United States Patent

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[45] **Aug. 1, 1972**

[54] **COLLAPSIBLE BICYCLE**

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[21] Appl. No.: **59,483**

[52] **U.S. Cl.** **280/7.16,** 280/278, 280/261, 280/231

[51] **Int. Cl.** **B62k 13/02**

[58] **Field of Search**....280/287, 7.16, 7.11, 231, 273, 280/278, 236, 259, 260, 261; 74/216.5, 217; 287/54 D

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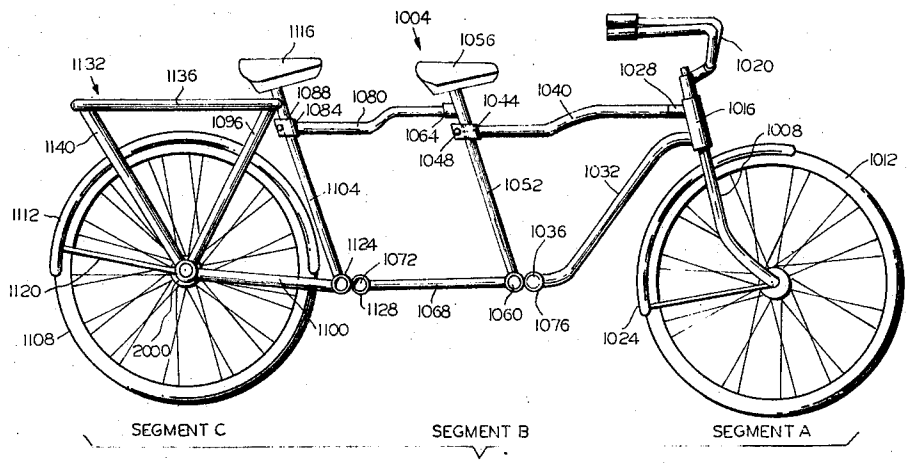
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Primary Examiner—Kenneth H. Betts
Attorney—Christen & Sabol

[57] **ABSTRACT**

A collapsible bicycle is disclosed which can be made into or converted into various tandem or coupled arrangements by means of interfitting and interchangeable segments.

