June 4, 1968 W. W. VYVYAN 3,386,128

SELF-ACTUATING, SELF-LOCKING HINGE

Filed Sept. 26, 1966 2 Sheets-Sheet 1

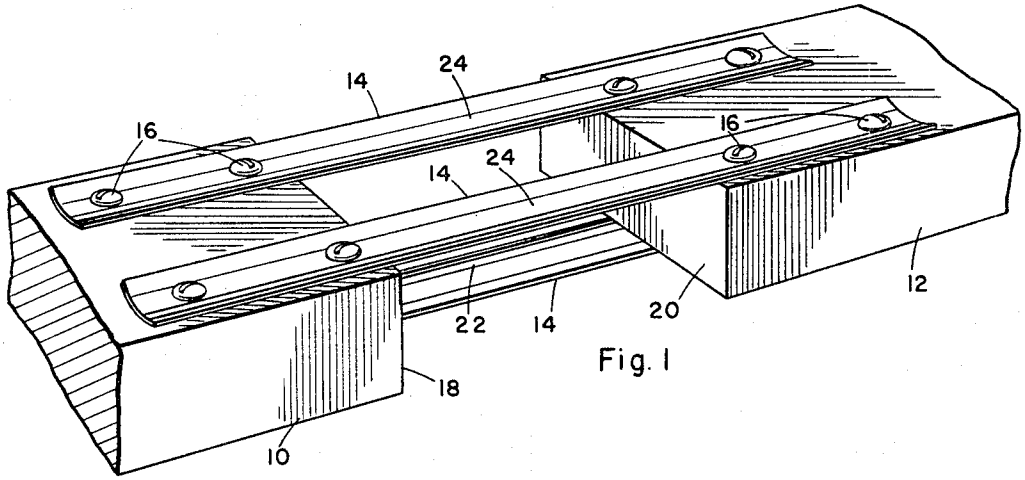

Fig. 1

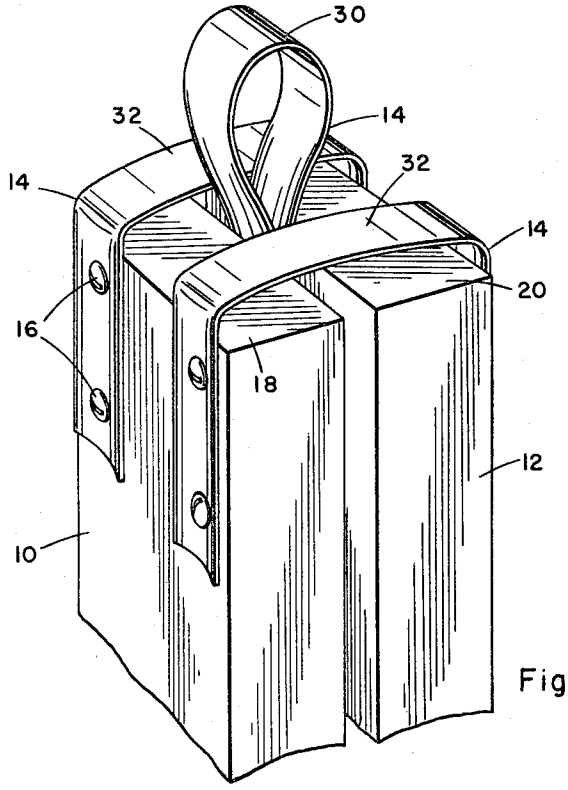

Fig. 2

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SELF-ACTUATING, SELF-LOCKING HINGE

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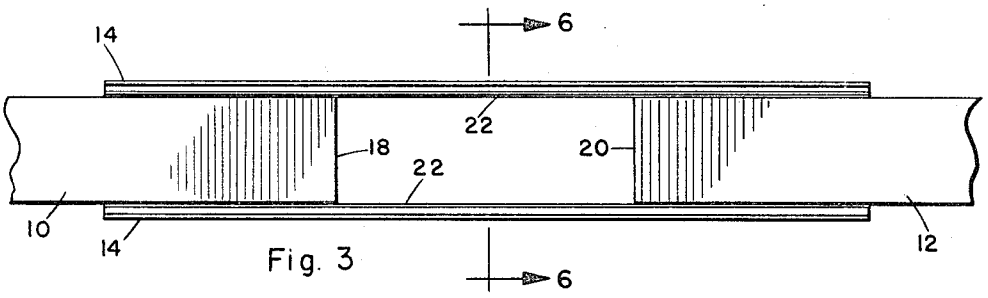

