Nov. 21, 1961 S. S. BODNER 3,009,169

HINGE CONFIGURATION AND METHOD FOR MAKING SAME

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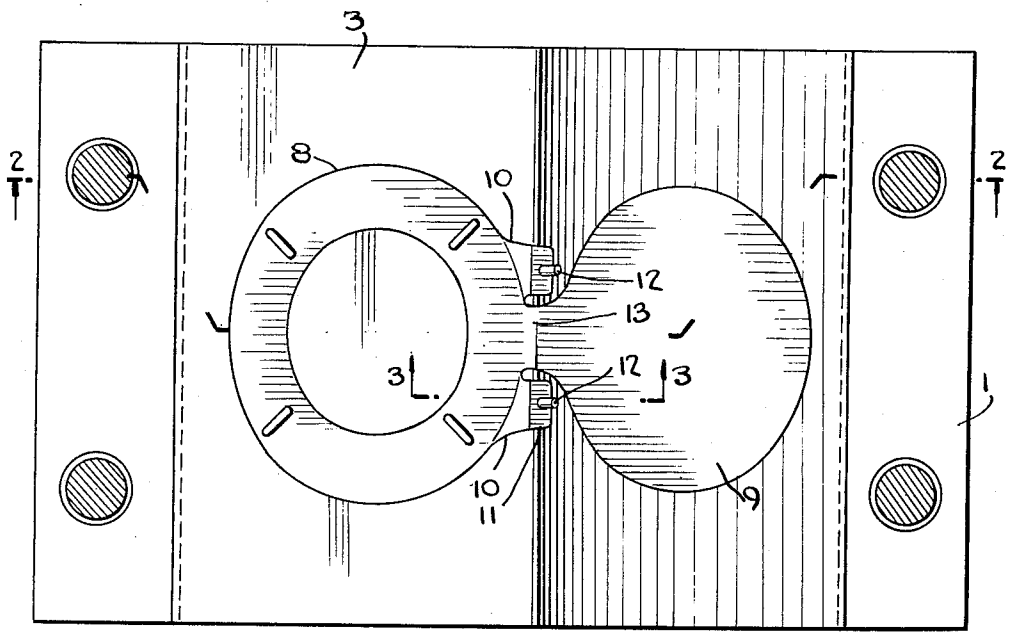


Fig. 1.

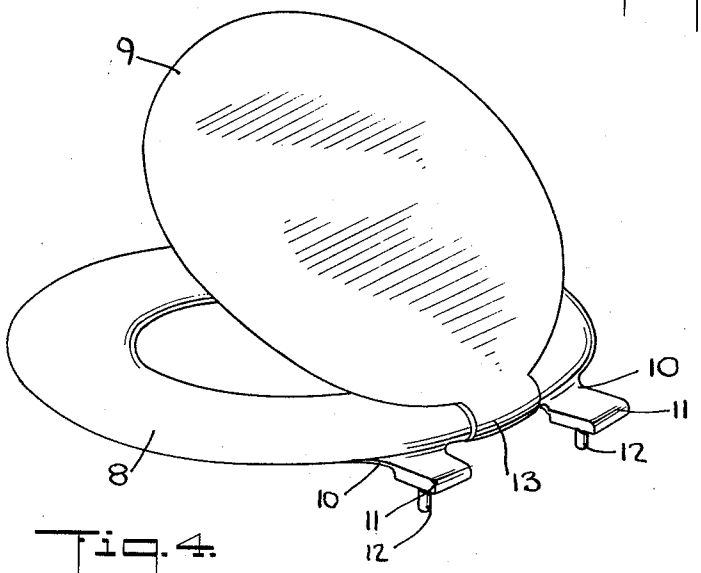


Fig. 4.

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Nov. 21, 1961 S. S. BODNER 3,009,169

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Filed Nov. 3, 1960 3 Sheets-Sheet 2

