

[54] **PLASTIC SEAL**
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 [73] Assignee: Stoffel Seals Corporation, New York, N.Y.

3,146,012 8/1964 King.....292/320
 2,656,209 10/1953 Conaway.....292/319
 3,290,080 12/1966 Dawson.....292/322
 3,367,701 2/1968 Wenk.....292/321

[22] Filed: Nov. 16, 1970

Primary Examiner—Robert L. Wolfe
 Attorney—Craig and Antonelli

[21] Appl. No.: 89,542

[52] U.S. Cl.292/321, 292/317, 292/322
 [51] Int. Cl.B65d 55/06
 [58] Field of Search292/307 R, 207 A, 317, 318,
 292/319, 320, 321, 322; 24/16, 16 PB, 30.5
 P, 206 A

[57] **ABSTRACT**

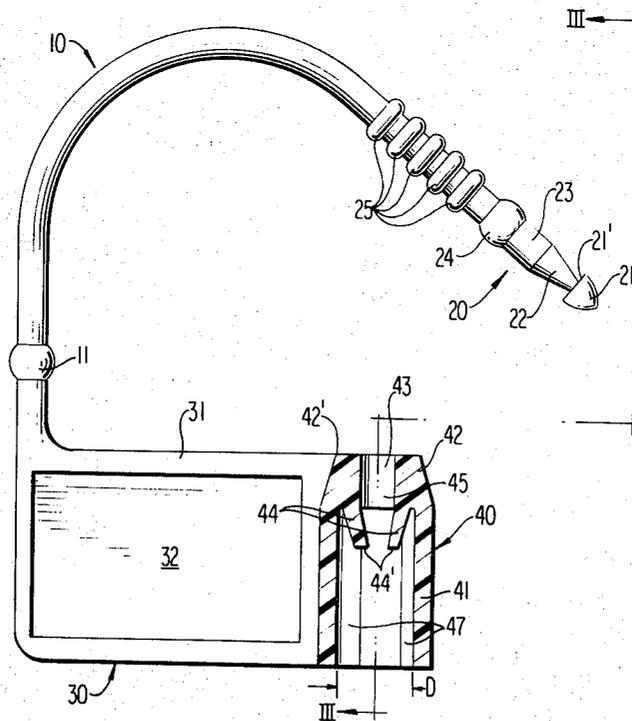
An all plastic seal in which the socket receiving the locking head of a strap connected to the seal body is provided with a housing open at both ends that is of such a ratio in its length to the opening in the housing at the end opposite where the locking head is inserted that access to the locking fingers is substantially precluded; additionally, the housing may be provided with inwardly projecting fluke-like projections minimizing the freedom of movement of the head in its locked condition in a direction transverse to the axial dimension of the housing.

[56] **References Cited**

UNITED STATES PATENTS

2,610,879 9/1952 Pope292/320
 3,372,952 3/1968 Newton.....292/307
 3,466,077 9/1969 Moberg.....292/322

