

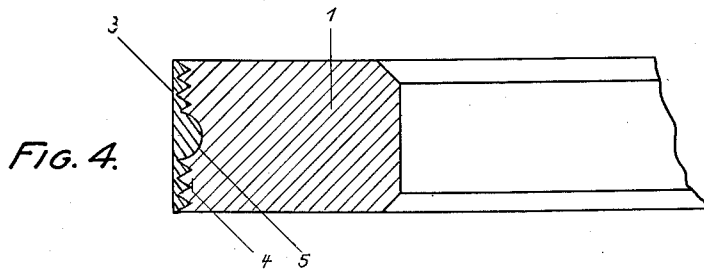
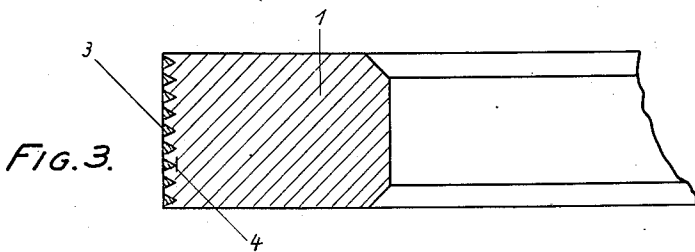
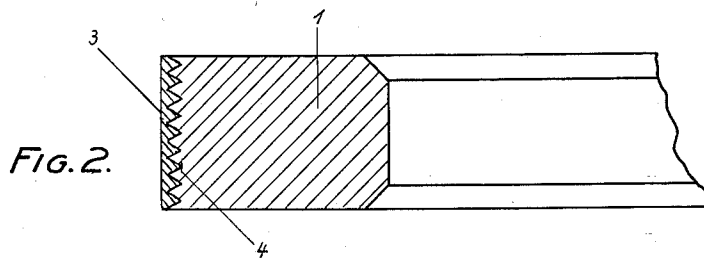
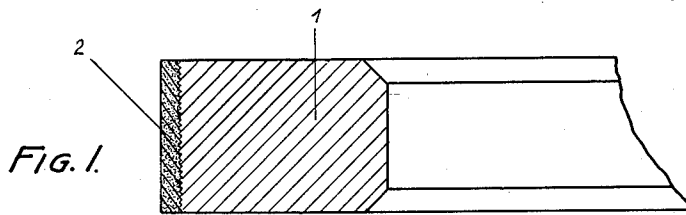
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F. W. SIEBEL

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MACHINE PART SUBJECTED TO SLIDING STRESS

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INVENTOR:
FRIEDRICH W. SIEBEL
BY *Herman Siebel*
ATTORNEY

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MACHINE PART SUBJECTED TO SLIDING
STRESSFriedrich Wilhelm Siebel, Burscheid, Germany;
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3 Claims. (Cl. 117—127)

This invention relates to machine parts subjected to sliding stress. Such machine parts have to comply with two demands. On the one hand, they have to resist wear so as to have as long a life as possible; on the other, they have to run, and especially run-in, well. It has proved difficult to comply with these two demands simultaneously, particularly if the run-in period is to be of the shortest possible duration.

It is already known to improve the sliding of metal upon metal by adopting materials capable of absorbing much oil or by producing porous oil-absorbing layers on the metal surfaces, whereby a film of lubricant is permanently retained on the metal surface or in the cavities of the porous layer, respectively, with a corresponding reduction of friction.

Layers of oxides have been provided for this purpose, and layers of phosphates on iron and zinc have likewise been proposed for attaining the same end, said layers having been produced by thermic or chemical treatment of the metal whilst using said metal as an active participant in the chemical reaction. The surface of the material treated in this way is more or less affected thereby, the processes adopted causing elevations on and cavities in the surfaces. Another objection to these processes is the danger that traces of the layer to be formed are frequently found also on those surfaces of the part that are not subjected to sliding stress.

The only object of the aforementioned layers is to facilitate the running-in of parts subjected to sliding stress. It is the principal object of the present invention to provide a means for safer, better and quicker running-in.

The invention consists in bringing a layer containing a finishing or polishing means or being itself such finishing or polishing means, to the sliding surface and making it firmly adhere thereto. Various ways may be adopted therefor, according as the polishing means bringing about the quick run-in is chosen.

