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(54) METHOD OF A DOUBLE STARWHEEL UNIT IN MULTIPLE ROWS WITH A MULTI-HOLE MANNER, AN INSTRUMENT AND THE LIKE

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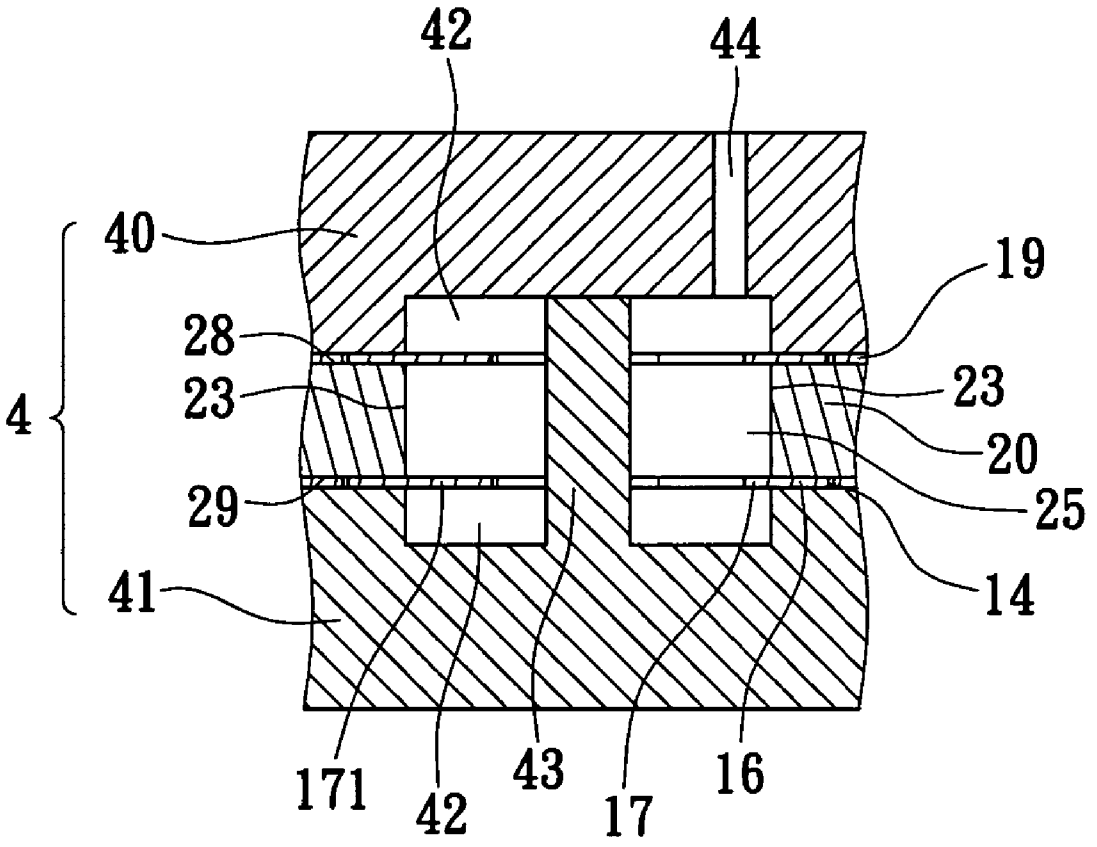
(57) ABSTRACT

A method of a double starwheel unit in multiple rows with a multi-hole manner, an instrument and the like. The double starwheel unit has a sleeve and two starwheel parallel-arranged and connecting the sleeve. The instrument has a plate-like assembly fixture and an orientation mechanism. The plate-like assembly fixture has a plurality of strip-like tools. The method combines the strip-like tools with the plate-like assembly fixture and a plurality of module holes, presses an exterior mold on the starwheel onto upper and lower surfaces of the plate-like assembly fixture, and injects a working fluid to shape the double starwheel units. The strip-like tools are engaged or disengaged by the orientation mechanism.



