The present invention relates to an expandable bracelet linkage, and in particular to one capable of being manufactured to minimal thickness.

The expandable bracelet, whether of the expandable or non-expandable type, are greatly in demand, largely because of their neatness in appearance and light weight. To construct an expandable linkage which is thin presents more of a problem than the construction of a non-expandable bracelet of the same degree of thinness, largely because the expandable bracelet has a plurality of links and linkages, and in many instances telescopingly related, links. In an attempt to meet the requirement for a thin resiliently expandable bracelet, the prior art has proposed forming such a bracelet of a plurality of hollow links of minimal height, thin flat connectors extending between and telescopingly sliding into adjacent hollow links via apertures formed in the side walls thereof. The hollow links contain springs active between their side walls and flanges formed on the connectors in order to resiliently urge the connectors into the hollow links and thus cause the linkage to assume a contracted condition with the hollow links urged toward one another. While linkages of this type have been constructed with acceptably small thicknesses and with acceptable degrees of resilient expansibility, they have suffered from a very serious disadvantage, to wit, the connectors have tended to separate from the hollow links, thereby breaking the continuity of the linkage. This tendency towards separation has been particularly marked when the linkage has been reversely bent, but is to say, bent longitudinally in a direction opposite to that which it will tend to assume when on the wrist.

The object of the present invention is to devise a linkage of the general type under discussion which is much more reliable and secure than comparable constructions of the prior art, and which will in particular tend to strongly resist reverse bending of the linkage or bending of the linkage in any direction, without separation or damage. These desirable results are achieved, in accordance with the present invention, by means of a construction which is readily manufactured and assembled at low cost on a mass-production basis.

The tendency of the prior art structures to separate when subjected to reverse bending or excessive longitudinal pulls has in large part been due to the fact that the connectors which extend between adjacent hollow links tend to have their body forced completely out from the openings in the hollow links through which those body portions normally slide, and once this occurs the remaining parts of the connector, particularly the flanges against which the springs or other resilient means act, are free to slide through the opening and cause complete disengagement from the hollow link. This tendency towards separation is prevented, in accordance with the present invention, by providing cooperating wall parts (e.g., flanges or lips) on the connectors and hollow links beneath the connectors and on the opposite sides of the connectors from those wall parts which are acted upon by the springs. These additional wall parts may be of very abbreviated height, thus adding inappreciably, if at all, to the overall thickness of the linkage, yet they cooperate to engage and positively retain the connectors within their respective hollow links even when the linkage is very strongly bent in a reverse direction. To facilitate the accomplishment of this result without adding appreciably to the thickness of the linkage, it is preferred that the connectors be slidably supported on their ends relative to the hollow links, with their body portions spaced slightly above the bottom walls of the hollow links, the aforementioned cooperating wall parts extending respectively down from the body portions of the connectors and up from the bottom walls of the hollow links.

To facilitate manufacture, the hollow links may be formed of separately manufactured top and bottom parts which are connected to one another to define the hollow link. Facing edges of the top and bottom parts are spaced from one another to define the openings through which the connectors pass. When the assembled linkage is bent the connectors become inclined relative to the plane of those openings and tend to pry the top and bottom parts away from one another. If this tendency is effective the openings are widened and the connectors can more readily become detached from the links, an obviously undesirable result. In order to minimize and, for practical purposes, prevent this tendency from becoming effective, downwardly facing surfaces of the bottom parts of the hollow links are provided with upwardly concave portions, and the top parts of the hollow links are provided with securing tabs which are bent around the ends of the lower parts and up into and along those concave portions. It has been found that this type of connection effectively prevents relative movement of the top and bottom parts of the hollow links even when subjected to strong prying forces. It is preferred that the downwardly concave portions of the lower parts of the hollow links be formed on raised end portions thereof, which raised end portions serve to slidably support the end portions of the connectors so that the body portions are spread upwardly from the bottom walls of the hollow links, as previously described.