If borates, such as sodium borate, or phosphates are to be used as polishing means, they are preferably applied by strewing them, in the shape of very fine powder, upon the sliding surface and thereafter subjecting the machine parts to a thermic treatment, for instance by quickly sweeping the powdered surface with a jet of fire. Even the most sensitive structures may be treated in this way without any danger of impairing them.

If meta-silicates or di-silicates or potassium silicate are selected as polishing means, the

layer is applied, for instance, by dissolving the chemical in some suitable solvent and thereafter laying the solution on thinly and uniformly by means of some soft instrument, such as a pad of cloth. The solvent will then evaporate, leaving the desired layer of polishing means firmly adhering to the sliding surface. After slight drying, the surface of the dried layer may then be roughened in some suitable way, for instance by soft grazing with a rubber-covered ledge, covering thereby the surface with crystals of microscopic fineness, which will further quicken the running-in process. Glass or glass-like, sprayable materials of good polishing qualities are best applied by spraying.

This specification of methods for producing the protective layer facilitating the sliding and adhering without binding means, has, of course, not exhausted the possibilities existing. The methods described have, however, proved particularly suitable for the above-mentioned layers.

It is also possible to employ a fine polishing powder laid on to the sliding surface by means of some suitable binding means, such as a solution of synthetic or natural resin. This can be effected either by first applying a suitable layer of resin or varnish, or by preparing the mixture of binding and polishing means beforehand and applying it thereafter as a whole. A particularly fitting polishing means is a fine grinding powder, such as is used for finishing cuts for metallographical examinations. It is proposed to employ some resin as binding means for the fine polishing powder and for making said powder stick to the surface of the machine part, providing, of course, that said resin be proof against gasoline, benzol, oil and heat, according as the machine part in question is used. By way of example, the following binding means may be enumerated: phenolic resin, cresylic resin, galalith, amino resin, acetate or nitrate of cellulose, benzyl cellulose, aniline resins, phthalic acid resins, mixed polymers or polyvinyl resins, acrylic acid resins, natural or synthetic rubber, chlorinated rubber, bitumen, various natural resins, an organic binding means such as potassium silicate.

Experience has shown, moreover, that a layer of resin with good polishing qualities, such as a layer of phenolic resin, led to sliding surfaces quickly running-in without any addition of special polishing means.

This protective run-in layer formed optionally either, for instance, by spraying or by lay-

ing-on, penetrates very well into the pores and working-grooves of the basic material. Moreover, this protective layer is softer than the materials of the machine parts working upon each other, as for instance of the piston-ring and cylinder. If a sliding surface pre-treated according to the present invention works upon its counterpart without preceding running-in, this protective layer has the effect of a fine polishing means upon the opposite surface upon which the first-mentioned part slides, thereby providing very quickly a good polish on both bearing faces without danger of scoring. Naturally, the thin protective layer is abraded during the run-in period in smallest particles. But since, as mentioned above, it adheres very well to the working grooves and pores of the basic material, these particles are retained for a rather long time, even when the basic material contacts directly with the opposite wall. In this way, the polishing effect is maintained beyond the proper run-in period.

A further advantage is realised when small particles break loose from a hard basic material. Heretofore, such particles frequently led to damaging of one or both bearing faces. When a protective layer according to the present invention is provided, these particles are rendered harmless by being pressed into and retained in the remainder of the soft layer still contained in the working-grooves. The particles are thereafter removed by and by without destructive effect.

For maintaining the described additional polishing effect, it may be sometimes advisable to provide one or more grooves deeper than the normal working-grooves in the sliding surfaces.

The principal advantage obtained by the procedure of the invention consists in that the sliding surface of the part treated as specified above, adapts itself readily to the opposite surface as the result of only very little reciprocating motion. This is particularly desirable for piston-rings, which are expected to seal the piston effectively from the very first start, if possible.

The invention is more fully explained in the accompanying drawing hereby made a part of this specification, choosing a piston-ring as an embodiment of the machine parts in question.

Fig. 1 shows a piston-ring with a layer according to the invention.

Figs. 2 and 3 show a ring with another run-in layer, Fig. 2 showing it previous to running-in and Fig. 3 after a short run-in period.

Fig. 4 is a view of a slightly modified ring.

In all figures, 1 designates the piston-ring. Its bearing face is provided with a layer 2, that may consist either of a resin and a fine grinding powder, or of borates, phosphates or silicates laid on from outside without binding means. There may be moreover provided a thin graphite coating—not shown in the drawing—on the layer 2, this coating adhering very readily to the slightest unevenness of the run-in layer. But even without this graphite coating, such a sliding surface produces an unobjectionable opposite sliding surface in the shortest possible time, adapting itself easily to this opposite surface. The run-in layer 2 has the further advantage of being porous to a certain degree and thereby retaining oil very well.