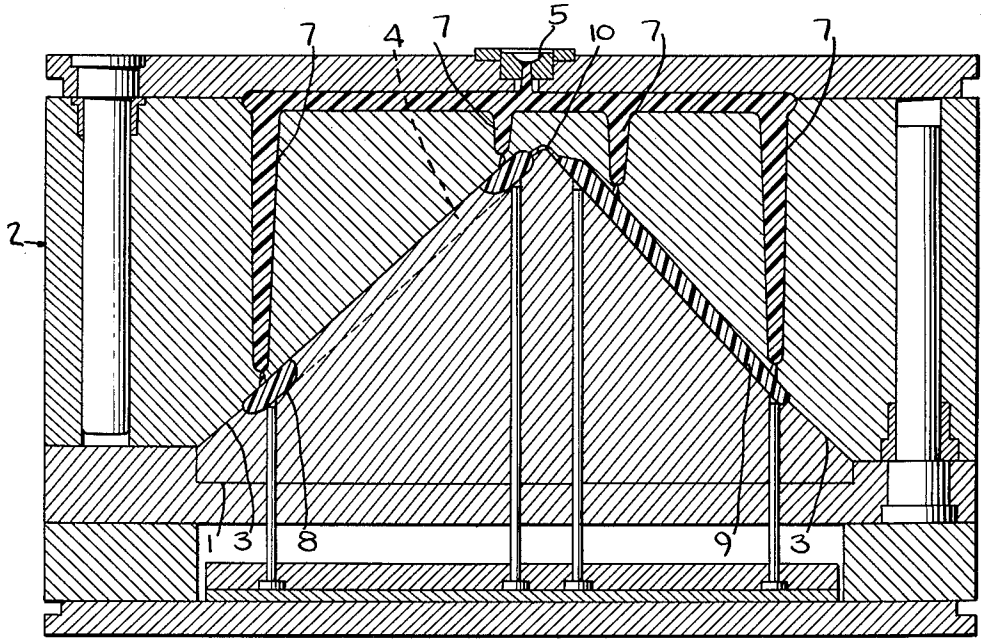


Fig. 2.

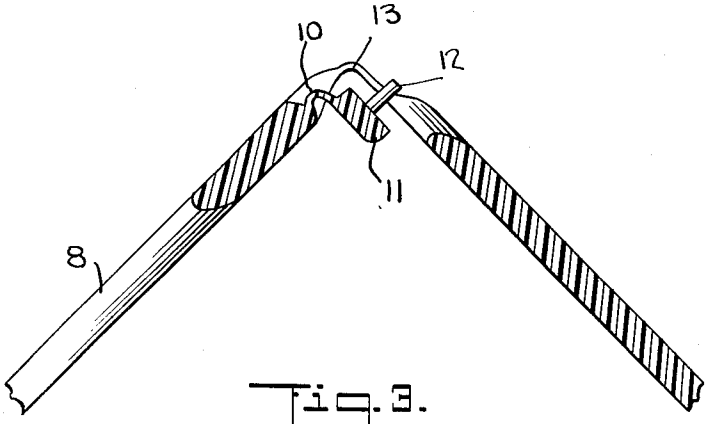


Fig. 3.

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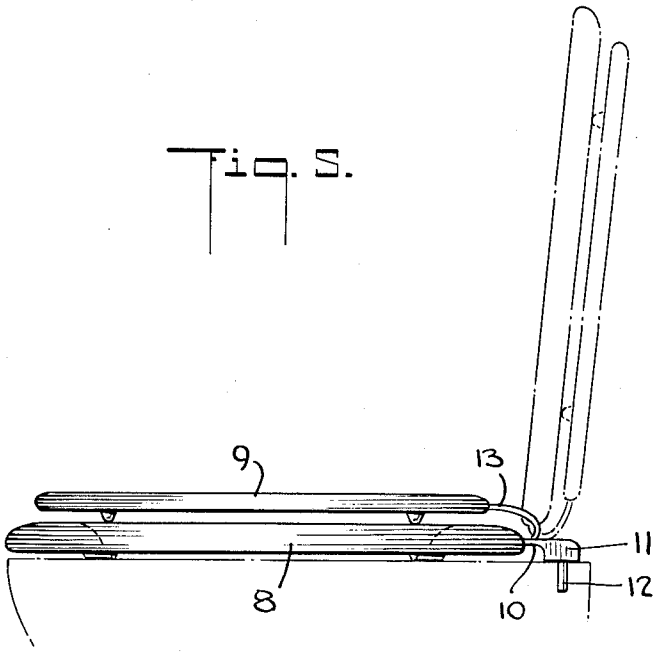
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Nov. 21, 1961 S. S. BODNER 3,009,169

HINGE CONFIGURATION AND METHOD FOR MAKING SAME

Filed Nov. 3, 1960 3 Sheets-Sheet 3

Fig. 5.