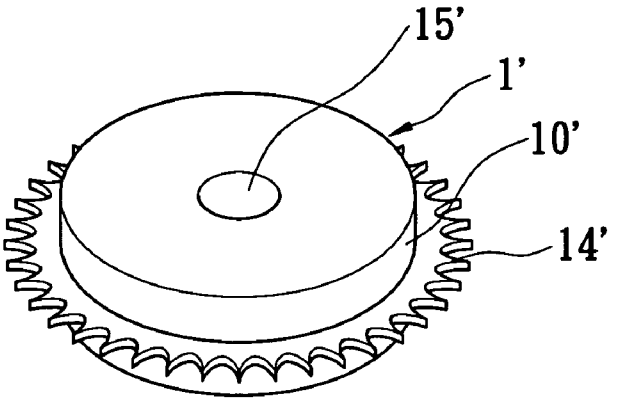


FIG. 1
PRIOR ART

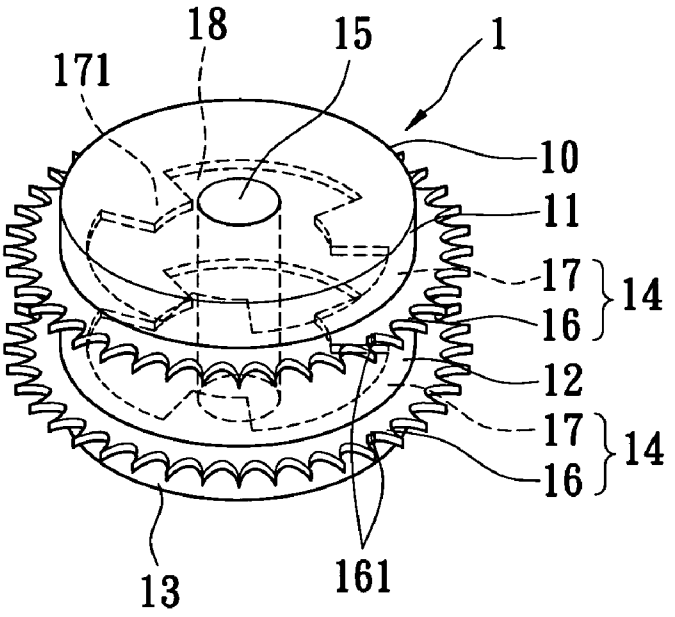


FIG. 2

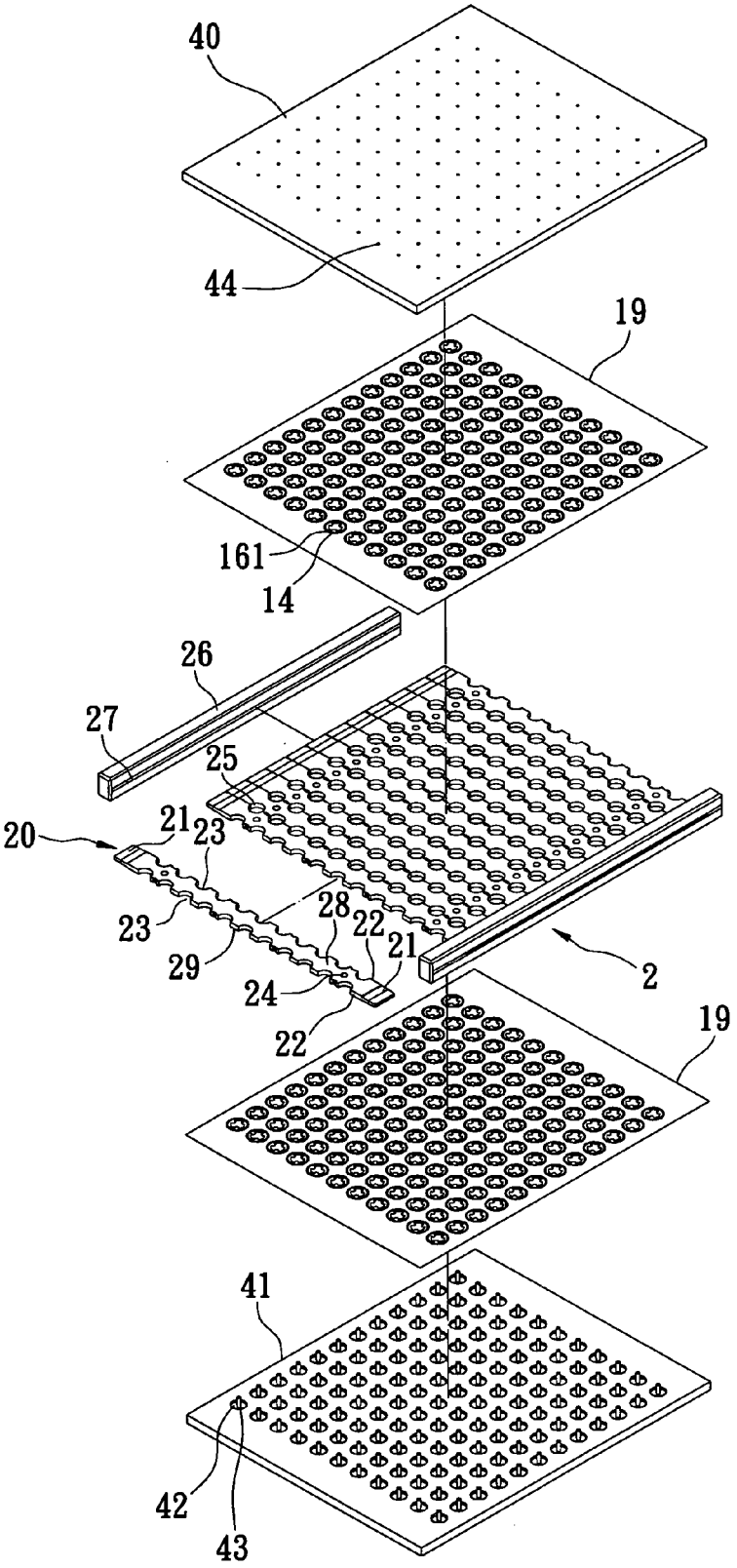


FIG. 3

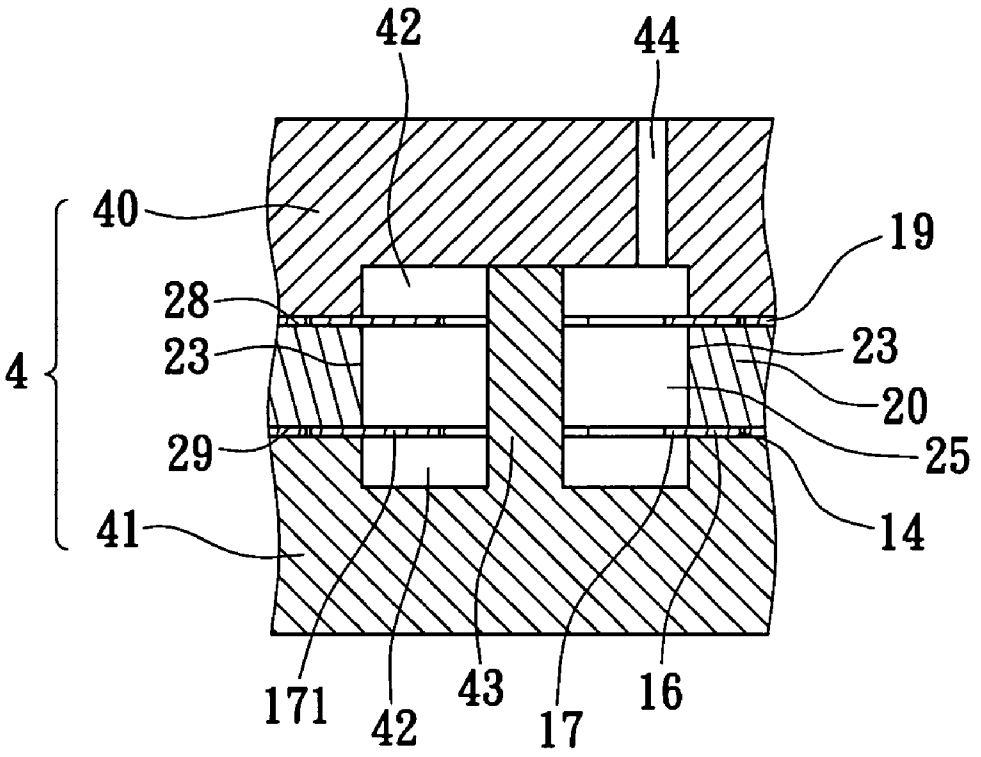


FIG. 4

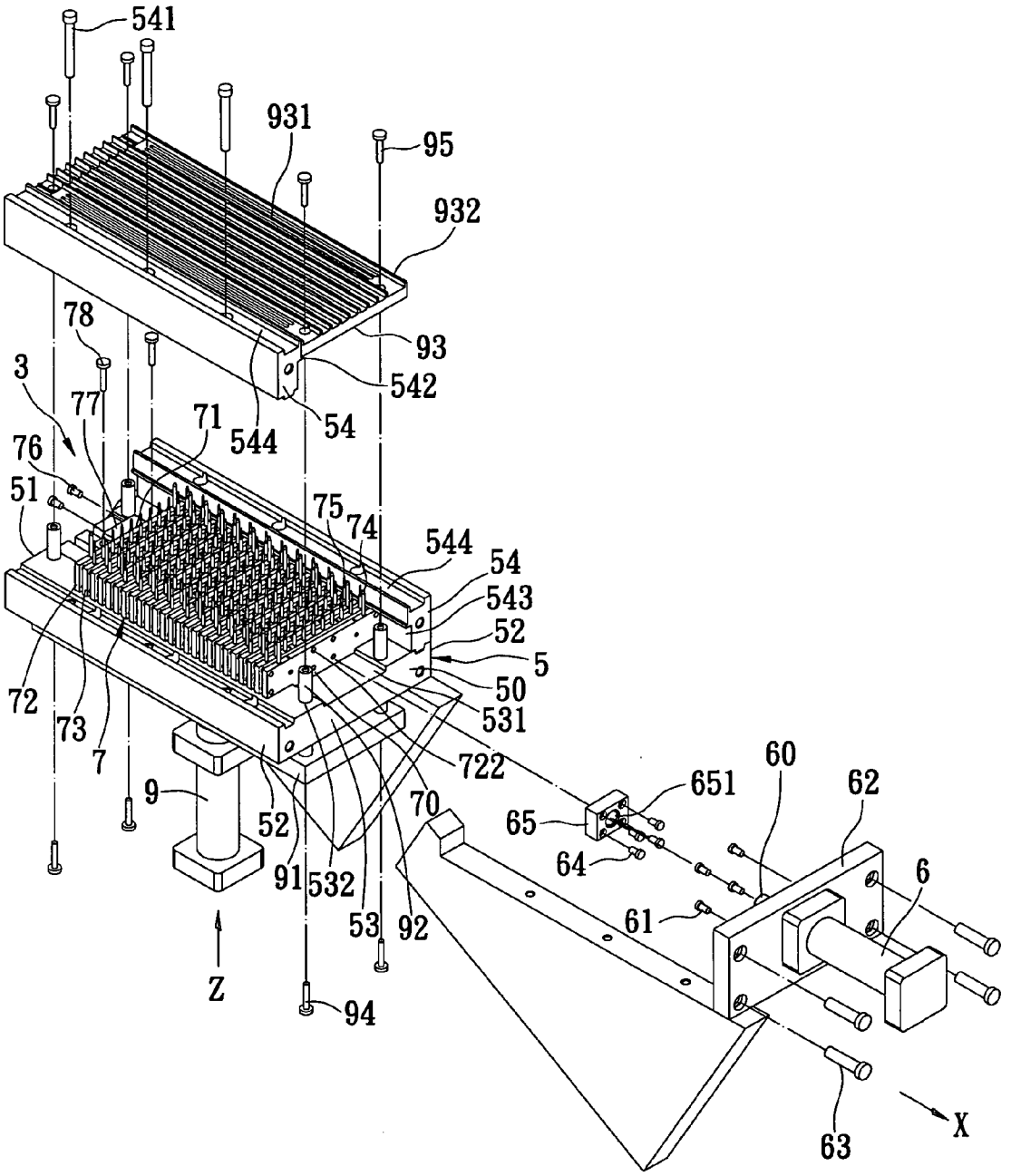

