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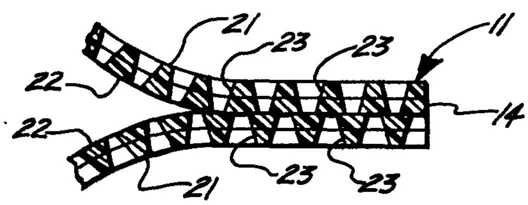
(54) Infusion bag.

(57) An odorless and tasteless, stable and strong and sufficiently porous (even when wet) infusion bag for particulate food products such as tea, coffee and the like comprises a coextruded multilayer perforated thermoplastic film (11) having a heat resistant outer layer (21) of film forming resing and an inner layer (22) of a somewhat less heat resistant film forming resin and having a multiplicity of minute substantially iniform holes (23) each of which is sufficiently small to prevent the migration of the particulate product therethrough and which are sufficiently large to permit adequate fluid flow therethrough. The heat resistant outer layer (21) of the film (11) forms the outside of the bag and the less heat resistant layer (22) of the film forms the inside of the bag.



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INFUSION BAG

The present invention is directed to infusion bags, especially tea bags and the like, and more particularly to an infusion bag constructed of a non-woven, fiber-free, perforated thermoplastic film.

The invention is particularly concerned with an infusion bag constructed of a coextruded multilayer perforated thermoplastic film having a plurality of uniform minute holes or openings therein.

Thermoplastic films such as polyethylene and polypropylene are common packaging materials. Multilayer films of various types are also quite common packaging materials. The films are generally non-porous and impervious to water and other inert liquids. At least one of the layers of film has strong adhesive qualities. Examples of such multilayer films may be seen in U.S. 4,254,169; U.S. 4,239,826; U.S. 4,233,367; U.S. 3,908,070; U.S. 3,423,231; U.S. 2,817,124 and U.S. 2,817,123.

Perforated thermoplastic films have many useful applications, including packaging of food products such as cheese, gardening and farming to prevent growth of weeds while permitting moisture to be transmitted through the film to the soil beneath and for making absorptive structures such as disposable diapers, for example, see U.S. 3,814,101.

Perforation of thermoplastic films is generally achieved by vacuum perforation of thin plastic films which involves the extrusion of molten polymeric materials such as polyethylene through a slot die. The hot melt web of film exiting the die impinges on a form through which a vacuum is drawn causing the film web to be perforated and holes formed therein. Depending upon the form used, films can be produced which have as few as 50 holes per square inch or which have thousands of holes per square inch. One of the earlier methods for vacuum perforation of plastic film is disclosed in U.S. 3,054,148.

Infusion-type tea bags are usually rectangular packets or sachets made from single or multiple pieces of paper folded in half and crimped or otherwise sealed along the edges. In another type, a single strip of paper is folded twice longitudinally to form an inner centrally disposed double fold joining the two meeting edges. In a type of flow-through tea bag, a triple transverse fold intermediate the length of the folded strip forms two pockets which are partially filled with tea before the open ends thereof are folded over and stapled to a strand of string usually having a tag on the end thereof.

Over the years, a wide variety of infusion packets or bags, usually for containing tea for subsequent brewing, have been developed. The bags are usually constructed of filter paper or some other type of porous material such as cloth or the like.

An infusion packet having two oppositely disposed, rigidly separated pockets of tea joined together by two tapering end portions which form a narrow, triangular shaped porous cup is shown in U.S. 3,597,222.

U.S. 3,653,913 discloses an infusion bag made from a rectangular strip of porous fibrous material, the longitudinal margins of which are folded together so as to form a longitudinal joint consisting of three layers which are knurled together. The tube is divided by a transverse bend so as to form a pair of chambers for holding an infusible substance, and the opposite ends of the tube are connected to each other so as to close the bag.

An early type of tea bag or tea ball wherein the bag is a triangularly-shaped pocket formed from a rectangular strip of perforated aluminum foil is described in U.S. 1,581,578.