13 Claims, 12 Drawing Figures



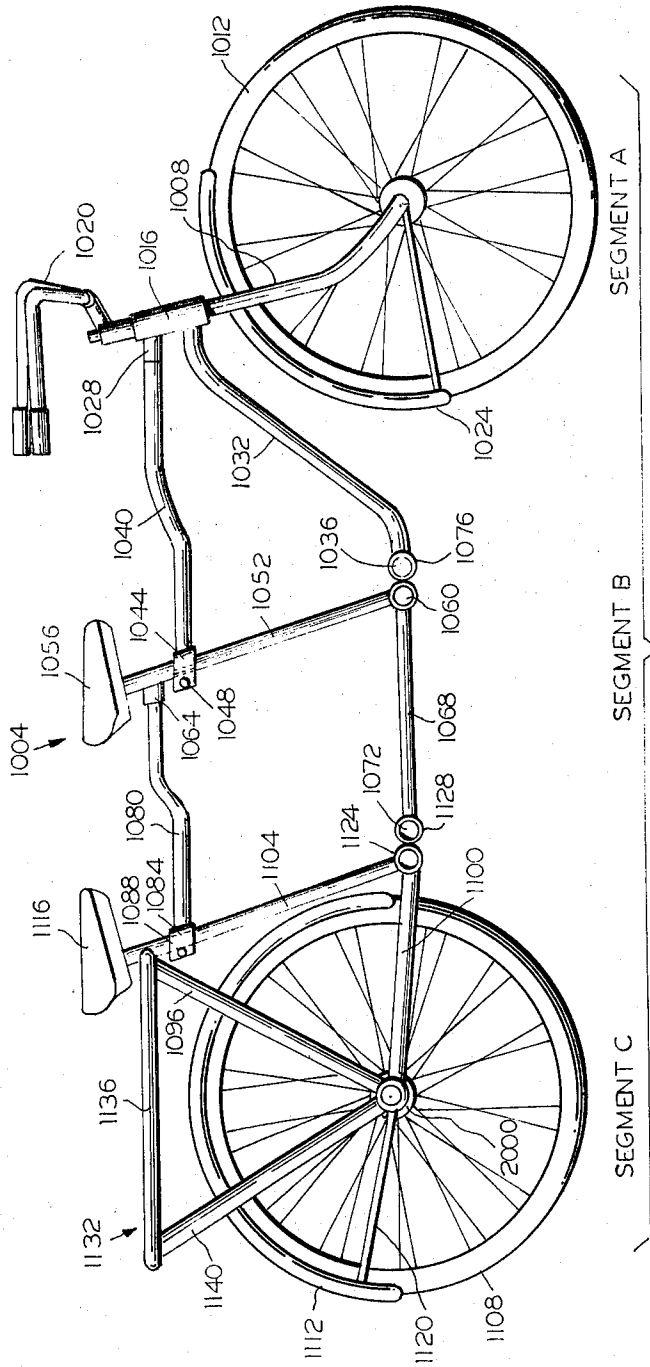


FIG. 1

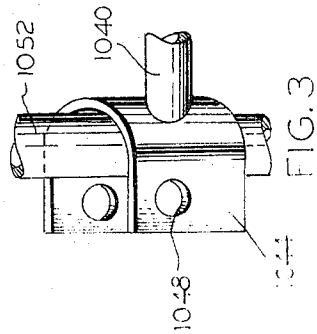


FIG. 3

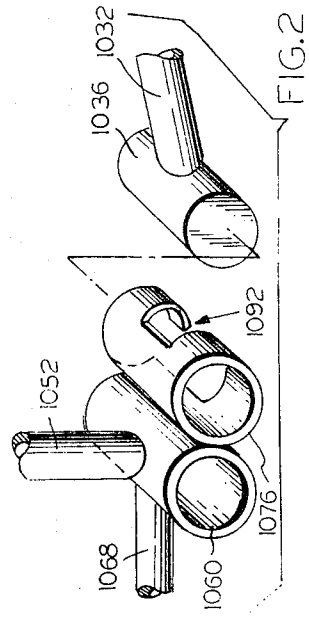


FIG. 2

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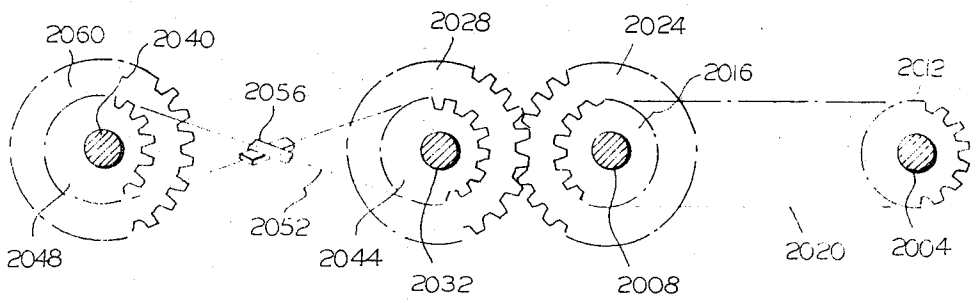