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FIG. 5

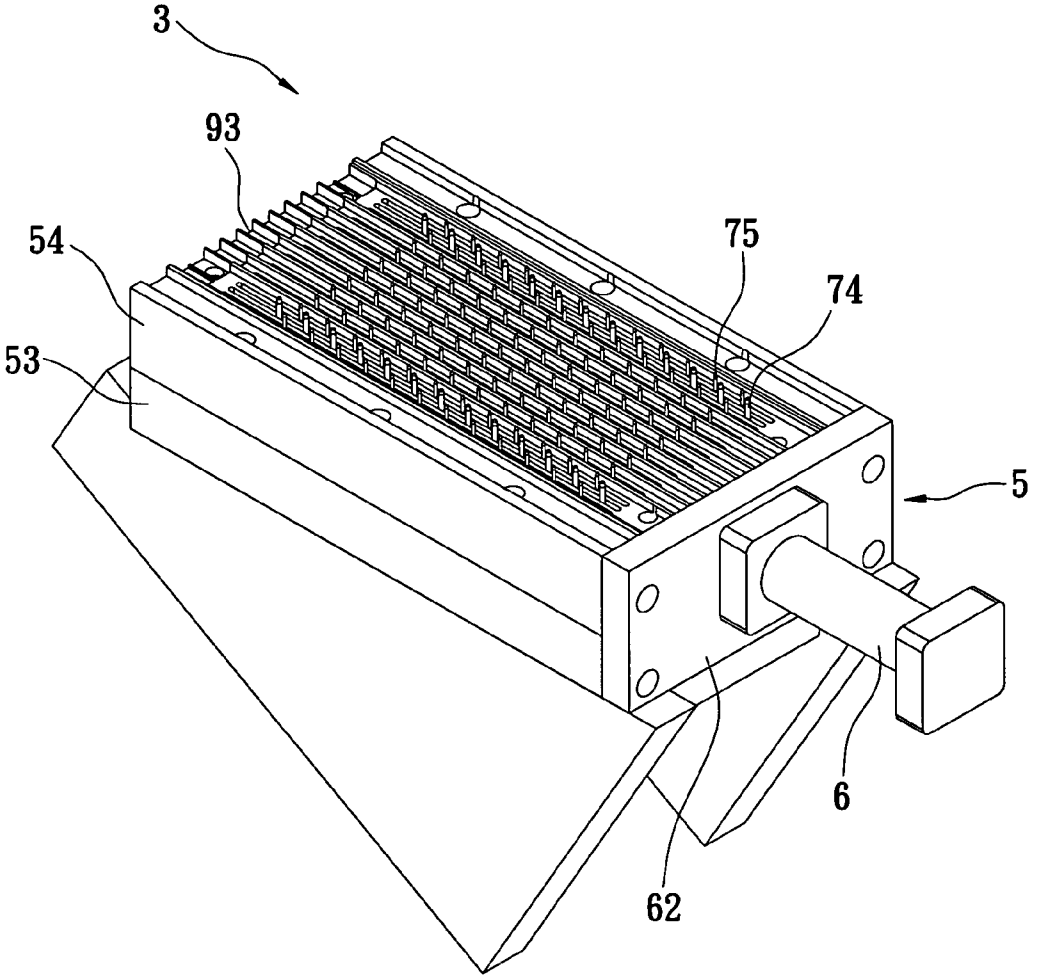

FIG. 6

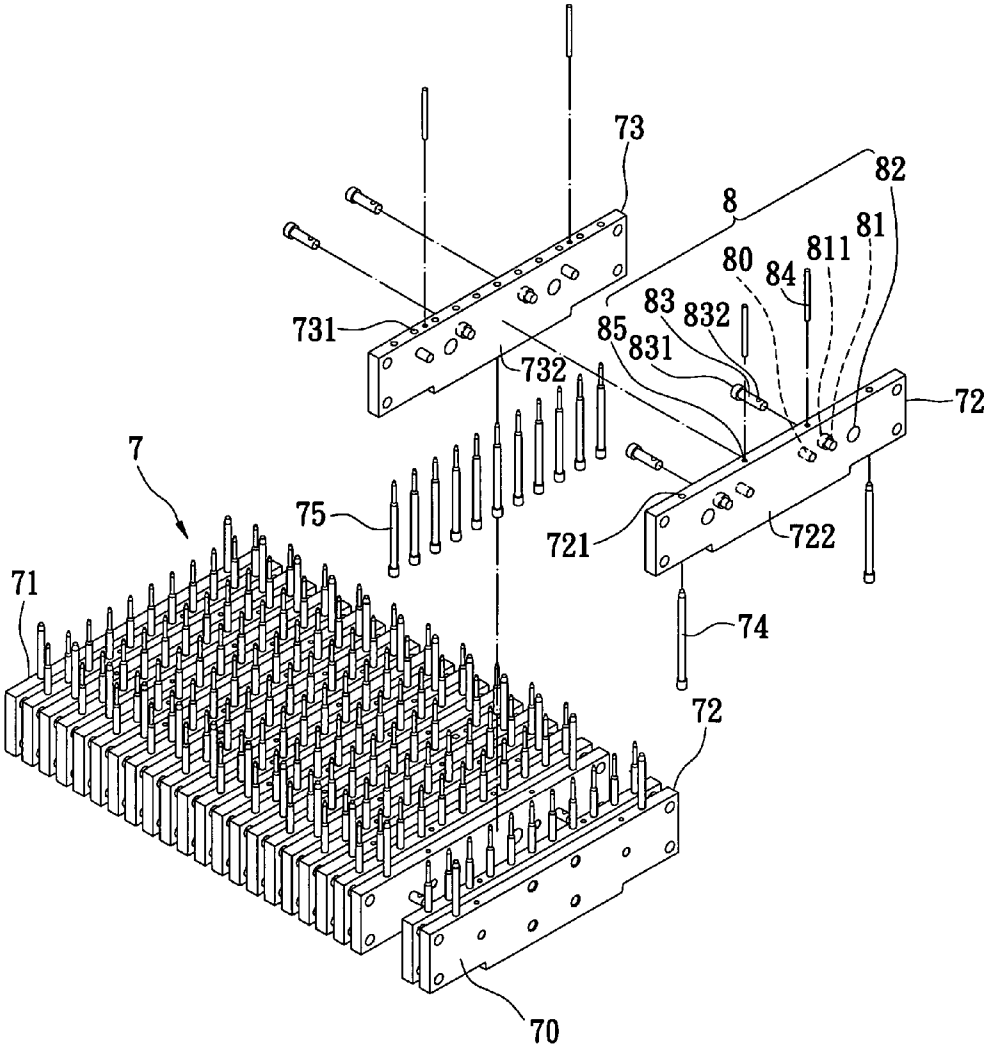

FIG. 7

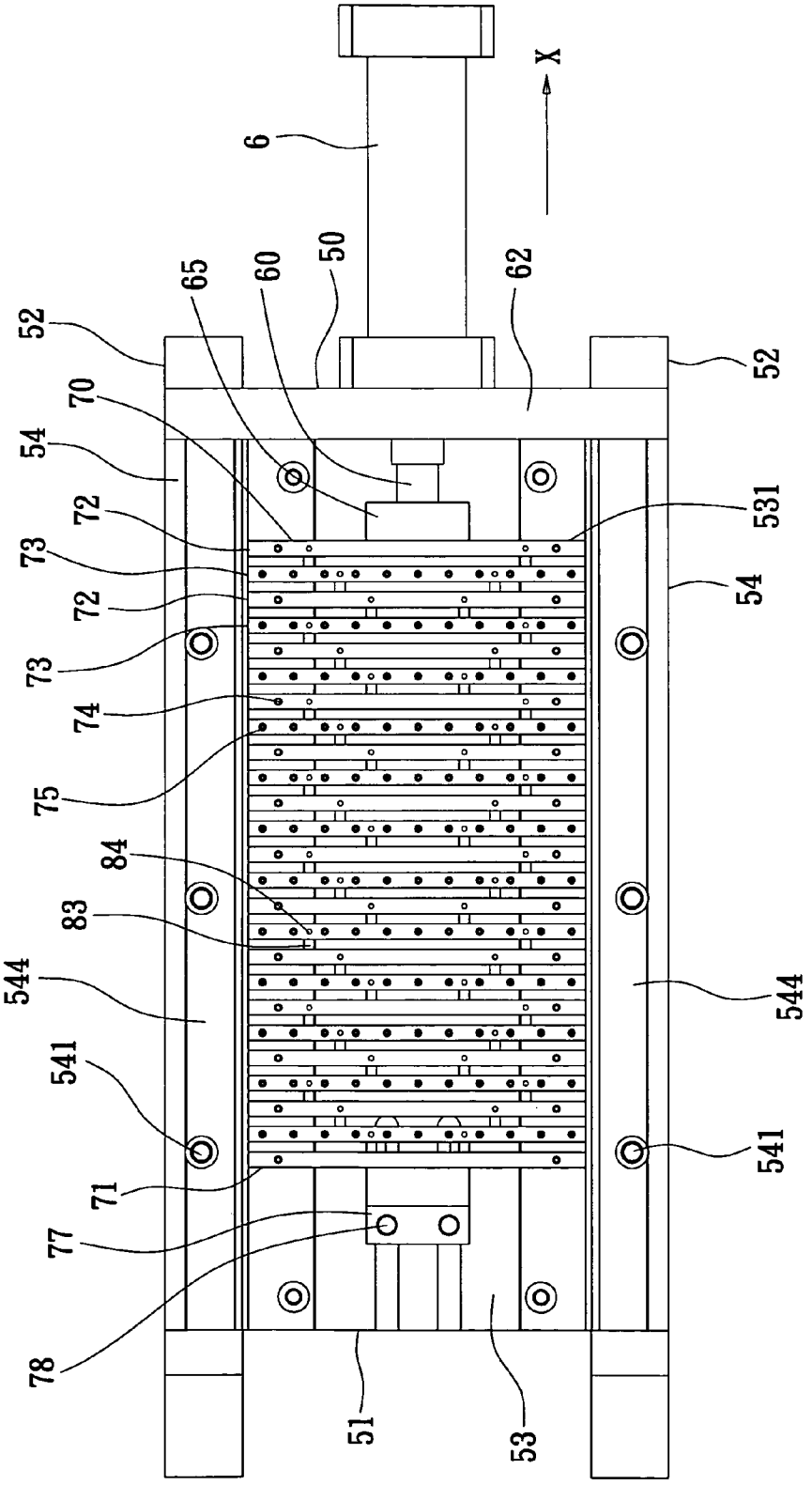
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FIG. 8