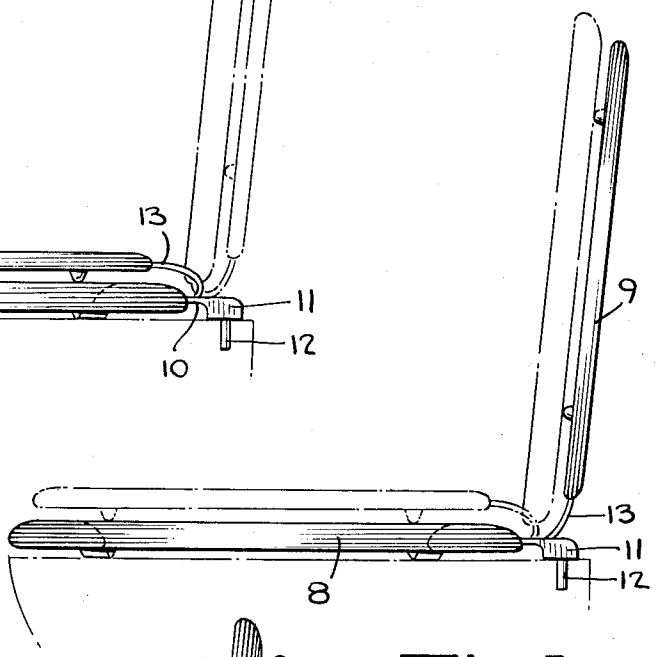
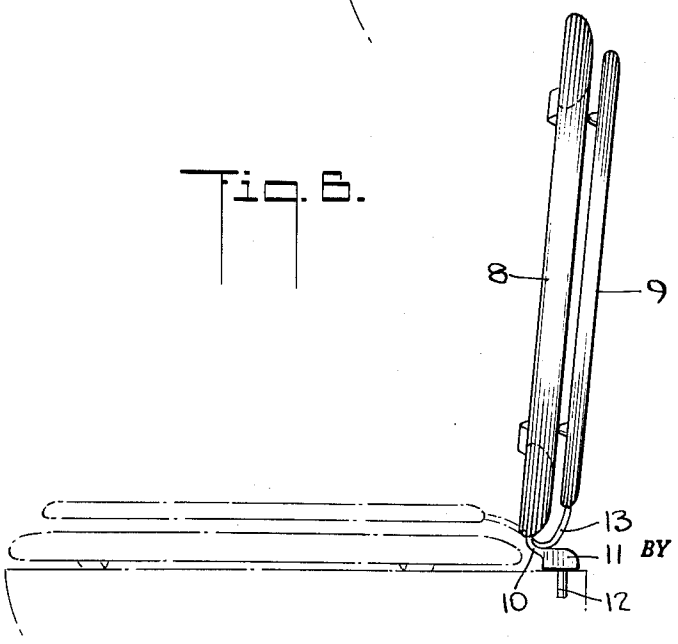


Fig. 7.

Fig. 6.



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3,009,169

Patented Nov. 21, 1961

3,009,169

HINGE CONFIGURATION AND METHOD FOR MAKING SAME

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Filed Nov. 3, 1960, Ser. No. 67,013

16 Claims. (Cl. 4—240)

My invention relates to molded double-hinge configurations and particularly relates to a toilet seat and cover assembly having a continuous double-hinge configuration molded so as to be integral with the members hinged and to a method for molding such a configuration.

Hinges that would not require periodic cleaning in detail and that would not harbor bacteria have long been desirable in many applications. There are many such places in the average household, typical examples being clothes hampers with trap-door lids, bread-boxes, lunch pails, medicine chests, and toilet seats and covers. All of these applications have in common the aforesaid requirement of cleanliness and ease of cleaning.

But heretofore these and many similar applications with such requirements have employed complicated hinges that defeated the ends recited. The greatest need for such a hinged construction has been in toilet seat and cover assemblies. Thus for example, toilet seats and covers have been separately hinged in brass or other sturdy metals, and more recently have been separately hinged in plastic. The use of plastic was engendered by the tendency of many metals to become unsightly and corroded because of exposure to urea and certain organic acids.

However, such toilet seat hinges, both before and after the use of plastic, employed the standard arrangement of two piece hinges, that is, a first hinge portion attached to one hinged element (such as the toilet) and a second hinged portion attached to the other hinged element (such as the toilet seat) with a pivot pin connecting the two. Sometimes one or more of these hinge parts were molded in plastic or otherwise integrally fabricated with the appropriate hinged element. But in all cases the hinge itself consisted of mating pivoted parts which were extremely annoying to clean and extremely likely to collect bacteria in the crevices.

