

COMMISSIONER'S DECISION

Obviousness: Metallic Seal Ring

The invention was for an annular seal ring comprising a "C"-shaped cross section of upper and lower disc members joined by a hinge member. In use the hinge is capable of "plastic" deflection, while the disc members are "elastically" deflectable. Utilization of both plastic and elastic deformation is not taught in the prior art.

Rejection: Reversed

The Final Rejection of application number 127,281 (Class 277/66), assigned to Fisher Controls Company Inc. and entitled "Metal Seal For A Control Valve And The Like" was referred to the Patent Appeal Board for consideration. There was a hearing before the Board on October 29, 1975 at which Mr. I. Fincham, Mr. E. Fincham and Mr. M. Cornwell of Fisher Controls Company Inc. represented the applicant.

The invention relates to a metallic seal ring for use with control valves where temperature and pressure variations result in substantial thermal expansion and contraction of the component parts. The ring is so constructed that when properly fitted between mating pipes (and the like) it provides a better seal which does not leak.

In the Final Action the examiner refused the application for failing to define any patentable subject matter over the following reference:

Br. Pat. 362,689	Dec. 10, 1931	Boyce et al
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In that action the examiner stated (in part):

The rejection of claims 1-4 inclusive is maintained and the reason for such rejection is lack of patentable subject matter in view of the applied reference and obviousness. The cited British patent discloses a metal seal having the same structure as claimed by applicant. Applicant argues that the ring of the cited British patent preferably employs an auxiliary ring 7 to prevent plastic deformation, whereas applicant's claimed

seal ring employs a hinge portion capable of substantial plastic deformation. It is conceded that these differences do exist. However it is contended that the seal ring of the cited Boyce et al patent could experience substantial plastic deformation, if the auxiliary ring 7 were not in place. It is concluded that Boyce et al knew that plastic deformation would occur with that particular seal ring structure and therefore utilized the auxiliary ring to prevent its occurrence. The mere deletion of an element with its corresponding function, in this case the auxiliary ring 7 and its prevention of plastic deformation of the seal ring, is not a patentable step. There is no unusual or unexpected result occurring from this deletion and therefore no patentable difference exists. It is obvious that the ratio of the thickness of the hinge portion to that of either of the thicker portions of the seal ring of the cited patent is less than one. Applicant states in the disclosure that it is preferable to use for "Inconel 718" a ratio of one to eight. But applicant does not show anything inventively different for that particular ratio in relation to all other ratios less than one. Therefore claims 1-4 inclusive are obvious.

The applicant in his responses to the Final Action dated February 7, 1975, February 10, 1975, and April 14, 1975, stated (in part):

To overcome the above deficiencies of known seals, applicant has discovered that self-sealing metallic seals may be utilized notwithstanding substantial temperature cycling of the mating parts between which it is confined. In particular, applicant has discovered that metal seals may be designed wherein a portion of the seal undergoes elastic deflection while a further portion of the seal undergoes plastic deflection.

The Examiner, in rejecting the claims in the instant application, has conceded that differences between the seal of applicant and the seal of Boyce et al do exist. These differences are clearly defined in claim 1 presently in the case and thus, it is believed that there is no dispute that claim 1 defines over the seal disclosed in the cited reference. In particular, applicant claims a seal having a hinge portion capable of substantial plastic deformation while Boyce et al utilizes an auxiliary ring which, for all intents and purposes, prevents plastic deflection.

However, the Examiner has hypothesized that Boyce et al knew that plastic deformation would occur with that particular seal ring structure disclosed and therefore has utilized the auxiliary ring to prevent its occurrence. In this connection, applicant submits that if Boyce et al knew about plastic deformation of seals, it was to the extent, and only to the extent, that it is common knowledge that a metallic material will bend if sufficient force is applied. This is indicated by the statement in Boyce et al at page 1, lines 40-43, that

Preferably, in order to safeguard against distortion of the cup ring beyond the elastic limit, an auxiliary ring is provided.

This would seem to indicate that Boyce does recognize that plastic deformation will occur beyond the elastic limit.

This naturally raises the question as to why Boyce et al, if he knew about plastic deformation, would employ an auxiliary ring which bridges the cup walls and prevents their collapse under the compression to which they are subjected. In this respect, it must be pointed out that the seal of applicant's invention represents a substantial improvement over prior art seals in that, in use, where is provided a leak-proof seal notwithstanding substantial temperature cyclings of the mating parts between which it is confined. Thus, although Boyce et al may have understood plastic deformation in the sense that it was known metal will bend if sufficient force is applied, he did not recognize how to employ such plastic deformation in constructing a seal ring. Indeed, if he did recognize the advantages of utilizing plastic deformation, no auxiliary ring would be provided.