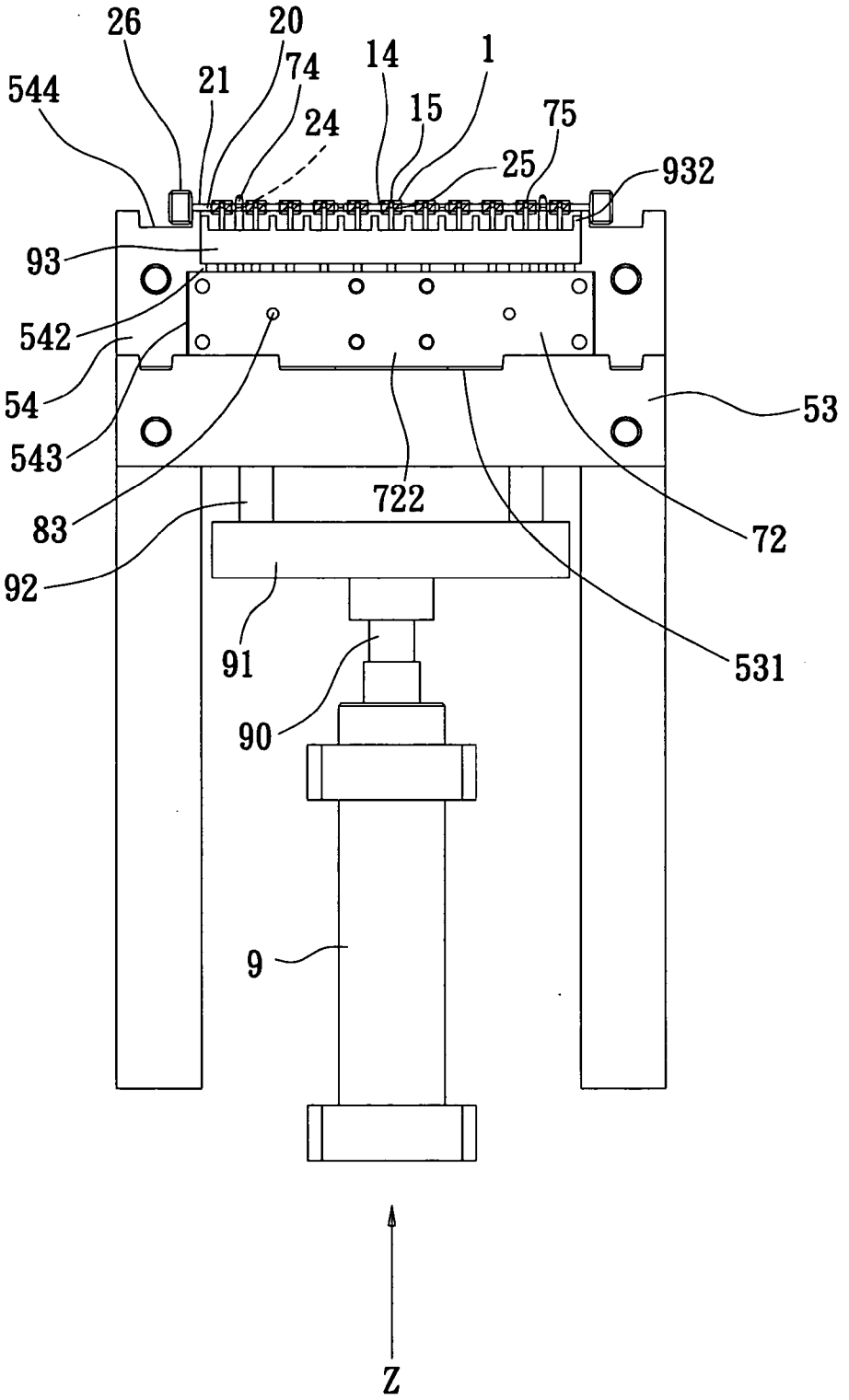
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FIG. 9

