Dec. 6, 1966 E. HÄFNER 3,289,972

REEL WITH REINFORCED FLANGES

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Fig.1

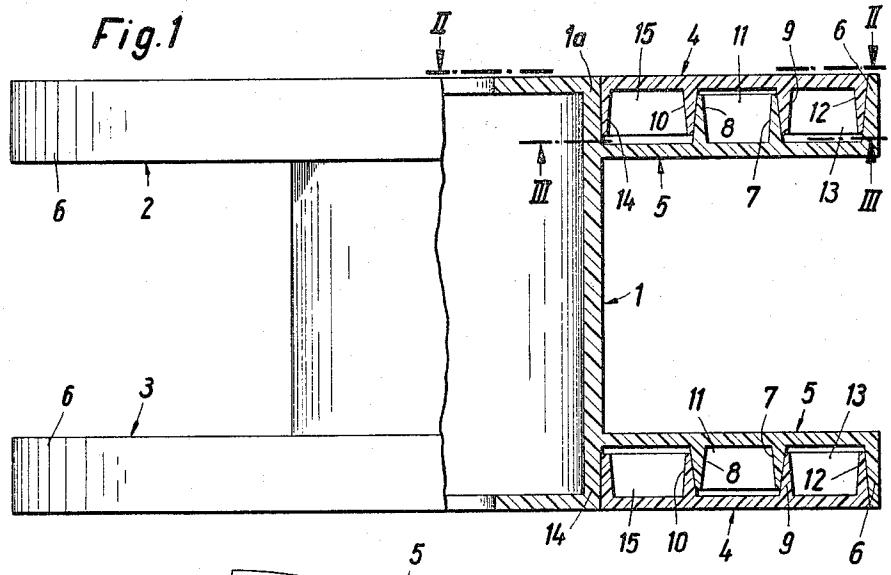


Fig.2

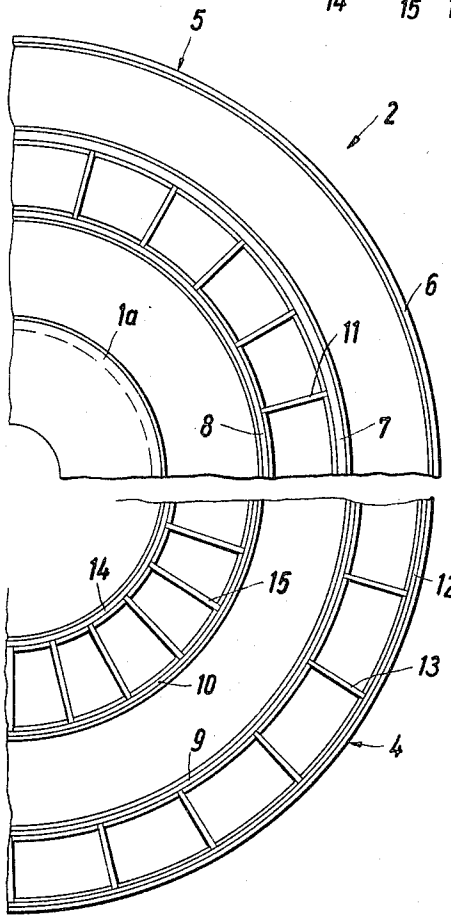


Fig.3

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REEL WITH REINFORCED FLANGES

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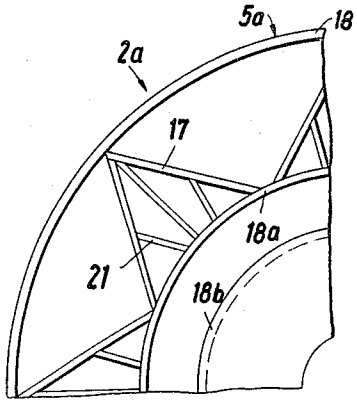