FIG. 5

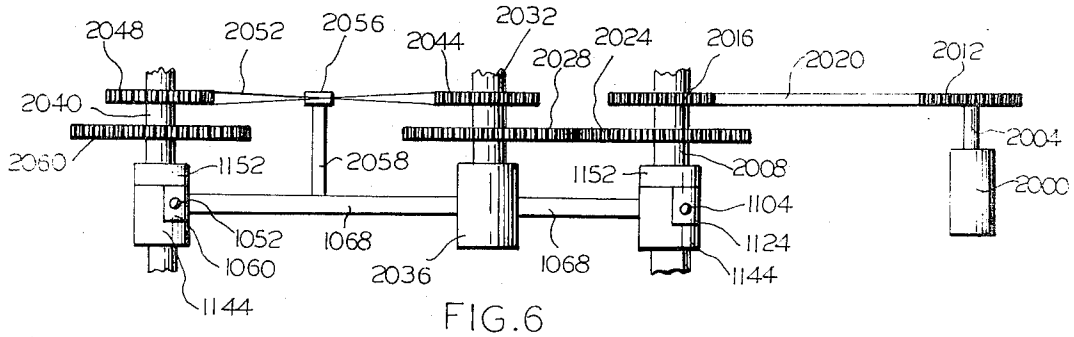


FIG. 6

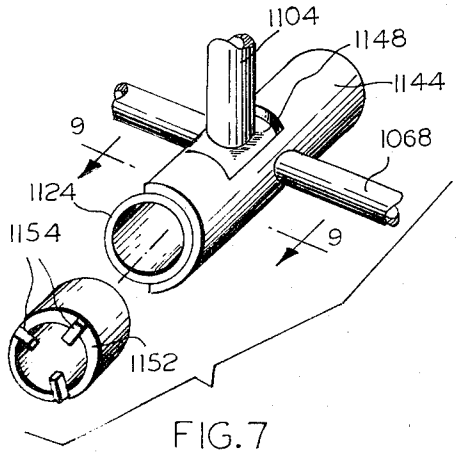


FIG. 7

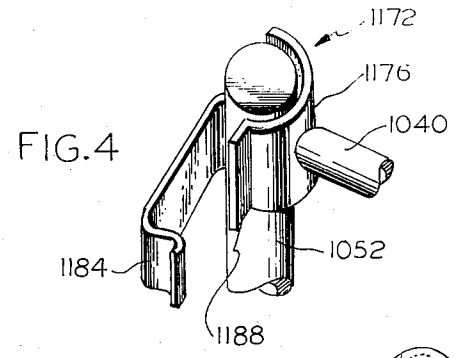


FIG. 4

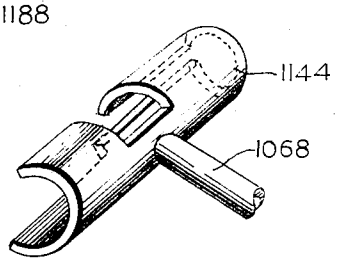


FIG. 8

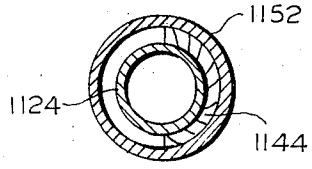


FIG. 9

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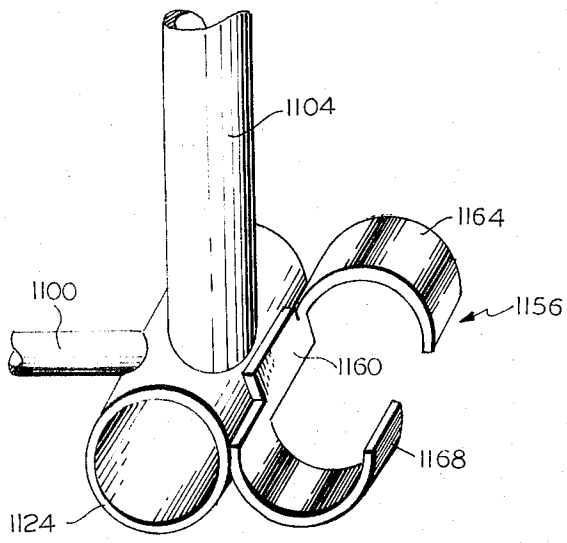


FIG.10

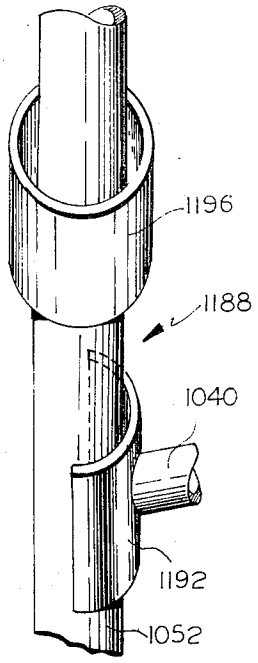


FIG.12

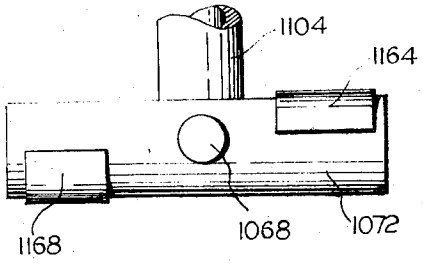


FIG.11

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COLLAPSIBLE BICYCLE

This invention involves a velocipede which can readily be assembled or disassembled, which can readily be converted into bicycles "built-for-two," etc., and which can readily be placed in a side-by-side configuration. The basic collapsible bicycle is comprised of two units; a front steering and wheel unit (segment A) and a central seat, peddling and rear wheel unit (segment C). These units are illustrated in FIG. 1. Each unit is constructed so that it detachably mates with the other units by means of an upper attachment means and a lower partial attachment means.