32 Claims, 12 Drawing Figures



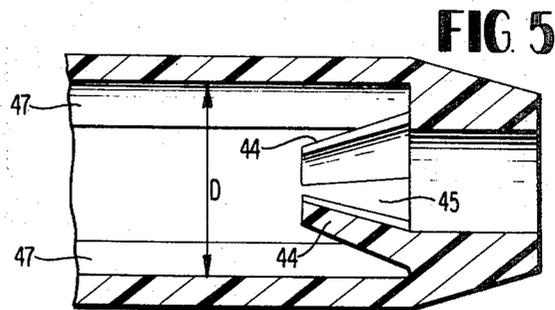
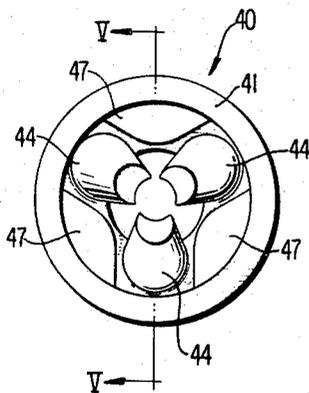
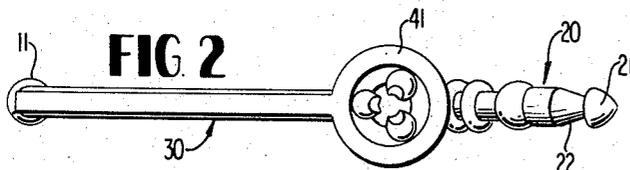
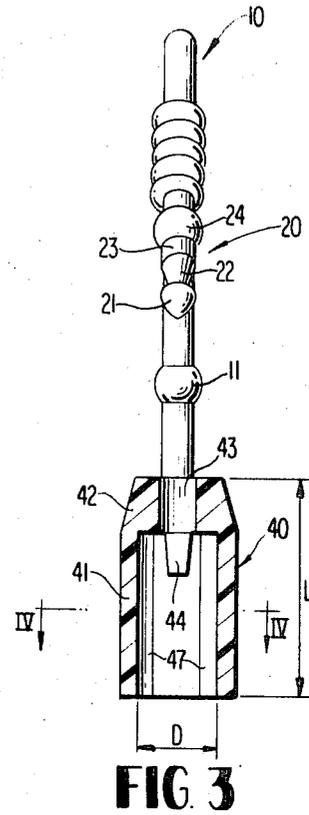
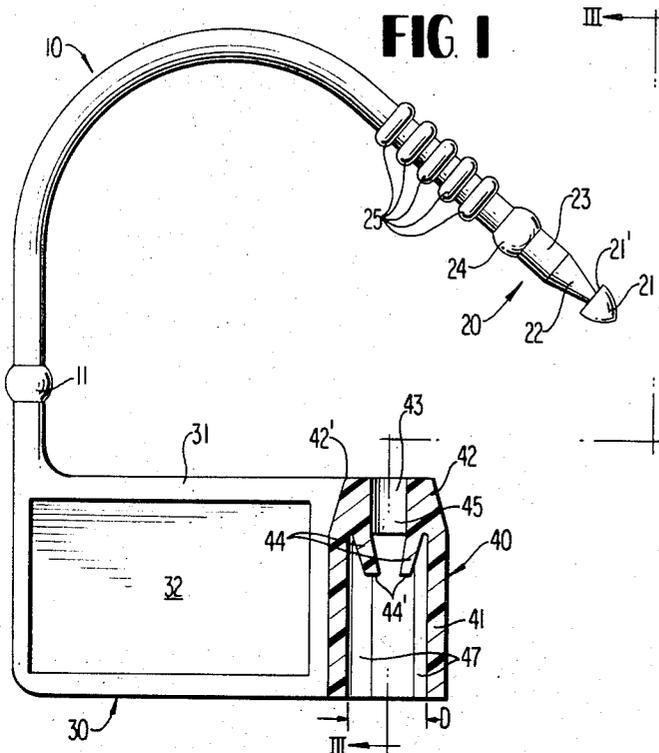