Fig. 3

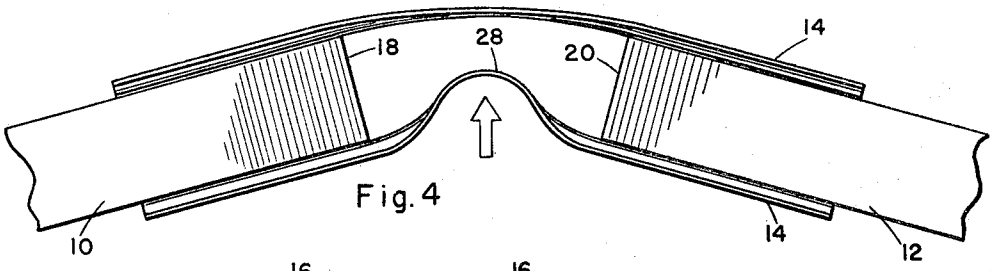

Fig. 4

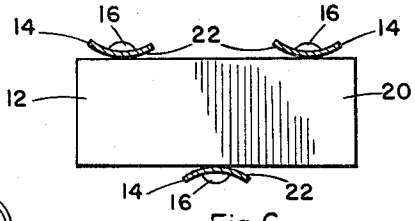

Fig. 6

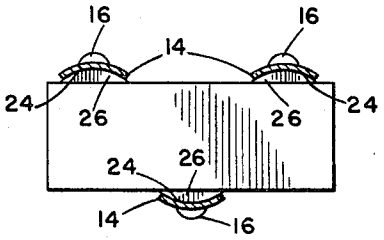

Fig. 7

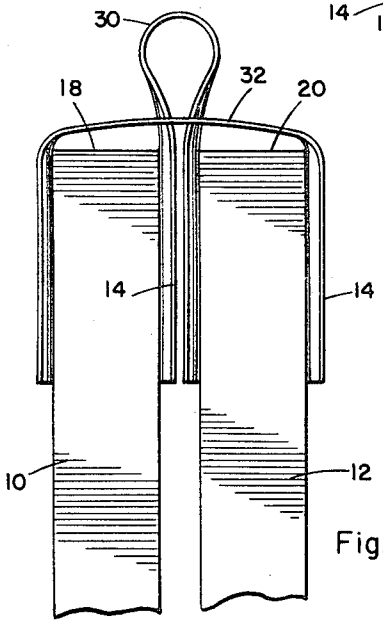

Fig. 5

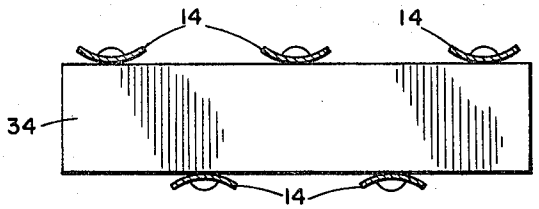

Fig. 8

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3,386,128

SELF-ACTUATING, SELF-LOCKING HINGE

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Filed Sept. 26, 1966, Ser. No. 581,862
4 Claims. (Cl. 16—150)

The present invention relates to hinges and specifically to a self-actuating, self-locking hinge.

Various types of self-opening hinges have been developed, usually involving a conventional pin centered hinge with a spring device attached to spread, or at least assist in spreading the hinge. To hold the hinge in a specific open position some type of stop or locking mechanism must be incorporated. This type of hinge is subject to binding or jamming to the extent that the spring cannot open the hinge properly, particularly after prolonged storage or non-use, or under adverse environmental conditions.

The hinge described herein has no pivotal parts to bind and requires no limiting stops. Instead, a plurality of resilient strap-like elements interconnect the members to be hinged, each resilient element being pre-formed to be substantially rigid in its normal extend position, yet being easily folded by making a slight intentional deformation. The collective resilient elements are attached to the hinged members in spaced parallel relation to interfit in a compact arrangement when folded in either direction and to form an extremely rigid open box type connecting structure resistant to compression and bending loads when extended.

The hinge and its operation are illustrated in the drawings, in which:

FIGURE 1 is a perspective view of the basic hinge structure in open or extended position;

FIGURE 2 is a perspective view of the hinge fully folded;

FIGURE 3 is a side elevation view of the extended hinge;

FIGURE 4 is a side elevation view showing the initial deformation of the hinge elements for folding;

FIGURE 5 is a side elevation view of the fully folded hinge;

FIGURE 6 is a sectional view taken on line **6—6** of FIGURE 3;

FIGURE 7 is a sectional view similar to FIGURE 6, but showing the hinge elements reversed; and

FIGURE 8 is a sectional view of a multiple element hinge for large members.

