

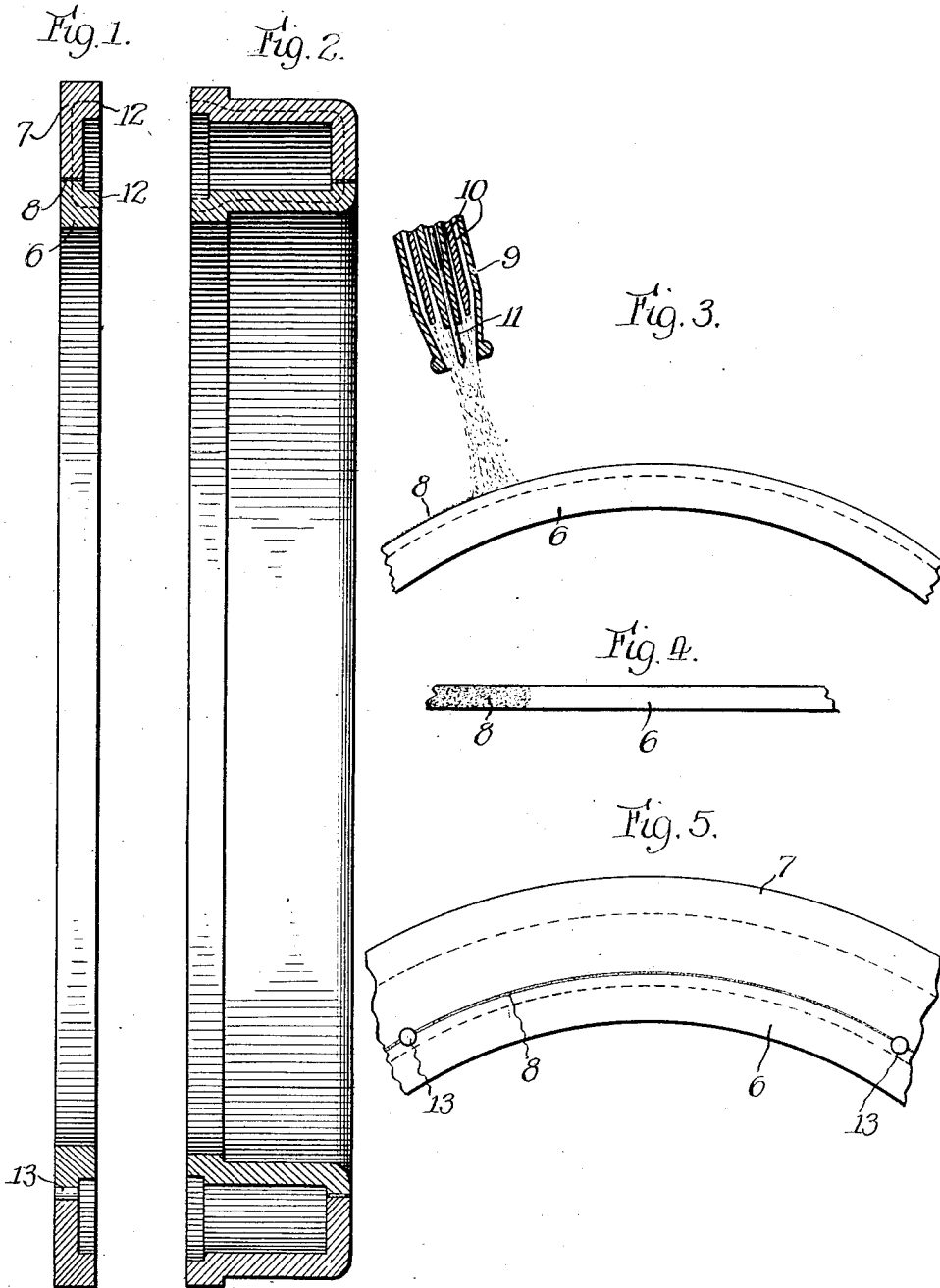
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PROCESS FOR FORMING MAGNETIC ELEMENTS

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UNITED STATES PATENT OFFICE

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PROCESS FOR FORMING MAGNETIC ELEMENTS

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This invention relates to improvements in the formation of electromagnetic elements and more particularly to elements which are used in electromagnetic friction devices such as clutches and brakes.

In ordinary magnetic friction devices wherein the coating surfaces of the magnet and its armature are brought into gripping engagement by magnetic attraction, residual magnetism of considerable magnitude develops upon the interruption of the energizing circuit. This prolongs the adherence of the elements thereby preventing release of the clutch or brake as the case may be.

One way to eliminate this undesirable effect is to provide a non-magnetic gap of fixed reluctance in the magnetic circuit. Owing to the small dimension of the gap it is customary to make the magnetic element in two parts between which is inserted a thin sheet of brass or other non-magnetic material. This method when employed in the formation of annular magnetic elements requires great precision in the formation of the rings and in securing them together in order to form an element having the desired rigidity. As a result the elements of this character heretofore constructed have been unduly costly.