As has been mentioned, the openings through which the connectors slide are defined in part by the downwardly facing edges of the side walls of the upper parts of the hollow links. In order to prevent the links from being sloppy or loose, the size of the openings, both horizontally and vertically, should correspond closely to the size of the connector portions slidably therethrough. However, when the linkage is extended the body portions of the connectors are visible between the separated hollow links, and constant or extensive engagement of the upper surfaces of the connectors and the downwardly facing edges of the openings through which the connectors slide would tend to cause areas of scratching and wear on the surfaces of the connectors, exposed when the linkage is expanded. Moreover, extensive engagement between connectors and link edges would produce appreciable frictional forces which would militate against free slidenavability during expansion and contraction of the linkage. It has been found to be highly advantageous if the downwardly facing edge defining the upper limit of the openings through which the connector slides, insofar as that edge tends to engage the connector, is defined by a plurality of widely laterally spaced projections, here specifically shown as three in number and located respectively adjacent the ends and in the center of the opening, with the tip of the central projection being somewhat below the two laterally disposed extensions. As a result, the areas where rubbing or wear on the upper surface of the connector, and frictional resistance to sliding movement of the connector relative to the hollow links occur, are minimized, yet proper orientation of the connectors and hollow links is ensured.

All of the parts of the linkage are readily shaped from sheet metal stock by means of conventional production techniques, a high degree of dimensional precision is not
required, yet the assembled linkage is attractively thin, is effectively resiliently expandible, and is reliable in operation even when subjected to severe dislocative forces.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the construction of an expandable bracket linkage as defined in the appended claims and as described in this specification, taken together with the accompanying drawings, in which:

FIG. 1 is a top plan view of the linkage in contracted condition;
FIG. 2 is a top plan view of the linkage in expanded condition;
FIG. 3 is a cross sectional view taken along the line 3—3 of FIG. 1;
FIG. 4 is a cross sectional view taken along the line 4—4 of FIG. 3;
FIG. 5 is a cross sectional view taken along the line 5—5 of FIG. 5;
FIG. 6 is a cross sectional view taken along the line 6—6 of FIG. 3;
FIG. 7 is a view similar to FIG. 6 but showing the linkage in expanded condition; and
FIG. 8 is a three-quarter perspective exploded view of the individual parts which make up the linkage, except for the springs.

The linkage of the present invention comprises a plurality of hollow links generally designated A with which connectors generally designated B are telescopically slidably associated, resilient means generally designated C being located inside the hollow links A and active between them and the connectors B so as to resiliently urge the linkage to contracted condition. In this contracted condition the links A engage one another, or substantially so, in order to produce a closed, compact and attractive appearance.

The bottom parts D of the hollow link A comprise a bottom wall 2 from the ends of which vertical walls 4 extend, substantially horizontal walls 6 extending outward laterally from the top of the end walls 4 and having vertical walls 8 extending upward therefrom. The walls 6 are preferably curved so as to define, on their downwardly facing surfaces, upwardly concave portions 10. Side walls 12 of abbreviated height extend up from the sides of the bottom wall 2.

The top parts E of the hollow link A comprise a top wall 14 with depending end walls 16 the lower portions 18 of which define securing tabs. Side walls 20 extend downward from the side edges of the top wall 14, the central portions of the side walls 20, constituting the major portion of the length thereof, terminating in downwardly facing edges 22 from which three projections 24, 26 and 28 extend downwardly for a short distance, the projections 26 and 28 being located substantially centrally of the edges 22 and the projections 24 and 26 being located respectively substantially at the lateral ends thereof. The projections 26 preferably extend down from the edges 22 for a slightly greater distance than the projections 24 and 28. These portions of the side walls 20 laterally outside the projections 24 and 28 respectively terminate in downwardly facing edges 30 which are higher than the edges 22.

