 1 and the slots 2 a substantially open frame having rounded ends 4 connected by spaced sides, each of said sides at the longitudinal center line of the band of metal used having an integral connection, indicated at 5, with the sector-shaped units of the ring. Such sector-shaped units include an inner narrower section 6, which at each end progressively widens into a sector flange 7, adjacent ends of the sector flanges 7 being separated by the slot 3. The slots 3 are somewhat wider at their inner than at their outer ends, and progressively decrease in width outwardly.

In the form of the invention shown in Figs. 1 to 9 inclusive, the narrowed section 6 previously mentioned is punched and cut from the metal to make an opening 9 and a tongue 8, which at its outer end is integral with the metal band but separated at its sides, as shown. The outer end of each opening 9 and the outer end of each tongue 8 are located substantially equal distances from the middle center line of the band, so that when the tongue 8 is later bent to form a supporting and reinforcing strut for the spaced flanges 7 of the sector-like units, the opening provided by thus bending and displaying a tongue 8 with its connected opening 9 is an opening extending across the middle center line of the metal band used and located substantially symmetrical with respect thereto.

In the shaping of the piston ring from the flat metal band, after it has been processed as described, the wider flange portions 7 are bent from their narrower connecting sections 6 in the same direction at right angles thereto to provide spaced ring flanges which are disposed in spaced apart horizontal planes when the ring is applied to a vertical piston in an internal combustion engine. In other engines, as horizontal, or with the cylinders located in a V-angle relative to each other, said flanges may not be horizontal but take other planes, but the two spaced apart series of flanges are in parallel planes and those at one side of the ring are against one side of the piston ring groove in which installed, and those at the other side of the ring against the other side of the groove. The rounded or generally semi-circular ends 4, one at each end of each opening 1, are also bent at right angles to their connecting sides and in the same direction that the flanges 7 are bent, and the tongues 8 are bent from the flanges 7 to which connected at right angles thereto, their free ends coming in substantial contact with the inner side of the opposed spaced apart sector flange 7, as best shown in Fig. 8.

With the ring as thus constructed, the inwardly bent semicircular loops which are provided by the parts 4 (Figs. 1 and 4), provide flexible spring connections between the several sector units, each of which sector units consist of the spaced apart flanges 7 and the connecting sections 6 between them. The ring is thereupon circumferentially

compressible with a straining of the spring loops 4 and the building up of forces in such loops 4 tending to expand the ring circumferentially. Thus, when it is in a ring groove of a piston and circumferentially compressed within a cylinder wall, the outer edges of the flanges 7 of the sector units bear with a pressure force against the bore or inner wall of the cylinder. The struts 8 maintain the flanges 7 of each of said sector units against movement of the same toward each other. When the ring is in a ring groove of a piston the side walls of the ring groove hold the flanges from movement outwardly and further separating from each other, so that said flanges are held against vibration, fluttering or the like.

It is also evident that the openings made through the ring at the slots 9, and the continuations thereof formed by bending the tongues 8 in the manner described, also the openings between the loops 4 and between said loops and the sector flanges 7, provide a maximum ventilation for free passage of oil which may be scraped from a cylinder wall and directed into the groove around the ring between the ring flanges 7. Such oil passing to the piston of the ring groove is drained away in the usual manner. It is of course understood that upon shaping the ring to its generally circular form, the sides of the slots 3 become substantially parallel to each other and the slots are radial. The outer bearing edges of the sectors 7 may be ground or otherwise machined to an arc which is an arc of a circle having a radius substantially equal to the radius of the bore of the cylinder in which the ring is used.

In Figs. 10 to 13 inclusive, the tongues 8 are wholly removed, thereby leaving transverse slots 9 closed at both ends, which will be substantially the same as the slots in the previously described ring when the tongues 8 have been bent at right angles to the flanges 7 to which integrally connected. At each end of the band from which the ring is made, a centrally disposed narrow band 10 extends therefrom, which has spaced lengths thereof at each side removed, leaving projecting tongues 11 with intermediate connecting narrower bands 12 between the spaced projections 11. Each of these narrow integrally connected lengths of flat metal, one at each end of the wider band, are very closely to one-half of the length of the wider metal band. Each at its integral connection of its inner end 10 to each end of the wider band, after the ring has been shaped and formed the same as the first described ring, is bent back upon and at the outer side of the formed ring to lie between the sector flanges 7. The distance from the outer edge of a projection 11 to the outer edge of its directly opposed projection is such that said projections come closely within the inner sides of the opposed flanges 7 of the sector-like units. This provides strut supports for the flanges of each of said sector units, serving the same purpose as the strut tongues 8 previously described. Otherwise the ring structure is the same and has the same advantages.

It is of course apparent that the openings 1 may be of varying widths and lengths, those shown in Fig. 11 being of a greater length and a narrower width than those in Fig. 2. It is also apparent that the loops 4, which are provided by bending the rounded generally semi-circular ends of the frame around each of the openings 1, may be bent at different distances outwardly from the middle longitudinal line of the band from which the ring is made, for obtaining vary-

ing or differing circumferential compressions and ring tensions. In the form of the ring shown in Figs. 1 to 9 inclusive, a minimum of material is used, the metal band from which a ring is made being substantially, if not exactly, the length of the circumference of the ring completed therefrom. The flexibility of the ring so that a sector or a number of sectors at any part of the length thereof may flex and move to follow an imperfect cylinder wall is apparent. The novel structure of ring is one which is easily manufactured at low cost.

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

I claim:

1. A piston ring of thin flat metal comprising, a plurality of connected sectors, each having a pair of spaced back portions and a flange extending from each end thereof, said flanges being substantially parallel to each other and spaced apart, adjacent ends of successive flanges being separated from but closely adjacent each other, said pairs of backs being of narrower width than the lengths of the flanges, and connecting members between successive pairs of backs of the sectors integrally connected at their ends thereto, each of said connecting members at its middle portion including two spaced apart arc-shaped loops located between the ends of adjacent flanges and extending outwardly across the joints therebetween and adapted to be yieldingly strained, whereby adjacent ends of said flanges may be brought closer together and the ring circumferentially compressed.

2. A structure as defined in claim 1, and means extending between the flanges of each sector out-

wardly of the backs of said sectors providing holding struts preventing movement of the flanges of said sectors toward each other.

3. A piston ring structure as defined in claim 1, one of said flanges of each of said sectors having an integral strut connected therewith extending at right angles therefrom to the inner side of its associated flange, each of said struts being from the back of its associated ring sector.

4. A structure as defined in claim 1, and a narrow band of metal connected at each end of the ring between the end flanges of said ring and lying between the flanges of the successive ring sectors, said narrowed bands in length having combined length equal substantially to the circumference of a piston ring, said narrowed bands at spaced apart distances in the length thereof having successive narrower and wider portions, said wider portions being equal to substantially the distance between the inner sides of the flanges of said sectors, and one of said wider portions being located between the spaced flanges of each of said sectors.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,290,321	Engelhardt	July 21, 1942
2,346,899	Bowers	Apr. 18, 1944
2,421,175	Zahodiakin	May 27, 1947
2,432,602	Zahodiakin	Dec. 16, 1947
2,443,065	Bowers	June 8, 1948