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(54) **TWO-PIECE CHECK VALVE ASSEMBLY**

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(52) **U.S. Cl.** **137/533.31**; 137/533.21; 137/543.21

(58) **Field of Search** 137/533.21, 533.25, 137/533.31, 543.21

(56) **References Cited**

U.S. PATENT DOCUMENTS

654,552	*	7/1900	Morris	137/543.21 X
718,771	*	1/1903	Kerfoot	137/533.31
1,912,786	*	6/1933	Moe	137/533.31 X
1,913,664	*	6/1933	Finger	137/543.21
3,548,868	*	12/1970	Mullaney	137/543.21 X
4,572,233	*	2/1986	Weeden	137/375
5,275,204	*	1/1994	Rogers et al.	137/533.25 X

* cited by examiner

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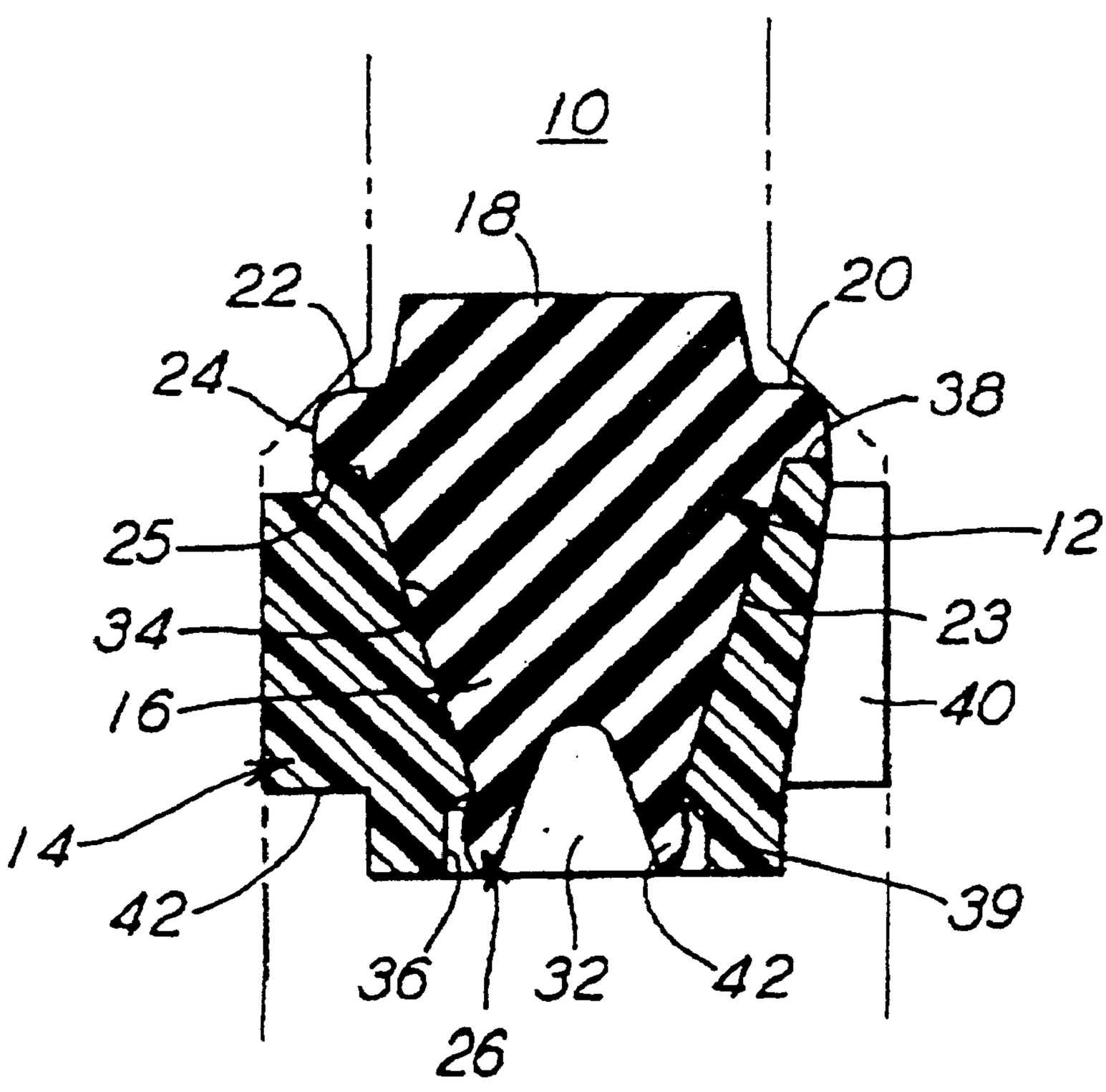
(57) **ABSTRACT**

A two-piece check valve device comprising a rubber sealing element and a plastic carrier member. A through bore in the plastic carrier member receives the sealing element, which is formed with an annular groove in which the carrier member is removably secured. The through bore and annular groove may be correspondingly tapered to facilitate assembly and disassembly of the check valve device.

