My invention relates to the manufacture of coated fabrics. It has particular relation to the manufacture of fabrics employed in the construction of gas cells for lighter than air-craft.

One object of the invention is to provide a fabric which is substantially impermeable to hydrogen and helium ordinarily employed as inflating media for such cells. Another object of the invention is to provide a fabric of the above designated character which is relatively inexpensive to manufacture and which possesses a high degree of flexibility and durability.

Heretofore, the gas cells of lighter than aircraft have been constructed of fabrics coated either with gold beater's skin (a thin membrane taken from the viscera of cattle) or with ordinary rubber. The first mentioned material possesses a high degree of resistance to diffusion of inflating gases and is also quite flexible, light of weight and durable. However, its cost is excessive both from the standpoint of the original material and because of the excessive amount of labor required to apply the relatively large number of small units of material necessary to cover such extensive surfaces as exist in gas cells of lighter than aircraft.

Rubberized fabrics may be manufactured with but slight expenditure of labor by spreading a thin film of rubber upon continuous sheets of fabric in any convenient manner. Since the basic ingredients required for manufacture of this type of fabric may be obtained at but slight cost, its use is highly desirable from considerations of economy. However, rubber is a comparatively imperfect barrier to such highly diffusible gases as hydrogen and helium. Therefore, its employment is objectionable in craft of the dirigible type in which it is desirable to retain the inflating fluid in the gas cells at all times, even during long periods of inactivity.

For that reason, much time and expense has been expended in an effort to find a suitable coating medium for gas cell fabric which possesses the high degree of flexibility and impermeability of gold beater's skin and, which at the same time, may be produced at a cost more nearly approximating that of rubberized fabric. Although many different materials have been tested for this purpose, most of them have been found by experience to be unsatisfactory either because of an excessive degree of permeability or because of excessive weight, lack of flexibility and durability.

My invention resides in the discovery that by coating gas cell fabric with mixtures of latex and viscose in a suitable manner, a fabric may be obtained which possesses most of the desirable features inherent in both gold beater's skin and ordinary rubber.

In practicing the invention, a solution consisting of latex is applied to a light, closely woven, rubber coated fabric of the type usually employed in the construction of gas cells. Additional films of material containing a greater percentage of viscose and a correspondingly smaller percentage of latex than each preceding film are then applied to this base coating until a ply of sufficient thickness to resist appreciable diffusion of gas is built up. This ply is then treated with a suitable regenerating agent in order to cause precipitation of the cellulose in the coating film as a solid flexible sheet upon the fabric. Although the compositions of the various films may be varied materially without departing from the principles of the invention herein disclosed, the following is a specific example of a formula which has been found by experience to be particularly satisfactory for coating fabric such as most frequently employed in the construction of gas cells for rigid aircraft.

First coat
- 120 grams of latex containing 67.5% rubber.
- 12 grams of 20% sodium hydroxide.
- 138 grams of water.

Second coat
- 72.8 grams of 67.5% latex.
- 114.3 grams of 7% viscose.
- 4 grams of glycerol.
- 200.9 grams of water.
Third coat
45.7 grams of 67.5% latex.
171.4 grams of 7% viscose.
6 grams of glycerol.
176 grams of water.

Fourth coat
32.7 grams of 67.5% latex.
228.8 grams of 7% viscose.
8 grams of glycerol.
130.7 grams of water.

Fifth coat
23.3 grams of 67.5% latex.
285 grams of 7% viscose.
10 grams of glycerol.
81 grams of water.

6th to 26th coats
247.2 grams of 67.5% latex.
5500 grams of 7% viscose.
192.5 grams of glycerol.
447 grams of water.

If desired, additional coatings containing essentially pure cellulose and no latex may be applied to the coatings above described. These additional coatings have the advantage of lending additional resistance to permeation by oils. However, their use is not absolutely necessary for purposes of the invention.

These materials may be applied to the fabric in any convenient manner, for example, by spraying, dipping or spreading. Each of the coatings should be given sufficient time to dry before the succeeding coating is applied. The drying operation is best performed while the fabric is stretched upon a tentering machine or a tentering frame. The fabric so treated should then be passed through a bath for regenerating the viscose contained in the various viscose coatings. The following is a specific example of a bath which is highly satisfactory for this purpose.

18 parts of glycerol
48 parts of alcohol
6 parts of boric acid
54 parts of water

This bath is highly satisfactory in connection with viscose coatings of this character because it is possible to use solutions thereof of such high concentrations as to preclude osmotic diffusion thereof through the coating films to cause the formation of blisters between the latter and the fabric base.