FIG. 4

FIG. 4a

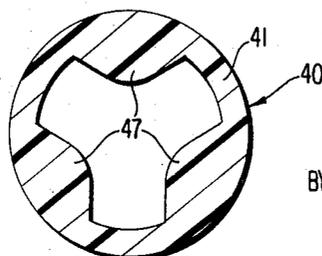
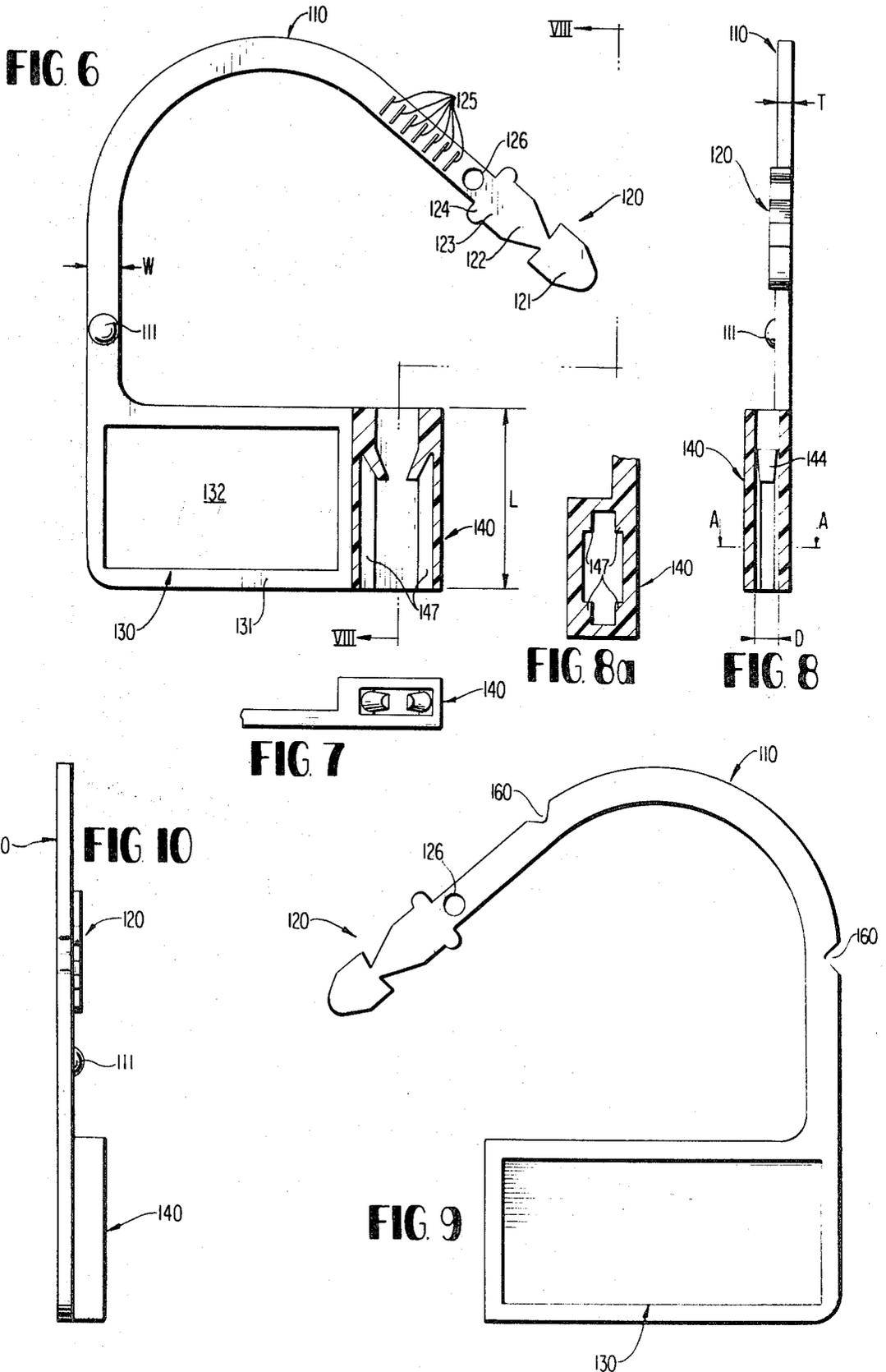


FIG. 5

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PLASTIC SEAL

The present invention relates to a plastic seal, and more particularly, to a self-locking tamper-proof seal made from synthetic resinous material.

Various plastic padlock and hasp seals are known already in the prior art. However, all of these prior art seals entail certain disadvantages, particularly as regards ease of manufacture and cost involved as well as tamperproofness in operation.

One prior art construction of a fastening device of this type (U.S. Pat. No. 3,402,435) consists of a filament, adapted to be attached to a tag, which is provided with a slotted socket forming fingers to receive the head at the end of the filament. However, the socket of this prior art construction is exposed so that the fingers can be easily spread to enable removal of the head. To enhance its tamper-proof characteristics, this prior art construction not only proposes a reduced diameter neck directly behind the head but also proposes an increase in brittleness at the neck, thereby requiring an additional annealing step in its manufacture. However, the ease of removal of the head by spreading the fingers defeats the additional safety measures of this prior art construction, apart from its increased manufacturing cost due to the required annealing operation.

Another prior art construction (U.S. Pat. No. 3,466,077) proposes to completely enclose the finger portions of the socket within a housing surrounding the socket to render such a seal more tamper-proof. In such prior art construction one housing end is completely closed. However, such a construction entails a substantial drawback as regards ease of manufacture and involved manufacturing costs since it requires an additional operating step, by the use of a die under suitable heat and pressure, to close the end of the housing by drawing in the wall of the end of the housing to be closed. Since plastic seals of this type are mass-produced, the additional step involved in closing the end of the housing in this prior art construction directly and substantially affects the cost thereof.