The central repetitive unit (segment B) is constructed so that it can be placed in the velocipede as a repetitive unit between segments A and C and contains a separate seat The central repetitive unit includes pivotal attachment means at the bottom which mate with the lower pivotal attachment means of segment A and the lower pivotal attachment means of segment C. The same male or female pivotal attachment portion is mounted on the back portion of both segments A and B; and the same female or male pivotal attachment portion is mounted on the front portion of segments B and C. More of the novel points of this invention are shown and explained in detail in the following paragraphs.

Several of the advantages of the present bicycle are that it is collapsible; can be used as a bicycle seating one person or can be modified to seat two, three or more persons, as desired; can be used abreast with one or more similar bicycles; etc. The bicycle can generally be assembled or disassembled without the use of any tools.

DETAILED DESCRIPTION OF THE INVENTION

The accompanying drawings illustrate several embodiments of this invention. In such drawings:

FIG. 1 is a side view of the man's or boy's version of the bicycle of this invention with two seats arranged in tandem and with the pedals, gears, chain, etc., not shown;

FIG. 2 is a partial perspective view, partially expanded, of a type of interlocking mounting means for attaching the bottom of the bicycle segments together;

FIG. 3 is a partial perspective view of the means for attaching the top of the bicycle segments together;

FIG. 4 is a partial perspective view of an alternative means to the attachment means of FIG. 3;

FIG. 5 is a side view of one type of chain and gear means for the bicycle of FIG. 1;

FIG. 6 is a top view of the chain and gear means of FIG. 5;

FIG. 7 is a partial perspective view, partially expanded, of another type of interlocking mounting means for attaching the bottom of the bicycle segments together;

FIG. 8 is a partial perspective view showing part of the attachment means of FIG. 7;

FIG. 9 is a sectional means of the attachment means of FIG. 7;

FIG. 10 is a partial perspective view of still another type of interlocking mounting means for attaching the bottom of the bicycle segments together;

FIG. 11 is a front partial view of the attachment means of FIG. 10; and

FIG. 12 is a partial perspective view of still another means for attaching the top of the bicycle segments together.

A novel collapsible bicycle (velocipede) 1004 is shown in FIG. 1. Bicycle 1004 is shown with two seats in tandem, but one seat can be used when segment B is not used. Bicycle 1004 is made up of segments A, B and C. Segment A includes front fork 1008, front wheel 1012, which is rotably mounted on fork 1108; head tube 1016, in which front fork 1008 is pivotally mounted; handle bar assembly 1020, which is attached to front fork 1008 and fender 1024. Any conventional bicycle seat can be used or a bicycle seat such as those described in U.S. Pat. No. 1,538,542 can be used. Top tube 1028 and bottom tube 1032 are mounted on head-tube 1016. Tube 1028 is short, and tube 1032 is shaped in a downward and outward direction. Tubes 1028 and 1032 can be any shape, but are preferably circular in cross-section. Short crossbar 1036 (see FIG. 2) is mounted on the end of tube 1032 away from head-tube 1016. Cross bar 1036 has a circular cross-section. Top attachment tube 1040 is connected to tube 1028 in either a permanent manner or detachable, which is preferred, by any suitable means such as the male end of 1040 is screwed into the female end of 1028. U-portion 1044, containing holes 1048, is attached to attachment tube 1040 as best shown in FIG. 3. Attachment tube 1040 as shown, contains a downwardly slanted portion in the center portion so as to facilitate its attachment to saddle pillars such as 1052. But attachment tube 1040 can be straight, upwardly slanted, etc.; and portion 1044, or its equivalent, can be attached to any point along saddle pillar 1052.

Top attachment bar 1040 can be arranged as in FIG. 1, which shows a man's or boy's version of the bicycle, or top attachment bar 1040 can be shaped so that a women's or girl's version of the bicycle is achieved. The latter is achieved by slanting top attachment bar so that it attaches to saddle pillar 1052 at a point near its bottom portion.