Other types of filter paper tea bags or the like with a variety of handles are illustrated in

U.S. 2,328,017; U.S. 2,359,292, U.S. 3,566,573; U.S. 4,153,153; and Great Britain 2,087,350. The British patent discloses a tea bag having a somewhat accordion fold.

Infusion bags with positioning means and flotation means are disclosed in U.S. 3,797,642 and U.S. 3,809,215, respectively. The tea bags themselves may be made of various materials including paper, plastics such as nylon, perforated plastic film, e.g., polyester, or woven or non-woven fabric of natural or synthetic origin.

A percolatable porous bag constructed of a blend of individualized textile or cellulosic fiber and a small amount of thermoplastic fiber is disclosed in Canadian patent 802,720.

Various degrees of success have been achieved with the foregoing infusion bags, with paper or fibrous bags presently dominating the market place. One of the problems with paper bags is lack of wet strength. This is even more of a problem with the larger bags for tea brewing commonly used by the food service industries.

Another problem with fibrous or paper bags is that as they become wet, the fibers expand or swell. Such expansion or swelling closes the openings in the bag material and removes the permeability thereof. When placed in a water containing vessel such as a cup or pot, the bags tend to float since the films structure is so closed or porosity so diminished that air is trapped inside the bag.

An infusion bag for items such as tea, coffee or similar food products for brewing must have a number of qualities. It must have an inability to impart a taste factor to the liquid product after brewing. In effect, it must be substantially odorless and tasteless. It must also be sufficiently strong to contain the brewing product in boiling water, e.g., in the steeping of tea, coffee, and similar liquid beverages. The bag must also be porous enough to permit liquid diffusion therethrough, but the pores or openings must be of such size that migration of the beverage material therethrough is inhibited, both when the bag is dry and when the bag has been immersed in a liquid. It is also important that infusion begins to take place within a few seconds. It is further desirable that a sachet, such as a tea sachet, retain sufficient stability that it can be compressed after brewing is completed without destruction of the container.

The present invention provides an infusion bag or sachet which meets all of these requirements.

The infusion bag of this invention is of a poriferous, non-woven, non-fibrous construction of a multilayer coextruded perforated thermoplastic film having a multiplicity of uniform fine holes or openings. The film is a multi-layer coextruded thermoplastic film with one outer layer being heat resistant and the other outer layer being somewhat less heat resistant and heat sealable. The heat resistant outer layer of the film forms the outside of the bag and the less heat resistant layer of the film forms the inside of the bag. The openings in the film are sufficiently small to retain particulated products such as tea, coffee or the like within the bag and to inhibit or prevent migration of the particles through the holes when the particles are either dry or wet. The holes in the film are also sufficient in number and sufficiently large to provide the desired degree of infusion. The outer layer of film of the bag is polyester, polypropylene or other thermoplastic of similar heat resistance and the inner layer of the bag is polyethylene or other sealable thermoplastic. An alternate form of the invention includes the inner layer of the bag being preferably polyethylene or other sealable thermoplastic material containing an effective amount of antistatic agent to inhibit the sticking of the packaged product thereto. The film is substantially odorless and tasteless.

Fig. 1 is a top plan view of one embodiment of the invention;

Fig. 2 is a side view of the embodiment of Fig. 1;

Fig. 3 is an end view of the embodiment of Fig. 1;

Fig. 4 is an enlarged sectional view across line 4-4 of Fig. 1; and

Fig. 5 is an enlarged top view of a portion of the thermoplastic film of which the embodiment of Fig. 1 is constructed.

Fig. 6 is an enlarged top view of a portion of the thermoplastic film of which the embodiment of Fig. 1 is constructed having alternately slotted holes.

Fig. 7 is a view similar to that of Fig. 6 illustrating an alternate embodiment of the film of the invention.

Referring now to the drawings, an infusion bag of the present invention is illustrated generally at 10. The bag or packet 10 is constructed of a rectangular strip of a perforated plastic film 11 which is described in more detail hereinafter. The strip of film 11 is folded at 12, sealed at edges 13 and 14 and filled with a particulated product P which can be seen through the film 11. After the product P is inserted in the sachet 10, the edge 15 is sealed, thereby encasing the product P within the bag 10.

