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(72) Inventor: **Kallionpää, Marko Juha**  
**20900 Turku (FI)**

(74) Representative: **Laako, Tero Jussi**  
**Berggren Oy Ab**  
**P.O. Box 16**  
**00101 Helsinki (FI)**

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(71) Applicant: **Ursuk Oy**  
**20521 Turku (FI)**

(54) **Trouser-jacket combination dry suit**

(57) The invention relates to a trouser-jacket combination dry suit comprising a long-legged trouser part (2), from the upper part of which extend trouser suspender straps (4) reaching over the user's shoulders (K1), and a long-sleeved jacket part (3) which covers said trouser suspender straps and is tightly joined to said trouser part. The openings of sleeves (7) and trouser-legs (8) as well as head opening (9) are furnished with means of sealing (13). A skirt (5) of jacket part (3) extends freely hanging over trouser part (2). Said skirt (5) is joined in watertight manner to the trouser part by a pleat band (1; 1a or 1b) running from the skirt on the inside of the jacket part.

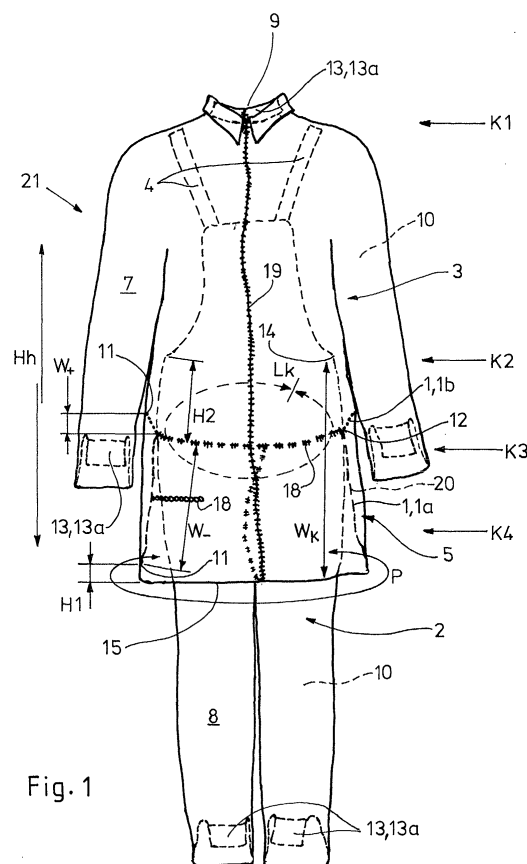


Fig. 1

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## Description

**[0001]** The invention relates to a trouser-jacket combination dry suit comprising a long-legged trouser part, from the upper part of which extend trouser suspender straps reaching over the user's shoulders, and a long-sleeved jacket part, which covers the trouser suspender straps and is tightly joined to the trouser part, in which said combination suit at least the parts of said trouser part and said jacket part which come into contact with the environment are made of a substantially non-stretching, flexible and waterproof cloth material and the sleeve openings and trouser-leg openings as well as the head opening are furnished with means of sealing.

**[0002]** Publication US-4 464 795 describes a one-piece diving suit, or so-called wet suit, made of stretching material, such as foam rubber, the length of which is adjusted to suit each user by taking up the excess length in a pleat at the waist or hips. In the first embodiment described by the publication the upper part of the suit is folded over the lower part and in the second embodiment the lower part is folded over the upper part and it is held in place by suspender straps which run on the outside of the suit. Such solutions are not suitable for a dry suit, such as a yachting suit, because the material used is unpleasant for this purpose, the suit does not keep the user dry and is not smart in appearance. Publication US-5 806 090 also describes a one-piece diving suit, which comprises a special stretching waist band between the upper part and the lower part which enables the suit to fit people of different heights. This solution has the same drawbacks that have already been stated above.