18 Claims, 2 Drawing Sheets



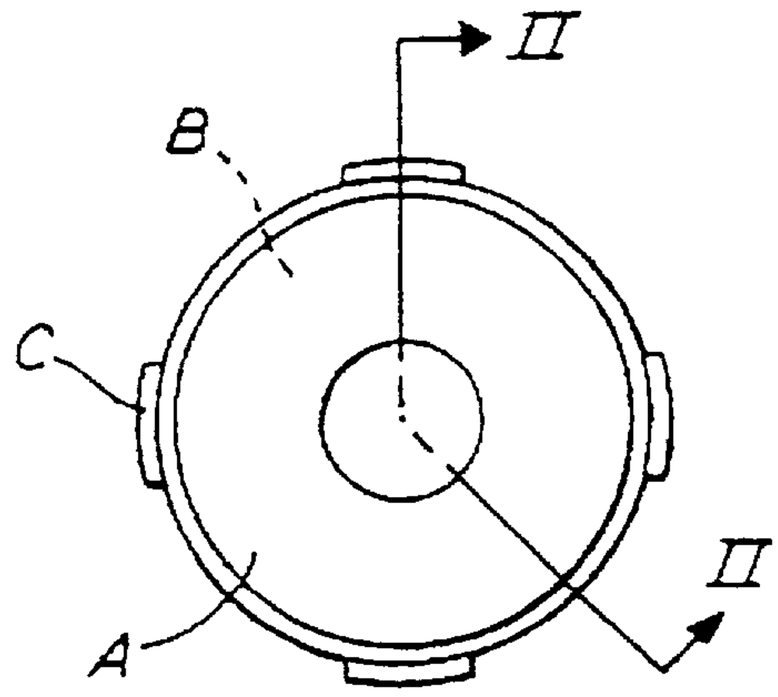


FIG. 1
PRIOR ART

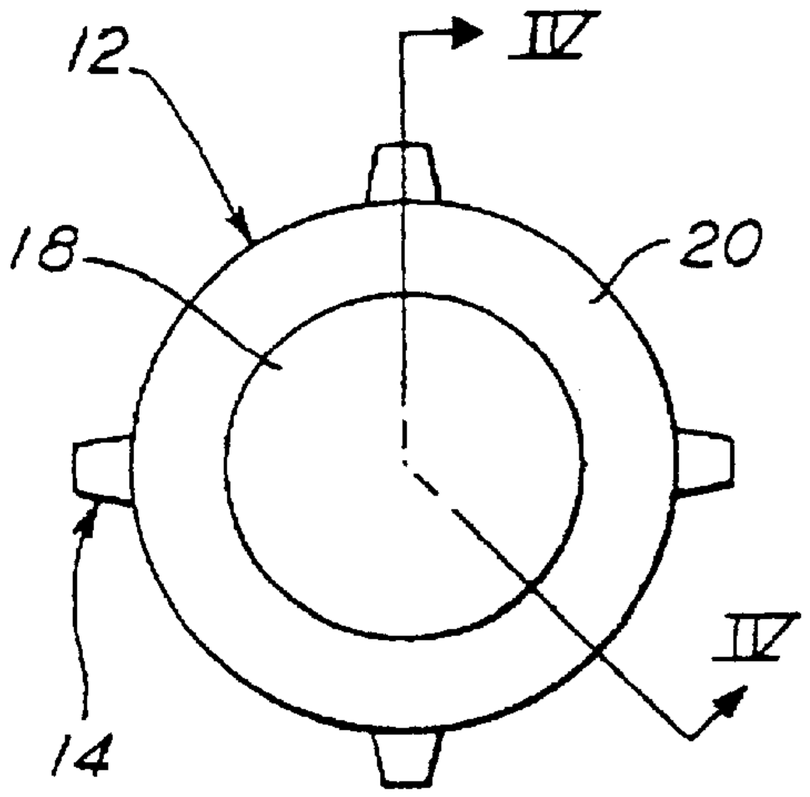


FIG. 3

FIG. 2
PRIOR ART

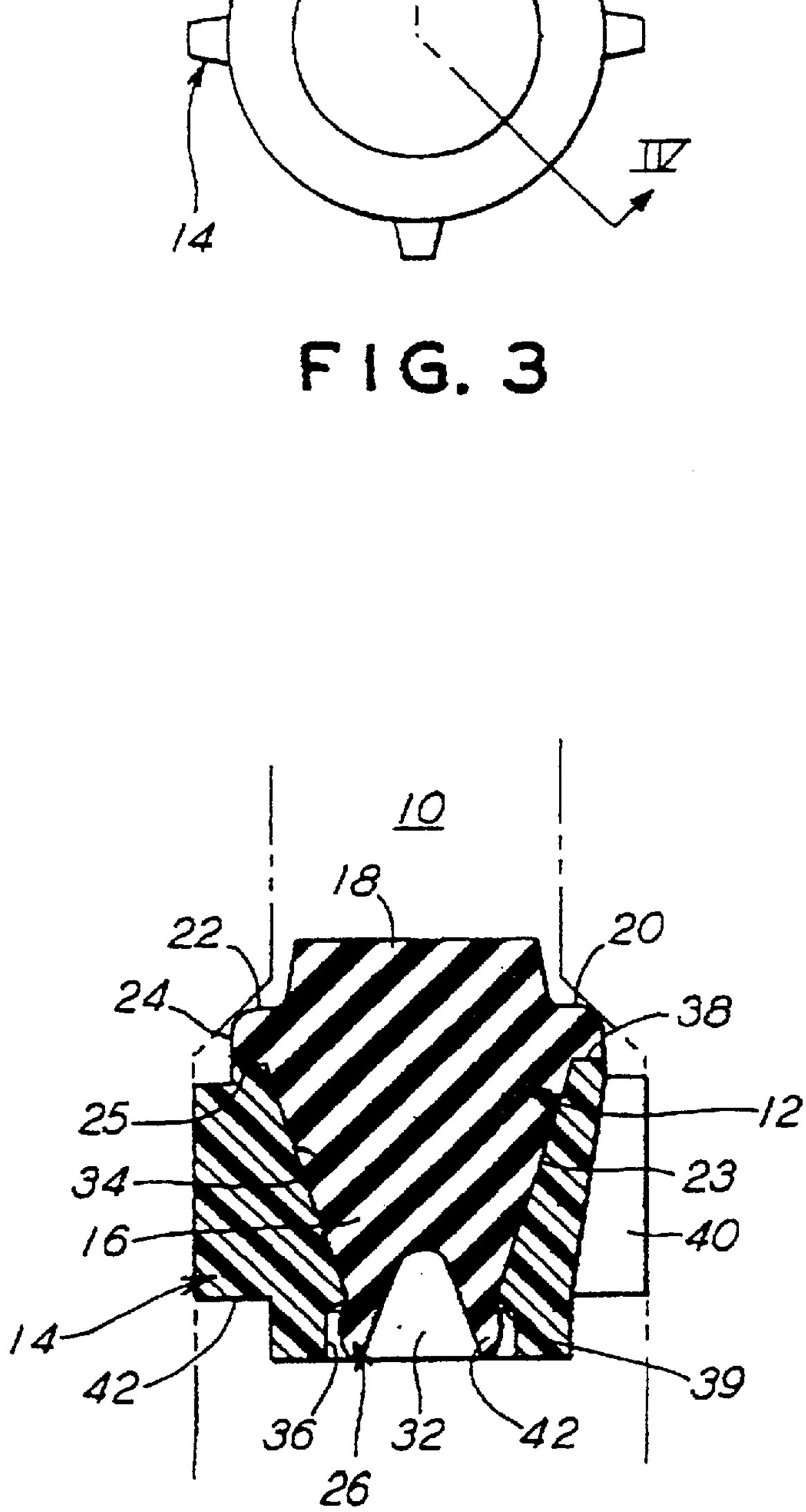


FIG. 4

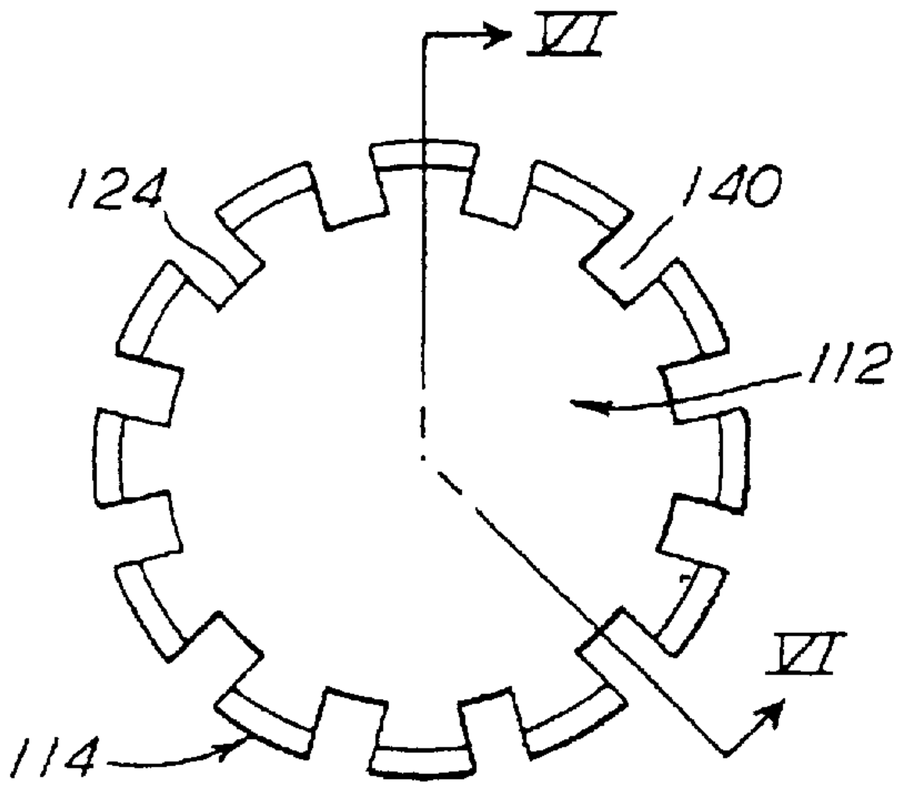


FIG. 5

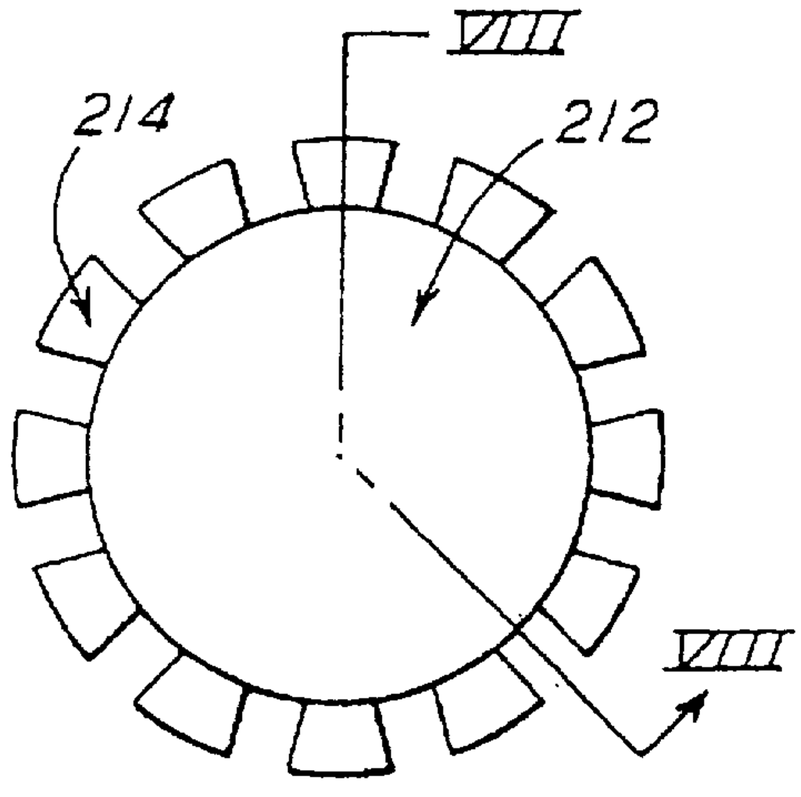


FIG. 7