As best seen in Figs. 4 and 5, the infusion bag 10 is constructed of a coextruded multilayer thermoplastic film 11 comprising an outer layer 21 of a heat resistant film forming thermoplastic resin such as polyester, polyolefin, polycarbonate or nylon with polyester being preferred, and an inner sealant layer 22 of a somewhat less heat resistant film forming thermoplastic resin, such as polyethylene, polyester, polycarbonate or nylon with polyethylene being preferred. The film 11 has a multiplicity of fine holes or capillaries 23 which are of a somewhat tapered construction, being more or less in the form of a truncated cone. Tapered holes help to speed infusion. The somewhat cone shape of the holes effectively channels liquid into the bag and into contact with the particles contained therein.

For simplicity of illustration, the holes or openings are shown as being circular or round. It can be appreciated that the openings may be of any desired shape such as oval, pentagonal, hexagonal or other geometric configuration. It is important that the holes be uniform and that they be sufficiently large in size and number to provide adequate infusion and be sufficiently small in size to prevent the migration of particles therethrough such as the particulated product P.

As alternatively illustrated in Figs. 6 and 7, the film 11 has a multiplicity of fine slots or rectangularly-shaped capillaries 43 which are of a somewhat tapered construction, being more or less in the form of a truncated box. The slots 43 are illustrated in alternate rows in a uniform, pre-determined pattern and represent an ideally shaped slot. The slots are rectangularly shaped with somewhat rounded ends. In actual construction, they may have slight bulges at their center. The slots are of such a size that particulate matter is inhibited from passing therethrough. The size of the slot can be adjusted by changing either the major axis or the minor axis. By changing the minor axis, the slot can control the size particulate matter that can be passed or sifted through the film. By changing either the major axis or the minor axis, the liquid infusion rate can be controlled. It is important that the slots be sufficiently large in size and in sufficient number to provide a desired rate of liquid infusion and yet be sufficiently small in size to prevent the migration of particles therethrough such as the particulated product P.

A perforated thermoplastic film 31 is illustrated in Fig. 7 which has slots 33 which are arranged in somewhat diagonal lines. It can be appreciated that

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the slots can be arranged in a variety of patterns as desired.

In the packaging of an item such as tea, a preferred hole size is from about two to 10 mils (0.00508-0.0254 cm), in diameter or across the opening, with a size of three to four mils being most preferred. A preferred slot size is from about one to four mils (0.00254 to 0.01016 cm) across the minor axis, with a size of two to four mils (0.00508 to 0.01016 cm) being most preferred. The major axis is about four to 10 mils (0.01016 to 0.0254 cm) across, with about four to six mils (0.01016 to 0.01524 cm) being preferred. The film has a base thickness of about 0.25 mil to two mils (0.000635 to 0.00508 cm) and about 500 holes or slots per square inch (77.5 per square centimeter) or more. About 1800 to 4200 openings per square inch (279 to 651 per square centimeter) are preferred, with about 2900 holes or slots per square inch (449.5 per square centimeter) being most preferred. The porosity of the film is about 50 to 500 cubic feet per minute (CFM) (23597 to 235,973.7 cubic centimeters per second).

The outer layer of the coaxial or coextruded perforated thermoplastic film of the bag is preferably a heat resistant polyester film having a melting temperature of about 425°F to 600°F (218.83°C to 315.56°C) with about 525°F (273.89°C) being most preferred. The inner sealant layer of the coextruded perforated thermoplastic film of the bag is preferably a somewhat less heat resistant polyethylene film having a melting temperature of about 180°F to 250°F (82.22 to 121.11°C) with 220°F (104.44°C) being most preferred. The use of an outer polyester layer enables a sealing/melting temperature differential of about 150°F (65.56°C) to be obtained. The film has a desired seal strength of 3/4 lb. per inch (133.9 grams/centimeters) width.