Like results may also be obtained by adding alcohol, glycerol or any other inert soluble material to an ordinary acid or acid salt bath, whereby to increase the concentration thereof to the point where osmotic diffusion is inhibited.

After the process of regeneration is completed, the fabric may be washed in a bath containing
12 parts of glycerol
54 parts of alcohol
54 parts of water.

Finally, the fabric is tentered, dried and swabbed with a 50 percent glycerol solution. This solution is allowed to stand upon the fabric for a period of approximately one hour in order to permit thorough permeation of the coating film. The excess of glycerol is then wiped off in any convenient manner.

The process is particularly desirable because no water-soluble adhesives are required for bonding the coating film to the fabric, and for that reason, the film may readily be regenerated in situ upon the fabric without any tendency to cause separation. Although cellulose as a coating for fabric has heretofore been suggested, adequate bonding of regenerated cellulose upon a rubberized fabric has not been previously accomplished. Fabrics so prepared possess a very high degree of flexibility and durability. The adhesion of the film to the fabric is also excellent. Furthermore, the rate of diffusion of hydrogen gas through the film amounts to approximately 35 liters per square meter during a period of 24 hours for a fabric weighing 5 ounces. This figure is probably less than that obtained by the use of gold beater’s skin as a coating medium. Since the basic ingredients for the new films are inexpensive to obtain and since they may be applied by means of machinery suitable for mass production, the expense of the fabric is of course relatively small.

Use of the fabric prepared in the previously described manner is not limited to the gas cell art, but includes many other fields where it is desirable to obtain a non-permeable material. For example, it may readily be employed in the manufacture of breather bags for oil tanks. In the latter construction, the rubber coatings prevent the penetration of moisture while the viscose prevents the decomposition of the rubber by volatile oils.

Although I have described the preferred embodiments of the invention, it will be apparent to those skilled in the art that the invention is not so limited but that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims. It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What I claim is:
1. The method of treating fabric which includes the steps of applying to the fabric successive layers of mixtures of latex and viscose, the first layer having a relatively large percentage of latex and subsequent layers having progressively decreasing percentages of latex and progressively increasing percent-
ages of viscose, thereafter regenerating the cellulose of the viscose upon the fabric under conditions preventing blistering.

2. The method of treating fabric for use in gas cells of lighter-than-air craft comprising applying to the fabric a coating which on the fabric side is largely latex, which on the outside is largely viscose, and which intermediate the fabric side and the outside comprises mixtures of viscose and latex, thereafter regenerating the cellulose of the viscose in situ under conditions preventing the formation of blisters.

3. A method of treating fabric for use in gas cells of lighter-than-air craft comprising applying thereto a coating which on the fabric side is largely latex, which on the outside is largely viscose, and in which decreasing proportions of latex and correspondingly increasing proportions of viscose characterize the material intermediate the fabric side and the outside, thereafter regenerating the cellulose of the viscose upon the fabric by means of a slightly acid bath maintained under conditions such that diffusion of the bath through the coating layers of the fabric is minimized.

4. The method of treating fabrics which includes the steps of coating the fabric with rubber, applying a plurality of coatings comprising varying mixtures of viscose and latex, the inner coatings comprising principally latex and the outer coatings comprising principally viscose, and regenerating the cellulose of the viscose by subjecting it to a bath maintained under conditions such that diffusion through the coatings is inhibited, said bath comprising a water solution of glycerol, alcohol, and boric acid.

5. The method of treating fabric which includes the steps of coating the fabric with rubber, applying a plurality of coatings comprising mixtures of viscose and latex of which coatings the innermost consists principally of latex and the outermost consists principally of viscose, and regenerating the cellulose of the viscose in situ by subjecting it to the action of a bath maintained under conditions such that diffusion through the coating film is inhibited; said bath comprising glycerol, boric acid and approximately equal amounts of alcohol and water.

6. The method of treating fabric which comprises coating the fabric with rubber, applying a plurality of coatings comprising mixtures of viscose and latex and an outside coating which is largely viscose, and regenerating the cellulose of the viscose by subjecting the same to the action of a bath maintained under conditions such that diffusion through the coating film is substantially inhibited and blistering thereby prevented, said bath comprising approximately 18 parts of glycerol, approximately 48 parts of alcohol, approxi-