United States Patent [19]

Tanaka

[11] **3,798,729**

[45] **Mar. 26, 1974**

[54] **PROCESS FOR THE MANUFACTURE OF A HIGHLY RESILIENT AND PLIANT EXPANDABLE BAND**

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[21] Appl. No.: **206,746**

[30] **Foreign Application Priority Data**

Dec. 26, 1970 Japan 45-119124

[52] **U.S. Cl.** ..... **29/160.6,** 63/5 R, 63/5 A

[51] **Int. Cl.** **B21f 43/00,** B23p 13/00

[58] **Field of Search** ..... 29/160.6; 63/2, 5 R, 5 A, 63/11, 3

[56] **References Cited**

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Primary Examiner—Charles W. Lanham
Assistant Examiner—Victor A. DiPalma
Attorney, Agent, or Firm—Steinberg & Blake

[57] **ABSTRACT**

A process for the manufacture of a highly resilient and pliant expandable band, characterized in that an annealed resilient metallic wire is wound repeatedly and continuously into a band-shaped or endless structure composed of a series of closely adjacent coils having the same number of turns, for each coil, so that every other coil is wound from top to bottom or vice versa and the interposed coil between such every other coil is wound from bottom to top or vice versa; the structure thus obtained is then subjected to a compressive force from its periphery; wedge pins are then inserted into any desirable coils and trimmed in their shape; and the overall structure is then subjected to quenching treatment from a high temperature.