Fig. 4

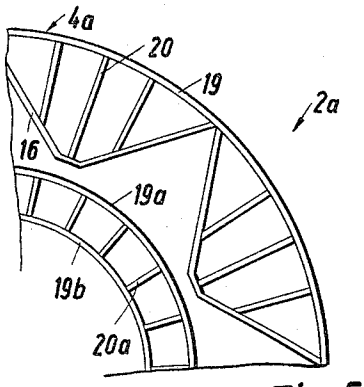


Fig. 5

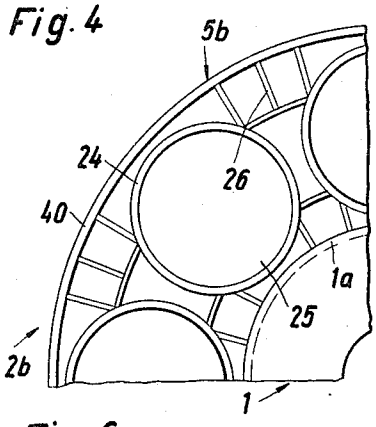


Fig. 6

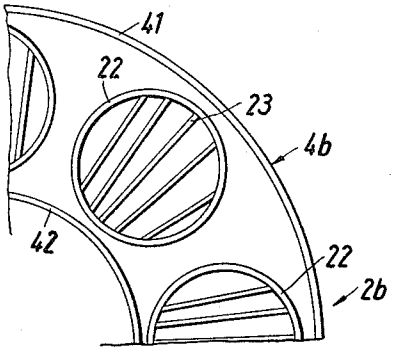


Fig. 7

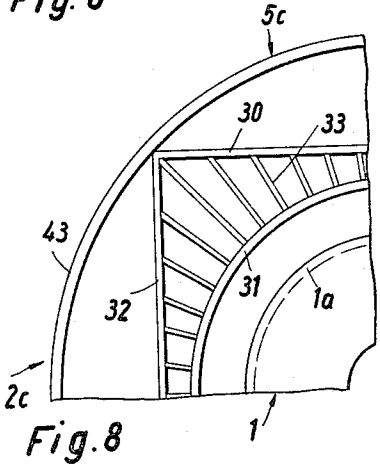


Fig. 8

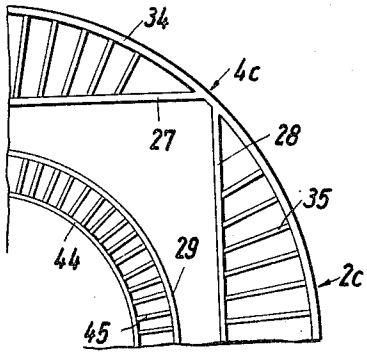


Fig. 9

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REEL WITH REINFORCED FLANGES

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14 Claims. (Cl. 242—118.7)

The present invention relates to reels, spools, bobbins and similar structures (hereinafter called reels) which serve to support convoluted wire-like material, and more particularly to a reel which is provided with novel flanges and which preferably consists of synthetic plastic material.

Reels with reinforced disk-shaped flanges are known in the art and millions of such reels are in daily use, especially when a reel is intended to support large quantities of wire-like or filamentary metallic, plastic or textile material. Such quantities of convoluted material tend to bend the flanges outwardly when the wire is convoluted around the core and a simple disk-shaped flange of constant thickness is unable to withstand such pressures excepting, of course, by overdimensioning with resultant increase in weight and initial cost of the flange. The danger of deformation and/or breakage is even more pronounced when large reels supporting a supply of copper wire, steel wire, steel cable or similar heavy material are dropped or handled by inexperienced workmen.

One-piece flanges with radially extending stiffening ribs cannot always withstand stresses which arise in heavy-duty reels because the thickness of ribs is dependent on and must be proportional to the thickness of disk-shaped flange portions. Thus, if the disk is too thin, the flange will bulge outwardly between the ribs with resultant damage to convoluted material even if the ribs are exceptionally stiff and are capable of resisting deformation.

Accordingly, it is an important object of my invention to provide an exceptionally simple and highly resistant flange, particularly for heavy-duty reels, which is capable of withstanding deformation during winding or unwinding of convoluted material and which can withstand rough handling even though it is a lightweight structure wherein the quantity of material is but a fraction of the material used in a conventional flange of equal strength.

Another object of the invention is to provide a reel which embodies one or two flanges of the above outlined advantageous characteristics and which can be mass-produced in simple machines and at low cost.

A further object of the invention is to provide a composite flange for use in heavy-duty reels for wire-like metallic or plastic material and which is constructed and assembled in such a way that each of its section offers satisfactory resistance to deformation and/or breakage.

Still another object of my invention is to provide a flange of the above outlined characteristics which is constructed in such a way that its components can be assembled only in a manner which insures that the ultimate product will offer optimum resistance to deformation and breakage.

A concomitant object of the invention is to provide a flange whose thickness is substantially less than the thickness of a conventional flange which exhibits the same resistance to deformation and breakage.