The primary object of the present invention is to simplify the formation of magnetic elements of the above character by providing a novel process for inserting the non-magnetic strip of material between the sections of which the element is composed.

In practicing this improved method two separate magnetic rings are formed of proper dimensions and an adhering coating of non-magnetic metal is deposited around all or part of the peripheral surface of one of the elements after which the two elements are assembled leaving the non-magnetic sheet of metal between them.

The invention also aims to provide a novel method of assembling the two elements after the non-magnetic coating has been applied.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figures 1 and 2 are sectional views of magnetic elements constructed in accordance with the present invention.

Fig. 3 is a fragmentary view of an electromagnetic element illustrating one way of applying the non-magnetic coating thereto.

Fig. 4 is a plan view of a surface of a magnetic element partially coated.

Fig. 5 is a fragmentary elevational view of a completed magnetic element.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring now to the drawings, Figure 1 shows a magnetic friction element constituting an armature for the annular magnet disclosed in Fig. 2, each of these elements being constructed with a gap interposed in its magnetic flux path which is indicated in dotted outline. It will be understood that for any two cooperating elements only one non-magnetic gap need be provided and that this may be located either in the armature or in the magnet core. For convenience of explanation the present method will be described with reference to the formation of the gap in the armature ring.

In constructing the annular armature two rings 6 and 7 of magnetic iron are formed of such diameters that the smaller will fit loosely within the larger ring. That is to say there is a gap left between the two elements when arranged in concentric relation, the radial width of which gap is slightly less than the width of the non-magnetic gap to be formed. In the present type of magnet a gap of .003 inch has been found to be wide enough to substantially eliminate the residual magnetism which would otherwise tend to develop.

An adhering coating 8 of non-magnetic material is then deposited on the outer pe-

ripheral surface of the smaller ring or on the inner surface of the larger ring. This may be accomplished in any preferred manner such as by the well known Schoop process of metal spraying or the layer may be deposited by electro plating. Fig. 2 illustrates the manner of applying the coating by the Schoop process to the external periphery of the inner ring 6. To this end a nozzle 9 is directed toward the surface to be coated and hydrogen and oxygen streams are caused to flow under pressure through the passageways 10 in the nozzle. These gases ignite within the nozzle and serve to melt and atomize metal such as brass from a rod 11 which is fed through the center of the nozzle. The finely divided molten particles, thus projected at high velocity against the surface of the ring, congeal on the surface and unite with each other to form the tenaciously adhering coating.

While the coating may be formed at a plurality of annularly spaced points around the ring it is preferred to coat the entire inner surface with a layer of uniform thickness. This may be accomplished by rotating the ring relative to the nozzle at a uniform rate, the thickness of the coating being determined by the rate of relative motion between the spray nozzle and the ring surface.

After depositing the non-magnetic coating the two rings 6 and 7 may be forced together by the application of axial pressure or the outer ring may be shrunk by thermal contraction onto the inner ring. In the latter case the ring 7 is expanded by heat to a point at which it will receive the inner ring 6. When thus assembled with their surfaces 12 in a common plane, the rings are allowed to cool, the contraction of the outer one producing a tight fit between them and producing an extremely rigid structure of the magnetic element as a whole.

To securely lock the two rings together against possible relative rotation when engaging a coating magnetic element under high axial pressure suitable keys 13 of non-magnetic material may be employed. These may be formed by drilling holes in the magnetic element at the junction between the two rings. These holes are then plugged with non-magnetic material such as bronze so as to preserve the non-magnetic gap between the rings. When bronze is used it may be melted directly into the holes.

It will be apparent that I have provided a simple process which greatly facilitates the formation and reduces materially the cost of annular magnetic elements having a non-magnetic gap in the flux path through them.

I claim as my invention:

1. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, depositing an adher-

ing coating of non-magnetic material on the peripheral surface of one of said rings, and assembling the rings with said coating between them.

2. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, coating portions of the peripheral surface of one of said rings with an adhering layer of non-magnetic material, and assembling the two rings so that said layer forms a gap of fixed reluctance in the magnetic flux path through the element formed by the two rings.

3. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, forming an adhering non-magnetic layer on the peripheral surface of one of said rings by depositing non-magnetic metal thereon, and assembling the two rings with said layer at the point of junction between the rings.

4. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, depositing a layer of non-magnetic metal on the peripheral surface of one of said rings by spraying molten atomized metal under pressure against said surface, and assembling said rings with said layer between them.

5. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, coating portions of the peripheral surface of one of said rings with an adhering layer of non-magnetic material, and shrinking the larger ring by thermal contraction onto the smaller ring with said layer between them.

6. The method of forming an annular magnetic element which consists in constructing two rings of magnetic material adapted to fit one within the other, coating portions of the peripheral surface of one of said rings with an adhering layer of non-magnetic material, fitting the two rings together with said layer between them, and keying the two rings together.

In testimony whereof, I have hereunto affixed my signature.

ARTHUR P. WARNER.