Segment B includes saddle pillar 1052; seat 1056, attached to saddle pillar 1052; housing 1060, upon which saddle pillar 1052 is mounted; top tube 1064, which is attached to saddle pillar 1052; bottom bar 1068; housing 1076, which is attached to housing 1060 and top attachment tube 1080, which is connected to top tube 1064. Cross bar 1072 has a circular cross section. Top attachment tube 1080 is connected to tube 1064 in any manner mentioned as suitable for attaching attachment tube 1040 to tube 1028. Top attachment tubes 1080 and 1040, as shown, are identically shaped but tube 1080 is shown shorter than tube 1040 because the latter must allow clearance of the front wheel. As explained above for attachment 1040, 1080 can have a multitude of shapes and can essentially be attached to saddle pillar 1104 at any place along its length by means of attachment means 1084 or its equivalent. U-portion 1084, containing holes 1088, is attached to attachment tube 1080 in a manner similar to that shown in FIG. 3. Housing 1076, which is a hollow circular tube, contains L-shaped passageway 1092 which is located generally in the bottom portion of housing 1076 and lies perpendicular to the general direction of bicycle 1004. To mount segments A and B, segment A and B are held in the same general plane but bottom

tube **1032** is held at about a **180** degree angle to saddle pillar **1052**. Cross bar **1036** is slid sideways into housing **1076**, and segments A and B are rotated into their normal positions, whereby U-portion **1044** fits over saddle pillar **1052** and whereby cross bar **1036** fits into housing **1076** and bottom tube **1032** is locked in the lower leg of L-shaped slot **1092**. A bolt and nut or a pin slid through holes **1048** locks saddle pillar **1052** in U-portion **1044**. Segments A and B are interlocked. The weight of a rider would have a tendency to push segments A and B together at the top and separate them at the bottom. The interlocking means of segments A and B utilizes this tendency.

Segment C includes top back fork **1096**; bottom back fork **1100**; saddle pillar **1104**, which is attached between forks **1096** and **1100**; back wheel **1108**; and fender **1112**; seat **1116**, attached to saddle pillar **1104**; fender support struts **1120**; housing **1124**; and housing **1128**, which is attached to housing **1124**. Segment C can include carrier **1132** which is comprised of bars **1136** and struts **1140**. Carrier **1132** is optional, but is preferred. Housing **1128**, which is a hollow circular tube, contains an L-shaped passageway similar to **1092** which is located generally in the bottom portion of housing **1128** and lies perpendicular to the general direction of bicycle **1004**. To mount segments B and C, segments B and C are held in the same general plane but bottom tube **1068** is held at about a 180° angle to saddle pillar **1104**. Cross bar **1072** is slid sideways into housing **1128**, and segments B and C are rotated into their normal positions, whereby U-portion **1084** fits over middle pillar **1104** and whereby cross bar **1072** fits into housing **1128** and bottom tube **1068** is locked in the lower leg of the L-shaped slot similar to **1092**. A bolt and nut or a pin slide through holes **1088** locks saddle pillar **1104** in U-portion **1084**. Segments B and C are interlocked. The weight of a rider would have a tendency to push segments B and C together at the top and separate them at the bottom. The interlocking means of segments B and C utilizes this tendency.

The lower attachments means shown in FIG. **2** can be replaced by the lower attachment means of FIG. **7**. In this embodiment, the housing corresponding to **1076** and **1128** are removed and the short cross bars corresponding to **1036** and **1072** are replaced with short cross member **1144**. FIG. **8** best illustrates cross member **1144**. Cross member **1144** is elongated, has a C-cross section end, has a narrow C-cross section at the other end (allowing that end to fit over a pedal crank shaft), and contains upper groove **1148** in which the saddle pillars fit. Ring **1152** is attached to housing **1124** by means of bars **1154**, which can be welded, bolted etc., to ring **1152** and housing **1124**, For example, cross member **1144** fits on housing **1124** and into the chamber formed by housing **1124** and ring **1152** so that ring **1152** fits over the end of cross member **1144**, interlocking segments B and C. See FIG. **9**. This attachment means can readily be used to attach any two segments of the bicycle of this invention. This alternate attachment means illustrates that several types of lower attachment means can be used that fit within the principles of this invention.

The lower attachment means shown in FIG. **2** can be replaced by the lower attachment means of FIG. **10**. In this embodiment, the housing corresponding to **1076** and **1128** are replaced by lower attachment means **1156**. Attachment means **1156** includes plate **1160**, which is attached to housing **1124** by any suitable means such as welding; upper C-portion **1164**, which is attached to one end of plate **1160** and which faces downwards; and C-portion **1168**, which is attached to the other end of plate **1160** and which faces upwards. To attach segment B to segment C, the two segments are placed perpendicular to each other, and short cross member **1072** is inserted into the opening in means **1156** just in front of plate **1160**. The segments are twisted **90** degrees into the same plane. FIG. **11** illustrates this interlock. U-portion **1084** fits around saddle pillar **1104**, and a bolt and nut or a pin slide through holes **1088** locks saddle pillar **1104** in U-portion **1084**. Segments B and C are interlocked. The weight of a rider should have a tendency to push segments B and C together at the top and separate them at the bottom. The interlocking means of segments B and C utilizes this tendency. This attachment means can readily be used to attach any two segments of the bicycle of this invention.