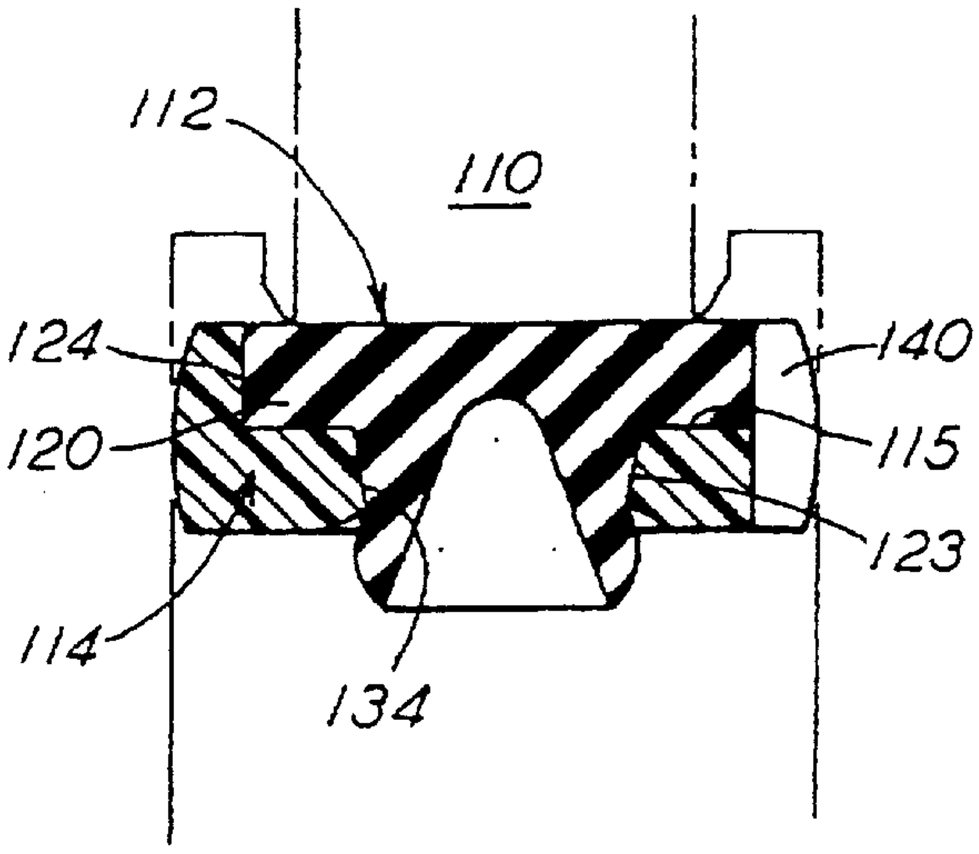


FIG. 6

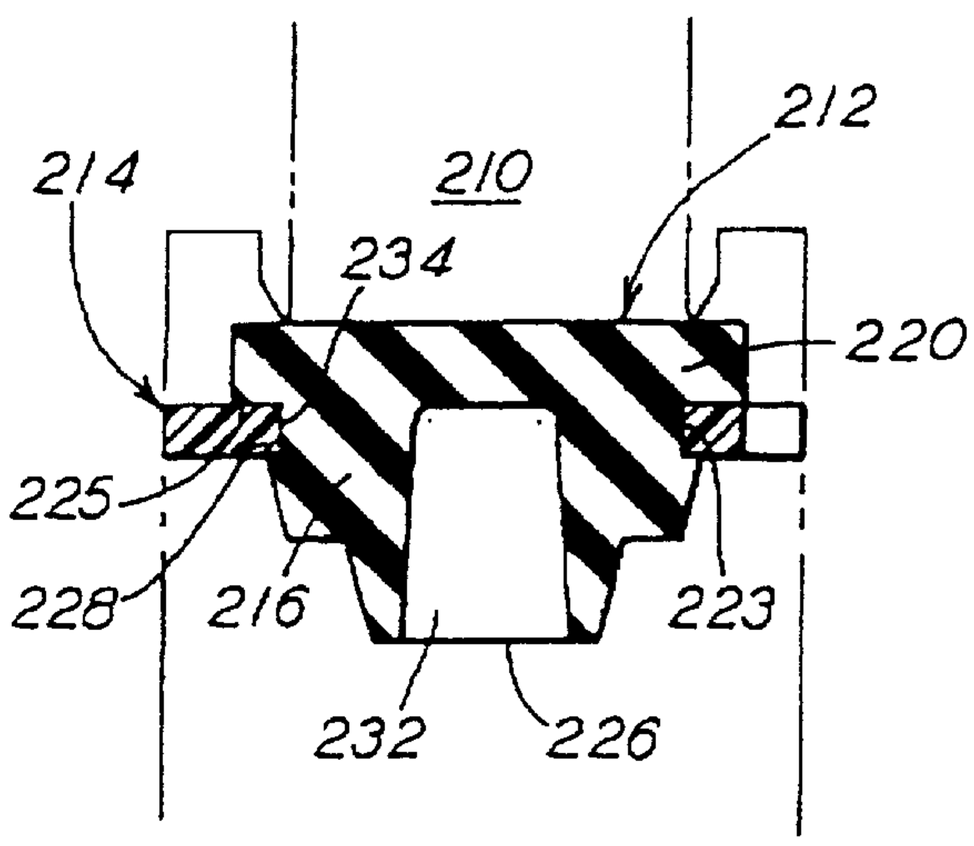


FIG. 8

TWO-PIECE CHECK VALVE ASSEMBLY

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

The present invention relates to check valves and particularly to poppet type check valves such as are typically employed in pneumatic brake control valve devices for railroad vehicles.

Poppet type check valves generally comprise a valve element that moves perpendicularly relative to a seat to open and close a fluid conducting passageway in which the valve element and seat are situated. When used as a backflow check, the valve element is arranged to disengage its valve seat in response to fluid flow in a desired direction and to engage its valve seat in response to fluid flow in the opposite direction. Alternatively, a piston actuator may be employed to operate the check valve element in a direction to engage or disengage its valve seat.