Other types of plastic seal constructions are also known in the prior art. In one such prior art construction (U.S. Pat. No. 3,146,012) the interlocking slotted housing is not only relatively complicated but is far from being tamper proof since access can be had to the interlocking parts by way of the openings thereof. In another such prior art construction (U.S. Pat. No. 3,367,701) the times of the engaging member are readily accessible from the open end of the socket, not to mention the fact that the interlocking parts are relatively complicated in design.

The present invention has as its purpose to eliminate the aforementioned shortcomings and drawbacks encountered in the prior art and to provide an all-plastic seal which is substantially more tamper-proof yet is simple in construction as well as easy to manufacture.

The self-locking seal of the present invention includes a housing accommodating the locking socket which is of such dimensions and construction that the interlocking parts cannot be reached by items in the normal possession of a person, such as a pencil, ball point pen or the like which could be used to reopen the interlocking parts by inserting, for example, the end of a small mechanical pencil into the open end of the

socket housing and gradually prying open the socket fingers as the head portion is wiggled back and forth, ultimately permitting its withdrawal out of the socket.

Accordingly, the present invention has as its principal purpose to eliminate the drawbacks and disadvantages of the prior art and to provide an all-plastic padlock seal that is considerably more tamper proof than the prior art devices without requiring additional manufacturing steps increasing the cost thereof. The present invention essentially consists in that the housing surrounding the locking socket has such a ratio of length to diameter of its bore as to make it substantially impossible to get at the locking prongs when the seal is closed and still effect a sufficient movement of the locking fingers. Additionally, as a further tamper-proof feature, flutes are provided on the inside of the housing which prevent the locked head from being wiggled in a substantially transverse direction to its ultimate withdrawal out of the socket.

Accordingly, it is an object of the present invention to provide a plastic seal of the type described above which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in a plastic seal of the type described above which can be manufactured in a simple manner without requiring any additional manufacturing steps other than the single molding operation thereof.

A further object of the present invention resides in an all plastic padlock seal which excels by its tamper-proof characteristics yet can be readily manufactured by mass production techniques utilizing conventional injection or pressure molding.

A still further object of the present invention resides in a plastic seal of the type described above which obviates any after-treatment of the molded seal.

These and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing, which shows, for purposes of illustration only, several embodiments in accordance with the present invention, and wherein

FIG. 1 is an elevational view of an all-plastic padlock seal in accordance with the present invention, illustrating the socket housing thereof in axial longitudinal cross-section.

FIG. 2 is a bottom plan view of the seal of FIG. 1.

FIG. 3 is a cross-sectional view taken along line III—III of FIG. 1.

FIG. 4 is a view, similar to FIG. 2, and showing certain details thereof on an enlarged scale.

FIG. 4a is a cross-sectional view taken along line IV—IV of FIG. 3.

FIG. 5 is a partial cross-sectional view taken along line V—V of FIG. 4.

FIG. 6 is an elevational view, similar to FIG. 1, of a modified embodiment of an all-plastic padlock seal in accordance with the present invention.

FIG. 7 is a partial bottom plan view of FIG. 6.

FIG. 8 is a cross-sectional view, taken along line VIII—VIII of FIG. 6.

FIG. 8a is a cross-sectional view taken along line A—A of FIG. 8.

FIG. 9 is an elevational view of a still further modified embodiment of the plastic seal of FIG. 6, and

FIG. 10 is a side view of the seal of FIG. 9.

Referring now to the drawing, wherein like reference numerals are used throughout the various views to designate like parts, and more particularly to FIGS. 1, 2 and 3, reference numeral 10 generally designates a flexible tie-member provided at its free end with a locking head generally designated by reference numeral 20 and secured at the other end to one side of a relatively flat body generally designated by reference numeral 30 which includes at the other side thereof, a locking housing generally designated by reference numeral 40 provided with a locking socket for the head 20. The body 30 in the illustrated embodiment is of approximately rectangular shape and of a thickness slightly smaller than the diameter of the substantially circular tie-member 10. However, the relatively flat body 30 may also be of any other suitable configuration and thickness, as may be desired for a particular use, for example, to contain a desired information on its front and/or back surface which may be formed thereon directly during the molding operation. Additionally, the body 30 may be provided with a rim 31 surrounding the main surface 32 recessed relative thereto which will receive the information. Since this information may be realized, for instance, by suitable engraving of the mold, the base 30 can be made to appear attractive. A small reinforcing enlargement 11 approximately spherically shaped may be provided in the member 10 near its connection with the body 30.

