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EP 0 301 845 B1

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Description

This invention relates to non-contact positional sensing systems and has particular reference to non-contact positional sensing systems for a piston movable longitudinally within a cylinder.

Non-contact positional sensing of pneumatic cylinder pistons is common practice. Normally, a permanent magnet is fitted to the piston and a reed switch or magnetically sensitive proximity sensors are attached to the cylinder barrel around its diameter.

The magnets which have been used heretofore have been of the ring type in various materials dependent upon the required field strength. Typical examples have been Samarium Cobalt, Ceramic Ferrite or a plastics material with a ferrite filler. The magnetic ring may be located between split piston halves.

Unfortunately, the magnetic materials which have a high strength tend to be very expensive and this makes the magnetic piston system expensive.

A similar positional sensing system for a piston movable longitudinally within a cylinder is described in DE-A 3 424 461. The purpose of the piston in the device of DE-A 3 424 461 is to concentrate the inductive force produced by an external coil, thereby providing positional information by way of feedback. To that end, the specific material disclosed in DE-A 3 424 461, namely Permalloy, is of the type that is very effective in concentrating magnetic flux but that cannot be permanently magnetised to any appreciable extent.

By the present invention there is provided a present non-contact positional sensing system for a piston movable longitudinally within a cylinder, in which the cylinder is formed of non-ferromagnetic material, there is a magnetically sensitive proximity sensor on the outside of the cylinder and the piston incorporates a permanent magnet, characterised in that the piston is formed substantially entirely from permanently magnetic material.

The piston may be moulded from magnetic material comprising magnetic particles in a non-magnetic matrix of plastics material. The piston may be moulded by injection moulding. The proportion of magnetic particles is preferably as high as practical and may be in the range 60-90%, preferably 70-90% and more preferably 80-90% by weight of the magnetic material. The plastics material may be nylon and is preferably nylon 6/10. The magnetic material may be a strontium ferrite filler. There may be present 88% by weight of strontium ferrite material.

The piston may be provided with non-magnetic seals which may be of conventional form. The seals may be cup seals or 'O' ring seals or disc seals.

By way of example embodiment of the present invention will now be described with reference to the accompanying drawings of which

FIGURE 1 is a cross section of a prior art piston with ring magnet

FIGURE 2 is a cross section of one form of the invention, and

FIGURE 3 is a cross section of a second form of the invention.

In Figure 1 there is provided a piston comprising a pair of moulded plastics halves 1, 2 which are conjoined together by an inner sleeve 3.

The two halves 1 and 2 trap between them a ring magnet 4. The pair of seals 5, 6 seal the piston within a cylinder. The cylinder and proximity sensors are well known and conventional and are not described herein.

In Figure 2, the magnetic piston comprises an injection moulded body 7 formed of 6/10 nylon and 88% by weight of strontium ferrite. The piston has a blind bore 8 permitting it to be attached to a piston rod, further piston or other piston follower. Cup seals 9 and 10 seal the piston within the cylinder.

The piston may be a hollow piston as shown in Figure 3 in which the piston 11 is in the form of an injection moulded tubular member having cup seals 12 and 13.

The use of an injection moulded piston assembly enables the complete piston to be produced from magnetic material. This permits a greater volume of magnetic material within the piston envelope (compared to conventional designs), which permits the use of weaker and hence cheaper magnetic material and also significantly cheaper plastics materials may be used.

In the preferred embodiment in which the piston is injection moulded, very close tolerances can be held to the design and a very good surface finish can be provided.

Because the piston is formed almost entirely of magnetic material, significant savings in the length of the piston can be achieved by using a moulded form of magnetic material.

Claims

1. A non-contact positional sensing system for a piston movable longitudinally within a cylinder, in which the cylinder is formed of a non-ferromagnetic material, there is a magnetically sensitive proximity sensor on the outside of the cylinder and the piston incorporates a permanent magnet, characterised in that the piston (11) is formed substantially entirely from permanent magnetic material.

2. A system as claimed in claim 1 in which the piston (11) is moulded from magnetic material comprising magnetic particles in a non-magnetic matrix of plastics material.

3. A system as claimed in claim 2 in which the proportion of magnetic particles is in the range of 60% to 90% by weight of the magnetic material.

4. A system as claimed in claim 3 wherein said proportion is in the range of 70 to 90%.

5. A system as claimed in claim 3 wherein said proportion is in the range of 80 to 90%.

6. A system as claimed in any one of claims 2 to 5 in which the plastics material is nylon.

7. A system as claimed in any one of claims 2 to 6 in which the magnetic particles are of strontium ferrite.

8. A system as claimed in any one of claims 2 to 6

in which the magnetic particles are of samarium cobalt or ceramic ferrite materials.