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It will furthermore be noted that the claims of Boyce et al clearly define a seal or joint wherein the outer surfaces are convex to the corresponding sealing surfaces of the parts to be joined. It is respectfully submitted that a reasonable construction of the specification of the cited reference can only lead to the conclusion that the improvement in seals which was made by Boyce et al is clear from his statement on page 2, line 40, in which he states:

Preferably, in order to safeguard against distortion of the cup ring beyond the elastic limit, an auxiliary ring is provided which bridges the cup walls and prevents their collapse under the compression to which they are subjected.

As may be seen from the above excerpts from the reference of Boyce et al, clearly the patentee was not dealing with the same problem as is applicant.

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The state of knowledge existing in the prior art is that shown in British patent 362,689. This patent specifically teaches that an auxiliary ring must be provided to prevent plastic deformation. The teachings of this reference are in a direction diametrically opposed to the teachings and structure of the seal ring of the instant application. Therefore, it is respectfully submitted that with the teachings of Boyce et al directing one away from a structure as claimed in the instant application, one knowledgeable in the art would not know that, not only can a seal without the auxiliary ring be employed, but that such a seal presents significant advantages.

In further support of the above, applicant is enclosing herewith an Affidavit sworn by Mr. Charles Jackson, a registered professional engineer in the State of Texas, United States of America. As outlined in his Affidavit, Mr. Jackson has extensive experience in the field of seal technology and is familiar with the subject matter of the instant application and the cited reference.

Mr. Jackson swears, in his professional opinion, that the sealing effectiveness of the Boyce et al seal depends upon compressive loading of the seal which is transmitted to the auxiliary ring thereof. The sealing effected by applicant's seal, on the other hand, occurs by virtue of compressive loading of the disk-like portions which is transmitted through the plastically deformable hinge portion of the seal.

Thus, in rebuttal of the Examiner's contention that applicant's structure is obvious in view of the structure of the seal of Boyce et al, a person who is skilled in the art has sworn that the sealing effectiveness of the two seals and the transmittal of the loading of the seal is completely different in applicant's seal vis-à-vis that of Boyce et al.

In other words, the disk-like flanges of the seal of the present invention are shaped to act more like a Belleville spring wherein the metal seal has two resilient thick disks which act "springy" under compression and a thin cylinder "hooking" or joining the disks together which, under compression, is "squashed".

The Boyce patent relates to high pressure joints for vessels used in the synthetic ammonia industry. In his joint the sealing engagement is effected by a ring placed between the seating surfaces of the parts to be joined. The ring is in cross sectional form a "V" or "U", with the leg portions contacting the seating surfaces to form a seal. In order to prevent distortion of the ring beyond its elastic limit, thus causing it to rupture, an auxiliary ring may be inserted between the two walls to keep them apart.

Claim 1 in the patent reads:

A joint for resisting high pressure, in which the sealing engagement is effected at opposite outer surfaces of a hard metal cup ring, as hereinbefore defined, the internal surfaces of which are exposed to the high pressure, the said outer surfaces being convex to the corresponding seating surfaces of the parts to be joined.

This application is for a seal composed of an annular body of resilient metal having upper and lower disc-like members joined together by hinge member. A cross-sectional view is in the form of a "C" or "U" shape in

which the thickness of the hinge is less than the thickness of the leg members. It is used under high temperature and pressure conditions where there is substantial thermal expansion and contraction of the constituent parts. According to the disclosure, the hinge portion undergoes substantial plastic deflection in use, while the disc portions undergo elastic deflection. Claim 1 reads:

A metal seal characterized by an annular body of resilient metal having upper and lower disk-like portions joined by an integral hinge portion, the ratio of the thickness of the hinge portion to that of either of the disk-like portions being such that said hinge portion is capable of substantial plastic deflection and said disk-like portions are capable of elastic deflection.

The question the Board must consider is whether the application is directed to a patentable advance in the art over the teaching of the cited reference.

At the hearing the applicant illustrated what he meant by "plastic" and "elastic" with a bobby pin. The legs of the pin are analagous to the cross sectional portions of the seal which are subject to "elastic" deflection, while the joining or hinge portion undergoes "plastic" deflection. Prior art seals of this type embodied a very thick cross-sectional hinge portion when compared to the leg portion, with the result that these seals were not suitable for the high temperature and high pressure cycling conditions encountered in industry today.