8 Claims, 20 Drawing Figures

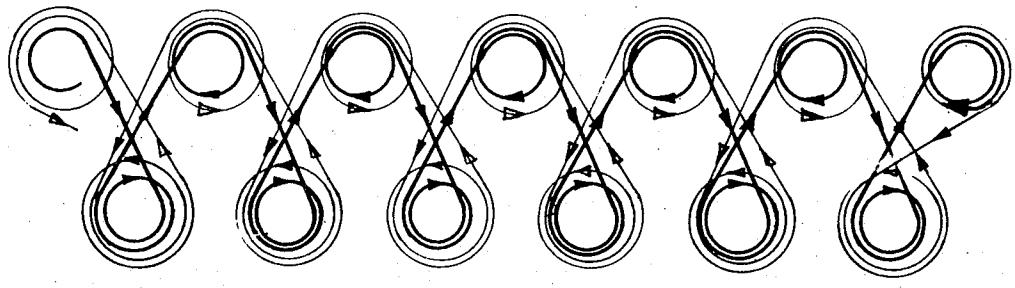

FIG.1

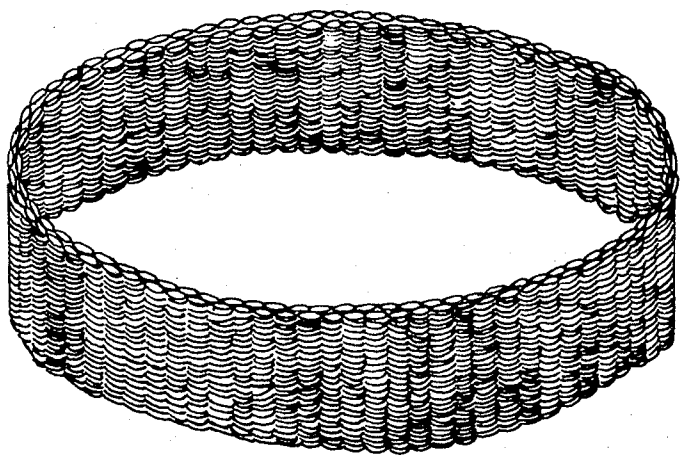

FIG.2

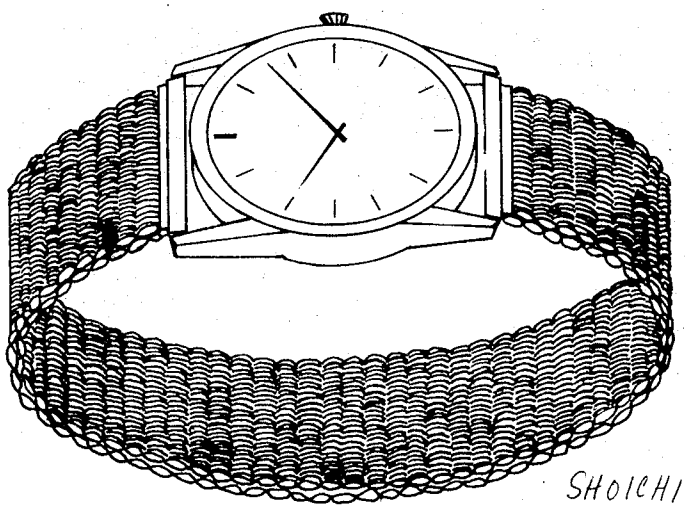

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FIG.13

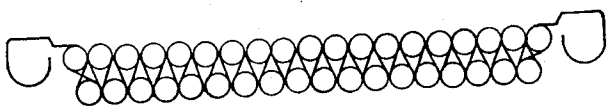

FIG.14

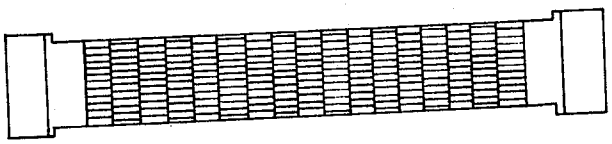

FIG.3

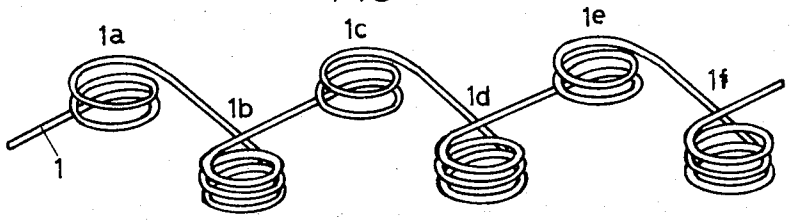

FIG.18

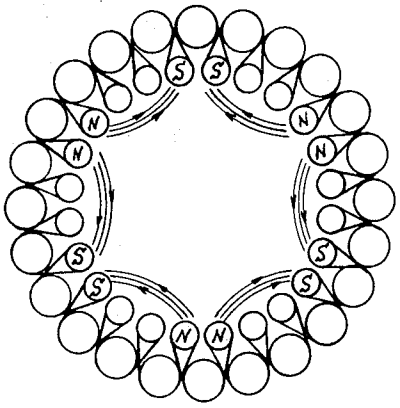

FIG.19

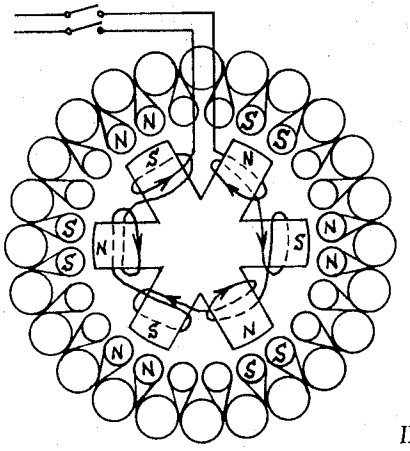

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FIG. 4