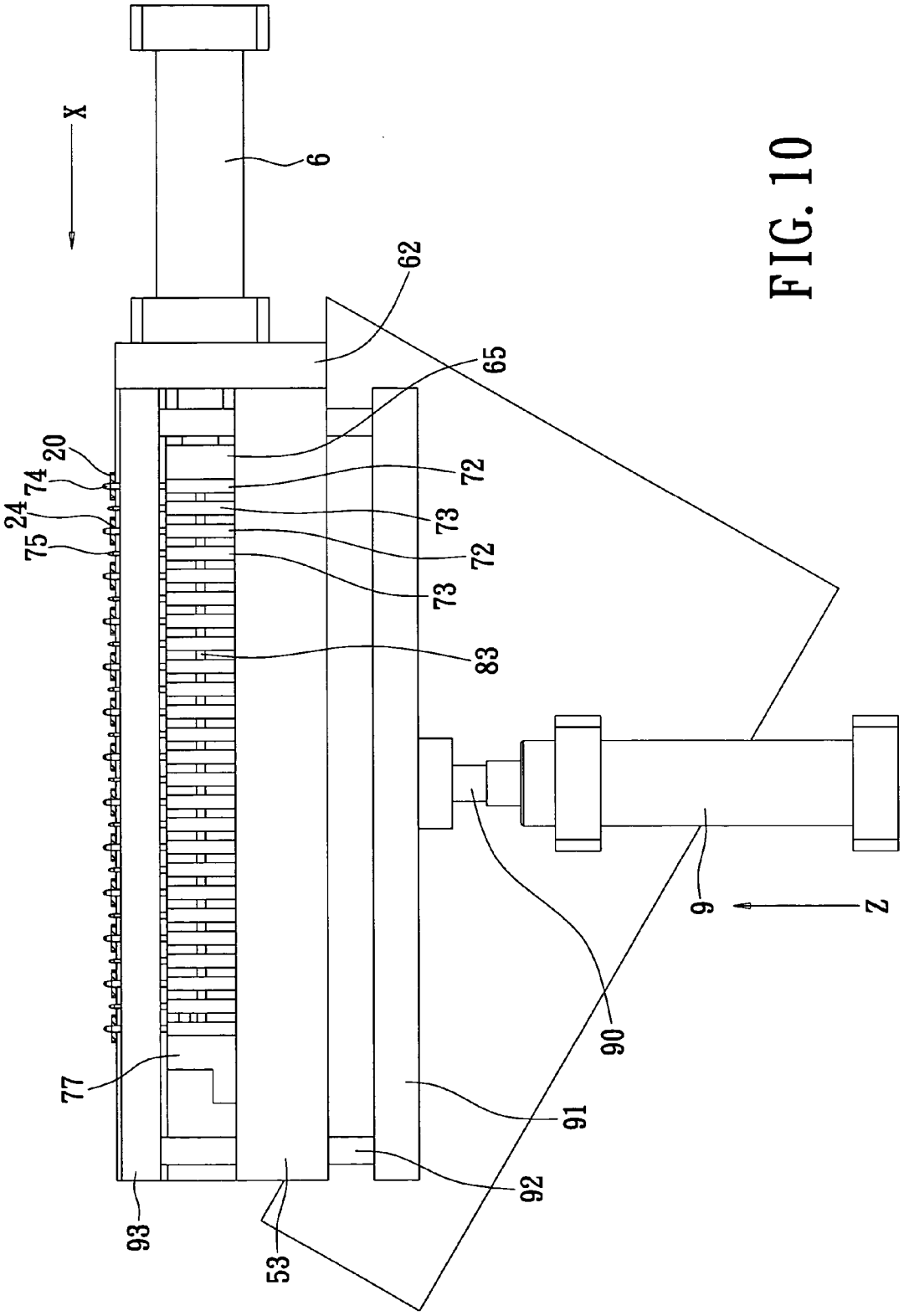

FIG. 10

METHOD OF A DOUBLE STARWHEEL UNIT IN MULTIPLE ROWS WITH A MULTI-HOLE MANNER, AN INSTRUMENT AND THE LIKE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a method of a double starwheel unit in multiple rows with a multi-hole manner, an instrument and the like, and particularly relates to a method of a double starwheel unit made integrally in one piece, an instrument and the like.

[0003] 2. Background of the Invention

[0004] An ink-jet printer usually uses a starwheel unit to increase friction while pushing a sheet of paper out from an outlet thereof after printing. With respect to **FIG. 1**, a first conventional starwheel unit **1'** is provided and includes a sleeve **10'** and a starwheel **14'** disposed in a middle of the sleeve **10'**. The sleeve **10'** has a center hole **15'** formed therein for wrapping a spring to be parallel with the outlet of the printer. The printer further includes a second starwheel unit (not shown), different from the first starwheel unit **10'** and engaging with a concave-convex structure, which is arranging on the sleeve **10'**.

[0005] The ink-jet printer requires many first conventional starwheel units **1'** for average loading on the paper; thus the cost and the assembly steps thereof increase. The ink-jet printer with the second conventional starwheel unit, which increases loading on the paper by the concave-convex structure, encounters more difficulties with module designing and sleeve engaging process than a printer with the first conventional starwheel unit **1'**, and further has so many problems both of yield rates of the sleeve engaging process and failure rates that cost of the ink-jet printer with the second conventional starwheel unit cannot be diminished.

SUMMARY OF INVENTION

[0006] The primary object of the invention is therefore to specify a method of a double starwheel unit in multiple rows with a multi-hole manner, an instrument and the like, so as to diminish the cost and manufacturing steps, to increase the yield rate and to drop the failure rate.

[0007] According to the invention, this object is achieved by a double starwheel unit including a sleeve and two starwheels. The sleeve has an upper portion, a middle portion and a lower portion sequentially arranged, and the sleeve further includes a central hole throughout the upper portion, the middle portion and the lower portion. The two starwheels are respectively defined as a first and a second starwheels parallel-arranged in an upper-and-lower manner. The two starwheels respectively have a first and a second external tooth **16** and a first and a second internal edge. The first internal edge of the first starwheel is disposed between the upper portion and the middle portion, and the second internal edge of the second starwheel is disposed between the middle portion and the lower portion. The first and the second internal edges respectively have a first and a second gear-wheel hole formed thereon and relating to the central hole of the sleeve, and the first and the second external teeth are exposed by the sleeve.

[0008] This object is further achieved by an instrument adopted for fabricating a plurality of double starwheel units in multiple rows with a multi-hole manner. The instrument includes a plate-like assembly fixture and an orientation mechanism. The plate-like assembly fixture includes a plurality of strip-like tools parallel to each other and a plurality of connection mechanisms for combining the strip-like tools with the plate-like assembly fixture. Each strip-like tool has a plurality of recesses respectively formed on two opposing longitudinal sides. The plate-like assembly fixture includes a module hole formed both by each of the recesses of the strip-like tools and a next recess relating thereto and the double starwheel units is oriented therein. The orientation mechanism combines the strip-like tools closely with and parallel to the plate-like assembly fixture, or to separate the strip-like tools from the plate-like assembly fixture.

[0009] This object is also achieved by a method adopted for fabricating a plurality of double starwheel units in multiple rows with a multi-hole manner, including: (a) bringing a plurality of strip-like tools increasingly closer together and parallel to each other for combination into a plate-like assembly fixture, the strip-like tools each having a plurality of recesses formed on two opposing longitudinal sides thereof, and a plurality of module holes formed by each of the recesses and the next recess relating thereto; (b) retaining two sheet-like substrates against an upper surface and a lower surface of the plate-like assembly fixture, the two sheet-like substrates each having a plurality of starwheels respectively relating to the module holes, of which each has a circumference ranging between those of the gear-wheel hole and an external teeth of each of the starwheels; (c) covering the plate-like assembly fixture with an exterior mold, and closely pressing the external teeth arranged on the upper and lower surfaces of the plate-like assembly fixture; (d) injecting a working fluid through an injection hole in the exterior mold and into the module holes therein, and transforming the working fluid into a sleeve to connect the starwheels of the two sheet-like substrates on the upper and the lower surfaces of the plate-like assembly fixture relating to each other for shaping a plurality of double starwheel units respectively oriented in the module holes; (e) removing the exterior mold; (f) taking a plurality of residents of the two sheet-like substrates off; and (g) separating the strip-like tools from and keeping the double starwheel units.

[0010] To provide a further understanding of the invention, the following detailed description illustrates embodiments and examples of the invention. Examples of the more important features of the invention thus have been summarized rather broadly in order that the detailed description thereof that follows may be better understood, and in order that the contributions thereto may be appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

[0012] **FIG. 1** is a perspective view of a conventional starwheel unit;

[0013] **FIG. 2** is a perspective view of the double starwheel unit according to the present invention;

[0014] **FIG. 3** is an enlarged-decomposition view according to a plate-like assembly fixture and an exterior mold respectively relating to a sheet-like substrate of a first and a second starwheels according to the present invention;

[0015] **FIG. 4** is an enlarged profile according to a nodule hole of the plate-like assembly fixture and a plurality of module slots of the exterior mold respectively relating to the first and the second starwheels according to the present invention;

[0016] **FIG. 5** is an enlarged-decomposition view according to an orientation mechanism while a retractable assembly mechanism in a stretched state according to the present invention;

[0017] **FIG. 6** is a perspective view according to the orientation mechanism while the retractable assembly mechanism is in the extended state according to the present invention;

[0018] **FIG. 7** is an enlarged-decomposition view of the retractable assembly mechanism according to the present invention;

[0019] **FIG. 8** is a top view without a top plate according to the orientation mechanism while the retractable assembly mechanism in the extended state according to the present invention;

[0020] **FIG. 9** is a side view without a horizontal reciprocal power source according to the orientation mechanism while the retractable assembly mechanism is in a retracted state according to the present invention; and

[0021] **FIG. 10** is a front view without a lateral base and two clips according to the orientation mechanism while the retractable assembly mechanism straddling a plurality of strip-like tools is in the extended state according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0022] With respect to **FIG. 2**, the present invention provides a double starwheel unit **1** including a sleeve **10** and two starwheels **14**. The sleeve **10** is made of a plastic material, and has an upper portion **11**, a middle portion **12** and a lower portion **13** sequentially arranged. The sleeve **10** further includes a central hole **15** throughout the upper portion **11**, the middle portion **12** and the lower portion **13**. The sleeve **10** is cylindrical in shape, and the middle portion **12** is thicker than the upper portion **11** and the lower portion **13**.

[0023] The two starwheels **14** respectively define as a first and a second starwheels parallel-arranged in an upper-and-lower manner. The two starwheels **14** respectively have first and second external teeth **16** and first and second internal edges **17**. The first internal edge **17** of the first starwheel is disposed between the upper portion **11** and the middle portion **12**, and the second internal edge **17** of the second starwheel is disposed between the middle portion **12** and the lower portion **13**. The first and the second internal edges **17** respectively have first and second gear-wheel holes **18** formed therein and relating to the central hole **15** of the sleeve **10**. The first and the second external teeth **16** are exposed by the sleeve **10**. Each first and second internal edge **17** has a plurality of projections **171** protruding inwardly and arranged symmetrically. Each starwheel **14** is shaped like a plate, and each first and second external tooth **16** has a conjunction point **161** connecting each of the two starwheels **14** to a sheet-like substrate **19** (see **FIG. 3**).