With the above objects in view, one feature of my invention resides in the provision of a reel which comprises a preferably tubular core serving to support a supply of convoluted wire-like material and two flanges which are rigid with the end portions of the core and at least one of which is constructed in accordance with the present invention. Each flange may comprise a first disk which is rigid with the respective end portion of the core and

one side of which is provided with two spaced ribs of polygonal (including circular) shape, and a second disk one side of which is adjacent to but spaced from the side of the first disk. This side of the second disk is also provided with a pair of polygonal ribs whose side faces abut against and are bonded to the side faces of ribs on the first disk. The arrangement is preferably such that one pair of ribs is received between the other pair of ribs and that the disk with such one pair of ribs comprises additional stiffening ribs which extend between the respective pair of ribs to reinforce such portions of the respective disk which are not reinforced by polygonal ribs.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved reel itself, however, both as to its construction and the mode of assembling the same, together with additional features and advantages thereof, will be best understood from the following detailed description of certain specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a partly elevational and partly axial sectional view of a reel whose flanges are constructed in accordance with one embodiment of my invention;

FIG. 2 is a fragmentary end view of one disk in the upper flange of the reel as seen in the direction of arrows from the line II—II of FIG. 1;

FIG. 3 is a fragmentary end view of the other disk as seen in the direction of arrows from the line III—III of FIG. 1;

FIG. 4 is a fragmentary end view of one disk in a modified flange;

FIG. 5 is a fragmentary end view of the other disk which may be assembled with the disk of FIG. 4 to form the modified flange;

FIG. 6 is a fragmentary end view of one disk in a third flange;

FIG. 7 is a fragmentary end view of the other disk which may be assembled with the disk of FIG. 6 to form the third flange;

FIG. 8 is a fragmentary end view of one disk in a fourth flange; and

FIG. 9 is a fragmentary end view of the other disk which may be assembled with the disk of FIG. 8 to form the fourth flange.

Referring to the drawings, and first to FIG. 1, there is shown a reel which consists of suitable rigid wear-resistant and corrosion-resistant synthetic plastic material and which comprises a tubular core here shown as a cylinder **1** whose end portions are rigid with two composite disk-shaped flanges of constant thickness (as seen in the axial direction of the core) including an upper flange **2** and a lower flange **3**. These flanges are constructed in accordance with my invention and, since the construction of the flange **2** is identical with that of the flange **3**, it suffices to describe the upper flange.

The flange **2** comprises an inner annular disk **5** which is integral with the upper end portion of the core **1** and whose outer side (i.e., the upper side, as viewed in FIG. 1, which faces away from the core) is provided with a series of spaced concentric circular ribs **6**, **7**, **8**, **1***a*, the circular rib **6** forming a peripheral wall portion of the disk **5** (see also FIG. 2). The rib **1***a* actually constitutes an extension of the upper end portion of the core **1** but, for the sake of clarity, it will be considered as the fourth and innermost circular rib of the disk **5**. The flange **2** further comprises an outer annular disk **4** which is manufactured as a separate article and which is thereupon permanently secured to the disk **5**. As shown in FIGS. 1 and 3, the outer disk **4** has an inner side which is adjacent to but spaced from the outer side of the disk **5** and which is pro-

vided with four spaced concentric circular ribs including a pair of median ribs **9**, **10** and a pair of outer ribs **12**, **14**, the circular rib **12** forming a peripheral wall portion of the disk **4**. When the two disks are assembled, the annular inner side face of the rib **6** abuts against the annular outer side face of the rib **12**, the annular outer side face of the rib **7** abuts against the annular inner side face of the rib **9**, the annular inner side face of the rib **8** abuts against the annular outer side face of the rib **10**, and the annular outer side face of the rib **1***a* abuts against the annular inner side face of the rib **14**. Thus, the ribs **12**, **14** are received between the ribs **1***a*, **6**; the ribs **7**, **8** are received between the ribs **9**, **10**; the ribs **9**, **12** are received between the ribs **6**, **7**; and the ribs **10**, **14** are received between the ribs **1***a*, **8**. The abutting side faces of these ribs are coated with layers of suitable adhesive (see the legend in FIG. 1) so that the ribs of the outer disk **4** are permanently bonded to the corresponding ribs of the inner disk **5**. Such construction of the flange **2** insures that the latter can withstand exceptionally high bending stresses and that the flange is of lightweight construction even though it will resist breakage just as well as or better than a full-bodied flange of equal dimensions.