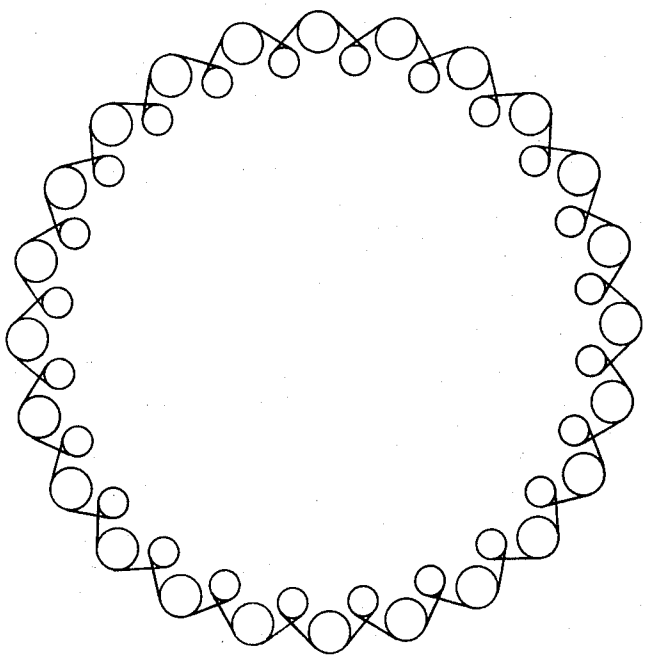

FIG. 5

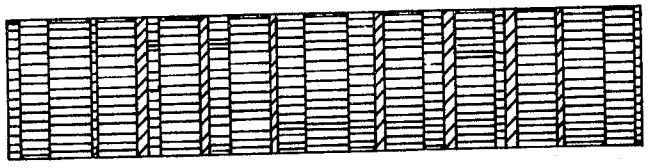

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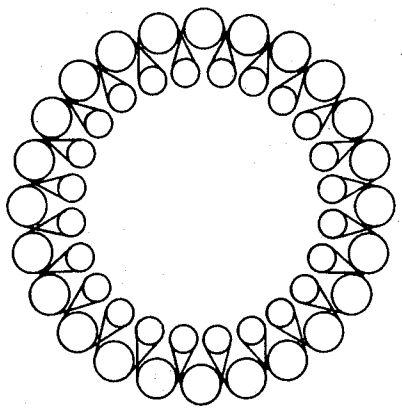
FiG.6



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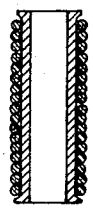

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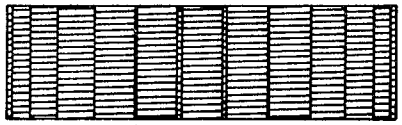

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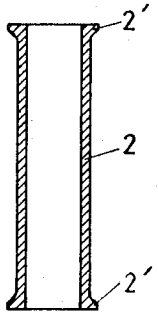

