

April 23, 1957

C. J. CROWLEY
INFLATABLE BALL HAVING A CARCASS, INCLUDING
A SYNTHETIC THREAD WINDING

2,789,821

Filed Jan. 12, 1954

3 Sheets-Sheet 1

Fig. 1.

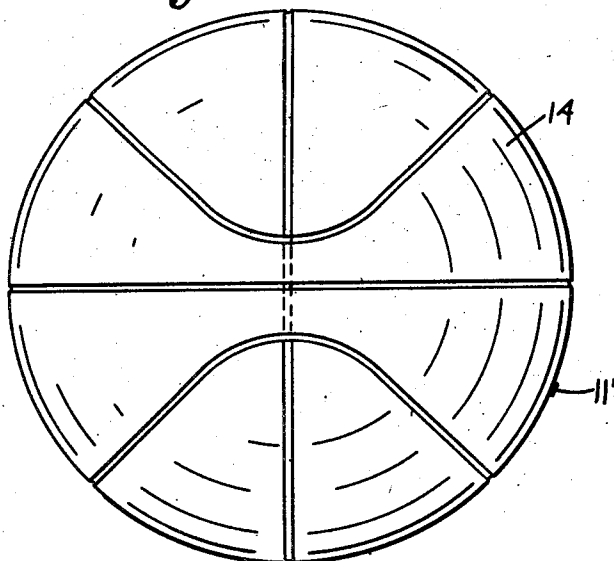
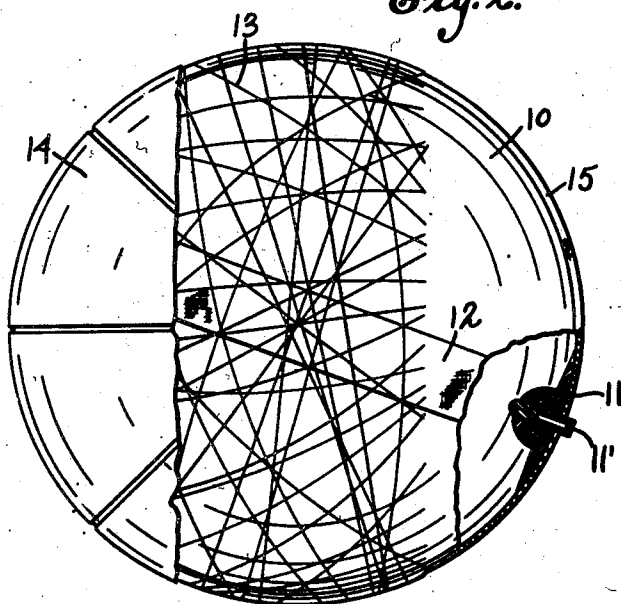


Fig. 2.



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Fig. 9.

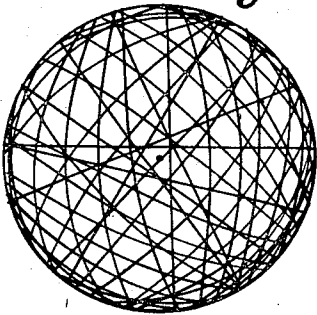


Fig. 3.

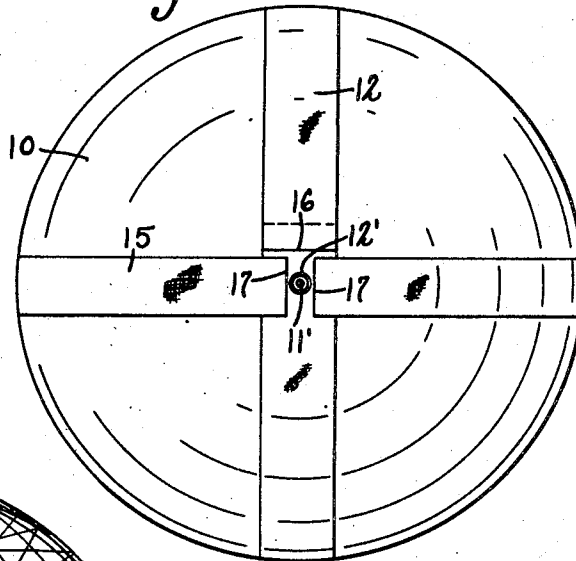


Fig. 4.