The upper attachment means shown in FIG. **3** can be replaced by the upper attachment means **1172** of FIG. **4**. Upper attachment means **1172** includes C-shaped plate **1176**; which mates with saddle pillar **1052**; lip **1188** on plate **1176**, and clip **1184**, which is pivotally attached to the end of plate **1176** away from lip **1080** and which clips over lip **1180**.

The upper attachment means shown in FIG. **4** can be replaced by the upper attachment means **1188** (FIG. **12**). which includes C-shaped plate **1192**, that mates with saddle pillar **1052**, and ring **1196**, that fits around the upper end of **1192** and saddle pillar **1052**. This demonstrates that many types of upper attachment means can be used that fit within the principles of this invention.

Conventional pedaling means have not been shown in FIG. **1** so as not to obscure important parts of the invention. Such conventional peddling means utilize tubular housings **1060** and **1124**, and housing **2000** to mount conventional sprockets, gears, chains, peddle arms, etc., For purposes of supplying that conventional information, the disclosure of U.S. Pat. No. 2,372,024 is incorporated herein by reference. Any chain should be constructed so that it can readily be dissambled for mounting or taking off.

FIGS. **5** and **6** show a special gearing and chain arrangement which can be used with bicycle **1004** of FIG. **1**, the lower attachment means of FIGS. **7** to **9** being used. This arrangement allows segment B to be used with segments A and C without having to touch or rotably the chain mounted on segment B. Shaft **2004** is rotatably mounted in housing **2000** of segment C and shaft **2008** is rotably mounted in housing **1124** of segment C. Gear **2012** is mounted on shaft **2004** and gear **2016** is mounted on shaft **2008**. Chain **2020** is mounted on gears **2012** and **2016**. Conventional peddle means (not shown) are mounted on shaft **2008**, which give segment C a unitary propulsion means which can be used when segment A is directly mated with segment C to make a bicycle having one seat. Gear **2024** is mounted on shaft **2008** and engages gear **2028**, which is mounted on shaft **2032**. Shaft **2032** is rotably mounted in housing **2036** which is mounted on bar

1068 at a position between lower attachment means 1144 (see FIG. 7) and housing 1060. Shaft 2040 is rotably mounted in housing 1060. Gear 2044 is mounted on shaft 2032 and gear 2048 is mounted on shaft 2040. Chain 2052 is mounted on gears 2044 and 2048 in a criss-cross manner, as shown in FIG. 5. At the criss-cross point, the chain is guided through chain guide 2056. Chain guide 2056 is attached to bottom bar 1068 by means of bar 2058. Gear 2060 is mounted on shaft 2040. Gears 2024, 2028 and 2060 are larger than gears 2016, 2044 and 2048 so that segments B and C can be engaged in a manner that allows interlocked driving means. Segment B has a separate driving means that readily interlocks with the driving means of segment C when a bicycle having two seats is used. Pedals (not shown) are attached to shafts 2040 and 2008.

The fork 1100 can be used as in FIG. 1, or can be mounted to saddle pillar 1104, or can be two unconnected bars mounted on saddle pillar 1104 or on housing 1124. Other obvious modifications of the conventional portions of the bicycle are within the scope of this invention.

FIG. 1 shows a two-seated tandem bicycle, but the basic bicycle of this invention is a bicycle containing only segments A and C. The bicycle of this invention also encompasses coupled bicycle arrangements and tandem-coupled bicycle arrangements.

Segment B can, and should, contain a separate set of handle bars behind seat 1004, which can be mounted in any convenient manner, say, on pillar post 1052, top tube 1064, top attachment tube 1080, etc.