FiG.10

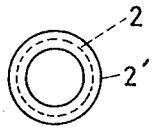

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FIG.11-A

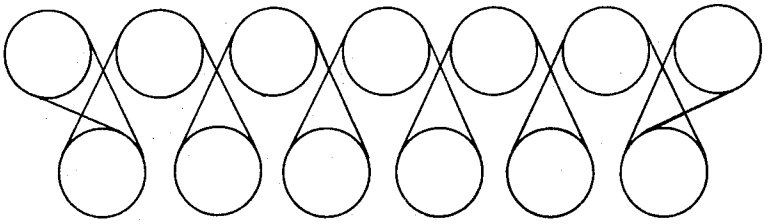

FIG.11-B

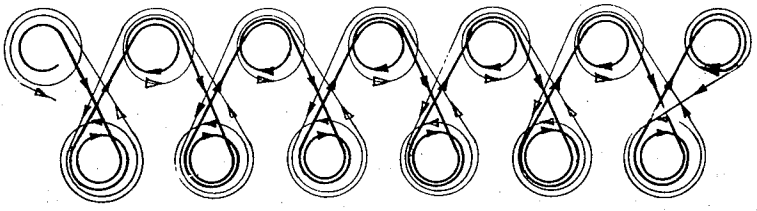

FIG.12

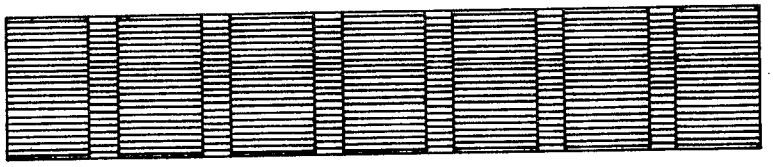

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FiG.15

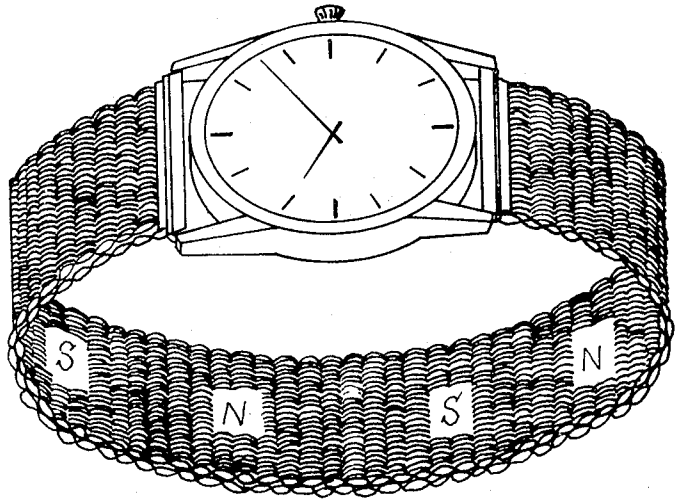


FiG.16

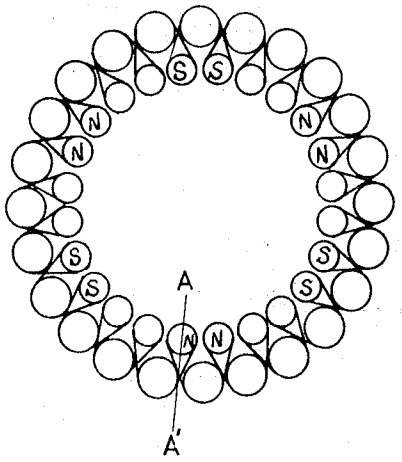
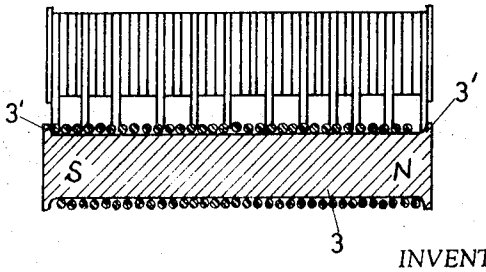


FiG.17



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PROCESS FOR THE MANUFACTURE OF A HIGHLY RESILIENT AND PLIANT EXPANDABLE BAND

SUMMARY OF THE INVENTION:

This invention relates to a process for the manufacture of an expandable band in a band or endless shape that serves as a a watch bracelet or a magnetic bracelet and has for its object to provide a highly resilient and pliant product by applying a simple and efficient process.

BRIEF EXPLANATION OF THE DRAWINGS

In the drawings showing preferred embodiments of the present invention,

FIG. **1** is a perspective view of an endless expandable band prepared by the process of the present invention,

FIG. **2** is a perspective view of a watch bracelet,

FIG. **3** is an explanatory view of the wire winding means to be applied in the present process,

FIG. **4** is a plan view showing a metallic wire to be formed into an endless expandable band by the aggregation of the larger and smaller coil groups,

FIG. **5** is a front view thereof,

FIG. **6** is a plan view showing the compressed condition modified from that of FIGS. **4** and **5**,

FIG. **7** is a front view thereof,

FIG. **8** is an enlarged sectional view showing the structure of the wire with wedge pins forcedly inserted into its coils,

FIG. **9** is an enlarged front view of a wedge pin,

FIG. **10** is a plan view thereof,

FIG. **11** A is a plan view showing a steel coil band structure according to another embodiment of the invention and composed of a series of coils having the same diameter,

FIG. **11** B is an explanatory view illustrative of the coiling procedure to be applied in the formation of the structure according to FIG. **11** A,

FIG. **12** is a plan view thereof,

FIG. **13** is a plan view showing a band-like expandable bracelet prepared by the winding process illustrated in FIGS. **11** and **12**,

FIG. **14** is a plan view thereof,

FIG. **15** is a perspective view showing the expandable band of FIGS. **13** and **14** applied for a watch bracelet,

FIG. **16** is a plan view showing an arrangement of magnetic poles and compressed windings in the magnetic band formed from nonmagnetizable metallic wires,

FIG. **17** is a cross section thereof, taken on line A-A' of FIG. **16**,

FIG. **18** is a plan view showing an arrangement of the magnetic poles in the magnetic band and compressed windings prepared from magnetizable metallic wire, and

FIG. **19** is an explanatory view illustrating the mode of magnetization of the magnetizable wire structure shown in FIG. **18**.