Patentansprüche

1. Berührungsloses Lagemeßsystem für einen Kolben, der innerhalb eines Zylinders in Längsrichtung beweglich ist, bei dem der Zylinder aus einem nicht ferromagnetischen Werkstoff gebildet ist, wobei sich außerhalb des Zylinders ein magnetisch empfindlicher Annäherungssensor befindet und der Kolben einen Permanentmagneten enthält, dadurch gekennzeichnet, daß der Kolben (11) im wesentlichen vollständig aus einem permanentmagnetischen Werkstoff gebildet ist, 5
2. System nach Anspruch 1, bei dem der Kolben (11) aus einem magnetischen Werkstoff geformt ist, der in einer nicht magnetischen Matrix aus Kunststoff magnetische Teilchen enthält. 10
3. System nach Anspruch 1, bei dem der Anteil der magnetischen Teilchen in dem Bereich von 60 bis 90 Masse% des magnetischen Werkstoffs liegt. 15
4. System nach Anspruch 3, bei dem der erwähnte Anteil in dem Bereich von 70 bis 90% liegt. 20
5. System nach Anspruch 3, bei dem der erwähnte Anteil in dem Bereich von 80 bis 90% liegt. 25
6. System nach einem der Ansprüche 2 bis 5, bei dem der Kunststoff Polyamid ist.
7. System nach einem der Ansprüche 2 bis 6, bei dem die magnetischen Teilchen aus Strontiumferrit bestehen. 30
8. System nach einem der Ansprüche 2 bis 6, bei dem die magnetischen Teilchen aus Samarium-Cobalt-Werkstoff oder aus keramischem Ferritwerkstoff bestehen. 35

Revendications

1. Système de détection de position sans contact pour un piston mobile longitudinalement dans un cylindre, dans lequel le cylindre est formé d'une matière non ferromagnétique, un capteur de proximité à sensibilité magnétique étant situé sur le côté extérieur du cylindre et le piston comprenant un aimant permanent, caractérisé en ce que le piston (11) est formé pratiquement en totalité de matière à aimantation permanente. 40
2. Système selon la revendication 1, dans lequel le piston (11) est moulé en matière magnétique comprenant des particules magnétiques dans une matrice non magnétique de matière plastique. 45
3. Système selon la revendication 2, dans lequel la proportion de particules magnétiques est de l'ordre de 60% à 90 % en poids de la matière magnétique. 50
4. Système selon la revendication 3, dans lequel ladite proportion est de l'ordre de 70 à 90%. 55
5. Système selon la revendication 3, dans lequel ladite proportion est de l'ordre de 80 à 90%. 60
6. Système selon l'une quelconque des revendications 2 à 5, dans lequel la matière plastique est un Nylon.
7. Système selon l'une quelconque des revendications 2 à 6, dans lequel les particules magnétiques sont en ferrite de strontium. 65

8. Système selon l'une quelconque des revendications 2 à 6, dans lequel les particules magnétiques sont en matières du type samarium-cobalt ou ferrite céramique

Fig. 1

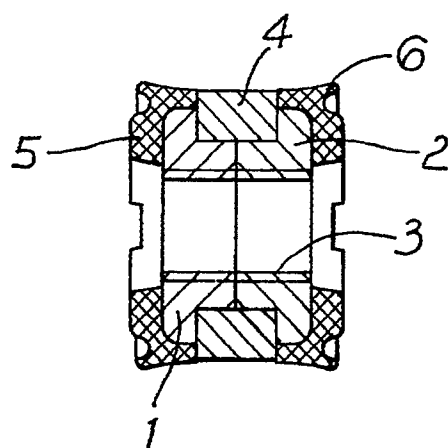


Fig. 2

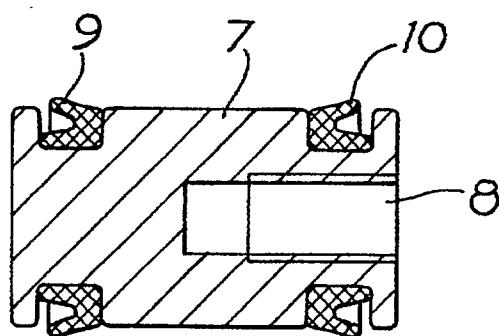


Fig. 3