A temperature of about 240°F (115.56°C) is required to melt the polyethylene film for sealing. To prevent sticking of the outer layer of thermoplastic film to the steel jaws of the sealing device or heat sealing machine, it is important that the melting temperature of the polyethylene inner layer be kept below about 260°F (126.67°C). It can be appreciated that particular polyolefin resins or other film forming resins may have higher or lower melting temperatures; however, it is essential that a melting temperature differential be obtained between each layer to achieve the desired seal without a deleterious effect on the film.

For example, a heat resistant polypropylene film layer has a melting temperature of about 230°F to 350°F (110 to 176.67°C) with about 320°F (160°C) being

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preferred. The melting temperature of 180°F to 250°F (82.22 to 121.11°C) of the somewhat less heat resistant polyethylene film layer provides the necessary melting temperature differential.

The edges of the film are heat sealed to complete the package. The melting temperature of the outer layer of the bag must be sufficiently high to prevent the film from sticking to the sealant jaws. The melting temperature of the inner sealant layer of the bag must be less than the melting temperature of the outer layer.

The edges of the bags may be readily heat sealed using standard sealing and automatic bag making machines. The edges may also be effectively sealed with use of impulse or band type sealers, hot wires, hot air or other suitable sealing apparatuses or techniques.

When using a film containing an antistatic agent during heat sealing, the static-free surface of the polyethylene film permits the particulated products to be directed away from the sealant area. For example, in a typical packaging operation, a rectangular strip of film is folded and sealed on the two sides adjacent to or at right angles to the fold, thereby forming a container or bag. A desired amount of particulated product is inserted in the bag while the bag is held in a vertical or upright position. The product particles immediately fall to the bottom of the container away from the top edge. The top edge is then sealed without any inhibition of the fine particles.

For the packaging of a typical commercial tea for brewing, a VisQueen® Vispore® film identified as X-6040 is especially suitable for constructing the infusion bag. The film is a coextruded polypropylene/polyethylene perforated thermoplastic film formed from a high density polyethylene resin and a polypropylene resin. The film can also be a coextruded polypropylene/polyethylene perforated thermoplastic film formed from a high density polyethylene resin to which about 2000 ppm (milligrams per liter) of an antistatic agent, identified by the manufacturer as Atmul 84 or ATMUL 84K, has been added and a polypropylene resin. The resins and antistatic agent are odorless and tasteless and approved for food packaging.

The antistatic agent is added to the polyethylene resin in an amount of about 500-10,000 parts per million (ppm) (milligrams per liter). The agent must meet the requirements of the U.S. Food and Drug Administration or any other applicable government specifications. An antistatic agent found to be particularly effective is ATMUL® 84 or ATMUL® 84K, identified by the manufacturer to be mono- and diglycerides (edible fats glycerolysis). It is

Generally Recognized As Safe (GRAS) food additive per FDA 121.101. The agent is in the form of ivory white beads or flakes and is blended or otherwise mixed with the polyethylene resin prior to extrusion.

ATMUL® 84 is a well known commercially available antistat or antistatic agent for polyolefins such as low density polyethylene (LDPE), medium density polyethylene (MDPE) and polypropylene (PP), but said by the manufacturer not to be sufficiently effective in high density polyethylene (HDPE). The agent is comprised mainly of mono- and diglycerides and contains a minimum of about 40 weight percent alpha monoglyceride with a maximum content of one weight percent of each water, free fatty acid and free glycerides.

Unexpectedly, it has been discovered that the antistatic agent not only is effective in HDPE, but also substantially increases the infusion rate of tea bags having an inner sealant layer of perforated polyethylene film when a small amount of the agent has been blended with the HDPE resin prior to extrusion.

The female side or surface of the thermoplastic film to be on the outside of the bag is also preferably flame or corona discharge treated. Such treatment enhances the flow of water into the bag and thus accelerates the infusion process.