What is claimed is:

1. A collapsible bicycle which comprises:

1. a front unit which includes:

a. a front fork;

b. a wheel means which is rotably attached to the lower end of said front fork (a);

c. a steering means which is attached to the upper portion of said front fork (a);

d. a head-tube which is rotably attached to the middle portion of said front fork (a) which allows said front fork (a) to be pivoted while said head tube remains stationary;

e. an upper bar which is attached on one end to said head-tube (d);

f. an upper attachment means which is permanently attached on one end to said upper bar (e);

g. a lower bar which is permanently attached on one end to said head-tube (d) below the attachment point of said upper bar (e) and which generally extends away from said head tube (d) in a downward direction; and

h. a lower attachment means which is permanently attached to the end of said lower bar(g); and

2. a back unit which includes:

i. pillar means;

j. a seat which is attached to the upper portion of said pillar means (i);

k. a housing, which is attached to said pillar means (i);

l. a first fork means, the head of which is attached to the lower portion of said pillar means (i) or said housing (k), and which is generally situated in a horizontal manner;

m. a second fork means, the head of which is attached to the upper portion of said pillar means (i) and which is situated so that the ends of the legs thereof are connected to the ends of said first fork (l);

n. wheel means rotably attached to forks (m) and

1. at the intersection of the ends of the legs thereof; and

o. propulsion means which is rotably mounted in said housing (k) and which is attached to said wheel means (n) in such a manner that said wheel means (n) rotates when said propulsion means rotates, said upper attachment means (f) being detachably affixed to said pillar means (i), said lower attachment means (h) being detachably affixed to said housing (k) or to the lower portion of said pillar means (i) just above said housing (k), and said lower attachment means (h) including transverse tubular means rotable or pivotable in a vertical plane during assembly.

2. A collapsible bicycle as described in claim 1 wherein said back unit (2) includes a carrier.

3. A collapsible bicycle as described in claim 1 wherein said upper bar (e) comprises a short tube, the end of said short tube opposite said end being attached to said head tube, and a long tube, which is attached to said short tube and said upper attachment means (f), wherein said upper attachment means (f) comprises a U-shaped piece which fits around said pillar means (i) and a bolt inserted through holes in said U-shaped piece which holds said pillar means (i) in place, wherein said lower attachment means (h) comprises a short cross bar, attached to the end of lower bar (g), and a short cross tube, which is attached to said housing (k) and which contains an L-shaped slot, said short cross bar having been inserted into said short cross tube and twisted so that said lower bar (g) locks said short cross bar in place.

4. A collapsible bicycle as described in claim 1 wherein the handle bars of said steering means (c) are detachably affixed to said remainder of said steering means (c).

5. A collapsible bicycle as described in claim 1 wherein said seat is slidably attached to pillar means (i).

6. A collapsible bicycle as described in claim 1 wherein said upper bar (e) comprises a short tube, the end of said short tube opposite said end, being attached to said head tube, and a long tube which is attached to said short tube and said upper attachment means (f), wherein said upper attachment means comprises a U-shaped piece which fits around said pillar means (i) and a bolt inserted through holes in said U-shaped piece which holds said pillar means (i) in place, where said lower attachment means (h) comprises a short cross bar, attached to the end of lower bar (g), and a short cross piece which contains a plate attached to housing (k) and two facing C-shaped pieces, one on each end of said plate said short cross bar having been inserted into said short cross piece and twisted so that said lower bar (g) locks said short cross bar in place.

7. A collapsible bicycle as described in claim 1 wherein said upper bar (e) comprises a short tube, the end of said short tube opposite said end being attached

to said head tube, and a long tube, which is attached to the said short tube and said upper attachment means (f) wherein said upper attachment means comprises a U-shaped piece which fits around said pillar means (i) and a bolt inserted through holes in said U-shaped piece which holds said pillar means (i) in place, wherein said lower attachment means (h) comprises a short cross hollow tube having both ends c-shaped attached to the end of lower bar (g), and a ring, said cross short hollow tube having been inserted over said housing and said ring inserted over said housing and one of said C-shaped end of said short cross tube and attached to the end of said housing, which locks said short cross hollow tube in place when said front and back units are twisted in place

8. A collapsible bicycle as described in claim **1** wherein said bicycle can be converted from a man's bicycle to a woman's bicycle and vice versa, by interchanging the properly shaped upper bars (e).

9. A process which comprises assemblying or disassemblying the bicycle of claim **1**.

10. A collapsible bicycle as described in claim **1** wherein said lower attachment means (h) is detachably affixed to the lower portion of said pillar means (i) just above said housing (k).