The connectors B comprise bottom walls 32 having a length closely the same as that of the bottom walls 2 of the bottom link parts A. Vertical walls 34 extend upward from the bottom walls 32 and have horizontal walls 35 extending outward therefrom. The height of the vertical walls 34 is somewhat less than the height of the vertical walls 4 of the link bottom parts A. Side walls 38 extend up from the sides of the bottom wall 32 to points above the horizontal walls 36, these vertically extending side walls 36 forming the top of the connector B being separated by gaps 40. In line with all or a part of the gaps 40 are downwardly extending side walls 42, which are of a height much less than the height of the upwardly extending side walls 38. The height of the downwardly extending side walls 42 on the connector B corresponds more or less to the height of the side walls 12 on the link bottom parts A.

The resilient means C may take a variety of forms, and are here shown as comprising bowed spring strips 44 having a length substantially that of the bottom walls 32 of the connectors B.

The hollow links A are formed by placing a top part E on a bottom part D, the top part E being supported vertically by the upper edges of the vertical walls 8 on the bottom part D, the parts D and E being permanently secured together by bending the connecting tab portions 18 around the corners defined between the walls 6 and 8 at each end of the bottom part D and up into and along the upwardly concave portions 10 formed thereby. With the parts D and E in this position, the upper edges of the walls 12 on the bottom part D will be spaced below the tips of the projections 24, 26, 28, and the downwardly facing edges 30 of the side walls 20 of the top part E will be spaced above the walls 6 of the bottom part D, thereby defining openings in the sides of the hollow links A, and close to the bottom walls 2 thereof, of a length and height such that the walls 32, 34 and 36 of the connectors B are freely slidably thereafter.

Each connector B extends between and into an adjacent pair of hollow links A by passing through the thus-formed openings in the opposed sides of those adjacent links A, the walls 36 of the connectors B slidably resting on the walls 6 of the bottom link parts D, the bottom walls 32 of the connectors B being thus supported above the bottom walls 2 of the link bottom parts D by a distance substantially equal to the height of the walls 12. The depending side walls 32 on the connector B are at a height closely the same as that of the side walls 12 of the link bottom part D, so that they extend inside the hollow links A substantially to the bottom walls 2. The upwardly extending side walls 38 on the connectors B have a height substantially equal to the distance between the connector bottom walls 32 and the top walls 14 of the link top parts E. The leaf springs 44 are disposed within the hollow links A above the bottom walls 32 of the connectors B, the central portions of those springs 44 engaging the central portions of the side walls 20 of the link top parts E and the tips of those springs engaging the upwardly extending side walls 38 of the connectors B.

When the linkage is in contracted condition as shown in FIGS. 1, 3 and 6, the springs C act to telescope the connectors B within the hollow links A and thus bring the hollow links A substantially into abutment with one another as well as bringing the connectors B substantially into abutment with one another. When the linkage is expanded, as is shown in FIGS. 2 and 7, the connectors B slide out of the hollow links A via the openings formed in the sides thereof, the springs 44 being resiliently compressed and the links A separating. This movement in extension can continue until the springs C are substantially solidly sandwiched between the side walls 38 of the connectors B and the side walls 20 of the upper link parts E, after which further extension is positively prevented.

If the linkage, when in this extended condition, is inverted so as to assume a longitudinally concave condition when viewed from above in FIG. 3, the downwardly extending walls 42 on the connectors B will engage with the upwardly extending walls 12 on the link bottom parts A and thus will prevent the connectors B from escaping from the links. The openings formed in the sides of the latter. In actual practice the heights of the walls 12 and 42 can be very small, on the order of one or two hundredths of an inch, so that they add...
little or nothing to the overall thickness of the linkage, yet they positively prevent disengagement between connectors B and links A.

If the reverse bending of the linkage, whether in expanded or contracted condition, is carried an extreme, the connectors B will tend to pry the link top parts D and bottom parts E away from one another, since the upper edges of the openings through which the connectors B pass are defined by the link top parts E and the lower edges thereof are defined by the link bottom parts D. When the securing tab portions 18 which hold the top and bottom D and E together are bent into and along the downwardly facing concave portions 10 on the link bottom parts D, the prying action is strongly and effectively resisted, thus adding materially to the security of attachment of the linkage parts.