The locking head 20 includes at its free end an approximately triangularly-shaped locking head portion 21 having slightly curved tapering surfaces. The head portion is adjoined by a tapering section 22 having its smaller diametric dimension adjacent the end surface 21' thereby forming an intentionally weakened place at the connection between surface 21' and section 22 adjacent the substantially flat end surface 21' of the head portion 21 which will break in case of tampering with the tie member 10, when someone attempts to unlock the seal. The tapering portion 22 is adjoined by a substantially cylindrical portion 23, followed in turn, by an enlargement 24 similar to the reinforcing enlargement 11 and constituting a stop member. Several annular beads 25, which are spaced at equal distances and follow the enlarged portion 24, provide a gripping area where the tie member 10 can be firmly gripped during the locking operation.

The socket housing 40 is formed of a cylindrical sleeve 41 open at the bottom end and provided at the top with a flaring section 42. The flaring section 42 is provided with an axial bore 43 of a diametric dimension slightly larger than the maximum diametric dimensions of the head portion 21 and of the cylindrical section 23, but smaller than the diametric dimension of the enlarged abutment 24 so that the head 20 can be inserted into the bore 43 with its head portion 21, tapering section 22 and cylindrical section 23 until the enlargement 24 abuts against the upper end surface 42' of the housing 40. Prong-like locking fingers 44, each of which defines on the inside thereof a part of a frusto-conical surface complementary to the surface of section 22, extend inwardly and downwardly within the housing 41, thus forming an interrupted tapering section 45 of frusto conical shape. The length of the frusto conical opening 45 formed by the locking fingers is thereby substantially equal to or very slightly larger

than the length of the tapering section 22 and the length of the bore 43 is thereby substantially equal to or very slightly larger than the length of the cylindrical section 23 so that the head portion 21 snaps into its locked position with the flat surface 21' thereof engaging against the end surfaces 44' of the prong-like fingers 44 when the abutment engages the end face 42' of the housing 40.

By making the ratio of the length L to the diameter D (FIGS. 1, 3 and 5) sufficiently large, for example by making this ratio greater than 5:2, it will be impossible to get at the prongs 44 when the seal is closed, particularly if the diametric dimensions D are relatively small, for example of the order of a quarter inch or less. However, in order to further enhance the tamper-proof characteristics of the seal according to the present invention, inwardly projecting flutes 47 of approximately triangular cross section and arranged intermediate the locking fingers 44 are provided on the inside of the housing 40 which extend essentially from the open end of the cylindrical housing 41 to the tapering part 42 thereof. Owing to the presence of the flute-like projections 47, the head portion 21 is substantially prevented from being moved to any substantial extent in the transverse direction, i.e., in a direction at an angle to the axis of the housing 40, thus making it impossible to withdraw the head 20 out of the socket formed by prongs 44 by wiggling the head 20 around to work it back past the prongs 44, possibly while attempting to spread the prongs 44 apart. Furthermore, in the event of an excessive force used in the attempt to open the seal, the member 10 would break at its intentionally weakened place in the area of the connection between the head portion 21 and tapering section 22, thereby indicating the tampering with the seal.

The embodiment of FIGS. 6, 7 and 8 is substantially similar to FIGS. 1 through 5 and similar parts thereof are designated by corresponding reference numerals of the 100 series. However, differing from the first embodiment, the flexible tie-member 110 of the embodiment of FIGS. 6, 7 and 8 is substantially flat and of rectangular cross-section, i.e., has a thickness substantially corresponding to the thickness of the body 130 and a width that is a multiple of its thickness, as can be seen from a comparison of FIGS. 6 and 8 where the thickness is indicated by T (FIG. 8) and the width by W (FIG. 6). Additionally, the head portion 121 is of similar flattened configuration, as can also be seen in FIGS. 6 and 8. Also, the head portion 121 is of partially frusto-conical and partially cylindrical configuration, adjoined again by a tapering section 122 which is followed by a cylindrical section 123 and an annular shoulder 124 again forming an abutment. In lieu of annular beads, several raised, very fine embossments 125 are provided to facilitate gripping of the tie-member 110 during the closing of the seal. Contrary to the circular configuration of the housing 40, the housing 140 of this embodiment is also of substantially rectangular configuration, provided with only two prong-like locking fingers 144 and with four flute-like projections 147 extending inwardly from the narrow sides of the rectangle so as to reduce the free space in the direction of the longer side of the substantially rectangular opening. The flute-like projections 147 again prevent the head 120 from being worked back past the prongs 144 by wiggling the head 120 around in the housing 140.