**[0003]** Publication US-4 535 477 describes a dry suit comprising a jacket and trousers furnished with suspender straps, which is intended especially for water sports, such as yachting and water skiing. When first the trousers have been put on and then the jacket, by pulling over the head like a pullover or anorak, the join between the jacket and the trousers is made watertight by rolling together the skirt of the jacket and a skirt surrounding the trousers into a tight roll at the waist. This dry suit appears in itself to be useable, but it forms an overall suit of unvarying length, the comfort in use and appearance of which are not of a very high standard. Additional clumsiness and discomfort are caused by the thick roll of cloth created at the waist, especially when it is necessary to use cloth that is wear-resistant and thus relatively thick and stiff. Further, the roll of cloth at the waist can collect water in its crevices.

**[0004]** An object of the invention is to achieve a trouser-jacket combination suit which would be presentably in appearance, easy to put on and take off and comfortable from the user's viewpoint even when worn for longer periods. This means *inter alia* that the suit should look like trousers and jacket separate from each other and at the same time form a watertight entity, which keeps out rainwater, spray or surrounding water if the user for

any reason should become immersed in water. The suit should thus keep its user dry even in difficult conditions. Further this means that no part of the suit, for example in the region of the user's buttocks, should hang loosely but instead the suit should be a so-called "good fit" regardless of the user's size. A second object of the invention is to achieve such a trouser-jacket combination suit that allows the user a wide variety of working possibilities. This means, for example, that the suit should be "yielding", i.e. should allow the user to move his/her hands, bend his/her body into different positions etc. without it being affected by the suit at least to any considerable extent. A third object of the invention is to achieve such a trouser-jacket combination suit that does not at least in any essential areas constrict the user's body and under which can be worn according to need various and varying quantities of other clothing, such as thermally insulating garments. A further object of the invention is to achieve such a trouser-jacket combination suit that can be manufactured from any combination cloth suitable for the purpose.

**[0005]** The problems described above and the objects defined above are solved by the trouser-jacket combination dry suit according to the invention, which is characterized by that which is defined in the characterization section of Claim 1.

**[0006]** Now surprisingly a solution has been invented to the many mutually conflicting requirements described above. The most essential advantage of the present invention is that the suit looks like stylish trousers and jacket. A second advantage of the suit according to the invention is that any impression of "baggy trousers" or otherwise being the wrong size is avoided, even though the same size of suit may be intended for people of very different sizes. A third advantage of the suit according to the invention is that the suit can be made completely watertight, so that it acts at least as a dry suit in boating and other water sports, but also as a life suit and equivalent. Nevertheless the suit according to the invention can be worn over other suitable garments without these getting wet while at the same time the suit is pleasantly loose and allows great freedom of movement. The only unavoidably tighter points are the sleeve openings, trouser-leg openings and neck opening, where there are elastic cuffs or similar to avoid the entry of water. A further advantage of the suit according to the invention is that in wear it feels like a normal outdoor-activity suit and hinders the activity concerned little if at all.

**[0007]** In the following the invention is described in greater detail with reference to the accompanying figures.

**[0008]** Fig. 1 represents a first and a second embodiment of a trouser-jacket combination dry suit according to the invention as seen from the front, with internal parts of the suit marked by broken lines or dotted lines.

**[0009]** Fig. 2 represents a third embodiment of a trouser-jacket combination dry suit according to the invention as seen from the front, with internal parts of the suit

marked by broken lines.