These prior art failings have been obvious in all the situations recited where cleanliness in a hinged member has been desired, especially where medicinal as well as aesthetic cleanliness has assumed importance to the user. But the application of hinges that has been the most unsatisfactory in these respects has been toilet seats and covers. Aside from the problem inherent in all hinged applications similar to those recited, toilet facilities must meet additional stringent tests as to cleanliness, because the average housewife deems her bathroom second only to her person as an index of her daintiness and propriety, and because toilet facilities have the highest exposure to infestation.

Moreover, the double hinged configuration of toilet seats and covers has doubly complicated this problem of keeping them spotless for appearance sake, and also has presented double the hinged crevices to actually retain and transmit bacteria and the like.

In recent years certain plastics have been developed having very high fatique strength, and among other applications of this property has been its use in molded hinges. One of the most common embodiments of such hinges has been in eye glass carrying cases. In such cases the upper and lower case covers are molded with a thin web connecting them along one mutual edge. The aforesaid fatigue properties of the plastic allow this web to act as a hinge capable of withstanding repeated opening and closing.

However, while molded hinges such as those employed

in eye glass cases have sufficed for such simple discardable items, use of such hinges in expensive furnishings such as toilet seats and covers has not heretofore been practical. This has been because the tendency of such hinges to eventually crack has distressed housewives, even when it occurs years after purchase when the plastic has already withstood an enormous number of flexures.

Since fatigue strength depends not only upon the characteristics of the plastic, but also upon the angle of flexure and the frequency of reverse flexure, a hinge configuration should therefore attain maximum life upon proper utilization of all these fatique strength considerations. This is true in all molded hinges, but is particularly crucial in toilet seats and covers because a double-hinged configuration is commonly employed, that is the toilet, the seat, and the cover are all three hinged together by two hinges for relative motion therebetween at mutually independent and variable angles of closure, and consequently a hinge configuration and molding method particularly adapted to minimize flexure stress is highly desirable, if the long life necessary to enhance the practicality of the sanitary and aesthetic advantages inherent in molded hinges themselves is to be attained.

Those molded hinged configurations that have heretofore been employed have always been single-hinged, as for example eye-glass cases. But double-hinged configurations such as toilet seat and cover assemblies present additional stress and fatigue because of the more complicated pattern of use with two hinges.

It is therefore an object of my invention to provide a continuous molded double-hinge configuration and a method for making it so as to present a sanitary, crevice free, easily cleanable construction.

Another object is to provide such a configuration and method adapted to be useful with a toilet seat and cover so as to allow independent hinging of the seat and cover.

Another object is to provide such a configuration and method adapted to be useful with members such as toilet seats and covers double hinged to the toilet and thus free to independently be opened and closed and molded in such a configuration so as to incur minimum flexure stress in the overall pattern of use.

Another object is to provide a continuously molded toilet seat and cover and hinges in such a molded double-hinge configuration so as to incur minimum flexure reversals and minimum angle of stressed flexure in the overall pattern of use so as to greatly prolong the duty life of the hinges.

Other objects and advantages of the invention will become more apparent from the following description and the accompanying drawings, in which:

FIGURE 1 is a plan view of a lower molding die half showing a hinged toilet seat and cover therein according to the present invention.

FIGURE 2 is a section view through line 2—2 of FIGURE 1 wherein additionally the upper molding die is in place, showing the angular position of the molded state of the toilet seat and cover and the means for injecting molding material.

FIGURE 3 is a partial section view through line 3—3 of FIGURE 1 wherein is shown the molded angular relation between all three hinged elements of the toilet seat and cover assembly.

FIGURE 4 is a perspective view of one embodiment of the hinge configuration of the present invention showing the toilet seat and cover assembly embodiment of FIGURES 1 to 3 with the hinged elements in the approximate position of installation.

FIGURE 5 is a side view of the toilet seat and cover assembly embodiment of FIGURE 4 showing both the seat and cover in a closed position.

FIGURE 6 is a side view of the toilet seat and cover assembly embodiment of FIGURE 4 showing both the seat and cover in an open position.

FIGURE 7 is a side view of the toilet seat and cover assembly embodiment of FIGURE 4 showing the seat in a closed position and the cover in an open position.