Since the connectors B extend for substantially the full width of the linkage, and since the openings in the sides of the hollow links A through which the connectors B pass have an effective height closely the same as the thickness of the connector B, the various parts of the linkage are retained in good alignment at all times. The action of the springs C on widely spaced points on the connectors B add their part to the production of proper alignment.

As may be seen from FIG. 2, when the linkage is expanded the upper surfaces of the bottom wall 32 of the connectors B are exposed to view. By reason of the fact that the upper edges of the openings through which the walls 32 slide are defined, in effect, by the tips of the extensions 24, 26 and 28, projecting down from the side wall 20 of the top link part E, such evidence of wear as may become apparent when the linkage is expanded will be limited to lines registering with those projections. Thus the entire surface exposed of the connector wall 32 will not be marred, and such lines of wear as do result will tend to have the appearance of an attractive design.

Moreover, because of the differences in height among the projections 24, 26 and 28, as here preferably disclosed, not all of them will be in engagement with the connector wall 32 at any one time, thus distributing the amount of wear and minimizing friction, but without adversely affecting the alignment of the various parts of the linkage. Indeed, vertical alignment and guiding of the connector B relative to the opening in the side of the hollow link A through which it passes can be provided primarily by walls 38 and 42, or some of them, sliding over the inner surfaces of the link walls 14 and 2 respectively. The wear thus produced is always invisible. The upper surface of the connector wall 32 will thus come into engagement with one or more of the projections 24, 26 and 28 only when the linkage is bent longitudinally, and visible lines of wear will be produced on the upper surfaces of the wall 32 only when the linkage is expanded or contracted while bent. Thus the amount of wear produced and rendered visible is greatly minimized. This effect is even greater when, as here specifically disclosed, the projection 26 is somewhat longer than the projections 24 and 28. In this event only the projection 26 normally will engage the connector wall 33, and then only when the linkage is reversely bent. The projections 24 and 28 function only to restrict and limit excessive tilting of the connector wall 32.

Since the projections 26 are located in line with the downwardly extending walls 42 of the connectors B, and engage the upper surfaces of the bottom walls 32 thereof, they have the additional function of ensuring engagement between the walls 42 and 12 of the connectors B and bottom link parts D respectively, and hence serve to prevent separation of the linkage parts therefrom.

It will be appreciated from the above that the construction here described, while simple and readily manufactured and assembled, is nevertheless highly effective for its designed purposes, and in particular produces an exceptionally thin resiliently expansible bracelet linkage with a high degree of security and reliability.

While but a single embodiment of the present invention has been here specifically disclosed, it will be apparent that many variations may be made in the details thereof, all within the scope of the instant invention as defined in the following claims.

We claim:

1. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom thereof, extending generally laterally from end to end of said side wall, and a connector having a body portion extending in the same direction as and slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said connector having a first flange extending upwardly from said body portion adjacent the side thereof, and resilient means operatively connected between said first flange of said connector and said side wall of said hollow link and effecting to support said connector on said link at their respective ends with an intermediate portion of said body portion of said connector spaced above the bottom of said link.

2. An expansible bracelet link comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom thereof, extending generally laterally from end to end of said side wall, and a connector having a body portion extending in the same direction as and slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said connector having a first flange extending upwardly from said body portion adjacent the side thereof, and resilient means operatively connected between said first flange of said connector and said side wall of said hollow link and effecting to support said connector on said link at their respective ends with an intermediate portion of said body portion of said connector spaced above the bottom of said link.

3. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom thereof, extending generally laterally from end to end of said side wall, and a connector having a body portion extending in the same direction as and slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said connector having a first flange extending upwardly from said body portion adjacent the side thereof, and a second flange extending downwardly from said body portion adjacent the side thereof, and resilient means operatively connected...
between said first flange of said connector and said side wall of said hollow link and effective to urge said connector into said link, said first and second flanges, when said connector is moved out from said link against the action of said resilient means, engaging said link side wall, said link comprising a bottom part and a top part, said bottom part having a bottom wall and raised end portions the lower surfaces of which are upwardly concave, said top part having securing tabs bent around and into the concavities of said lower surfaces, said top and bottom parts having side walls between the end edges of which said opening is formed.