**[0010]** The invention relates to a trouser-jacket combination dry, i.e. keeping its user dry from external water, suit 21. Said combination suit comprises firstly a long-legged trouser part 2, from the upper part of which extend trouser suspender straps 4 reaching over the user's shoulders K1. Secondly said combination suit comprises a long-sleeved jacket part 3, which covers said trouser suspender straps and is tightly joined to said trouser part. Here by tightly joined is meant that jacket part 3 and trouser part 2 form in some way an substantially watertight entity, i.e. a suit for the user that is as watertight as possible. In said combination suit 21 at least the parts of said trouser part and said jacket part which come into contact with the environment are made of at least mainly of a substantially non-stretching, flexible and waterproof cloth material 10 and the openings of sleeves 7 and trouser-legs 8 as well as head opening 9 are furnished with means of sealing which are denoted by the general reference number 13. These sealing means 13 may be elastic cuffs 13a, watertight gloves 13b, watertight socks or boots 13c or watertight hood 13d. It is clear that in combination suit 21 these means of sealing may be used in different combinations, for example watertight socks 13c and watertight hood 13d may be used with watertight cuffs 13a at the openings of the sleeves, or some other combination as may be considered appropriate. The possible cuffs 13a are fixed at the openings of sleeves 7 and trouser legs 8 and similarly at head opening 9, but gloves 13b, socks or boots 13c or hood 13d are joined, when they are garments separate from the combination suit, in watertight fashion to combination suit 21 by some suitable method either known *per se* or new, so that it will not be described here in more detail. Watertight gloves 13b and/or socks or boots 13c and/or hood 13d may also be permanently fixed to combination suit 21 thus forming a united entity with the suit, in which case special joins to seal or be sealed in dressing are not needed.

**[0011]** According to the invention skirt 5 of jacket part 3 extends freely-hanging over trouser part 2 and skirt 5 of the jacket part is joined in watertight manner to the trouser part by a pleat band, which is denoted by the general reference number 1, running from said skirt inside the jacket part. Skirt 5 of the jacket part thus extends over the trouser part and, when the user is standing without contact with external objects, hangs down under the effect of its own weight. Pleat band 1, which runs inside the skirt, i.e. inside jacket part 3, typically in an upward direction, in this case pleat band 1a together with the freely hanging skirt 5 forms in this case form a V-shaped pleat, as is shown in Figures 1 and 2 by continuous and broken lines. A pleat of this form is created when one first edge 11 of pleat band 1, in this case of pleat band 1a, is attached in watertight manner either to the bottom edge 15 of skirt 5 of the jacket part or close thereto and the second edge 12 of said pleat band is attached in watertight manner to the trouser part at a

point which is higher than the above-mentioned attachment point of said first edge to skirt 5 of the jacket part or higher than skirt 5 of the jacket part. A A-shaped pleat, in a sense the inverse of that described above, is created when one first edge 11 of pleat band 1, in this case of pleat band 1b, is attached in watertight manner to skirt 5 of jacket part 3 at a relatively high point, for example in the region of waist K2 or in the neighbourhood thereof, and the second edge 12 of said pleat band is attached in watertight manner to the trouser part at a point which is lower than the above-mentioned attachment of first edge 11 to jacket part 3. This second form of pleat is represented by dotted lines in Figure 1. It should be remembered that also in the case of the second form of pleat the skirt of jacket part 3 extends over trouser part 2 and, when the user is standing without contact with external objects, said skirt hangs under the effect of its own weight, but the cloth may be unlined or single for that length of the skirt which extends downwards from the pleat band, e.g. for the area of lower edge 15. At the present time it is believed that employment of a V-shaped pleat as described first above is a more preferable embodiment. Skirt 5 can extend on the outside over trouser part 2 to a greater or lesser extent, i.e. the mutual overlap  $W_K$  of the jacket part and the trouser part between bottom edge 15 of the skirt and the upper periphery 14 of the trouser part is always greater than zero,  $W_K > 0$  and thus an overlap exists. A given combination suit has either a V-shaped pleat or a  $\Lambda$ -shaped pleat, as described above, and correspondingly a pleat band 1a or 1b.