Referring now to the drawings, FIGURES 1, 2 and 3 relate to the method by which I integrally mold a hinged toilet seat and cover into a configuration according to the present invention. I provide a lower die **1** which mates with an upper die **2** along an interface **3** so as to define therebetween a cavity **4** which is the female mold of a hinged toilet seat and cover configuration according to the present invention. Within upper die **2** is provide a main sprue **5** for receiving molding material, and a runner-in **6** communicating therewith and of sufficiently large cross section to deliver a large volume of molding material without appreciable temperature loss. Communicating in turn with runner-in **6** are a plurality of preferably insulated sub-sprues **7**. These sub-sprues **7** should be arranged to supply molding material to the various centers of volume of the mold cavity **4** so as to attain the best distribution of material while it is still in a sufficiently hot plastic state. In the embodiment shown, wherein a hinged toilet seat and cover mold is disclosed, two sub-sprues **7** supplying molding material to seat **8** and two sub-sprues **7** supplying molding material to cover **9**. The various hinges therebetween are thus each disposed to receive sufficiently heated material to form a continuous web without faults or voids.

As shown in FIGURE 2, the hinge **10** between cover **9** and seat **8** is disposed at approximately a 90° angle and preferably at slightly greater than a 90° angle. I prefer to arch the actual hinge **10** itself, and throughout my description herein, when I name an angle as attributed to a hinge I refer to the angle between the members hinged, irrespective of any arching of the hinge section itself, as at hinge **10**. Thus the preferably slightly greater than 90° angle of hinge **10** is the angle between cover **9** and seat **8**.

As shown in FIGURE 3, the seat **8** has hinged thereto a mounting bracket **11** with posts **12** integrally fabricated thereto. The hinge **13** between mounting bracket **11** and seat **8** is preferably more arched than hinge **10**, but the angle of hinge **13** is the same as the angle of hinge **10**, that is, also at approximately a 90° angle, but preferably at slightly less than a 90° angle. That is to say, mounting bracket **11** is molded approximately parallel to cover **9**, as best shown in FIGURE 3.

Of the new plastics having excellent fatigue characteristics, polyethylene and polypropylene are the most outstanding. A polyethylene section can conservatively withstand a lifetime of 10,000 cycles of stress reversal without cracking. Polypropylene is even more outstanding, and can conservatively withstand 1,000,000 cycles of stress reversal without cracking. It is of course conceivable that plastics developed in the future will approach or exceed these performances. I therefore do not wish to limit my inventive configuration to the materials that are presently most advantageously employed in it.

The invention comprises a configuration adapted to make possible a practical heavy duty hinged article in solid plastic, particularly double-hinged articles such as toilet seats and covers, I therefore seek to use a high fatigue strength plastic material adapted to exceed 10,000 reverse stress cycles without cracking. Present members of this group are polyethylene and polypropylene. The inventive configuration greatly increases the duty-life of double-hinged embodiments to which it is applied. It may be used with any moldable material having the stated fatigue strength as a starting point. Therefore while present members of such a group are polyethylene and polypropylene, it is apparent that the plastics that be employed in the invention may be increased in number in the future.

When polyethylene or polypropylene is employed with the die configuration of FIGURES 1 and 2, the heated plastic is forced into sprue **5** under pressure so as to flow into runner **6** and thence through sub-sprues **7** and into the mold cavity **4** itself. The four sub-sprues supply heated plastic evenly to form seat **8** and cover **9** and mounting bracket **11** without appreciable cooling before all the cavity **4** has been filled. The hinges **10** and **13**, although appreciably thinner in section than the adjoining members are formed in the hot plastic so as to present an even smooth web without voids or faults.

When the plastic has set and the top die member **2** has been removed, the integral seat, top and mounting bracket assembly is revealed as shown in FIGURE 1. The configuration is in the unstressed condition as molded. That is, the orientation of seat **8** to mounting bracket **11** and to cover **9** as shown in FIGURE 3 in section is the molded orientation of the members to one another, and that is therefore the unstressed orientation of those members. It follows that anytime mounting bracket **11** bears the angular relation to seat **8** that it does in FIGURE 3, there will be a condition of zero flexure stress between those two members, that is, in hinge **13**. So also any time seat **8** bears the angular relation to cover **9** that it does in FIGURE 3, there will be zero flexure stress between those members, that is, in hinge **10**.

When the seat **8**, cover **9**, and mounting bracket **11** assembly is taken from mold **1** and trimmed of waste plastic, it is ready for use as shown in FIGURES 4 through 7. In FIGURE 4 is shown a perspective view of an embodiment of a hinge configuration according to the present invention. This embodiment is a toilet seat and cover assembly with a mounting bracket **11** hinged to seat **8** by hinge section **10** and a cover **9** hinged to seat **8** by hinge section **13**. The assembly is shown in an orientation so that the various parts are positioned as they are in use, that is with mounting bracket **11** horizontal and with seat **8** and cover **9** at some position in the 90° between horizontal and vertical. This is obviously a re-orientation from FIGURE 3 and certain of the hinges will always therefore be stressed as hereinafter explained.