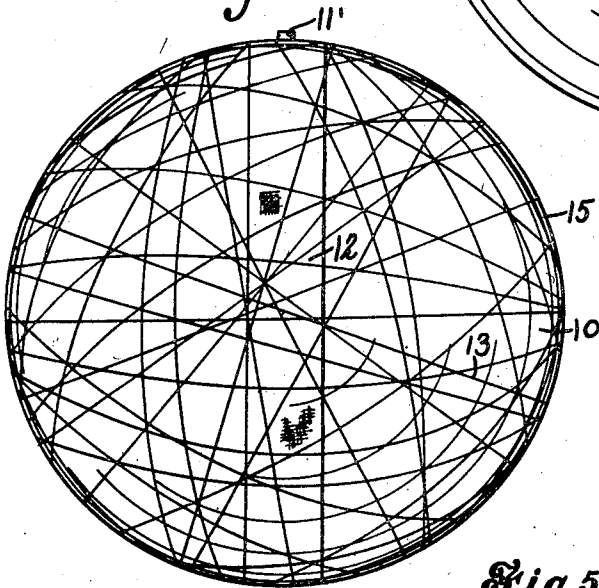


Fig. 6.



Fig. 7.

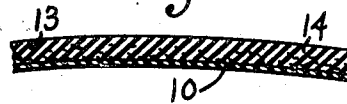
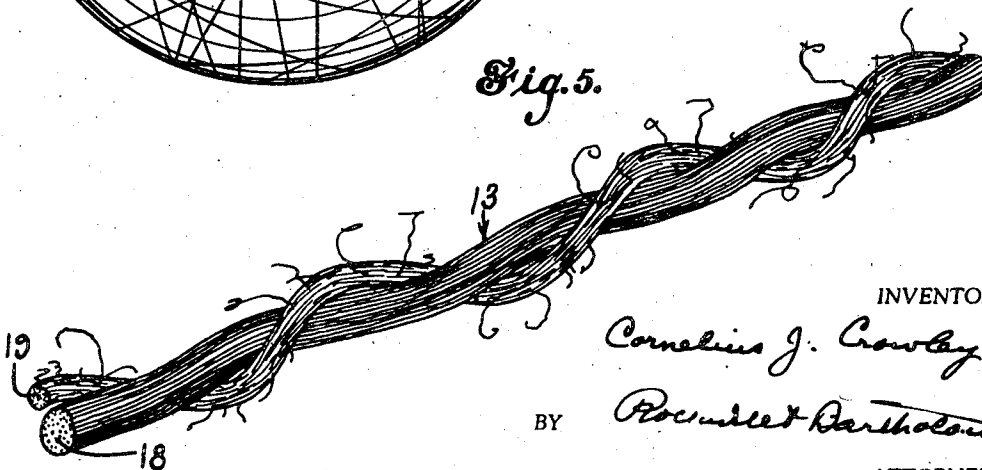


Fig. 5.



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Fig. 8.



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INFLATABLE BALL HAVING A CARCASS, INCLUDING A SYNTHETIC THREAD WINDING

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Application January 12, 1954, Serial No. 403,505

2 Claims. (Cl. 273—65)

This invention relates to inflatable athletic balls and has particular reference to spherical balls such as basketballs, soccer balls, and volley balls.

This application is a continuation in part of my application Serial No. 130,931, filed December 3, 1949 and since abandoned.

An important object of the invention is to provide an inflatable athletic ball of the type in which the bladder and the cover are bonded together so as to make the bladder an integral part of the ball, in which the size and shape of the article as manufactured or fabricated will be maintained thereafter under effective control, and will be kept within very close limits.

Another object is to provide a ball that is precisely shaped and will maintain its shape in hard service.

Another purpose is to provide a ball which is very strong and very durable in comparison to prior articles of this class.

A further purpose is to provide an athletic ball of the inflatable type having a strong wall structure in which the amount of material employed is reduced to a minimum, and more particularly in which the use of rubber and fabric is reduced to a minimum, and in which the process of manufacture is considerably simplified.