In order to further reinforce the flange **2**, the disk **4** is provided with two sets of additional stiffening ribs including a first set of straight radial ribs **13** which extend between the circular ribs **9**, **12** and a second set of straight radial ribs **15** which extend between the circular ribs **10**, **14**. The disk **5** is provided with a single set of additional ribs **11** which extend radially between the circular ribs **7**, **8**. The height of all of the ribs on the disk **4** may be the same, i.e., the end faces of the ribs **13**, **15** may be coplanar with the end faces of the ribs **9**, **10**, **12**, **14**, but the end faces of the ribs **11** on the disk **5** are coplanar only with the end faces of the ribs **7**, **8**.

The additional ribs **11**, **13** and **15** reinforce such sections of the flange **2** which are not stiffened by the circular ribs. It goes without saying that the ribs **7–11** may be omitted and that the ribs **13**, **15** may be replaced by a single set of radial ribs extending all the way between the circular ribs **12**, **14**. On the other hand, it is equally possible to provide additional pairs of concentric circular ribs on each of the disks **4**, **5** and to provide radial ribs in such a way that annularly arranged sets of radial ribs on the disk **4** alternate with sets of annularly arranged radial ribs on the disk **5**. Furthermore, the ribs **11**, **13** and **15** need not be straight and need not extend radially since it is equally possible to form the disks with undulate, zigzag-shaped, U-shaped or otherwise configurated ribs which serve to reinforce the annular disk sections between the circular ribs.

Since the adhesive coats the side faces of adjacent ribs, and since the areas of such side faces are very large, the resultant bond is exceptionally strong and prevents separation of disks **4**, **5** even if the reel is dropped by a careless workman.

If desired, the position of the disks **4**, **5** may be reversed, i.e., the ribs of the disk **5** may extend toward the flange **3** provided, of course, that each disk of the flange **3** is bonded to the core **1** so that the disk **4** of the flange **2** may be slipped over the core and toward the disk **5** before the disks of the flange **3** are attached to the core.

The construction of the flange **3** is identical with that of the flange **2**, see FIG. 1.

It will be understood that, and particularly if the disks **4**, **5** are of polygonal shape, the circular ribs shown in FIGS. 1–3 may be replaced by polygonal ribs.

FIGS. 4 and 5 respectively illustrate the disks **5***a*, **4***a* of a modified flange **2***a* wherein the ribs whose side faces are bonded to each other include circular and non-circular ribs. Thus, the disk **5***a* comprises circular **18**, **18***a*, **18***b*, inclined straight ribs **17** which extend between the ribs **18**, **18***a*, and straight radial ribs **21** which extend between the ribs **17**, **18***a*. The disk **4***a* comprises circular ribs **19**, **19***a*, **19***b*, inclined straightf ribs **16** which extend

from the rib **19** toward but short of the ribs **19***a*, and two sets of straight radial ribs including a first set of radial ribs **20** which extend between the ribs **16**, **20** and a second set of radial ribs **20***a* which extend between the ribs **19***a*, **19***b*. When the disks **4***a*, **5***a* are assembled to form the flange **2***a*, the outer side face of the circular ribs **19** abuts against and is bonded to the inner side face of the rib **18**, the inner side faces of the inclined ribs **16** abut against and are bonded to the outer side faces of the inclined ribs **17**, the inner side face of the rib **18***a* abut against and is bonded to the outer side face of the rib **19***a*, and the outer side face of the rib **18***b* abuts against and is bonded to the inner side face of the rib **19***b*. Thus, the construction of the flange **2***a* is clearly analogous to that of the flange **2** or **3** with the exception that certain ribs whose side faces are bonded to each other are of non-circular shape. It will be noted that the ribs **17**, **18***a* together form pologonal multi-section structures which define compartments for reception of the ribs **21**. Analogously, the ribs **16**, **19** also form a series of polygonal multi-section structures which define compartments for the ribs **20**. In this manner, all zones of the assembled flange **2***a* are reinforced by ribs to prevent bulging of certain disk portions. The inclined ribs **16**, **17** respectively form two zigzag-shaped multi-section ribs which abut against and which are bonded to each other. These multi-section ribs replace the ribs **7**, **9** of the flange **2** or **3**.