**[0012]** The aforesaid pleat band 1 has in the direction transverse to the peripheral direction of the skirt a width  $W_+$  or  $W_-$  which is substantially greater than the dimensional variations caused by the user's movements in the length direction Hh of the suit, which corresponds to the user's height. Then the movements of the user such as bending take up at the back some of the cloth stored in the pleat formed between skirt 5 of the jacket part and pleat band 1, or more precisely pleat band 1a or 1b. Typically for pleat band 1 this width  $W_+$  or  $W_-$  is at least 10 cm, or preferably at least 20 cm. In the case of a V-shaped pleat described above and assumed to be more advantageous the width  $W_-$  extends downwards and in the other case of a  $\Lambda$ -shaped pleat the width  $W_+$  extends upwards. The first edge 11 of pleat band 1 is thus attached either at bottom edge 15 of skirt 5 of the jacket part or at a first distance H1 therefrom. Said first distance H1 may thus be zero, a few centimetres such as between 2 cm and 20 cm, or greater such as between 20 cm and 40 cm. Said first distance H1 then extends upwards in the length direction Hh of the suit. In principle the join between first edge 11 and skirt 5 almost to under the armpits K5, i.e. to the point where the underside of sleeves 7 separate from the rest of the jacket part. The second edge 12 of the pleat band is attached in watertight manner to the trouser part either at point 14 immediately below the trouser suspender straps or braces

and extending around the user, i.e. at the highest point at which the trouser part completely encircles the user, or at a second distance H2 therefrom. Said second distance H2 then extends downwards in the length direction Hh of the suit and may vary within the same wide range as first distance H1.

**[0013]** The peripheral length  $L_L$  of skirt 5 of the jacket part is substantially greater than the user's circumference  $L_K$  in the waist-hips region, which makes possible movement of skirt 5 and particularly its lower region near its bottom edge 15 as the user moves and changes position. The bottom edge 15 of the skirt of the jacket part extends a substantial distance H3 from the user's waist K2 towards the legs. This distance H3 can be taken as the height of the lower region of the skirt of jacket part 3 and it makes the jacket part look like a jacket. By the height of the lower region of the skirt or the distance H3 is described specifically only how far the bottom edge 15 of the skirt extends in the downwards direction, it is not intended to express anything about how and at what point the pleat band 1 is arranged. Preferably the bottom edge 15 of the skirt extends at least to the region of the user's hips K3 or to the region of the user's crotch K4 - i.e. to the region where the thighs join the trunk - but may also extend lower, as in Figure 1. In an extreme case the second edge 12 of pleat band 1, 1b may be attached at the highest point at which trouser part 2 completely encircles the user, i.e. at the point at which the second distance H2 = 0, and the first edge 11 of the pleat band even higher than this.

**[0014]** The aforesaid pleat band 1 may according to a first embodiment of the invention connect jacket part 3 and trouser part 2 permanently together into a single united suit entity. In this case first edge 11 and second edge 12 of pleat band 1 are both for example sewn or in other manner permanently fastened to jacket part 3, i.e. the cloth material 10 or 20 of the pleat band is united with the cloth material 10 of jacket part 3 and correspondingly trouser part 2 by some method either known *per se* or new, which will thus not be described here in more detail. A sewn or other seam is naturally made watertight if necessary by some method either known *per se* or new, such as by taping, gluing, hot seaming etc. When using the solution described the jacket part and trouser part cannot be separated from each other during use, but the combination suit 21 formed by them looks just as though the user has on separate trousers and jacket. The functionality of the combined suit in use is substantially better than the traditionally known overalls.

**[0015]** The aforesaid pleat band 1 may according to a second embodiment of the invention be fastened in the peripheral direction P of the skirt - the peripheral direction is mainly parallel to the peripheral length  $L_L$  of skirt 5 - either to jacket part 3 or to trouser part 2 by a watertight first zip fastener 18, such that its halves separate from each other when the zip fastener is opened. Alternatively said pleat band 1 includes in the peripheral direction P of the skirt a watertight first zip fastener 18,