Another object is to provide a wall structure for an inflatable ball which combines a maximum number of advantageous features.

In the accompanying drawings:

Fig. 1 is an elevation of a basketball constructed in accordance with my invention;

Fig. 2 is a broken view showing different layers of material in the wall of the ball;

Fig. 3 is an elevation of the bladder as it appears preliminary to the application of the cord winding;

Fig. 4 is a view showing the cord winding applied to the bladder;

Fig. 5 is a considerably enlarged perspective view of a part of the cord used in winding the bladder;

Fig. 6 is an enlarged section of the wall in a region where one of the fabric tapes is located;

Fig. 7 is a section similar to Fig. 6, taken in a region remote from the tape;

Fig. 8 is a microphotographic view looking toward the inner face of the rubber layer in which the winding is embedded; and

Fig. 9 is a view illustrating a modified form of ball.

By way of example, there is described a basketball and the steps employed in its manufacture. In making the ball shown in Figs. 1 to 8, a spherical valve-equipped bladder of rubber is provided, and, after inflation of the bladder to such an extent that a rather firm sphere of the proper size is provided, the bladder has applied thereto strips of rubberized tape that have the arrangement hereinafter described. In this particular case, two tapes are applied to the bladder in encircling relation thereto. Then a winding of cord or thread is applied to the bladder, the turns of which are disposed approximately on great circles. Then a layer of unvulcanized rubber

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is applied over the layer of cord, and at a later stage this rubber is vulcanized, and in the case shown this rubber provides the external surface of the completed ball. The term "rubber" is used in a broad sense so as to include rubberlike material as well as natural rubber and synthetic rubber.

In the drawings, the rubber bladder is indicated at 10, and the inflating valve at 11. The valve has a rubber stem 11' into which an inflating needle can be introduced and which extends through the ball wall so as to be accessible at the exterior. In Fig. 2 one of the fabric tapes is shown at 12, the cord winding at 13, and the rubber layer at 14. The structure of the ball will be more fully understood from the following description of a preferred method of constructing the ball.

The bladder has a relatively thin rubber wall, and it may be made by accurately cutting a number of quadrants and seaming them together in the manner described in the Madsen Patent 2,218,919, of October 22, 1940. By proceeding in this manner it is possible to make the bladder accurately spherical. The bladder is vulcanized or partly vulcanized as a preliminary step, and the valve placed in position therein. The bladder is then inflated to the extent previously mentioned. The next step is to apply the tape 12, previously mentioned, and a second fabric tape 15, these two tapes being disposed in planes perpendicular to each other so that the expansion of the bladder is limited in those planes. The tapes are of fabric with the threads running on the bias, and each tape is impregnated with uncured rubber so that when placed in position upon the bladder surface it will adhere closely thereto. The tape 12 is arranged on a great circle coinciding with the stem 11' of the valve and completely encircles the bladder, with a perforation 12' therein disposed over the valve stem, this perforation being located at a short distance from one extremity of the tape. The two extremities of the tape are overlapped in a region slightly to one side of the valve, and are adhesively secured together as indicated at 16. The tape 15 is placed in position after the tape 12 and is somewhat shorter than the tape 12, the tape 15 being on a great circle passing through the valve stem, and the extremities 17 of this tape being lapped upon said marginal portions of the tape 12 and adhered thereto, as shown in Fig. 3. It is understood, of course, that at the side opposite that shown in Fig. 3, the tape 15 extends across and is adhered to a portion of tape 12.

The next step is to place on the bladder the winding of cord or thread 13. This may be done by placing the bladder in a suitable winding machine, which winds on a length of cord substantially on great circles so as to form a strain-resisting layer of cord over the fabric tapes and the exposed bladder surface between the tapes. The layer of cord is relatively open and thin so as to provide a number of open places or interstices between the cord portions, as shown in Fig. 4. After the application of the cord the outer cover is applied, and this may be done in a known manner as by placing portions such as quadrants of uncured sheet rubber stock upon the article with their edges in overlapping relationship, preliminary to vulcanizing. The article is then placed in a spherical mold having the size of the completed ball, the mold being subjected to heat. Air is introduced into the ball through the valve, so as to condense the wall and shape it against the interior of the mold, and preferably vulcanization is brought about by the heat imparted to the mold at this stage. After the article has been subjected to the proper pressure of air within the mold for a suitable period, to effect proper shaping and vulcanizing, the article can be removed from the mold.