It is also apparent that the principles of the invention apply to toilet seat and cover assemblies of other variations, as for example where cover **9** is hinged to mounting bracket **11** instead of to seat **8**. So also it is apparent that the principles of the invention apply to articles other than toilet seat and cover assemblies, where such double-hinged configurations may also be used. The present embodiment is merely illustrative of an application of the inventive principles, and such other applications and embodiments are also within the scope of the present invention.

Refering now particularly to FIGURES 5 through 7, therein is shown a toilet seat and cover assembly having a hinge configuration according to the present invention. FIGURE 5 shows the orientation of the mounting bracket **11** as horizontal with the posts **12** depending vertically therefrom. The mounting bracket **11** is thus adapted to mount on the standard horizontal mounting surface at the rear of standard toilets, with posts **12** depending into mounting holes of the toilet. Clearly mounting bracket **11** may be varied to fit any toilet mounting configuration.

In FIGURE 5, seat **8** and cover **9** are shown in the horizontal position. In the standard toilet configuration seat **8** is horizontally positioned for use, but when cover **9** is also positioned horizontally the toilet is covered in order to be less objectionable looking when not in use. The unstressed molded orientation of mounting bracket **11** to seat **8** is approximately so as to include a 90° angle therebetween. Thus with the seat **8** in the position of FIGURE 5 the hinge **10** is rotated 90° from the stress free position in which it was molded. For convenience this will be referred to as 90° of stress.

Although the hinge 10 has a certain amount of resilience or spring to it, the restorative force tending to oppose the aforesaid 90° of stress by moving seat 8 clockwise is far outweighed by the weight of seat 8 pressing downward or counterclockwise. The cover 9, when in the horizontal position of FIGURE 5 has also been rotated 90° from the molded relation with seat 8 as shown in FIGURE 3. Hinge 13 is thus under 90° of stress, but the cover remains securely down because of its weight. The horizontal orientation of both seat 8 and cover 9 as shown in FIGURE 5 is the normal posture of such assemblies when not in use, which is generally 95% of a 24 hour day.

FIGURE 7 shows the common operating position of the usual toilet seat and cover assemblies. FIGURE 6 shows another common operating position. In FIGURE 7, the seat 8 remains horizontal for use, while the cover 9 has been rotated clockwise or up slightly greater than 90° from the closed position of FIGURE 5. Since the cover 9 is now oriented at slightly greater than 90° from the seat 8, which is the molded position shown in FIGURE 3, there is no stress in hinge 13, that is there is 0° of stress from the molded position. Since there is no stress in hinge 13, the cover 9 will remain open with no tendency to close by spring force.

As shown in FIGURE 6, both the seat 8 and the cover 9 may be rotated upwardly to the open position for cleaning or use of the toilet. When cover 9 is in the open position there is 0° of stress between it and the horizontally positioned seat 8 in hinge 13, as has already been noted with regard to FIGURE 7. So also, when seat 8 is in the horizontal or closed position there is 90° of stress between it and mounting bracket 11 in hinge 10, as has also been mentioned in regard to FIGURE 7.

Thus as in FIGURE 6, the raising or opening of cover 9 is itself a stress decreaser, that is, it increases the angle between cover 9 and seat 8 to slightly greater than 90° which is the molded or stress free condition, for hinge 13. But when seat 8 is moved open together with cover 9, or is moved open after cover 9, then the angle between seat 8 and cover 9 remains or becomes, respectively, 0° which is a condition of 90° stress in hinge 13 since as shown in FIGURE 3 the seat 8 and cover 9 were molded at slightly greater than 90° apart. Moving both seat 8 and cover 9 to the open position together involves no increase of stress in hinge 13. Moving both seat 8 and cover 9 to the open position involves no increase stress in hinge 13. Moving cover 9 open first and then moving seat 8 open involves reduction of stress in hinge 13 from 90° to 0° and then back to 90°.