such that its halves separate from each other when the zip fastener is opened, in which case the parts or sections of the pleat band on jacket part 3 and correspondingly on trouser part 2, the widths of which parts or sections together constitute the total width W of the pleat band, are fastened to each other by zip fastener 18. A zip fastener according to this latter alternative is shown in Figure 1 marked by a circle line from the left-hand edge for only part of its real length in the peripheral direction P. In this advantageous embodiment jacket part 3 and trouser part 2 can be joined together and separated from each other during use. Further, jacket part 3 and trouser part 2 can be used individually independent of each other. Nevertheless when jacket part 3 and trouser part 2 are used joined together by a watertight zip fastener 18 a completely watertight combination suit 21 is obtained, which then looks like a separate jacket and trousers but which in use has substantially better functionality than the traditionally known overalls.

**[0016]** The pleat band 1, = pleat bands 1a or 1b is made in the first embodiment of a substantially non-stretching, flexible and waterproof cloth material 10, i.e. of the same cloth material as jacket part 3 and/or trouser part 2. It is emphasized especially that although the same reference number 10 is used for the cloth material of the jacket part and the trouser part, they may besides being of the same material also quite well be of different materials. Either one or the other can be used in the pleat band. In the second embodiment the pleat band 1 = 1a or 1b is made of a different waterproof cloth material 20, such as a more flexible waterproof cloth material 20 than the trouser part or jacket part. The waterproof cloth materials dealt with here include for example of a micro-porous membrane located or laminated between suitable layers of cloth, such as is generally available commercially e.g. under the "GORE-TEX" registered trade mark of W.L. Gore & Associates Inc. and also under other trade marks, or of some other substantially non-stretching, flexible and waterproof cloth material or material combination known *per se* or new which is suitable for the use in question.

**[0017]** The jacket part 3 comprises additionally a second zip fastener 19, the length and position of which are adapted to allow putting on of at least the jacket part. In the case of Figure 1, in which jacket part 3 is completely separable from trouser part 2, the second watertight zip fastener 19 extends from head opening 9 at least to the bottom edge 15 of skirt 5 in the same way as is usual in jackets. This is sufficient in the situation in which the first watertight zip fastener 18 runs right along the first edge 11 of pleat band 1. The pleat band 1 then remains entirely fixed to trouser part 2 when the trouser part and jacket part 3 are separated from each other. In those cases in which the first watertight zip fastener 18 runs right along the second edge 12 of pleat band 1 or at some intermediate point in the width  $W_+$  or  $W_-$  of the pleat band, the second watertight zip fastener 19 should extend also into the pleat band for that part of the width

which extends from its first edge 11 to the position of the first watertight zip fastener 18, as shown in Figure 1 by discontinuous marking. Then the pleat band 1 remains, depending on the position of first zip fastener 18, in part or in its entirety fixed to jacket part 3 when trouser part 2 and the jacket part are separated from each other. If needed pleat band 1 and, depending on the situation, either the jacket part or the trouser part can be furnished for example with hook-and-loop tapes, press fasteners, a second zip fastener half or corresponding elements by which the pleat band can be fastened to the jacket part or trouser part when the jacket part and the trouser part are completely separated from each other. This prevents possibly disturbing flapping of the pleat band when trouser part 2 or jacket part 3 is used alone. In the embodiment described above it is possible to position the second zip fastener 19 to run differently, but the traditional manner described is believed to be the most practical. In the case of Figure 2, in which jacket part 3 and trouser part 2 are always permanently attached to each other, a second watertight zip fastener 19 may be positioned in many different ways and relatively freely. In this embodiment the essential point is that the second watertight zip fastener 19 is sufficiently long so that the user has enough room to get into combination suit 21 through the aperture created by said zip. It is preferred that second watertight zip fastener 19 is located in a position that can be reached by the user him/herself when wearing the suit according to the invention. In Figure 2 one possibility is shown in which the second zip fastener 19 runs diagonally from one shoulder downwards to the hip on the opposite side, although there are other location possibilities.