FIGS. 6 and 7 respectively illustrate two disks **5***b*, **4***b* which may be assembled to form a flange **2***b*. The disk **5***b* comprises two circular ribs which are concentric therewith and which include an outer rib **40** adjacent to the periphery of the disk **5***b* and an inner rib **1***a* which is integral with the end portion of the core **1**. This disk **5***b* further comprises a plurality of additional circular ribs **24** which are not concentric therewith and whose centers are located on the periphery of a circle which is located midway between the circular ribs **1***a*, **40**. Additional stiffening ribs **26** extend radially and concentrically with the rib **40** to fill the compartments between the ribs **24**, **1***a* and **40**. The compartments **25** defined by the ribs **24** are not filled with ribs.

The disk **4***b* comprises a pair of concentric ribs **41**, **42**, a series of additional circular ribs **22** which are not concentric with the ribs **41**, **42**, aud radially extending stiffening ribs **23** which are provided in the compartments defined by the ribs **22**. When the disks **4***b*, **5***b* are assembled to form the flange **2***b*, the inner side face of the rib **40** is bonded to the outer side face of the rib **41**, the inner side face of the ribs **42** is bonded to the outer side face of the rib **1***a*, the inner side faces of the ribs **24** are bonded to the outer side faces of the ribs **22**, and the ribs **26** fill the compartment between the ribs **22**, **41**, **42**.

The disks **5***c*, **4***c* of FIGS. 8 and 9 are very similar to the disks **5***a*, **4***a* of FIGS. 4 and 5. These disks may be assembled to form a composite flange **2***c*. As shown, the disk **5***c* comprises at its outer side three concentric circular ribs **43**, **31**, **1***a*, a multi-section polygonyl rib (only two sections **30**, **32** are shown), and radially extending straight ribs **33** which are located in the compartment defined by the ribs **31**, **30**, **32**. The disk **4***c* comprises concentric circular ribs **34**, **29**, **44**, a multi-section polygonal rib (only the sections **27**, **28** of this rib are shown) which is provided in the compartment defined between the circular ribs **29**, **34**, a first set of straight radial ribs **35** which extend between the ribs **27**, **28**, **34**, and a second set of radial ribs **45** which extend between the ribs **29**, **44**. The two multi-section ribs form a pair of true squares but, of course, it is equally possible to utilize multi-section ribs of oval, pentagonal, hexagonal or similar shape.

When the disks **4***c*, **5***c* are assembled to form the flange **2***c*, the circular ribs **29**, **44** are received between and their side faces are bonded to the side faces of the ribs **1***a*, **31**; the ribs **30**, **32** are received within and their side faces are bonded to the inner side faces of the ribs **27**,

28; and the outer side face of the rib 34 is bonded to the inner side face of the rib 43.

As adhesive bonding agents can be used benzol and toluol. High impact polystyrene may be used in the manufacture of the improved reel.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; and a flange comprising a first disk rigid with said end portion and having a peripheral wall portion and a side provided with a pair of spaced ribs, a second disk having a peripheral wall portion abutting the peripheral wall portion of said first disk, a side adjacent to but spaced from the side of said first disk and a pair of ribs extending from said side thereof, said first and second disk, said peripheral wall portions and said core defining a box-shaped annular body, said ribs being located within the confines of said annular body, each of said ribs having a side face extending substantially in the direction of said core and the said side faces of one pair of ribs abutting against the side faces of the other pair of ribs, the abutting side faces of said ribs and abutting peripheral wall portions being bonded to each other to stiffen said flange.

2. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; and an annular box-shaped flange comprising a first disk rigid with said end portion and having a side provided with a pair of spaced concentric circular ribs, a second disk having a side adjacent to but spaced from the side of said first disk and a pair of concentric circular ribs extending from said side thereof, each of said ribs having a side face and one pair of said circular ribs being received between the other pair with the side faces of one pair of ribs abutting against the side faces of the other pair of ribs, the abutting side faces of said ribs being bonded to each other to stiffen said flange, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs; and additional ribs provided between said one pair of circular ribs and having side faces extending substantially in direction of said core.

3. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; an annular box-shaped flange comprising a first disk rigid with said end portion and having a surface provided with axially projecting ribs spaced radially of said core a second disk having a surface adjacent to but spaced from the surface of said first disk and ribs projecting axially from said surface of said second disk and also spaced radially of said core, said ribs having abutting side faces which extend substantially in the direction of said core and are bonded to each other to stiffen said flange, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs and at least one additional rib on at least one of said disks extending from this disk toward the other disk.

4. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; an annular box-shaped flange comprising a first disk rigid with said end portion and having a side provided with a pair of spaced concentric circular ribs one of which is adjacent to the periphery of said first disk and the other of which is adjacent to the end portion

of said core, and a second disk having a side adjacent to but spaced from the side of said first disk and provided with a pair of spaced concentric circular ribs and extending from said side thereof, said ribs having side faces extending substantially in the direction of said core and the side faces of one pair of ribs being received between and being bonded to the side faces of the other pair of ribs, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs and at least one additional rib on at least one of said disks extending from this disk toward the other disk.

5. A combination as set forth in claim 4, wherein at least one of said disks comprises a plurality of substantially radially extending ribs projecting from said side thereof and located between said pairs of circular ribs.

6. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; and an annular box-shaped composite flange comprising a first disk rigid with said end portion and having a side provided with a first pair of spaced ribs which together form a polygonal outline and additional ribs extending between said first pair of ribs, and a second disk having a side adjacent to but spaced from the side of said first disk, the side of said second disk being provided with a second pair of ribs which together form a polygonal outline and with additional ribs extending between said second pair of ribs, said ribs having side faces extending substantially in direction of said core and the side face of one rib on one of said disks abutting against and being bonded to the side face of one rib on the other disk, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs.

7. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; an annular box-shaped flange comprising a first disk rigid with said end portion and having a side provided with a rib, a second disk having a side adjacent to but spaced from the side of said first disk and a rib extending from said side thereof, said ribs having abutting side faces which extend substantially in the direction of said core and are bonded to each other to stiffen said flange, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs, said core and said disks consisting of synthetic plastic material and at least one additional rib on at least one of said disks extending from this disk toward the other disk.

8. In a reel, in combination, a core arranged to support a supply of convoluted wire-like material and having an end portion; an annular box-shaped flange comprising a first disk integral with said end portion and having a side facing away from said core and provided with a rib, a second disk having a side adjacent to but spaced from the side of said first disk and a rib extending from said side thereof, said ribs having abutting side faces which extend substantially in the direction of said core and are bonded to each other to stiffen said flange, said sides of the respective disks being spaced from one another between the radially innermost and the radially outermost ribs and at least one additional rib on at least one of said disks extending from this disk toward the other disk.

9. In a reel, in combination, a tubular core arranged to support a supply of convoluted wire-like material and having an end portion; an annular box-shaped flange comprising a first disk rigid with said end portion and having a side provided with a rib, a second disk having a side adjacent to but spaced from the side of said first disk and a rib extending from said side thereof, said ribs having abutting side faces which extend substantially in the direction of said core and are bonded to each other to stiffen said flange, said sides of the respective disks being spaced from one another between the radially innermost and the

radially outermost ribs and at least one additional rib on at least one of said disks extending from this disk toward the other disk.

10. A heavy-duty plastic reel, comprising a hollow cylindrical core arranged to support a supply of convoluted wire-like material, said core having two spaced end portions; and a pair of composite, annular box-shaped flanges of constant thickness, each of said flanges comprising a first annular disk surrounding and being integral with one end portion of said core and having an outer side facing away from the other first disk, each first disk further having at least two concentric circular ribs including an outer rib which is adjacent to the periphery thereof and an inner rib which is adjacent to the respective end portion of said core, and each flange further comprising a second annular disk concentric with and having an inner side adjacent to but spaced from the outer side of the respective first disk, each second disk also having an outer circular rib and an inner circular rib both extending from the inner side, said sides of the respective disks being spaced from one another between the radially innermost and the radialy outermost ribs thereof, said ribs further having side faces and the ribs of said second disks being received between and having their side faces in abutment with the side faces of ribs on the respective first disks, and layers of adhesive material bonding the abutting side faces to each other so that each first disk is permanently connected with the respective second disk; and at least one polygonal rib provided on each of said disks between the inner and outer ribs thereof, said polygonal ribs having side faces extending substantially in direction of said core, and said

polygonal ribs of said disks being bonded to each other in the same way as said circular ribs.

11. A reel as set forth in claim **2**, wherein each disk further comprises a plurality of non-concentric additional circular ribs provided between the circular ribs of the respective disks, said additional circular ribs being bonded to each other in the same way as said first mentioned circular ribs.

12. A reel as set forth in claim **10**, wherein each outer disk comprises a plurality of substantially straight radially extending ribs disposed between said inner and outer ribs thereof.

13. A reel as set forth in claim **2**, wherein each of said disks further comprises zig-zag shaped ribs which are provided between the circular ribs of the respective disks and which are bonded to each other in the same way as said circular ribs.

14. A reel as set forth in claim **10**, wherein the inner circular rib of each first disk constitutes an extension of the respective end portion of said core.

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