Since the seat 8 stresses hinge 10 by 90° when it is in the horizontal or closed position, opening the seat 8 to the position of FIGURE 6 decreases the stress in hinge 10 by 90°. When the seat 8 and cover 9 are both in the open or raised position of FIGURE 6 there is stress of 90° in hinge 13 and a resultant tendency to push the seat 8 and cover 9 apart, which since cover 9 is generally supported from further clockwise rotation by the toilet back (not shown) or other stop, tends to push seat 8 down or closed. But this tendency is resisted by two factors. First the seat and cover are opened slightly past the vertical, which is standard in all toilet arrangements, so that a slight component of the seat's weight urges it clockwise and thus open. Second, the normal stress free position of hinge 10 is when seat 8 and mounting bracket 11 are slightly less than 90° apart, as shown in FIGURE 3. Thus the seat 8 is urged open, or at least is restrained somewhat from closing, by the springiness of hinge 10 which is unstressed in the open seat position of FIGURE 6. The slight spring force in hinge 13 is thus overcome by the weight of the leaning seat 8 and the springiness in hinge 13, and seat 8 will stay open.

There are thus three possible positions that the seat and cover assembly can be employed in. Both can be open as in FIGURE 6, both can be closed as in FIGURE 5, or the cover 9 can be open and the seat 8 closed as in FIGURE 7. In the usual use both will be closed 95% of the time, and one or both will be open during the remaining period.

It will be noted that the stress patterns of the hinges are evenly distributed over the pattern of use of the assembly of seat 8 and cover 9. Thus when both seat 8 and cover 9 are closed (FIGURE 5) both hinge 10 and hinge 13 are under 90° of stress. When both seat 8 and cover 9 are open (FIGURE 6) hinge 13 is under 90° of stress and hinge 10 is unstressed. When seat 8 is down and cover 9 is up (FIGURE 7) it is hinge 10 that is under 90° of stress and hinge 13 that is unstressed.

Since it is not the amount of the time spent in each position that determines fatigue, but rather the stressing and unstressing pattern, it is apparent that the above pattern assures even stressing and unstressing of the two hinges throughout the pattern of use.

Moreover the other prime consideration in fatigue is stress reversals. It is apparent that in all the positions described, neither hinge 10 nor hinge 13 undergoes a stress reversal. That is, they are never stressed in one direction, then back to zero stress and through to stress in the opposite direction. Stress reversal constitutes a zero to positive to zero to negative to zero etc. pattern. Such reverse stressing is a major cause of fatigue. In the configuration shown, there is never a reversal of stress. Each hinge is stressed from the molded or unstressed state to slightly more than 90° of stress and back without then passing through the unstressed state and into the reverse or negative stress of flexure in the opposite direction past the neutral stress zone.

What is more, the inventive configuration allows the seat 8 and cover 9 to be placed in any position and stay there despite the fact that at least one hinge is always stressed. This arrangement together with the even distribution of stressing and unstressing on the two hinges throughout the pattern of use, and also together with the absence of stress reversals, combine to make it highly practical to employ integrally molded hinges in a toilet seat and cover assembly for the first time. The even stress distribution and lack of reversals also greatly increaes the fatigue life of the hinges.

It is apparent that such an integral embodiment is economical to manufacture and easy to clean. Polypropylene particularly may be steam cleaned, and so is highly practical in public or hospital facilities where many toilets must be cleaned. There are no cracks to be unsightly and retain and transmit bacteria. Moreover the embodiment shown greatly enhances the life of the plastic employed and so makes the sanitary benefits economically practical.

It is to be understood that the inventive configuration is adapted to use with any double-hinged embodiment, the advantages being merely most evident in the present embodiment.

Thus while I have herein referred in detail to a construction in which my invention may be embodied, numerous changes and modifications may be made in the form and construction thereof and therefore it should be understood that the types of my invention herein shown and described are intended for the purpose of illustration and are not intended to limit the scope of my invention.

I claim:

1. A hinge configuration for pivotally connecting two pivotable members and a fixed member so that each pivotable member may be independently pivoted to varying degrees of closure between an open position and a closed position relative to said fixed member comprising a continuous section connecting each said member to one other of said members, each said section being appreciably thinner than said members contiguous thereto, one said section having a condition of minimal internal flexural stress in the open position and the other said section

having a condition of minimal internal flexural stress in the closed position.

2. A hinge configuration for pivotably connecting two pivotable members and a fixed member so that each pivotable member may be independently pivoted to varying degrees of closure between an open position and a closed position relative to said fixed member comprising a continuous section connecting each said member to each other member contiguous thereto, each said section being appreciably thinner than said members contiguous thereto, one section having a condition of minimal internal flexural stress in the open position and the other said section having a condition of minimal internal flexural stress in the closed position.