One such poppet type check valve known in the prior art is shown in FIGS. **1** and **2** of the drawings and is commonly employed in the aforementioned pneumatic brake control valve devices. The valve element A of such poppet type check valves is typically made from a rubber compound that is bonded during a molding process to a stamped metal insert B to form a unitary structure. The metal insert gives rigidity to the rubber valve element and provides a fluted guide C that is adapted to engage the passageway in which the check valve is disposed. The flutes are designed to permit fluid to pass around the solid molded structure and to maintain proper alignment of the valve element with its seat.

In the manufacture of these insert-molded, unitary poppet type check valves, difficulty is encountered not only in the molding process itself, but also in the after-molding process of removing flashing produced during the molding operation. In addition, such a unitary valve structure requires replacement of the entire check valve, including the metal insert, when the rubber valve element becomes worn.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a new, poppet type check valve device that is simple to manufacture and low in cost.

It is an extension of the foregoing to provide a check valve device that requires no bonding of the rubber valve element to a metal insert or the like.

Another object of the invention is to provide a two-piece check valve that permits replacement of either piece independently of the other.

Still another object of the invention is to employ a plastic carrier with which the rubber valve seal element is arranged in a two-piece assembly.

These objectives are carried out by means of a two-piece, snap-together check valve device that permits individual molding of the separate check valve components, which makes a simpler, less costly molding operation, such as injection molding, possible. The rubber valve seal element is designed to be retained in a separate plastic carrier member so that it can be removed therefrom and replaced when worn. The carrier member has a through bore in which the rubber seal element is removably secured by engagement with an annular groove in the body of the seal element. The

carrier member has a fluted periphery that guidably positions the check valve device in its passageway without cocking, in order to ensure the integrity of the check valve seal when engaged with its seat and to permit passage of fluid around the periphery of the check valve. The ability to individually mold the separate check valve components affords greater design latitude and consequently enhances the cost effectiveness of the check valve device according to the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following more detailed explanation when taken in connection with the accompanying drawings in which:

FIGS. **1** and **2** are top and sectional elevation views respectively of a molded type unitary check valve device known in the prior art;

FIGS. **3** and **4** are top and sectional elevation views respectively of a preferred embodiment of a poppet type check valve device featuring a snap-together plastic check valve assembly in accordance with the present invention;

FIGS. **5** and **6** are top and sectional elevation views respectively of an alternate embodiment of a check valve device according to the present invention; and

FIGS. **7** and **8** are top and sectional elevation views respectively of another alternate embodiment of a check valve device according to the present invention.

DESCRIPTION AND OPERATION

In each of the various embodiments herein disclosed, there is provided a segmented check valve device **10** comprising a rubber seal element **12** and a plastic carrier member **14**, for which a glass-filled nylon is the preferred material.

In the preferred embodiment of the invention, as shown in FIGS. **3** and **4**, seal element **12** is formed by a rubber body portion **16** having a head **18**, an annular shoulder **20** that extends laterally from head **18**, and a bulbous shaped bottom end **26**. The upper surface **22** of shoulder **20** provides a sealing area with which a valve seat (shown in phantom) of a poppet valve assembly is engageable. In the case of the tapered style seat represented, the sealing area is generally the edge of shoulder **20** between the upper surface **22** and its periphery **24**.

In FIG. 4 it is clearly shown that in rubber seal element 12 of check valve device 10 the surface of such annular shoulder 20 between upper surface 22 and its periphery 24 has a rounded or arcuate shape. FIG. 4 also shows the start of a seal being made adjacent the arcuate surface of shoulder 20 on the right side of the check valve device 10 while a slight space between the arcuate surface and the valve seat (shown in phantom) is seen on the left side of the drawing. In an actual application, since the seal element 12 is made of an elastomeric material, it is quite possible that a seal may start in one area of the check valve device 10 before the seal is totally formed. However, with a continued application force being exerted on the check valve device 10 a seal with the valve seat will be formed. Accordingly, it can be seen that annular shoulder 20 forms a seal with the valve seat at one of such upper surface 22 or such arcuate surface between the upper surface 22 and its periphery 24.

Formed in the periphery of body portion **16** between the underside **25** of shoulder **20** and bulbous bottom end **26** is an annular groove **23** in which carrier member **14** is retained. The base of groove **23** is tapered such that the diameter is

smaller at bulbous end **26** than at shoulder **20**. The bulbous end **26** of body portion **16** has an opening **32** that extends inwardly a distance at least beyond bulbous end **26** to provide flexure of bulbous end **26** in order to facilitate insertion of seal element **12** into carrier member **14** and subsequent removal therefrom.