[0024] Referring to **FIGS. 3-6**, the present invention provides an instrument adopted for fabricating a plurality of double starwheel units **1** in multiple rows with a multi-hole manner. The instrument includes a plate-like assembly fixture **2** and an orientation mechanism **3**. The plate-like assembly fixture **2** includes a plurality of strip-like tools **20** parallel to each other and a plurality of connection mechanisms arranged and connecting alternatively between the strip-like tools **20**. Each connection mechanism includes two clips **26** parallel to each other, and the two clips **26** respectively having two embedded slots **27** relating to each other. Each strip-like tool **20** has two opposing ends **21** clamped by the two clips **26** into the two embedded slots **27** in a one-on-one manner to combine the strip-like tools **20** with the plate-like assembly fixture **2**. Each strip-like tool **20** has a plurality of recesses **23** respectively formed on two opposing longitudinal sides **22**. The plate-like assembly fixture **2** includes a module hole **25** formed both by a recess **23** of a strip-like tool **20** and the next recess **23** relating thereto. Each double starwheel unit **1** and each strip-like tool **20** includes an orientation hole **24** formed therein and adjacent to each of the two opposing ends **21**.

[0025] The plate-like assembly fixture **2** connects and covers an exterior mold **4** (see **FIG. 4**), which includes an upper mold **40** and a lover mold **41**, a plurality of module slots **42**, a plurality of posts **43** arranged in the module slots **42**, and a plurality of injection holes **44** communicating with the module slots **42**, for covering the plate-like assembly fixture **2** and so that the exterior mold **4** closely presses the external teeth **16** of each of the double starwheel units **1** arranged on each of upper and lower surfaces **28**, **29** of the plate-like assembly fixture **2**. The gear-wheel hole **18** communicates with the module hole **25**, which has a circumference ranging between that of the gear-wheel hole **18** and the external teeth **16**. Each module slot **42** corresponds to the module hole **25** and each post **43** penetrates through the module hole **25** and the gear-wheel hole **18**. A working fluid is injected through injection holes **44** in the exterior mold **4** and into module hole **25**. The working fluid transforms into the sleeve **10** and the posts **43** each retain the central hole **15** therein. The sleeve **10** connects the two double starwheels **14** arranged relatively on each of the upper and lower surfaces **28**, **29** of the plate-like assembly fixture **2** to form a double starwheel unit **1** oriented in the module hole **25**.

[0026] The orientation mechanism **3** is used for engaging with or disengaging from a strip-like tool **20** and the next strip-like tool **20** relating thereto. Referring to **FIG. 5** and **FIG. 6**, the orientation mechanism **3** includes a housing **5**, a horizontal reciprocal power source **6** and a retractable assembly mechanism **7**. The housing **5** has a front side **50** and a rear side **51** relating to the front side **50**. The horizontal reciprocal power source **6** is disposed on the front side **50** of the housing **5** and has a lateral telescopic lever **60** parallel to a horizontal direction X of the housing **50**. The retractable assembly mechanism **7** includes a front-end face **70** and a rear-end face **71** relating to the front-end face **70**. The front-end face **70** connects to the lateral telescopic lever **60** and slides on the housing **5**, and the rear-end face **71** connects to the rear side **51** of the housing **5**.

[0027] With respect to **FIG. 7** and **FIG. 8**, the retractable assembly mechanism **7** includes an orientation plate **72**, a reception plate **73**, an orientation pin **74**, a collection pin **75** and a linkage mechanism **8**. The orientation plate **72** is arranged alternatingly with the reception plate **73**. Each front-end face **70** and rear-end face **71** of the retractable assembly mechanism **7** is the orientation plate **72**. The linkage mechanism **8** is arranged between the orientation plate **72** and the reception plate **72** for extending and retracting. The linkage mechanism **8** includes a secure hole **80**, a pivot hole **81**, a reception hole **82**, a pivot pin **83** and a secure pin **84**. The secure hole **80**, the pivot hole **81** and the reception hole **82** are respectively formed in two adjacent orientation plates **72** and the reception plate **73**. Each orientation plate **72** and reception plate **73** has an insertion hole **85** communicating with the secure hole **80**. The linkage mechanism **8** further includes a limitation slot **811** formed in the pivot hole **81** and facing a retraction direction of the retractable assembly mechanism **7**. The pivot pin **83** has a through hole **832** formed in an end thereof and an expansion limitation portion **831** arranged at an opposing end thereof and facing the retraction direction of the retractable assembly mechanism **7**. The pivot pin **83** penetrates through the pivot hole **81** and the secure hole **80**. The secure pin **84** inserts into the insertion hole **85**, the secure hole **80** and the through hole **832** for orienting the pivot pin **83** in the secure hole **80**. The expansion limitation portion **831** mates with the limitation slot **811** for pivoting on the reception hole **82**. Referring to **FIG. 7** and **FIG. 9**, the orientation plate **72** has a first lengthwise hole **721** for the orientation pin **74** to connect therein, and the orientation pin **74** has a top exposed by the first lengthwise hole **721**. Each strip-like tool **20** corresponds to the orientation plate **72** and the orientation hole **24** sleeves on the top of the orientation pin **74**. The reception plate **73** has a second lengthwise hole **731** formed therein for receiving the collection pin **75**, and the collection pin **75** has a top exposed by the second lengthwise hole **731**. The central hole **15** of each of the double starwheel unit **1** is relatively sleeved on the top of the collection pin **75**.

[0028] As illustrated in **FIG. 5**, **FIG. 7**, and **FIG. 9**, the housing **5** includes a base **53** and two opposing lateral bases **54**. The housing **5** further includes an upper groove **531** formed on the base **53** and parallel to the horizontal direction X. The orientation plate **72** and the reception plate **73** respectively have a lower protrusion (**722**, **732**) mating with the upper groove **531**. Each opposing lateral base **54** is bolted on two opposing sides **52** of the base **53** with a plurality of screw bolts **541**. The two opposing lateral bases **54** are parallel to the horizontal direction X, and each opposing lateral base **54** has an inner raised strip **542** and a lateral groove **543** formed between the inner raised strip **542** and the base **53**. The orientation plate **72** and the reception plate **73** respectively have two opposing edges, where each slidably mates with the inner raised strip **543**.

[0029] The plate-like assembly fixture **2**, which is combined with the strip-like tools **20**, and the double starwheel units **1**, which is orientated in the module hole **25**, are both arranged on the retractable assembly mechanism **7**. The lateral base **54** has a concave portion **544** formed in a top face thereof for the two clips **26** straddling the concave portion **544**, and allows the two clips **26** to clamp on or off the two opposing ends **21** thereby.

[0030] In **FIG. 5** and **FIG. 10**, the horizontal reciprocal power source **6** is connected to a fixed plate **62** by a screw bolt **61**. The fixed plate **62** is disposed on the base **53** and the lateral base **54** with a screw bolt **63**. The orientation plate **72** of the retractable assembly mechanism **7** connects to a connection plate **65** with a screw bolt **64**, and the lateral telescopic lever **60** of the horizontal reciprocal power source **6** movably penetrating through a shaft hole **651** of the connection plate **65**. The orientation plate **72** of the retractable assembly mechanism **7** has a fixed clip **77** connected thereto by a screw bolt **76**, and the fixed clip **77** is connected to the base **53** by a screw bolt **78**.

[0031] With respect to **FIG. 5**, **FIG. 9** and **FIG. 10**, the orientation mechanism **3** includes a vertical reciprocal power source **9**, a top-retention plate **91**, a plurality of pillars **92** and a top plate **93**. The vertical reciprocal power source **9** and the top-retention plate **91** are disposes beneath the base **53**. The top plate **93** is arranged between the plate-like assembly fixture **2** and the retractable assembly mechanism **7**. The vertical reciprocal power source **9** includes a longitudinal telescopic lever **90** defining a vertical direction Z and vertical to the plate-like assembly fixture **2**. The top-retention plate **91** connects to the end of the longitudinal telescopic lever **90**. The base **53** has a plurality of through holes **532**. Each pillar **92** has an end connecting to the top-retention plate **92** and an opposing end penetrating through each of the through holes **532** of the base **53** to connect to the top plate **93**, and the top plate **93** restrictedly moves on the inner raised strip **542**. The top plate **93** has a plurality of guiding slots **931** formed therein and a plurality of partitions **932** all parallel to the horizontal direction X. The orientation pin **74** and the collection pin **75** respectively penetrate each of the guiding slots **931** and are actuated therein.