In the Boyce seal the disc members are joined by an integral hinge member where the disc portions are also substantially thicker than the hinge. His patent is for a high pressure joint in which the convex leg portions of the seal contact corresponding seating surfaces of the parts to be joined. In order to safeguard against distortion of the disc members beyond the elastic limit Boyce suggests it is preferable that an auxiliary separation ring bridge the cup walls to prevent their collapse under compressive load. This ring is illustrated in all the embodiments shown in the drawings.

In his disclosure Boyce states that:

In the joint of the present invention, however, the sealing contact is made over a narrow band and the effective sealing force is thereby magnified and the joint enabled to accommodate greater variations of internal pressure without failing, while at the same time the seating surfaces and the surfaces of the cup ring do not need to be machined to such accurate limits as in the said previously proposed joint.

Boyce is concerned with the presence of a convex contact surface to form the sealing surface, and this is the feature he has emphasized in his patent. While it is true that Boyce recognized the elastic limit of the discs, and uses an auxiliary separation ring to prevent distortion, there is no reference to using "plastic" and "elastic" deflection in his seal, such as is envisaged by the applicant.

To obtain the "elastic" and "plastic" deflection in his seal the applicant uses a metal having "resilient, spring characteristics such as a metal alloy marketed under the trade mark Inconel 718." Boyce states on page 2, line 58 that his material is a "steel cup ring of V-shaped section and an auxiliary steel ring bridges its walls". Further, at line 84, he adds that "pressure within the vessel will result in the walls of the ring 4 being forced outwardly against the faces 1 and 2, thus tightening the joint, the ring of course being made sufficiently flexible for this purpose." The use of a steel cup ring as well as a steel auxiliary ring in Boyce shows that he was concerned with a tight seat engagement between the convex sides of the ring and the corresponding faces to be joined. This was attained by tightening bolts to draw the parts together and a vent in the ring to permit the pressure within the vessel to act on the seal walls, thus increasing the sealing force.

Since Boyce used an auxiliary steel ring to prevent elastic deformation, his disclosure would not in our opinion lead a person skilled in the art to construct a seal possessing elastic and plastic deformation. By using a seal whose

hinge is capable of plastic deflection, the applicant is able to "custom fit" to allowable valve manufacturing tolerances so that his sealing ring functions satisfactorily under extreme conditions. The utilization of both plastic and elastic deformation is not taught in the prior art.

In the Final Action it was stated that mere deletion of an element with its corresponding function (in this case the auxiliary ring 7 which prevents plastic deformation of the seal ring) is not a patentable step. We agree that it may be often obvious to omit one or more parts of a machine or manufacture with a corresponding omission of function, but here that omission results in a new mode of operation of the parts retained, with unexpected advantages. In this invention deletion of the separation ring permits elastic deformation of the discs to give a better seal than is possible with the separation ring present. Consequently this constitutes a new mode of operation of the parts retained. In Hosiers Ltd. v Penmans Ltd. 1925 Ex. C.R. 93 at 102 it was stated that:

If a process exists which consists of different steps created by machinery, and there is an improvement in that process caused by a new element added to or taken from the machinery, then, the process existing and being known, the party who added to or took away the part of the machinery might if it were useful, be entitled to a patent, not for the process which formerly existed and was well known, but only for that which had been added to or taken from the mechanism.

Boyce stresses that the sealing engagement is effected by the outer ring surface which is convex with respect to the corresponding seating surfaces to be joined. According to his disclosure previous joints required contact over the whole area of the sides of the ring which meant that both ring surface and seating surfaces had to be machined to accurate limits. The applicants seal has a hinge having deformation characteristics integral with flexible disc portions which combine to compensate for manufacturing tolerances of the surfaces to be sealed without requiring a concave ring surface or any machining of the parts.

In these circumstances, the Board is satisfied that claims 1 to 6 represent a patentable advance in the art.

The Board recommends that the Final Action refusing the application be withdrawn.



G. Asher
Chairman
Patent Appeal Board

I concur with the findings of the Patent Appeal Board and withdraw the Final Action. The application is returned to the examiner for resumption of prosecution.



J.A. Brown
Acting Commissioner of Patents

Dated at Hull, Quebec,
this 17th. day of November,
1975

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