Although a coextruded multilayer polyester/polyethylene film is preferred, other combinations of multilayer films are suitable. Using the following designations:

Polypropylene	PP
Polyethylene	PE
Crystalline polyester	CPE
Amorphous polyester	APE
Polycarbonate	PC
Nylon	N

some examples of other suitable multilayer films are as follows:

PP/PE	PC/PE	N/PP
CPE/PP	PC/PP	N/PE
CPE/APE	PC/APE	N/APE

It can readily be appreciated that other film forming resins can be used providing they can be effectively perforated and provided that there is an adequate melt differential between the outer layer of the bag and the inner sealant layer of the bag.

With some resins, it may be necessary or desirable to provide multilayer films of more than two layers. For example, a triple layer film is suitable. Regardless of the number of layers of film, it is essential that the melting temperature differential be

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maintained between the outer layer of the bag and the inner sealant layer of the bag. The layers of a sheet of film must also, of course, not be subject to separation or delamination.

The film is preferably clear in color, but may be manufactured in its natural color or a variety of colors as desired or permitted.

The film has a dry surface and has no tendency to stick, cling or "block".

In the construction of infusion bags, the male side of the film is on the inside of the bag.

The invention is illustrated in its simplest form, and as a typical small size infusion bag for the packaging of individual servings of tea for brewing. Larger size packages, such as those customarily used in the food services industry can also be constructed. Such bags are constructed of two rectangular strips of film and sealed on all four edges. The bags or packages of the invention can be constructed in other geometrical configurations as desired. Rectangularly shaped packages are generally more suitable for boxing or other type of group packaging and can usually be more easily fabricated.

The infusion bags of the present invention have excellent wet strength and will not deteriorate in boiling water. The bags themselves are odorless and tasteless and do not impart any foreign taste to the item being packaged. They are, in effect, substantially inert.

Unlike bags constructed of fibrous materials, the porosity of the bags of this invention is unaffected by the brewing process. The holes or openings in the thermoplastic film remain unchanged when submerged in water and the porosity of the film remains constant. The infusion bag of the invention is also not as prone to entrap air as a bag of fibrous material. Entrapped air causes flotation of the bag and slows the brewing process.

Although the invention is particularly suitable for the packaging of tea, it can be used for packaging of other types of finely ground or particulated food products such as coffee and grits. The bags of the invention are also suitable for packaging items such as tobacco, snuff and the like. The bags may be used for packaging of any items in which infusion is desired.

An antistatic agent or antistat as used herein is an internal material blended with a polyolefin resin to reduce static-electrical charges on film made from the resin by allowing the charge to leakoff or otherwise inhibits the clinging of particles to the film and which is approved by appropriate regulatory agency as a food additive or suitable for use in packaging of foods.

The effectiveness of the infusion bags of the present invention is illustrated by the following comparative tests using regular Tetley and Lipton teas available at any supermarket.

Infusion rating tests were conducted illustrating the effectiveness of the infusion bags of the present invention in comparison with samples of tea bags of the leading domestic tea manufacturers readily available in a supermarket.

Test Materials and Equipment

2 boxes of commercial Tetley pillow type tea bags (100 bags per box) - orange pekoe tea

1 box of commercial Lipton Flo-Thru tea bags (100 bags per box) - orange pekoe tea

Sheet of Vispore® X-6005 coextruded perforated thermoplastic film [PP/MDPE, 40 mesh (0.420 mm openings), 10 mil (0.0254 cm) hexagonal holes, 1.25 mils (0.003175 cm) thick (0.8 mil (0.002 cm) PP + 0.45 mil (0.00114 cm) MDPE - calculated) and having a porosity of 225 CFM (106,188.75 cubic centimeters per second)].

Sheet of Vispore® X-6018 coextruded perforated thermoplastic film (PP/MDPE + ATMUL 84), 40 mesh (0.420 mm openings), 10 mil (0.0254 cm) hexagonal holes, 1.25 mils (0.003175 cm) thick (0.75 mil (0.001905 cm) PP + 0.50 mil (0.00127 cm) MDPE + ATMUL 84) and having a porosity of 225 CFM (106,188.75 cubic centimeters per second).