4. The linkage of claim 3, in which said side wall of said top part terminates short of said connector and is provided with laterally spaced downward extensions which slidably engage said connector.

5. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom walls thereof, said opening extending generally laterally from end to end of said top and raised end portions and including the lower surfaces of which are upwardly concave, said top part having securing tabs bent around and into the concavities of said lower surfaces, said top and bottom parts having side walls between the end edges of which said opening is formed.

6. The linkage of claim 5, in which said side wall of said top part terminates short of said connector and is provided with laterally spaced downward extensions which slidably engage said connector.

7. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom walls thereof, said opening extending generally laterally from end to end of said top and raised end portions and including the lower surfaces of which are upwardly concave, said top part having securing tabs bent around and into the concavities of said lower surfaces, said top and bottom parts having side walls between the end edges of which said opening is formed, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall.

8. The linkage of claim 7, in which said side wall of said top part terminates short of said connector and is provided with laterally spaced downward extensions which slidably engage said connector.

9. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom walls thereof, said opening extending generally laterally from end to end of said top and raised end portions and including the lower surfaces of which are upwardly concave, said top part having securing tabs bent around and into the concavities of said lower surfaces, said top and bottom parts having side walls between the end edges of which said opening is formed, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall.

10. The linkage of claim 9, in which said side wall of said top part terminates short of said connector and is provided with laterally spaced downward extensions which slidably engage said connector.

11. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein and a connector slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said hollow link comprising a bottom part and a top part, said bottom part having a hollow link seat having end portions which are upwardly concave, said top part having securing tabs bent around said end portions and into the concavities of said lower surfaces of said end portions, said top and bottom parts having side walls between the end edges of which said opening is formed, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall, said first flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall.

12. The linkage of claim 11, in which said side wall of said top part terminates short of said connector and is provided with laterally spaced downward extensions which slidably engage said connector.

13. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein and a connector slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said hollow link comprising a bottom part and a top part, said bottom part having a hollow link seat having end portions which are upwardly concave, said top part having securing tabs bent around said end portions and into the concavities of said lower surfaces of said end portions, said top and bottom parts having side walls between the end edges of which said opening is formed, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall.

14. An expansible bracelet linkage comprising a series of hollow links having a side wall with an opening therein spaced from both the top and bottom thereof, said opening extending generally laterally from end to end of said side wall, and a connector having a body portion extending in the same direction as and slidably passing through said opening into said hollow link and adapted to be connected to an adjacent link, said connector having a first flange extending upwardly from said body portion adjacent the side thereof and a second flange extending downwardly from said body portion adjacent the side thereof, and resilient means operatively connected between said first flange of said connector and said side wall of said hollow link and effective to urge said connector into said link, said bottom part having a bottom wall and raised end portions the lower surfaces of which are upwardly concave, said top part having securing tabs bent around and into the concavities of said lower surfaces, said top and bottom parts having side walls between the end edges of which said opening is formed, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall, said first flange having a height substantially corresponding to the distance between said connector body portion and said link bottom wall.
through said opening into said hollow link and adapted to be connected to an adjacent link, said connector having a first flange extending upwardly from said body portion adjacent the side thereof and a second flange extending downwardly from said body portion adjacent the side thereof, and resilient means operatively connected between said first flange of said connector and said side wall of said hollow link and effective to urge said connector into said link, said first and second flanges, when said connector is moved out from said link against the action of said resilient means, engaging said link side wall, said opening being located close to the bottom wall thereof, said first flange having a height greater than that of said second flange, said links having ends and being arranged in said linkage with said side walls directed toward adjacent links and with said ends directed generally outwardly toward the lateral periphery of said linkage, said connectors having ends correspondingly positioned relative to said link ends, and means operatively connecting said connector and said link and effective to support said connector on said link at their respective ends with an intermediate portion of said body portion of said connector spaced above the bottom of said link, said second flange having a height substantially corresponding to the distance between said connector body portion and said link bottom, said first flange having a height substantially corresponding to the distance between said connector body portion and said link top.

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