In Fig. 5 there is shown a portion of a thread or cord greatly enlarged, which I use in providing the above-

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mentioned winding of thread turns. This thread or cord is made of synthetic fibers, preferably "nylon," and comprises two strands one of which, indicated at 18, is of substantially larger diameter than the other. The larger strand 18, moreover, is of a different character and fiber composition from the smaller strand 19, in that it is composed of continuous parallel filaments which extend throughout the length of the winding, whereas the smaller strand is composed of a short or staple fiber spun to create a yarn-like member from which fine short fibers project, as shown in Fig. 5. The projecting parts of the fine fibers or filaments may have a length of say one inch to three inches. In the case of a basketball, for example, the element 18 can be plied from 140 continuous filaments each having a denier of 6, so that the denier of the filamentary body will be 840, and in this example the denier of the strand 19 is about one third of that figure. The two elements or strands are inter-twisted in the manner schematically shown in Fig. 5, the element 19 on account of its smaller diameter taking more of the twist, and the number of twists per inch being of the order of 5, for example. One effect of combining the two strands in the manner described is to provide a thread of two strands of which the larger is relied upon for providing great strength in a linear direction, while the other provides a ridge formation upon the first as well as providing the projecting or exposed ends of the fine short fibers. The strand 19 is twined about the heavier strand so as to leave a considerable amount of the heavier strand exposed and unencumbered and yet so as to provide upon the heavier element a ridge-like projection helically disposed and provided with a multiplicity of projecting fine filaments extending in all directions.

It has been found that a cord of the kind above described has numerous advantages when used in the manner above described, that is, in providing the cord winding of an inflatable ball such as a basketball, for example. The "nylon," as distinguished from materials previously used, such as cotton and rayon, provides many desirable characteristics, including markedly greater strength of the ball, resistance to growth, resistance to distortion, much longer life, and simplicity of manufacture. Heretofore, so far as I am advised, it has not been possible to utilize for this purpose the "nylon" products used as substitutes for thread or yarn of cotton, rayon and the like. "Nylon" yarns spun from staple fibers do not, in the requisite small diameters for the intended purpose, have the necessary properties including the necessary tensile strength. For the purpose of incorporation in a ball of the type described, it is necessary that the cord be adapted for winding in the ordinary winding machines, a relatively thin layer of cord being desirable for permitting reduction of the wall thickness of the ball to a minimum, and because of the strength imparted to the wall by the embedment of the cover stock in the interstices of the winding, which interstices are preferably fairly large. Moreover, it is required that, when the cord be laid on the inflated bladder, it be under light tension only, because, when the ball is inflated in the mold, the cord is considerably lengthened (and reduced in diameter) and the surrounding parts vulcanized while the cord is in this considerably stretched condition. When the relatively thin and open layer of cord on the bladder is under light tension, holding the turns in place when the wound bladder is subjected to later operations presents a considerable problem. The turns of cord should be applicable to the ball by the winding machine in a manner such that during this operation the turns do not slip off of the ball, nor should the conditions be such that, in the later stages of the manufacture, the turns are likely to slip off of the ball, or at least be considerably displaced from their proper positions in which they are intended to be placed by the winding machine. These various conditions are admi-

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rably met by the use of a cord such as described, preferably made of "nylon," in which the plied-together substantially straight and parallel continuous filaments supply in relatively small compass at least the greater part of the necessary strength for the building of the ball wall and for its longevity, and in which the turns of the yarn-like short fiber element, by being helically disposed about the other element at a relatively long pitch, and by being provided with a multiplicity of projecting filamentary members, maintain each turn of cord in position with respect to all of the turns with which it makes contact. For example, a turn of cord, crossing the portion shown in Fig. 5, will be held in position in a very secure manner by virtue of the interengagement or interlocking of the staple fiber strands presenting the ridge formations and also by virtue of the interentanglement of the short fibers of the staple fiber strands. The relationship of the turns of cord in a given region of the ball in the completed ball is shown in Fig. 8, which is a view of the under face of the cord and rubber layer as it appears when stripped off of the bladder.