DETAILED DESCRIPTION OF THE INVENTION

This invention relates generally to a process for the manufacture of an expandable band in a band shape or endless shape that is applied as a watch bracelet or a magnetic bracelet, and has for its object to provide a highly resilient and pliant product by applying a simple and efficient process.

The present invention resides in such a background that an annealed resilient metallic wire is wound repeatedly and continuously into a band-shaped or endless structure composed of a series of closely adjacent coils having the same number of turns for each coil, so that every other coil is wound from top to bottom or vice versa and the interposed coil between such every other coils is wound from bottom to top or vice versa; the structure thus obtained is then subjected to a compressive force from its periphery; wedge pins are then inserted into any desired coils and trimmed in their shape; and the overall structure is then subjected to quenching.

Referring to the accompanying drawings, certain preferred embodiments of the invention will be described in detail. A resilient metallic band **1** made from stainless steel wire, by way of an example, is coiled in a desired number of turns, forming the first coil **1***a* in starting from the top, by way of an example, as shown in FIG. **3**. Then, the same steel wire **1** is coiled again in the same number of turns, forming the second coil **1***b* in starting from the bottom. Further, the third coil **1***c* is wound from the same steel wire **1** in the same number of turns. In this way, the steel wire is coiled further continuously so as to provide a series of adjacent coils **1***d*, **1***e*, **1***f*, ... The coils of FIG. **3** may be considered as being formed starting from the left and progressing toward the right in FIG. **3** in such a way that the coil **1***a* is formed before the coil **1***b*, and so on, with the convolutions of each coil being wound in a clockwise direction as viewed from above in FIG. **3**, and it will be noted that the coils are arranged alternately to form a series of outer coils **1***a*, **1***c*, **1***e*, and inner coils **1***b*, **1***d*, **1***f*, with the continuous wire progressing from the top convolution of coil **1***a* to the bottom convolution of coil **1***b*, from the top convolution of coil **1***b* to the bottom convolution of coil **1***c*, and so on, so that if the series of alternating inner and outer coils are considered as having corresponding opposed ends, it will be seen that the wire progresses from one of the opposed ends of an outer coil to the opposite opposed end of an adjacent inner coil, and then from the opposed end of the latter inner coil to the opposite end of the next outer coil, and so on. In this way the wire portions which interconnect the adjacent coils are arranged in such a way that at one of the series of inner or outer coils the wire portions cross each other while extending to the next adjacent coils while considered at the other series of inner or outer coils, the wires at the opposed ends of each coil diverge from each other while progressing to the next adjacent coils. In other words referring to FIG. **3** if it is considered that the coils **1***b*, **1***d*, and **1***f* form successive coils of the inner series, then the wire portions at the ends of these coils cross each other while extending in opposite directions to the next adjacent outer coils, whereas on the other hand if the coils **1***a*, **1***c*, and **1***e* are considered as being successive coils of the outer series then the wire portions at the ends of each of the latter coils diverge from each other while extending in opposite directions to the next adjacent inner coils. Both opposite ends of thus formed structure are connected to each other into a band-shaped or endless structure, as shown in FIGS. **4** and **5**. The endless structure thus obtained is subjected to a compressive force from its periphery. In this way, the adjacent coils of the endless structure are disposed inside and outside separately from each other so that every other coil is ar-

ranged inside the neighboring coils and the overall volume of the structure is considerably reduced (see FIGS. 6 and 7). Then, wedge or retaining pins 2 are forced into any desirable coils thus arranged in a zigzag alignment. Thus, as may be seen from a comparison of FIG. 8 and FIG. 3, a selected number of wires coiled as shown in FIG. 3 are placed one next to the other with their coils coaxially arranged, and the pin 2 is then inserted through the selected number of wires 1 arranged in this way, to achieve a band of desired width. This feature is also illustrated in FIG. 17 which clearly illustrates how a plurality of wires as shown in FIG. 3 are situated one next to the other with their coils coaxially arranged to receive the pins which in the case of FIG. 17 are pins 3 referred to in greater detail below. Then, the ends of the wedge pins 2 are enlarged in their diameters by upsetting so as to provide bulged rims 1' and retain the overall shape of the endless structure. The latter is then quenched in situ into the desired product as shown in FIG. 1. A modified process for the formation of the endless structure is shown in FIGS. 11 and 12. According to this modified embodiment, the steel wire is wound repeatedly in the same way as before into a series of mutually connected coils. Then, the steel wire is wound in the opposite direction starting from the last coil until overlapping on the first coil. FIGS. 13 and 14 show a product which has been completed following the step of compression. FIG. 2 shows thus obtained expandable band as mounted to a wrist-watch.