[0032] In addition, the present invention provides a method adopted for fabricating a plurality of double starwheel units **1** in multiple rows with a multi-hole manner. The method includes:

[0033] (a) obtaining a plurality of strip-like tools **20** parallel to each other and arranged increasingly closer to each other to be combined with a plate-like assembly fixture **2**, the strip-like tools **20** each having a plurality of recesses **23** formed on two opposing longitudinal sides **22** thereof, and a plurality of module holes **25** (see **FIG. 3**) each formed by a recess and a next recess relating thereto. The plate-like assembly fixture **2**, referring to **FIG. 9**, straddles a lateral base **54** of an orientation mechanism **3**, each strip-like tool **20** has an orientation hole **24** sleeved on an orientation pin **74** of a retractable assembly mechanism **7**, which is disposed on the orientation mechanism **3**. In a retracted state, two clips **26** of the plate-like assembly fixture **2** are moved and sleeved on an embedded slot of each of the clips **26** on an end of each of the strip-like tools **20** for combining the strip-like tools **20** with the plate-like assembly fixture **2**. A longitudinal telescopic lever **90** of a vertical reciprocal power source **9** of the orientation mechanism **3** is raised to retain a plurality partitions **932** of a top plate **93** of the orientation mechanism **3** against the plate-like assembly fixture **2**, so that the orientation hole **24** and the module hole **25** are removed from the orientation pin **74** and the collection pin **75** of a retractable assembly mechanism **7**.

[0034] (b) retaining two sheet-like substrates **19** against upper surface and lower surfaces **28**, **29** of the plate-like assembly fixture **2**. Each sheet-like substrate **19** has a plurality of starwheels **14** respectively relating to the module holes **25**, each of which has a circumference ranging between those of a gear-wheel hole **18** and an external teeth **16** of each of the starwheels **14** (see **FIGS. 3 and 4**).

[0035] (c) covering the plate-like assembly fixture **2** with an exterior mold **4**, and closely pressing the external teeth **16** arranged on the upper and lower surfaces **28**, **29** of the plate-like assembly fixture **2**. The exterior mold **4** includes an injection hole **44** communicating with the module hole **25** and the gear-wheel hole **18** (see **FIGS. 3 and 4**), the exterior mold **4** is covered with an upper mold **40** and a lower mold **41** thereof by a shaping machine (not shown), and one of the sheet-like substrates **19** in the lower mold **41** to be closely pressed.

[0036] (d) injecting a working fluid through the injection hole **44** in the exterior mold **4** and into the module holes **25** therein, and transforming the working fluid into a sleeve **10** to connect the starwheels **14** of the two sheet-like substrates **19** on the upper and the lower surfaces **28**, **29** of the plate-like assembly fixture **2** relating to each other for shaping a plurality of double starwheel units **1** respectively oriented in the module holes **25** (with respect **FIG. 2** and **FIG. 4**).

[0037] (e) removing the exterior mold **4**, which is removed from the plate-like assembly fixture **2** by the shaping machine.

[0038] (f) removing a plurality of residents of the two sheet-like substrates **19**; the two sheet-like substrates **19** should be clamped by a hook (not shown) to obtain a conjunction point **161** that connects the starwheels. When opened, the hook removes the residents.

[0039] (g) separating the strip-like tools **20** from the double starwheel units **1** (see **FIGS. 9 and 10**). The plate-like assembly fixture **2** is transferred by a carrying machine (not shown) to the orientation mechanism **3** and straddles the partitions **932** on the top plate **93**. Simultaneously, the strip-like tools **20** relate to an orientation plate **72** of the retractable assembly mechanism **7**, downwardly shifting a longitudinal telescopic lever **90** of the vertical reciprocal power source **9** of the orientation mechanism **3** to carry the plate-like assembly fixture **2** to the lateral base **54** of the orientation mechanism **3**. The orientation hole **24** of each of the strip-like tools **20** and a central hole **15** of each of the double starwheel units **1** sleeves on the orientation pin **74** and the collection pin **75** of the retractable assembly mechanism **7**, separating the two clips **26** for extending the retractable assembly mechanism **7** by a lateral telescopic lever **60** of a horizontal reciprocal power source **6** of the orientation mechanism **3**. The orientation plate **72** of the retractable assembly mechanism **7** separates from a reception plate **73** of the retractable assembly mechanism **7**, and the strip-like tools **20** are actuated to slip by the orientation pin **74**, so that the module hole **25** expands to be larger than the external teeth **16**, and each double-starwheel unit **1** separates from the exterior mold **4** and falls onto the collection pin **74**. The lateral telescopic lever **60** recovers to move the strip-like tools **20** closer to the plate-like assembly plate **2**.

[0040] Some characteristics of the present invention that provides a method of a double starwheel unit in multiple rows with a multi-hole manner, an instrument and the like are listed as follows:

[0041] (1) the sleeve **10** connects the two starwheels **14** and both are made in one piece integrally. The yield rate is thus increased, and the failure rate is efficiently decreased.

[0042] (2) the strip-like tools **20** are parallel-arranged closer to fabricate the plate-like assembly fixture **2** and the module hole **25**, and then the exterior mold **4** is covered and the starwheels **14** closely pressed onto the plate-like assembly fixture **2**. Many double starwheel units **1** are thus manufactured in one step.

[0043] (3) the strip-like tools **20** are disposed closer or far from each other to engage with or disengage from the double starwheel units **1** in the extended state or retracted state of the retractable assembly mechanism **7**. The efficiency of formation and removal is thus increased.

[0044] It should be apparent to those skilled in the art that the above description is only illustrative of specific embodiments and examples of the invention. The invention should therefore cover various modifications and variations made to the herein-described structure and operations of the invention, provided they fall within the scope of the invention as defined in the following appended claims.

What is claimed is:

1. A double starwheel unit comprising:

a sleeve having an upper portion, a middle portion and a lower portion sequentially arranged, with a central hole passing throughout the upper portion, the middle portion and the lower portion; and

a first and a second starwheels parallel-arranged in an upper-and-lower manner and respectively having first and second external teeth and first and second internal edges, the first internal edge disposed between the upper portion and the middle portion, the second internal edge disposed between the middle portion and the lower portion, both the first and the second internal edges respectively having first and second gear-wheel holes formed therein and relating to the central hole, and the first and the second external teeth being exposed thereby.

2. The double starwheel unit of claim 1, wherein the sleeve is cylindrical in shape, and the middle portion is thicker than the upper portion and the lower portion.

3. The double starwheel unit of claim 1, wherein the first and the second internal edges respectively have a plurality of projections protruding inwardly and arranged symmetrically.

4. The double starwheel unit of claim 1, wherein the first and the second starwheels are respectively shaped like a plate, and the first and the second external teeth respectively

have a conjunction point connecting each of the first and the second starwheels to a sheet-like substrate.

5. An instrument adopted for fabricating a plurality of double starwheel units in multiple rows with a multi-hole manner, comprising:

a plate-like assembly fixture having a plurality of strip-like tools parallel to each other and connection mechanisms arranged thereon and connecting alternatingly between the strip-like tools, wherein each strip-like tool has a plurality of recesses respectively formed in two opposing longitudinal sides, the plate-like assembly fixture includes a module hole formed both by each of the recesses of the strip-like tools and a next recess relating thereto, and each double starwheel unit includes a gear-wheel hole formed therein and oriented in the module hole; and

an orientation mechanism engaging with or disengaging from each strip-like tool and a next strip-like tool relating thereto.

6. The instrument of claim 5, wherein:

the plate-like assembly fixture connects to an exterior mold, wherein the exterior mold includes a plurality of module slots, a plurality of posts arranged in the module slots, and a plurality of injection holes communicating with the module slots;

the exterior mold covers the plate-like assembly fixture and closely presses external teeth of each double starwheel unit arranged on upper and lower surfaces of the plate-like assembly fixture, respectively;

the gear-wheel hole communicates with the module hole, wherein a circumference thereof ranges between that of the gear-wheel hole and that of the external teeth; and

each module slot corresponds to the module hole and each post penetrates through the module hole and the gear-wheel hole;

whereby a working fluid is injected into the injection holes in the exterior mold and into the module hole, the working fluid transforms into a sleeve and each posts retains a central hole therein, the sleeve connects the two double starwheels arranged respectively on each upper and lower surface of the plate-like assembly fixture to shape a double starwheel unit oriented in the module hole.