Carrier member **14** is formed with a bore **34** and a counterbore **36**, bore **34** having a taper conforming to the taper of groove **23** in body portion **16**. Seal element **12** is assembled with carrier member **14** by inserting bulbous end **26** of body portion **16** into tapered bore **34**, at the larger diameter thereof, until the bulbous end enters counterbore **36**. The diameter of bulbous end **26** is greater than the smaller diameter of tapered bore **34**, such that the bulbous end flexes inwardly during insertion just before entering counterbore **36**, the diameter of which is greater than the diameter of bulbous end **26** to permit the flexed bulbous end to expand to its normal unflexed condition. In this manner, the assembly of seal element **12** with carrier member **14** is fixed or locked by engagement of the underside **26** of shoulder **20** with an upper surface **38** of carrier member **14**, and by engagement of bulbous end **26** with a lower surface **39** of carrier member **14** formed by the base of counterbore **36**.

The relatively large mass of seal element **12** combined with the relatively large support area of the tapered through bore of carrier member **14** provides such rigidity as to prevent distortion of seal element **12** under load, without requiring a metal insert, as employed for such purpose in the prior art practice. In addition, the taper of through bore **34** accommodates insertion of bulbous end **26** of seal element **12** into carrier member **14** without interference therebetween until the seal element approaches final insertion, thus making assembly easy.

Carrier member **14** is further formed with a fluted periphery **40** that is sized in accordance with the diameter of the passageway in which the check valve device is disposed, in order to provide a guide for alignment of the check valve device with its seat and to permit generally unrestricted flow of air past the guide when the check valve device is unseated during operation. An annular recess **42** in the bottom surface of carrier member **14** provides a seat to accommodate a spring when such is employed to bias the check valve device toward engagement with its seat. In this preferred embodiment of the invention, the shoulder **20** of seal element **12** is absent any support at its periphery, since such design is intended for use with a tapered type seat, as represented by the dot-dashed lines in the drawing. During engagement with seal element **12**, the tapered seat tends to laterally contain the seal so as to not require any peripheral support.

In the event seal element **12** becomes worn or damaged, it can be removed from its assembly with carrier member **14** by inserting a blunt nosed tool, for example, into opening **32** with sufficient force to cause bulbous end **26** to flex inwardly and thereby release its locking engagement with the base **39** of counterbore **36**. In this manner, the worn or damage seal element may be removed from carrier member **14** and replaced with a new seal element, without requiring replacement of the carrier member.

In an alternate embodiment of the invention shown in FIGS. **5** and **6**, a check valve device **110** is shown, which is intended for installations requiring a more compact check valve design than the embodiment of FIGS. **2** and **3**; and also for such installations in which a vertically disposed valve seat is employed instead of a tapered valve seat as in the embodiment of FIGS. **2** and **3**.

Check valve device **110** differs from check valve device **10** in that tapered groove **123** of body portion **112** is shorter in length than groove **23**, and the periphery of carrier member **114** is arcuate and surrounds the periphery **124** of shoulder **120**. In shortening tapered groove **123** in body portion **112**, a more compact design is realized for installations where space limitations exist. In addition, carrier member **114** is formed with a recess **115** in its top surface into which tapered bore **134** opens. When seal element **112** is inserted into carrier member **114**, shoulder **120** of seal element **112** is retained within recess **115** such that the periphery of carrier member **114** surrounds the periphery **124** of shoulder **120** in order to prevent lateral displacement and distortion of the seal element during seat engagement. The fluted periphery **140** of carrier member **114** is further shaped arcuately to guide the check valve device **110** in its bore without binding and cocking, as the carrier member of this design is inclined to do because of its relatively thin size and to permit passage of fluid.

Another alternate embodiment of the invention is shown in FIGS. **7** and **8**, in which check valve **210** differs from the previous embodiments by reason of annular groove **223** being non-tapered and by the absence of a bulbous shaped bottom end of seal element **212**. In this embodiment, the annular groove **223** in body portion **216** is formed between the underside **225** of shoulder **220** and a spaced-apart, confronting side **228** that is generally parallel to underside **225**. As opposed to the tapered annular groove **23**, **123** of body portion **12**, **112** in the previous embodiments, the periphery of body portion **216** within groove **223** in this embodiment is normal to sides **225** and **228** and is thus not tapered. Neither, therefore, is the correspondingly shaped bore **234** in carrier member **214** tapered. It will be appreciated that a tapered retention area of body portion **212** and correspondingly tapered bore of carrier member **214** are unnecessary in this design, due to the relatively short distance the seal element **212** needs to be inserted to realize locking assembly with the relatively thin carrier member **214**.

While the annular groove of body portion **216** is non-tapered, the area between groove **223** and bottom **226** is tapered. The purpose of this taper, in conjunction with the opening **232** in body portion **216** is to ensure sufficient flexure of body portion **216** to facilitate insertion of seal element **212** into carrier member **214** during assembly therewith and subsequent removal therefrom.