**[0018]** By the watertight first and second zip fasteners 18 and 19 described above is meant any watertight joint that can be opened and closed from end to end repeatedly, in which a part which is pulled along the joint presses the opposing sides of the joint into each other, whereon they also lock together, and pulled in the opposite direction separates them from each other. The materials of the zip fastener, the interlocking structure of the opposing sides and the elements that produce sealing between the opposing sides may be of any type whatsoever, known *per se* or new, so they will not be described in more detail. It is to be understood that in the figure only the principles of the combination suit according to the invention are represented and that in practice the dimensions and proportions may deviate from what is shown in the figure.

## Claims

1. A trouser-jacket combination dry suit comprising a long-legged trouser part (2), from the upper part of which extend trouser suspender straps (4) reaching over the user's shoulders (K1), and a long-sleeved jacket part (3) which covers said trouser suspender

straps and is tightly joined to said trouser part, in which combination suit at least those parts of said trouser part and said jacket part being in contact with the environment are made of a substantially non-stretching, flexible and waterproof cloth material (10) and the openings of sleeves (7) and trouser-legs (8) as well as head opening (9) are furnished with sealing means (13), **characterized in that** skirt (5) of jacket part (3) extends freely hanging over trouser part (2); and that skirt (5) is joined in watertight manner to the trouser part by a pleat band (1) running from the skirt inside the jacket part and being made of a non-stretching, flexible and waterproof cloth material (10 or 20).

2. A combination dry suit according to Claim 1, **characterized in that** one edge (11) of pleat band (1) is attached in watertight manner either to bottom edge (15) of skirt (5) of the jacket part or at a first distance (H1) therefrom, and the other edge (12) of said pleat band is attached in watertight manner to the trouser part either at a point (14) immediately below the trouser suspender straps and extending around the user, or at a second distance (H2) therefrom.
3. A combination dry suit according to Claim 1 or 2, **characterized in that** said pleat band (1) has in the direction transverse to the peripheral direction (P) of the skirt a width ( $W_+$  or  $W_-$ ) which is substantially greater than the dimensional variations caused by the user's movements in the length direction (Hh) of the suit; and that said width ( $W_+$  or  $W_-$ ) is at least 10 cm, or preferably at least 20 cm.
4. A combination dry suit according to any of the preceding Claims, **characterized in that** the peripheral length ( $L_L$ ) of skirt (5) is substantially greater than the user's circumference (LK) in the waist-hips region to allow movement of said skirt; and that bottom edge (15) of said skirt extends a substantial distance (H3) from the user's waist (K2) towards the legs, or preferably bottom edge (15) extends at least to the region of the user's hips (K3) or to the region of the user's crotch (K4).
5. A combination dry suit according to any of Claims 1 to 4, **characterized in that** said pleat band (1) connects jacket part (3) and trouser part (2) permanently together into a single united suit entity.
6. A combination dry suit according to any of Claims 1 to 4, **characterized in that** said pleat band (1) is fastened in the peripheral direction of the skirt either to jacket part (3) or to trouser part (2) by a watertight first zip fastener (18), such that its halves separate from each other when the zip fastener is opened, or alternatively said pleat band (1) includes in the peripheral direction of the skirt a watertight zip fastener

er (18), such that its halves separate from each other when the zip fastener is opened, and by which zip fastener the parts of the pleat band on jacket part (3) and correspondingly on trouser part (2) are fastened; whereupon the jacket part and the trouser part can be joined together and separated from each other. 5

7. A combination dry suit according to any of the preceding Claims, **characterized in that** said pleat band (1) is of the same waterproof cloth material (10) as trouser part (2) or jacket part (3); or said pleat band (1) is of more flexible waterproof cloth material than the trouser part or jacket part. 10 15

8. A combination dry suit according to any of the preceding Claims, **characterized in that** jacket part (3) additionally comprises a second watertight zip fastener (19), the length and position of which are adapted to allow putting on of at least the jacket part. 20 25