11. A collapsible bicycle which includes:

1. a front unit which includes:
   a. a front fork;
   b. a wheel means which is rotably attached to the lower ends of said front fork (a);
   c. a steering means which is attached to the upper portion of said front fork (a);
   d. a head-tube which is rotably attached to the middle portion of said front fork (a) which allows said front fork (a) to be pivoted while said head tube remains stationary;
   e. an upper bar which is attached on one end to said head tube (d) and which has a slight curve therein;
   f. an upper attachment means which is permanently attached on one end to said upper bar (e);
   g. a lower bar which is permanently attached on one end to said head-tube (d) below the attachment point of said upper bar (e) and which generally extends away from said head tube (d) in a downward direction; and
   h. a lower attachment means which is permanently attached to the end of said lower bar (g);
2. a center unit which includes;
   i. pillar means, which is detachable affixed upper attachment means (f);
   j. a seat which is attached to the upper portion of said pillar means (i);
   k. a housing, which is attached to said pillar means (i), and which is detachably affixed to lower attachment means (h);
      1. an upper bar which is attached on one end to said pillar means (i);
   m. an upper attachment means which is permanently attached on one end to said upper bar (1);
   n. a lower bar which is permanently attached on one end to said pillar means (i) below the attachment point of said upper bar (1);
   o. a lower attachment means which is permanently attached to the end of said lower bar (n); and
   p. propulsion means which is rotably mounted in said housing (k); and
3. a back unit which includes:
   q. pillar means, which is detachably affixed to upper attachment means (m);
   r. a seat which is attached to the upper portion of said pillar means (q);
   s. a housing, which is attached to said pillar means (q), and which is detachably affixed to lower attachment means (o);
   t. a first fork means the head of which is attached to the lower portion of said pillar means (q) or said housing (s), and which is generally situated in a horizontal manner;
   u. a second fork means the head of which is attached to the upper portion of said pillar means (q) and which is situated so that the ends of the legS thereof are connected to the ends of said first fork (t);
   v. wheel means rotably attached to forks (u) and (t) at the intersection of the ends of the legs thereof; and
   w. propulsion means which is rotably mounted in said housing (s) and which is attached to said wheel means (v) and said propulsion means (p) in such a manner that said wheel means (v) rotates when said propulsion means (p) and (w) rotate, said lower attachment means (h) and (o) including transverse tubular means rotable or pivotable in a vertical plane during assembly.

12. A collapsible bicycle as described in claim **11**, wherein said propulsion means (p) comprises crank shaft (x) and a pair of foot pedals attached thereto, wherein said propulsion means (w) comprises crank shaft (y) and a pair of foot pedals, wherein wheel means (v) is mounted to forks (u) and (t) by means of rotable shaft means (aa), wherein small gear (bb) is mounted on rotable shaft means (aa), wherein small gear (cc) is mounted on crank shaft (y), wherein small gear (bb) and small gear (cc) are interconnected by means of bicycle chain (dd), wherein large gear (ee) is mounted on crank shaft (y), wherein housing (ff) is mounted on lower bar (n) between housing (k) and lower attachment means (o), wherein shaft (gg) is rotably mounted in housing (ff), wherein large gear (hh) is mounted on shaft (gg) and intermeshes with large gear (dd) in a rotable manner, wherein small gear (ii) is mounted on shaft (gg), wherein small gear (jj) is mounted on crank shaft (x), and wherein small gear (ii) and small gear (jj) are interconnected by means of bicycle chain (kk), said bicycle chain (kk) being placed on said small gears (ii) and (jj) in such a manner that it crosses over itself forming an X in the space between said gears (ii) and (jj).

13. A driving mechanism for a multiple-seat, multiple-pedal bicycle which comprises a two-wheeled bicycle containing small gear (a) mounted on the rear wheel shaft, small gear (b) mounted on the rear crank shaft, bicycle chain (c) interconnecting small gear (a) and small gear (b), large gear (d) mounted on the rear crank shaft, small gear (e) mounted on the next-to-rear crank shaft, shaft housing (f) mounted on the bar connecting the housing for the rear and next-to-rear crank

shaft housings, shaft (g) rotably mounted in shaft housing (f), small gear (h) mounted on shaft (g), bicycle chain (i) interconnecting small gear (e) and small gear (h), bicycle chain (i) being placed on said small gears (e) and (h) in such a manner that it crosses over itself forming an X in the space between small gears (e) and (h), and large gear (j) mounted on shaft (g), said large gear (d) and large gear (j) intermeshing in a rotable manner.

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