I claim:

1. For a poppet valve assembly including a valve seat in a fluid pressure passageway, a check valve device cooperatively arranged relative to said valve seat for establishing and interrupting flow of fluid under pressure in said passageway, said check valve device comprising:

a) an annular carrier member having opposing upper and lower surfaces and a through bore extending therebetween; and

b) an elastomeric seal element comprising a body having an annular shoulder extending laterally therefrom at one end of said body, a flexure portion at the other end of said body and an annular groove in the periphery of said body between an underside of said shoulder and a confronting surface of said flexure portion, said upper surface of said carrier member engaging said underside of said shoulder and said lower surface of said carrier member engaging said confronting surface of said flexure portion, said shoulder having an upper surface with which said valve seat is engageable in a seal area having generally opposed relationship with said upper surface of said carrier member.

2. A check valve device as recited in claim **1**, further characterized in that the periphery of said body is tapered.

3. A check valve device as recited in claim **2**, wherein the diameter of the tapered periphery of said body decreases in a direction from said shoulder to said flexure portion.

4. A check valve device as recited in claim **3**, further characterized in that said body further includes an opening in said other end extending into said body at least a distance corresponding to the distance between said other end and said confronting surface of said flexure portion.

5. A check valve device as recited in claim **1**, further characterized in that the periphery of said carrier member is fluted.

6. A check valve device as recited in claim **1**, wherein said carrier member is plastic.

7. A check valve device as recited in claim **2**, wherein the tapered periphery of said body includes said groove.

8. A check valve device as recited in claim **7**, wherein said through bore in said carrier member is formed with a taper corresponding to the tapered periphery of said groove.

9. A check valve device as recited in claim **8**, further characterized in that said through bore is contiguous with said tapered periphery of said body within said groove.

10. A check valve device as recited in claim **9**, wherein said through bore comprises a bore and a counterbore between which is formed said lower surface of said carrier member.

11. A check valve device as recited in claim **10**, wherein said flexure portion is formed with a bulbous end in surrounding relationship with said opening, said bulbous end providing said confronting surface of said flexure portion and extending laterally into said counterbore to provide said engagement of said confronting **[**face**]** *surface* with said lower surface of said carrier member.

12. A check valve device as recited in claim **1**, wherein said carrier member comprises a recess in the upper surface thereof having an annular sidewall, the periphery of said annular shoulder being contiguous with said annular sidewall of said recess.

13. A check valve device as recited in claim **12**, wherein the periphery of said carrier member is arcuate.

14. A check valve device as recited in claim **2**, wherein the periphery of said body is tapered between said groove and said flexure portion.

15. A check valve device as recited in claim **14**, wherein the periphery of said body is non-tapered within said groove.

16. A check valve device for a poppet valve assembly including a valve seat disposed in a fluid pressure passageway, said check valve device being cooperatively arrangeable relative to such valve seat for establishing and interrupting a flow of fluid under pressure in such passageway, said check valve device comprising:

a) an annular carrier member having opposing upper and lower surfaces and a through bore extending therebetween; and

b) an elastomeric seal element including a body portion having an annular shoulder extending laterally therefrom intermediate a first end and a second end of said body portion, a flexure portion disposed at said second end of said body portion and an annular groove formed in a periphery of said body portion between an underside of said annular shoulder and a confronting surface of said flexure portion, said upper surface of said annular carrier member engaging said underside of said annular shoulder and said lower surface of said annular carrier member engaging said confronting surface of said flexure portion, said annular shoulder having at least one of an upper surface and an arcuate surface with which such valve seat is engageable in a seal area having a generally opposed relationship with at least one of said said upper surface and said arcuate surface of said annular shoulder.

17. A check valve device for a poppet valve assembly, according to claim 16, wherein said arcuate surface is engageable with such valve seat in a seal area having a generally opposed relationship with said arcuate surface of said annular shoulder.

18. A check valve device for a poppet valve assembly including a valve seat disposed in a fluid pressure passageway, said check valve device being cooperatively arrangeable relative to such valve seat for establishing and interrupting a flow of fluid under pressure in such passageway, said check valve device comprising:

a) an annular carrier member having opposing upper and lower surfaces and a through bore extending therebetween; and

b) an elastomeric seal element including a body portion having an annular shoulder extending laterally therefrom adjacent a first end, a flexure portion adjacent a second end of said body portion and an annular groove in a periphery of said body portion between an underside of said annular shoulder and a confronting surface of said flexure portion, said upper surface of said carrier member engaging said underside of said annular shoulder and said lower surface of said carrier member engaging said confronting surface of said flexure portion, said annular shoulder having an upper surface with which such valve seat is engageable in a seal area having a generally opposed relationship with said said upper surface and said carrier member.

* * * * *