The ratio of length L in this embodiment to the dimension D' (FIGS. 6 and 8) is again chosen so as to be of the order of 5:2 or larger to improve the tamper-proof characteristics, especially with dimension of D' of the order of an eighth of an inch or less.

The embodiment of FIGS. 9 and 10 differs from that of FIGS. 6 through 8 only in the provision of two cut-outs 160 provided in the tie-member 110 which serve the purpose of facilitating breaking of the seal without the need of scissors or a tool and of assuring that the seal breaks in the strap. Additionally, these cut-outs serve as further intentionally weakened places to break in case of tampering with the seal.

In addition to the intentionally weakened places so far described, other intentionally weakened places may also be provided either in addition to those described or in lieu thereof. For example, a semi-circular hole 126 (FIGS. 6 and 9) may be provided in or behind the shoulder 124 or in a shoulder forming the equivalent of stop 24 which can be made of such a diameter that the strap 10 or 110 breaks in this weakened area before it breaks at 22 or 122. Furthermore, any other suitable additional weakening means may be provided to suit the particular design requirements.

In all embodiments, the smallest diameter of the tapering section 22 or 122 is so chosen, taking into consideration the plastic material used, that any forcible attempt to withdraw the head 20 or 120 out of the socket would result in a breaking off of the connection between the head portion 21 and the adjoining end of the tapering section before there is any substantially yielding and/or possible destruction of the locking fingers of the socket, thus further ensuring the safety of the seal. Of course, in the presence of other weakened sections, such as at 126 and/or at 160, the seal may also break at this place or these places, or at any other intentionally weakened place before it breaks at 22 or 122.

It will be readily recognized from the above that the seal according to the present invention can be manufactured by a single operating step without requiring any after treatment, yet offering a substantially completely tamper-proof structure. Any known suitable synthetic resinous material may be used for the plastic seal of the present invention and any suitable known molding techniques may be used for the purpose of molding the same.

While I have shown and described only several embodiments in accordance with the present invention, it is understood that the same is not limited thereto, but is susceptible of numerous changes and modifications as known to those skilled in the art. For example, the body 30 and 130 may be modified in shape and/or may be even omitted, leaving only a housing of suitable shape, to which the tie-member would then be connected in an appropriate manner. Additionally, other cross-sectional configurations may be used for the various parts of the seal such as the tie-member and/or the head, as well as the socket. Furthermore, a shoulder similar to shoulder 124 may be used in lieu of stop 24. Thus, it is obvious that the present invention is not limited to the details shown and described herein, and I therefore do not wish to be limited to the same, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim is:

1. A seal which includes a housing means, a locking socket means, a tie-member operatively connected to the housing means, and a locking head means provided at the free end of the tie-member for insertion into the socket means to lock the seal, the socket means including inwardly projecting prong-like locking elements and the head means including a head portion with a shoulder and of such dimension as to elastically expand the prong-like locking elements during insertions thereof so that the shoulder formed between the head portion and an adjoining section with smaller cross section snaps in behind the end surfaces of the prong-like locking elements when the head portion is inserted into said socket means, the housing means being provided with internal longitudinally extending bore means open at both ends thereof, the socket means being located near one end of the housing means and being enclosed by said bore means, and wherein the housing means is provided in said bore means with inwardly projecting means at least in the area behind the end surfaces of the locking element substantially minimizing the freedom of movement of the head portion in the bore means, when in the locked position thereof, in a direction transverse to the longitudinal axis of the housing means.

2. A seal according to claim 1, characterized in that said bore means is of substantially circular cross-section.

3. A seal according to claim 1, characterized in that said bore means is of substantially rectangular cross-section.

4. A seal according to claim 1, characterized in that the dimensions of said shoulder and of the adjoining section of smaller cross-section are so chosen that the connection of the head portion with said adjoining section forms a place of intentional failure in case of tampering with the seal.

5. A seal according to claim 1, characterized in that said inwardly projecting means is formed by substantially longitudinally extending flutes provided on the inside of the bore means.

6. A seal according to claim 1, characterized in that said tie-member and said housing means are of substantially circular cross-section.