Next, a process for the formation of a magnetic bracelet or a watch attached with a magnetic bracelet will be explained in detail. An elastic nonmagnetic metal wire, such as stainless steel wire, is wound repeatedly as before into an endless structure composed of a series of adjacent coils. The endless structure thus obtained is then subjected as before to the step of compression. Then, a number of permanent magnet pieces 3 are forced into any desired coils, instead of wedge or retaining pins 2. Then, the ends of the permanent magnet pieces 3 are enlarged in their diameters by upsetting so as to provide flanges 3'. In this way, the permanent magnet pieces 3 are held in position and prevented from accidental disengagement. The overall structure is then subjected to quenching treatment. When the permanent magnet pieces 3 are forced into coils in a desired arrangement, as shown in FIG. 16, a north pole may be followed by a south pole or two successive north poles may be followed by two successive south poles.

When a magnetizable metal wire such as known under the trade mark "baicalloy" is used as starting material, the same process of formation into a series of coils, compression and quenching will be used, as that explained in the first and second embodiments of the invention. The only difference is that the coils arranged inside the endless structure are magnetized, by using a conventional apparatus as shown in FIG. 19, so that the north pole is followed by the south pole or two successive north poles are followed by two successive south poles. FIG. 15 shows a product completed according to this process.

The expandable band prepared by the present process is made in its entirety from a fine metal wire about 0.1 to 0.2 mm diameter. Thus, the band itself is highly pliant and resilient. By virture of the wedge pins which are enlarged at their ends, the band is safeguarded against collapse. Moreover, since the expandable band is produced by the process of repeatedly coiling a single metallic wire, a considerable saving will be attained in the man power required for the manufacture, thus resulting in high operational efficiency. In addition, the production costs of the expansible band can be considerably reduced.

What we claim is:

1. In a process for manufacturing an elastic, flexible, expandable and contractable band for a bracelet, wristwatch, or the like, the steps of winding a continuous wire into a plurality of coils which have equal numbers of convolutions and parallel axes, while arranging the successive coils in a zig-zag pattern to form a series of outer and a series of inner coils while winding first a coil of one series and then a coil of the other series so that the inner and outer coils alternate along the band, and extending 3 wire portions from the opposed ends of each coil of each series to opposed ends of the next adjacent coils of the other series.

2. In a process as recited in claim 1, the step of inserting retaining pins into at least some of said coils to be surrounded by the convolutions thereof.

3. In a process as recited in claim 2, the step of arranging a plurality of the thus-wound wires next to each other with their coils coaxially arranged, and introducing the retaining pins each through a row of coaxially arranged coils of the several wires.

4. In a process as recited in claim 1, compressing the thus-wound wire to situate the coils closely adjacent to each other, and then heating the wire and following the heating by quenching.

5. In a process as recited in claim 1, the step of winding the coils progressively one after the other in one direction and then returning the wire in an opposite direction to form a second set of coils which overlap the first coils.

6. In a process as recited in claim 1, the step of introducing magnetic retaining pins into coils of at least one of said series with the magnetic pins arranged so that some of the latter are respectively followed by others which have a reversed polarity.

7. In a process as recited in claim 6 and wherein a plurality of magnetic retaining pins of the same polar orientation are followed by another plurality of retaining pins of an opposite polar orientation with the same number of pins constituting each of the plurality of pins of the same polar orientation.

8. In a process are recited in claim 1, utilizing for the wire a material which is capable of being magnetized, and then magnetizing the series of coils which form the inner series with opposite polarities distributed along the band.

* * * * *