The short fibers projecting from the ancillary helical strands assist in holding the turns firmly in place by catching or entangling with corresponding parts of other turns. The multiplicity of projecting short fibers together with the configuration of the cord in which the yarn-like element has a number of twists per inch about the substantially straight and stronger inner element provide for very effective anchoring of the cord in the rubber placed over the winding. The thread or cord is an unbalanced one, owing to the fact that the element of less diameter is wound on the element of greater diameter and has several twists per inch, whereas the other element is substantially straight. The anchorage of the thread is derived mostly from the spun element which, by the arrangement described, has a much greater exposure (effective length) than the strength-giving element of continuous filaments.

Before or after application to the bladder the cord can be impregnated with uncured rubber if desired, and if the impregnation follows the winding on the bladder, the turns of cord will be held firmly in position during the impregnation by virtue of the structural make-up of the winding, as above described.

An important feature of the described cord is the high degree of extensibility possessed by the principal strand. The ancillary strand, on the other hand, has ample extensibility by reason of the fact that its effective length is considerably greater than that of the principal strand due to the helical disposition of the ancillary strand.

By this invention the ball wall can be made very thin while providing surprising strength and durability, the reduction in thickness of the thread winding permitting enlarged apportionment of thickness to other elements of the wall. In the form above described a small amount of fabric represented by the two crossing tapes is used, but it is possible to dispense with fabric altogether and to wind the thread on the naked bladder, as shown in Fig. 9, and as disclosed in my application Serial No. 82,786, filed March 22, 1949, now Patent No. 2,662,771, dated December 15, 1953.

It is apparent that if the turns of the ancillary strand were placed too closely together on the principal strand the fine filamentary extensions would not be sufficiently exposed to project in all directions and perform their function as herein described, but by the construction herein described the winding of the ancillary strand about the principal strand is sufficiently open for the purposes in view, there being a relatively large exposure of the filamentary ends around or circumferentially of the principal element. It is understood that in the principal or strength-imparting strand the individual filaments extend continuously throughout the length of the winding.

What I claim is:

1. An inflatable athletic ball of spherical shape con-

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sisting of a spherical valve-equipped bladder of rubber-like material having a substantially smooth external surface exposed for direct contact with a thread winding, a thin open winding of thread laid on the bladder in great circles crossing one another, said thread consisting of two strands of "nylon" of substantially different diameters, the strand of greater diameter being an inner substantially straight primary strand consisting of continuous approximately parallel filaments and the other strand being a yarn-like auxiliary strand of spun discontinuous fibers presenting a multiplicity of fine filamentary ends which project therefrom to a substantial extent in all directions, said auxiliary strand having a plurality of twists per inch about the primary strand that create a ridge-like helical formation on said primary strand, the projecting filamentary ends of the auxiliary strand of each thread turn being interlaced with one another and being interlaced with the filamentary ends of other thread turns, and a layer of vulcanized rubber externally of the bladder and in which said primary strand is anchored by the fine filamentary ends of the auxiliary strand embedded in said layer.

2. An inflatable athletic ball of spherical shape consisting of a spherical valve-equipped bladder of rubber-like material having a substantially smooth external surface exposed for direct contact with a thread winding, a thin open winding of thread laid on the bladder in great

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circles crossing one another, said thread consisting of two strands of "nylon" of substantially different diameters, the strand of greater diameter being an inner substantially straight primary strand consisting of continuous approximately parallel filaments and the other strand being a yarn-like auxiliary strand of spun discontinuous fibers presenting a multiplicity of fine filamentary ends which project therefrom in all directions to an extent of from one to three inches, said auxiliary strand having approximately five twists per inch about the primary strand that create a ridge-like helical formation on said primary strand, the projecting filamentary ends of the auxiliary strand of each thread turn being interlaced with one another and being interlaced with the filamentary ends of other thread turns, and a layer of vulcanized rubber externally of the bladder and in which said primary strand is anchored by the fine filamentary ends of the auxiliary strand embedded in said layer.

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