7. A seal according to claim 1, characterized in that said tie-member, said head means, and said housing means are substantially flat with an approximately rectangular cross-section of relatively slight thickness.

8. A seal according to claim 5, characterized in that the tie-member is connected to one side of a seal body, and the housing means is located at the other side thereof.

9. A seal according to claim 8, characterized in that said body is relatively flat while said tie-member, head means and housing means are of substantially circular cross-section.

10. A seal according to claim 8, characterized in that said body, said tie-member, said head means, and said housing means are substantially flat.

11. A seal according to claim 4, characterized by further means in the form of at least one additional cut-out constituting an intentional place of failure in case of tampering with the seal.

12. An all-plastic seal according to claim 1, characterized in that the inwardly projecting means are con-

structed as flute means extending longitudinally from the area of said socket toward said other end and substantially preventing any wiggling of the head when in the locked position.

13. A seal according to claim 1, characterized in that said seal is of a unitary construction.

14. A seal according to claim 13, characterized in that said seal is constructed entirely of homogenous plastic material.

15. A seal according to claim 5, characterized in that said flutes have a uniform cross-section throughout their length, and in that said flutes extend from the other open end up to a position immediately adjacent the prong like locking elements of the socket means.

16. A seal according to claim 15, characterized in that said seal is of a unitary construction.

17. A seal according to claim 16, characterized in that said seal is constructed entirely of homogenous plastic material.

18. An all plastic seal according to claim 12, characterized in that the ratio of the dimension of said housing in the longitudinal direction to the maximum dimension of the cross-section of said passage is at least 5:2.

19. An all-plastic seal according to claim 18, characterized in that said seal is of a unitary construction.

20. A seal according to claim 1, characterized in that said head means includes a stop member spaced from said shoulder a distance corresponding to the distance between the end surfaces of the prong-like elements and the end surface of said housing means immediately surrounding the bore means at the one end of the housing means whereby longitudinal movement of said head means is precluded by engagement of said stop means with said end surface of said housing means once the head portion is snapped in position by the prong-like locking elements.

21. A seal according to claim 20, characterized in that the end surface of said housing means and the end surfaces of said prong-like elements extend substantially transversely to said longitudinally extending bore means.

22. A seal according to claim 21, characterized in that the seal is of a unitary, homogenous plastic construction.

23. A seal according to claim 15, characterized in that said head means includes a stop member spaced from said shoulder a distance corresponding to the distance between the end surfaces of the prong-like elements and the end surface of said housing means immediately surrounding the bore means at the one end

of the housing means whereby longitudinal movement of said head means is precluded by engagement of said stop means with said end surface of said housing means once the head portion is snapped in position by the prong-like locking elements, the end surfaces of said housing means and the end surfaces of said prong-like elements extending substantially transversely to said longitudinally extending bore means.

24. A seal according to claim 1, wherein the ratio of the dimension of the bore means in the longitudinal direction to the smallest cross-sectional dimension of the bore means at the other open end opposite the socket means is such as to substantially preclude access to the locking elements from the said other open end of the housing means when the head portion is lockingly inserted into the socket means.

25. A seal according to claim 15, wherein the ratio of the dimension of the bore means in the longitudinal direction to the smallest cross-sectional dimension of the bore means at the other open end opposite the socket means is such as to substantially preclude access to the locking elements from said other open end of the housing means when the head portion is lockingly inserted into the socket means.

26. A seal according to claim 17, wherein the ratio of the dimension of the bore means in the longitudinal direction to the smallest cross-sectional dimension of the bore means at the other open end opposite the socket means is such as to substantially preclude access to the locking elements from said other open end of the housing means when the head portion is lockingly inserted into the socket means.

27. A seal according to claim 24, characterized in that said ratio is at least 5:2.

28. A seal according to claim 27, characterized in that the smallest cross-sectional dimension is at most of the order of 0.2 inch.

29. A seal according to claim 24, characterized in that said inwardly projecting means is formed by substantially longitudinally extending flutes provided on the inside of the bore means.

30. A seal according to claim 25, characterized in that said ratio is at least 5:2.

31. A seal according to claim 26, characterized in that said ratio is at least 5:2.

32. A seal according to claim 27, characterized in that said bore means is of substantially uniform cross-section from said other open end up to a position adjacent the prong-like elements.

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