Color gradient chart of three colors as follows:

Yellow - Flair Hot Line

Pink - Carter's Hi-Liter

Orange - Sanford's No. 1500

Electrical hot plate

Mr. Coffee or like Purex breaker for boiling water

Pyrex No. 1000 - 400 mL beaker

Distilled Water

Stop watch

Sealine hand held heat sealer, Model 70

Razor blades, glass cutting plate, paperboard template 1-11/16 inches x 11 inches (4.286 x 27.94 centimeters), and ruler.

Sample Preparation

Perforated thermoplastic film tea bags were individually prepared by hand from each film sample as follows:

The male surface of a strip of film was sandwiched and/or snugged around the paperboard template. The hand sealer was set at 270°F (132.22°C) and the film sealed along the open end. Approximately 1/8 inch (0.3175 centimeters) film overhang was left from the outer sealed area. Excess film was cut from the fabricated tube. The paper-board template was removed leaving a tube of film having an inside diameter of 1-11/16 inches (4.286 centimeters). Three specimens, each 2-10/16 inches (6.6675 centimeters) long were cut from the fabricated tube. One edge of each specimen was sealed with the hand sealer. A distance of 2-2/16 inches (5.3975 centimeters) was measured from the inside edge seal and marked. The tea from a Tetley tea bag was poured into the fabricated perforated film bag. The fabricated film bag was sealed with the hand sealer along the 2-2/16 inches (5.3975 centimeters) measured area. Additional bags as needed were similarly fabricated.

Ten Tetley bags and ten Lipton bags were randomly selected for tea weight loading measurements. The bags had substantially the same weight loading and averaged 2.2 grams of tea per bag. Weight loading measurements are set forth in Table I hereinafter.

Tetley and Lipton tea bags were tested as regularly packaged.

Procedure and Testing

Twenty-five bags of each of the four types of bags were used for each series of tests. Six and eight ounce (177.44 and 236.6 cubic centimeter) cups were selected. The 400 mL beaker was set at eye level. The color gradient chart was adjusted two inches in back of the beaker. The Mr. Coffee container or pyrex beaker was filled with distilled water, placed on the hot plate and the water was heated to a full rolling boil. A tea bag was placed in the bottom of the 400 mL beaker. The stop watch was started as six or

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eight ounces of boiling water was poured over the tea bag. The tea bag was lightly stirred or spooned. Visual inspection was made for infusion at a distance of eight to ten inches from the brewing tea looking through the liquid to the color gradient chart. Time intervals of elapsed time were recorded at each instance where the yellow, pink and orange colors were no longer visible on the color gradient. Averages for 25 bags were calculated. The results are set forth hereinafter in Tables II-VII.

Table I

Tea Weight and/or Loading Measurements
(Net Weight of Tea in Grams)

Tetley Pillow Bags	Lipton Flo-Thru Bags
2.2955	2.2143
2.0705	2.2190
2.1832	2.1653
2.3338	2.1694
2.1138	2.1588
2.2946	2.1262
2.2821	2.2562
2.2424	2.2211
2.2173	2.2082
2.1651	2.2156
Average = 2.2198 grams/bag	Average = 2.1954 grams/bag

Table II

6 Oz. (177.44 Cubic Centimeters) Cup - Yellow Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea X-6005	Perforated Film Bags with Tetley Tea X-6018
55				
50			3	
45			1	
40			7	
35	2	1	5	4
30	3	2	8	4
25	12	3	1	15
20	6	18		2
15	2	1		
Average No. Seconds 25 Bags	27.16	24.00	39.40	30.10

Table III

6 Oz. (177.44 Cubic Centimeters) Cup - Pink Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea X-6005	Perforated Film Bags with Tetley Tea X-6018
75				
70			1	
65			2	
60			4	
55		1	2	
50	4		7	2
45	1	2	7	3
40	5	4	1	5
35	12	9	1	14
30	3	9		1
Average No. Seconds 25 Bags	39.92	38.00	53.50	40.40