Similar characters of reference indicate similar or identical elements and portions throughout the specification and throughout the views of the drawing.

The two structural members **10** and **12** to be hinged together are shown, for purposes of illustration, as simple rectangular bar or beam members, but could be panels, doors, or other unitary or built up members. The only requirement is that the members have sufficient thickness, or at least end portions of sufficient thickness, to space the hinge elements far enough apart for rigidity, as hereinafter described.

Each hinge element **14** is an elongated, straplike element having a bowed or cambered cross section and being made from metal, plastic, or composite material with sufficient resiliency to return to its normal shape when deformed. At least one hinge element **14** is attached to each side of the members **12** and **14**, the preferred minimum being two on one side and one on the other in a triangular arrangement when viewed in section, as in FIGURE 6. This provides torsional rigidity and maintains alignment of the two connected members. The hinge elements **14** are staggered on opposite sides and spaced in parallel relation so that the hinge element from

one side can pass alongside or between those on the other side without contact. The ends of the hinge elements are secured to members **10** and **12** by screws **16**, or any other suitable means depending on the material and structure of the members.

It should be noted that the members **10** and **12** are spaced apart at a distance slightly more than the combined thickness of the confronting ends **18** and **20**, the hinge elements **14** bridging the gap and forming a box-like open frame structure. As illustrated in FIGURES 1 to 6, the hinge elements are secured with their convex faces **22** against the members.

However, the hinge elements can also be secured with their concave faces **24** toward the members, as in FIGURE 7, with small filler blocks **26** inserted to prevent flattening of the elements by their attachment screws. Each hinge element has inherent stiffness due to its bowed or cambered cross section and will resist bending in either direction, although more so when bent toward the convex side than to the concave side. Thus the box-like frame arrangement joining the two structural members, with corresponding sides of the hinge elements facing each other, will have considerable resistance to bending and will maintain a rigid coupling.

To fold the hinge it is only necessary to deform the hinge element on one side by flattening the central portion **28** and pressing the element inwardly between the members **10** and **12**, as in FIGURE 4. By so collapsing one side of the box frame structure the hinge elements on the other side can be bent back with a minimum of effort. Continuing the folding action will cause the deformed hinge element to bow inwardly and pass between the hinge elements on the other side, the latter being stretched across the ends **18** and **20**. In the fully folded position the members **10** and **12** are in closely spaced parallel relation, with just sufficient space therebetween for the now return folded hinge element whose looped portion **30** projects beyond the ends of the members. It will now be evident why the members **10** and **12** must be spaced apart in the extended position as mentioned above. The spacing is sufficient to allow the bridging portions **32** of the hinge elements now on the outside of the hinge to extend across the combined thickness of ends **18** and **20** and leave space between the members for the return folded hinge element.

In the folded position the members can be restrained by any suitable means, according to the nature of the structure. When released, the natural resiliency of the hinge element **14** will snap the assembly to the extended, rigid position without any assistance.

For wide members or panels, any required number of hinge elements may be used, the elements being staggered in spaced relation on opposite sides of the members, as indicated on the member **34** in FIGURE 8. Regardless of the number of elements used the hinge will fold in either direction.

The light weight and simplicity of the hinge structure make it ideal for use on spacecraft for such operations as extending solar cell panels, antennas, booms and the like. In addition, the self-actuating feature eliminates the need for special drive or operating mechanisms and greatly increases the reliability of operation. Many other uses will be apparent, such as for folding doors, screens, or the like.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawings are to be considered as merely illustrative rather than limiting.

I claim:

1. A self-actuating, self-locking hinge for interconnecting a pair of adjacent members, the confronting edge

portions of which have a certain thickness, the hinge comprising:

a plurality of elongated, strap-like hinge elements of resilient material each having a cambered cross section;

the ends of said hinge elements being secured to the pair of members with the confronting edges of the members spaced apart and the hinge elements bridging the gap therebetween in substantially parallel relation;

said hinge elements being secured to both sides of the members and thus spaced apart by the thickness of the members to form a box-like open frame structure connecting the members.

2. The structure according to claim **1**, wherein said hinge elements are staggered on opposite sides of the members and spaced apart so that the hinge elements on one side, when folded, can pass alongside and between the hinge elements on the other side.

3. The structure according to claim **1**, wherein said hinge elements all have the correspondingly curved faces thereof disposed toward the members.

4. The structure according to claim **1**, wherein the confronting edges of the members are spaced apart a distance slightly greater than the combined thickness of the confronting edges.

References Cited

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BOBBY R. GAY, *Primary Examiner.*