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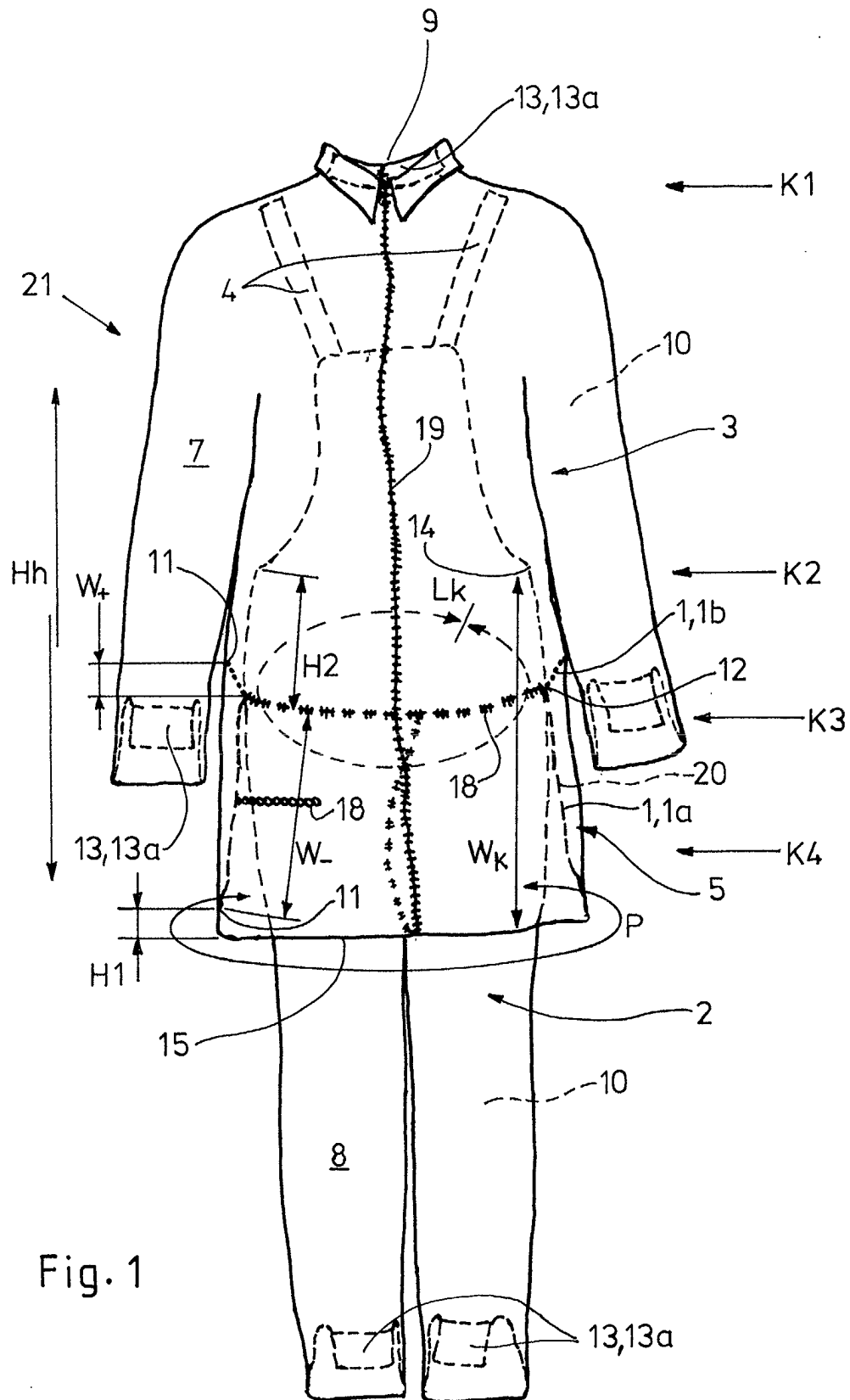