Table IV

6 Oz. (177.44 Cubic Centimeters) Cup - Orange Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea X-6005	X-6018
130		1		
125		2	2	
120		3	1	
115	1	2		
110		3	3	
105	1	6	1	
100		4	2	
95	5	4	3	1
90	4		5	3
85	2		3	
80	7		4	4
75	3		1	8
70				6
65	2			3
Average No. Seconds 25 Bags	87.72	110.80	97.00	77.90

Table V

8 Oz. (236.6 Cubic Centimeters) Cup - Yellow Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea X-6005	X-6018
70			2	
65				
60		2	5	1
55	1	4	7	
50	1	8	6	2
45	3	4	4	8
40	7	5	1	10
35	9	2		4
30	4			
Average No. Seconds 25 Bags	39.76	49.08	56.00	44.50

Table VI

8 Oz. (236.6 Cubic Centimeters) Cup - Pink Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea	
			X-6005	X-6018
90		2	1	
85		2	3	
80		2	3	
75		6	2	1
70	1	8	8	1
65	3	4	6	1
60	8	1	2	3
55	2			13
50	5			5
45	4			1
40	2			
Average No. Seconds 25 Bags	56.32	75.60	74.2	58.20

Table VII

8 Oz. (236.6 Cubic Centimeters) Cup - Orange Color
(Number of Tea Bags)

Elapsed Time in Seconds	Tetley Tea Bag	Lipton Flo-Thru Bag	Perforated Film Bags with Tetley Tea X-6005	Perforated Film Bags with Tetley Tea X-6018
215		1		
210		1		
205				
200		2		
195				
190		1		
185		5	2	
180		1		1
175		2		
170		2		
165		3	1	
160	1	2	1	
155		1	1	
150	2	3	5	
145	1	1	4	
140	3		1	
135			5	2
130	1		2	2
125	2		1	5
120	6		2	1
115	2			4
110	5			5
105	1			3
100				2
95	1			
Average No. Seconds 25 Bags	125.72	177.16	147.20	121.20

From the foregoing, it is readily seen that the infusion rates of the perforated plastic film bags incorporating an antistatic agent with the resin are substantially greater than the infusion rates of the perforated plastic film bags made from film in which no antistatic agent was used. The former bags also have an infusion rate comparable to that of the regular commercial Tetley tea bags.

The blend of monoglycerides and diglycerides also provides a film surface which does not tend to block. This is important in the rapid production of large quantities of perforated thermoplastic film.

Corona discharge treatment of the perforated plastic film prior to bag fabrication further assures a "cling free" film. A treatment level of about 33 to 44 dynes provides maximum functionality.

It will be readily appreciated that the present infusion bags, although ideally suited to the food industry, are not necessarily limited in terms of uses thereto.

CLAIMS:

1. An infusion bag for particulate products constructed of a multilayer, preferably coextruded, perforated thermoplastic film having a heat resistant outer layer of film forming resin and an inner sealant layer of a somewhat less heat resistant film forming resin, said perforated film having a multiplicity of minute substantially uniform holes or openings sufficiently small to inhibit migration of the particulate product packaged and sufficiently large to permit the flow of liquids therethrough to achieve a desired infusion.

2. A bag as claimed in claim 1, wherein said inner layer has an effective amount of an antistatic agent.

3. A bag as claimed in claim 1, wherein the holes or openings are in the form of slots.

4. A bag as claimed in claim 1, wherein the holes or openings are round, oval, pentagonal or hexagonal.

5. A bag as claimed in any one of claims 1 to 4, wherein the resin of said outer layer is polyester, polyolefin, e.g. polypropylene, polycarbonate or nylon.

6. A bag as claimed in any one of claims 1 to 5, wherein the resin of the inner sealant layer is a polyolefin, e.g. polyethylene, or amorphous polyester.

7. A bag as claimed in any one of claims 1 to 6, wherein the film has from about 1800 to 4200 holes or openings per square inch (279 to 651 holes per square centimeter) therein.