The grain and hardness of the polishing means may naturally vary according to the use to which it is put. These factors are influenced also by the peculiarities of the opposite metal surface

and by the speed and pressure at which the surfaces are subjected to sliding stress.

In Figs. 2 to 4, 1 designates again the ring. The layer 3, however, consists of a synthetic resin in filling up the turning-grooves 4. The layer 3 has to be resistant to abrasion, but it must have good run-in and sliding properties, too, without being too hard. The layer can be formed with optional methods, for instance by spraying or laying-on. If a phenolic resin is selected, it will naturally have to be hardened by subjecting the ring, after application of the layer, to a predetermined temperature for a predetermined time.

Fig. 3 shows the ring of Fig. 2 after some minutes' run in the cylinder of an internal combustion engine. The layer 3 is abraded down to the ridges of the turning-grooves, but is still present in the grooves 4 so as to form a surface of uniform smoothness on the whole bearing face of the ring. The turning-ridges cannot break loose as they are completely embedded in and therewith effectively supported by the layer 3.

For normal piston rings, it will be sufficient to let the protective run-in layer extend down to the bottom of the turning-grooves, for when the material of the piston-ring has been abraded to this extent, there is an unobjectionable mirror-polish on both faces. For particularly difficult cases, however, it will be perhaps advisable to maintain the finely polishing effect of the protective run-in layer for some more time. For this purpose, one or more grooves 5, as shown in Fig. 4, may be provided, said grooves being of greater depth than the turning-grooves.

If natural or synthetic resins or similar materials have been mentioned in the preceding description, this does not preclude that for attaining special effects, fillers are added in known manner to said materials. It is imaginable, for instance, that graphite is added to phenolic resin for improving the qualities of the layer during the sliding action and under dry-run conditions. Fillers improving the heat resistance of the run-in layer on parts subjected to high thermic stress may likewise be added.

Piston rings have been chosen as examples for explaining the objects of the present invention, but these objects are not confined to such rings. The invention is applicable in all machines wherein one part of the co-operating elements can follow-up its wear. In piston rings, for example, the inherent radial tension makes the ring extend to the full external diameter it had before wear set in; in packing rings, it is the force of the spring contracting the ring upon the shaft; in guides, such as one-sided cross-heads, the required force may be supplied by the weight of the machine part itself; in joints, it is, for instance, imaginable to make the surfaces resilient so as to enable them to follow up the loss in size by wear.

What I claim is:

1. As an article of manufacture, a first metallic machine part adapted to work in sliding contact with a cooperating second metallic machine part, said first part having added to its surface a running-in relatively hard and coherent coating comprising a binder and a quantity of mildly abrasive polishing material, said coating being softer than the metal of said parts and being adapted to wear down to a highly polished finish relatively rapidly during running-in while polishing the engaged surface of said second part, particles of said coating which become abraded during running-in being adapted in part to be-

come re-embedded in the coating and in part to be removed from said parts until eventually all the material of the coating is removed.

2. As an article of manufacture, a first metallic machine part adapted to work in sliding contact with a cooperating second metallic machine part, said first part having added to its surface a running-in relatively hard and coherent coating comprising a layer of binder applied to said surface and a quantity of mildly abrasive polishing material applied to the layer of binder and held thereby on said surface, said coating being softer than the metal of said parts and being adapted to wear down to a highly polished finish relatively rapidly during running-in while polishing the engaged surface of said second part, particles of said coating which become abraded during running-in being adapted in part to become re-embedded in the coating and in

part to be removed from said parts until eventually all the material of the coating is removed.

3. As an article of manufacture, a first metallic machine part adapted to work in sliding contact with a cooperating second metallic machine part, said first part having added to its surface a running-in relatively hard and coherent coating comprising a layer of mixed binder and mildly abrasive polishing material, said coating being softer than the metal of said parts and being adapted to wear down to a highly polished finish relatively rapidly during running-in while polishing the engaged surface of said second part, particles of said coating which become abraded during running-in being adapted in part to become re-embedded in the coating and in part to be removed from said parts until eventually all the material of the coating is removed.

FRIEDRICH WILHELM SIEBEL.