7. The instrument of claim 5, wherein:

the orientation mechanism includes a housing, a horizontal reciprocal power source and a retractable assembly mechanism;

the housing has a front side and a rear side relating to the front side; and

the horizontal reciprocal power source is disposed on the front side of the housing and has a lateral telescopic lever parallel to a horizontal direction of the housing, the retractable assembly mechanism includes a front-end face and a rear-end face relating to the front-end face, the front-end face connects the lateral telescopic lever and slides on the housing, and the rear-end face connects the rear side of the housing.

8. The instrument of claim 7, wherein:

each strip-like tool includes an orientation hole formed therein, the plate-like assembly fixture and the double starwheel units are arranged on the retractable assembly mechanism, and the retractable assembly mechanism includes an orientation plate, a reception plate, an orientation pin, a collection pin and a linkage mechanism;

the orientation plate is arranged alternatingly with the reception plate, wherein each front-end face and rear-end face of the retractable assembly mechanism is the orientation plate;

the linkage mechanism is arranged between the orientation plate and the reception plate for extending and retracting;

the orientation plate has a first lengthwise hole for the orientation pin to connect therein, and the orientation pin has a top exposed by the first lengthwise hole;

each strip-like tool corresponds to the orientation plate and the orientation hole sleeves on the top of the orientation pin;

the reception plate has a second lengthwise hole formed therein for receiving the collection pin therein, and the collection pin has a top exposed by the second lengthwise hole; and

the central hole of each of the double starwheel unit relatively sleeves on the top of the collection pin.

9. The instrument of claim 8, wherein:

the linkage mechanism includes a secure hole, a pivot hole, a reception hole, a pivot pin and a secure pin;

the secure hole, the pivot hole and the reception hole are respectively formed on two adjacent orientation plates and the reception plate, and the orientation plates and the reception plate respectively have an insertion hole communicating with the secure hole;

the linkage mechanism further includes a limitation slot formed in the pivot hole and facing a retraction direction of the retractable assembly mechanism;

the pivot pin has a through hole formed in an end thereof and an expansion limitation portion arranged in an opposing end thereof and facing a retraction direction of the retractable assembly mechanism;

the pivot pin penetrates through the pivot hole and the secure hole, the secure pin inserts into the insertion hole, the secure hole and the through hole for orienting the pivot pin in the secure hole; and

the expansion limitation portion mates with the limitation slot for pivoting on the reception hole.

10. The instrument of claim 8, wherein the housing includes a base, and an upper groove is formed in the base and parallel to the horizontal direction, the orientation plate and the reception plate each having a lower protrusion mating with the upper groove.

11. The instrument of claim 10, wherein the housing includes two opposing lateral bases respectively disposed on two opposing sides of the base and parallel to the horizontal direction, each opposing lateral base has an inner raised strip and a lateral groove formed between the inner raised strip

and the base, both the orientation plate and the reception plate respectively have two opposing edges, and each opposing edge slidably mates with the inner raised strip.

12. The instrument of claim 11, wherein:

the orientation mechanism includes a vertical reciprocal power source, a top-retention plate, a plurality of pillars and a top plate;

the vertical reciprocal power source and the top-retention plate are disposed beneath the base;

the top plate is arranged between the plate-like assembly fixture and the retractable assembly mechanism;

the vertical reciprocal power source includes a longitudinal telescopic lever defining a vertical direction and is vertical to the plate-like assembly fixture;

the top-retention plate connects to the end of the longitudinal telescopic lever;

the base has a plurality of through holes;

each pillar has an end connecting to the top-retention plate and an opposing end penetrating through each of the through holes of the base to connect to the top plate, and the top plate restrictedly moves on the inner raised strip;

the top plate has a plurality of guiding slots formed therein and a plurality of partitions all parallel to the horizontal direction; and

the orientation pin and the collection pin each penetrate into each of the guiding slots and are actuated therein.

13. The instrument of claim 11, wherein:

each connection mechanism includes two clips parallel to each other, and the two clips respectively have two embedded slots relating to each other;

each strip-like tool has two opposing ends clamped by the two clips into the two embedded slots in a one-on-one manner to combine the strip-like tools with the plate-like assembly fixture; and

the lateral base has a concave portion formed in a top face thereof to allow the two clips to straddle the concave portion, the two clips clamping on or off the two opposing ends thereby.

14. The instrument of claim 11, wherein the horizontal reciprocal power source connects to a fixed plate, the fixed plate being disposed on the base and the lateral base, the orientation plate of the retractable assembly mechanism connecting to a connection plate, and the lateral telescopic lever of the horizontal reciprocal power source movably penetrating through a shaft hole of the connection plate.

15. The instrument of claim 10, wherein the orientation plate of the retractable assembly mechanism has a fixed clip connecting the base.

16. A method adopted for fabricating a plurality of double starwheel units in multiple rows with a multi-hole manner, comprising:

(a) obtaining a plurality of strip-like tools parallel to each other and arranged increasingly closer to be combined with a plate-like assembly fixture, the strip-like tools each having a plurality of recesses formed in two opposing longitudinal sides thereof, and a plurality of module holes formed by each of the recesses and a next recess relating thereto;

(b) retaining two sheet-like substrates against an upper surface and a lower surfaces of the plate-like assembly fixture, the two sheet-like substrates each having a plurality of starwheels respectively relating to the module holes, wherein each has a circumference ranging between that of the gear-wheel hole and that of external teeth of each of the starwheels;

(c) covering the plate-like assembly fixture with an exterior mold, and closely pressing the external teeth arranged on the upper and lower surfaces of plate-like assembly fixture;

(d) injecting a working fluid into an injection hole in the exterior mold and into the module holes therein, and transforming the working fluid into a sleeve to connect the starwheels of the two sheet-like substrates on the upper and the lower surfaces of the plate-like assembly fixture relating to each other for shaping a plurality of double starwheel units respectively oriented in the module holes;

(e) removing the exterior mold;

(f) removing a plurality of residents of the two sheet-like substrates; and

(g) separating the strip-like tools from the double starwheel units.

17. The method of claim 16, wherein the plate-like assembly fixture of step (a) straddles a lateral base of an orientation mechanism, the strip-like tools each having an orientation hole sleeved on an orientation pin of a retractable assembly mechanism, wherein the retractable assembly mechanism is disposed on the orientation mechanism in a retracted state, and step (a) further includes moving two clips of the plate-like assembly fixture and sleeved an embedded slot of each of the clips on an end of each of the strip-like tools for combining the strip-like tools with the plate-like assembly fixture, raising a longitudinal telescopic lever of a vertical reciprocal power source of the orientation mechanism up for a plurality partitions of a top plate of the orientation mechanism to be retained against the plate-like assembly fixture, so that the orientation hole and the module hole removed the orientation pin and the collection pin of a retractable assembly mechanism.

18. The method of claim 17, wherein the exterior mold of step (c) further includes an upper mold and a lower mold, and step (c) further includes arranging one of the sheet-like substrates in the lower mold to be closely pressed.

19. The method of claim 18, wherein the retractable assembly mechanism of the orientation mechanism of step (g) is in a retracted state, while the plate-like assembly fixture straddles the partitions of the top plate of the orientation mechanism, the strip-like tools relates to an orientation plate of the retractable assembly mechanism, downwardly shifting a longitudinal telescopic lever of the vertical reciprocal power source of the orientation mechanism to carry the plate-like assembly fixture to the lateral base of the orientation, the orientation hole of each of the strip-like tools and a central hole of each of the double starwheel units sleeves on the orientation pin and the collection pin of the retractable assembly mechanism, further separating the two

clips for extending out the retractable assembly mechanism by a lateral telescopic lever of a horizontal reciprocal power source of the orientation mechanism, the orientation plate of the retractable assembly mechanism separates from a reception plate of the retractable assembly mechanism, the strip-like tools are actuated to slip by the orientation pin, so that the module hole expands to be larger than the external teeth, and each double starwheel unit separates from the exterior mold and falls to sleeve on the collection pin.

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