8. A bag as claimed in claim 7, wherein the film has about 2900 holes or openings per square inch (449.5 holes per square centimeter).

9. A bag as claimed in any one of claims 1 to 8, wherein the openings or holes are tapered capillaries with the larger capillary opening being in the outer layer and the smaller capillary opening being in the inner layer.

10. A bag as claimed in any one of claims 1 to 9, wherein the openings or holes are about 2-10 mils (0.00508-0.0254 cm) across at their widest or in diameter, as appropriate.

11. A bag as claimed in any one of claims 1 to 10, wherein the openings or holes have been formed by vacuum perforation.

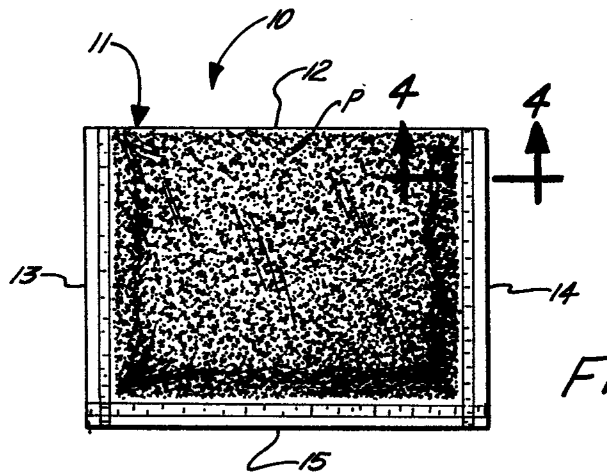

FIG. 1.

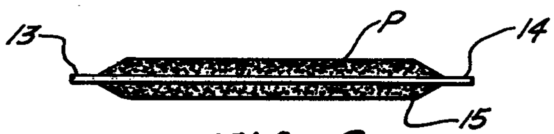

FIG. 2.

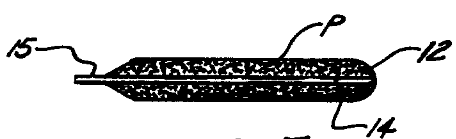

FIG. 3.

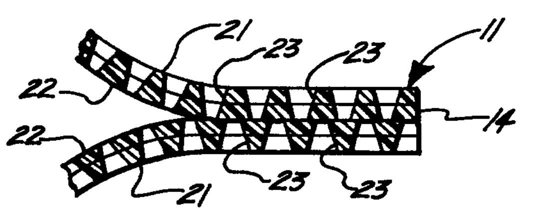

FIG. 4.

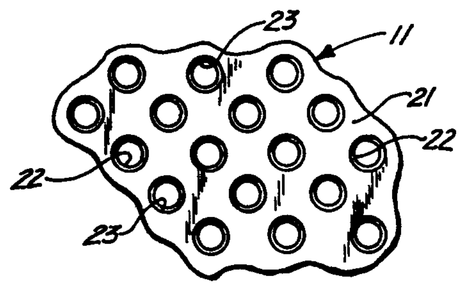

FIG. 5.

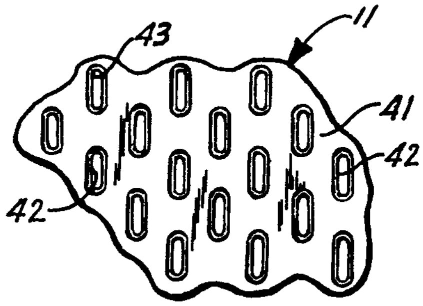

FIG. 6.

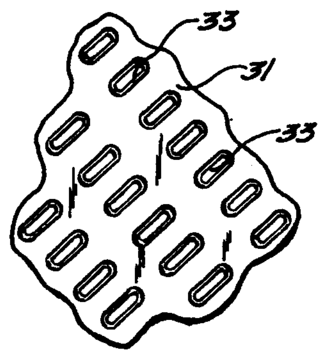

FIG. 7