3. A hinge configuration for pivotably connecting two pivotable members and a fixed member so that each pivotable member may be independently pivoted to varying degrees of closure between an open position and a closed position relative to said fixed member comprising a continuous section connecting each said member to each other member contiguous thereto, each said section being appreciably thinner than said members contiguous thereto, one said section having a condition of minimal internal flexural stress in the open position and the other said section having a condition of minimal internal flexural stress when one pivotable member contiguous thereto is in the closed position and the other pivotable member contiguous thereto is in the open position.

4. A hinge configuration for pivotably connecting two pivotable members and a fixed member so that each pivotable member may be independently pivoted to varying degrees of closure between an open position and a closed position relative to said fixed member comprising a continuous section connecting each said member to each other member contiguous thereto, each said section being appreciably thinner than said members contiguous thereto, a first of said sections connecting said fixed member and the pivotable member contiguous thereto, a second of said sections connecting said pivotable members, said first section having a condition of minimal internal flexural stress when a first pivotable member contiguous thereto is in the open position and the second said section having a condition of minimal internal flexural stress when said first pivotable member is in a closed position and the second pivotable member is in the open position.

5. The hinge configuration according to claim 4, wherein said members and sections are polypropylene.

6. The hinge configuration according to claim 4, wherein said members and sections are polyethylene.

7. A toilet seat and cover assembly for use with a fixed toilet seat fixture comprising a seat member adapted to rest upon said toilet fixture when in a closed position, a cover member adapted to rest upon and to close said seat member when in a closed position, a first hinge configuration connecting one of said seat member and said cover member to said toilet fixture, and a second hinge configuration connecting said seat member and said cover member, said members being thereby pivotable between an open and a closed position relative to said toilet fixture, each said hinge configuration comprising a continuous section appreciably thinner than the members contiguous thereto.

8. A toilet seat and cover assembly for use with a fixed toilet seat fixture comprising a seat member adapted to rest upon said toilet fixture when in a closed position, a cover member adapted to rest upon and to close said seat member when in a closed position, a first hinge configuration connecting said seat member to said toilet fixture, and a second hinge configuration connecting said seat member to said cover member, said members being thereby pivotable between an open and a closed position relative to said toilet fixture, each said hinge configuration comprising a continuous section appreciably thinner than the members contiguous thereto.

9. A toilet seat and cover assembly for use with a fixed toilet fixture comprising a seat member adapted to rest upon said toilet fixture when in a closed position, a cover member adapted to rest upon and to close said seat member when in a closed position, a hinge configuration connecting one of said seat member and said cover member to said toilet fixture, and a hinge configuration connecting said seat member and said cover member, said members being thereby pivotable between an open and a closed position relative to said toilet fixture, each said hinge configuration comprising a continuous section appreciably thinner than the members contiguous thereto, one said section having a condition of minimal internal flexural stress when the pivotable member contiguous thereto is in the open position and the other said section having a condition of minimal flexural stress when said cover member is in the open position and said seat member is in the closed position.

10. A toilet seat and cover assembly for use with a fixed toilet seat fixture comprising a seat member adapted to rest upon said toilet fixture when in a closed position, a cover member adapted to rest upon and to close said seat member when in a closed position, a first hinge configuration connecting said seat member to said toilet fixture, and a second hinge configuration connecting said seat member to said cover member, said members being thereby pivotable between an open and a closed position relative to said toilet fixture, each said hinge configuration comprising a continuous section appreciably thinner than the members contiguous thereto, said first hinge configuration having a condition of minimal internal flexural stress when said seat member is in the open position and said second hinge configuration having a condition of minimal internal flexural stress when said cover member is in the open position and said seat member is in the closed position.

11. The toilet seat and cover assembly of claim 10, wherein said members and sections are polypropylene.

12. The toilet seat and cover assembly of claim 10, wherein said members and sections are polyethylene.

13. A molded configuration adapted for use as a toilet seat and cover assembly comprising a seat member, a cover member, and a mounting bracket member, a first continuous section connecting said mounting bracket member and said seat member, a second continuous section connecting said seat member and said cover member, each said section being appreciably thinner than the members contiguous thereto, said cover member being disposed approximately 90° from said seat member with said first continuous section in a condition of minimal internal flexural stress, and said mounting bracket member being disposed approximately 90° from said seat member so as to be approximately parallel with said cover member and with said second continuous section in a condition of minimal internal flexural stress.

14. A molded configuration according to claim 13, wherein the unflexed angle included between said seat member and said cover member is slightly greater than 90°, and the unflexed angle included between said seat member and said mounting bracket is slightly less than 90°.

15. A molded configuration according to claim 13, wherein said members and sections are polypropylene.

16. A molded configuration according to claim 13, wherein said members and sections are polyethylene.

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