Fig. 1

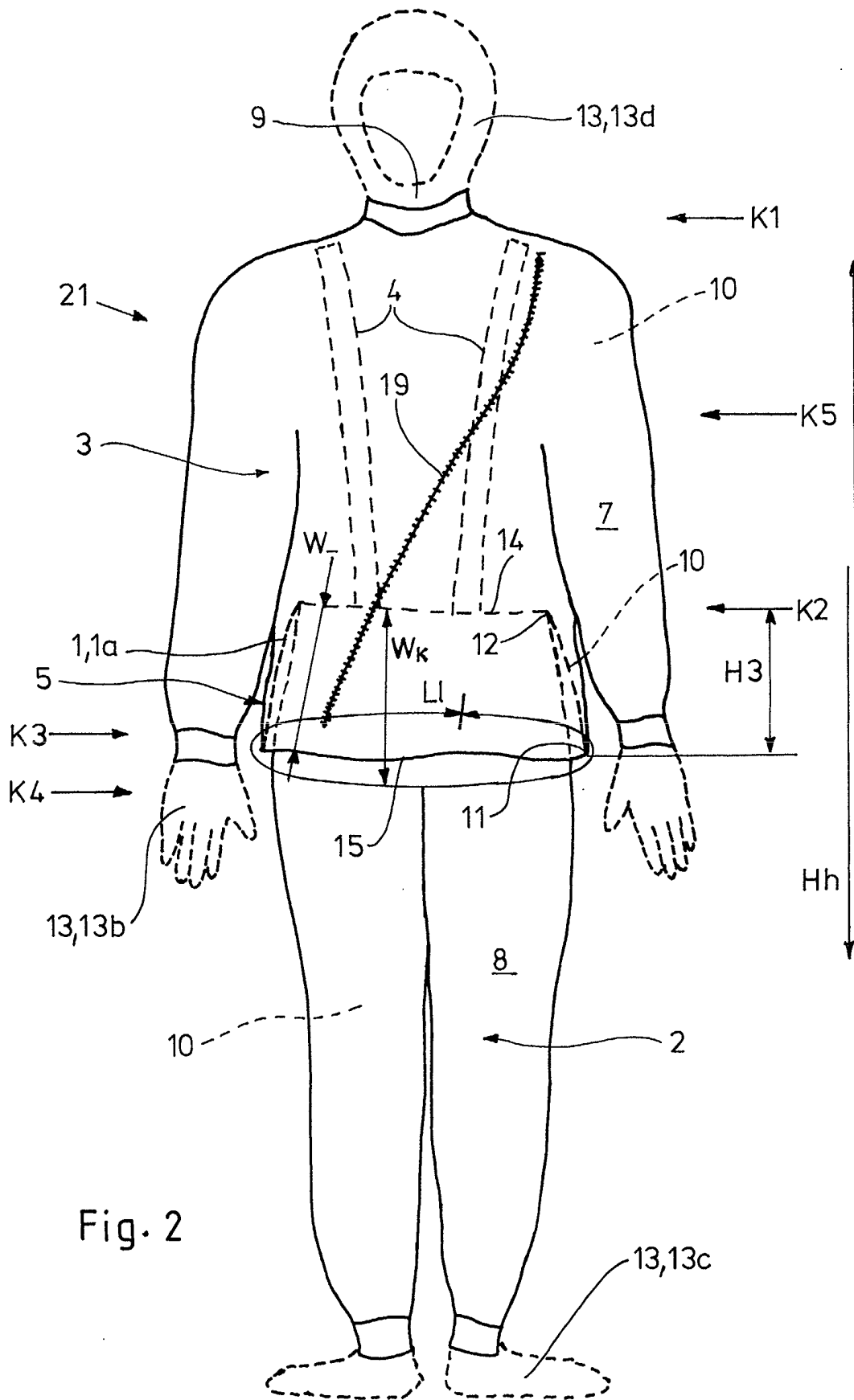


Fig. 2