Sept. 12, 1944. G. S. HIERS 2,358,227

SIMULTANEOUS FLOCKING

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FIG. I

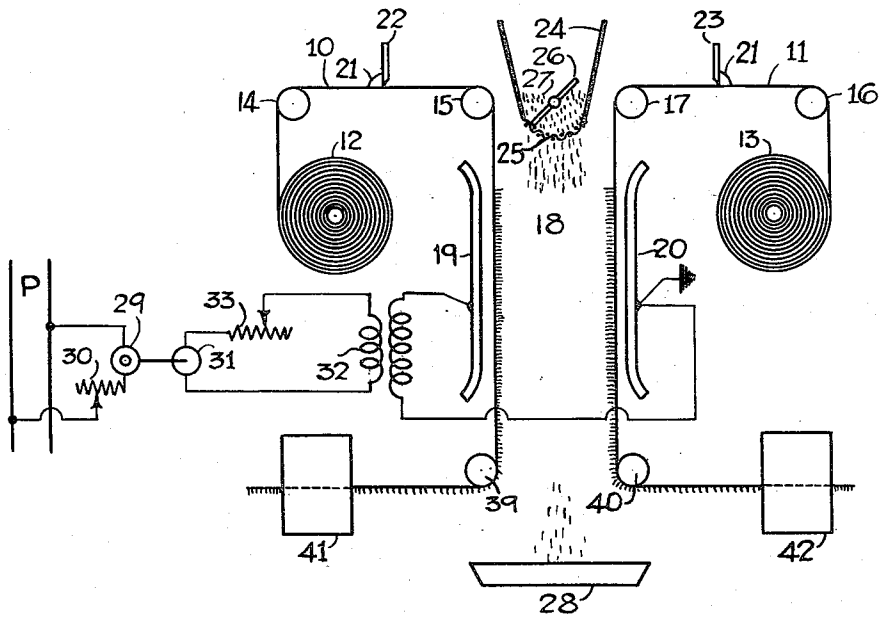
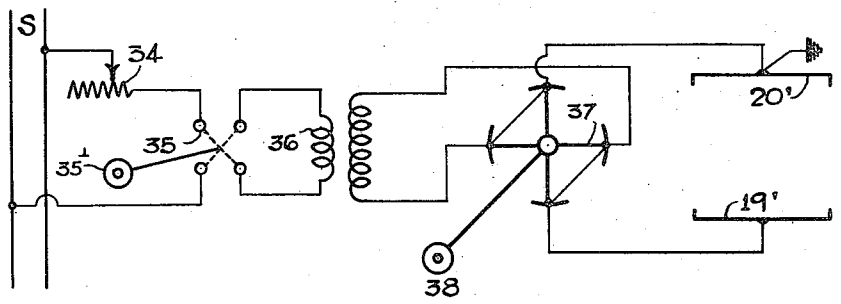


FIG. II



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FIG. III

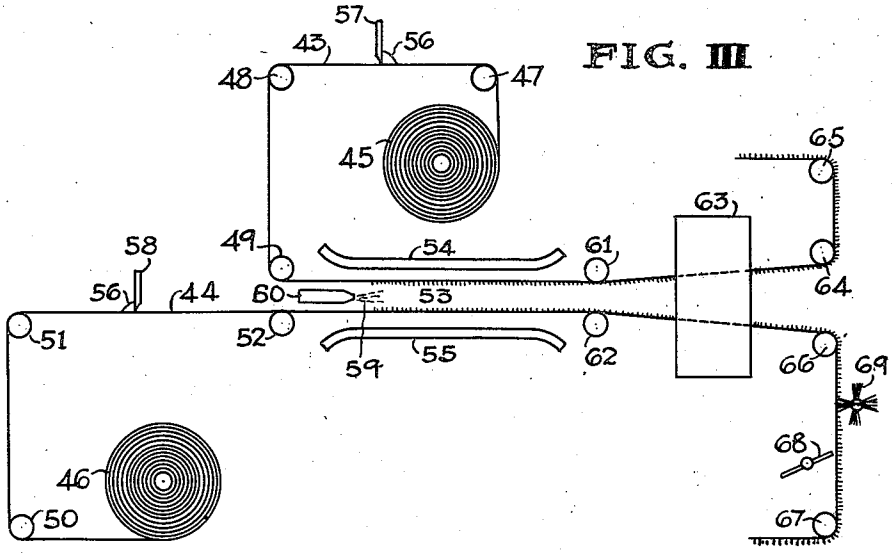
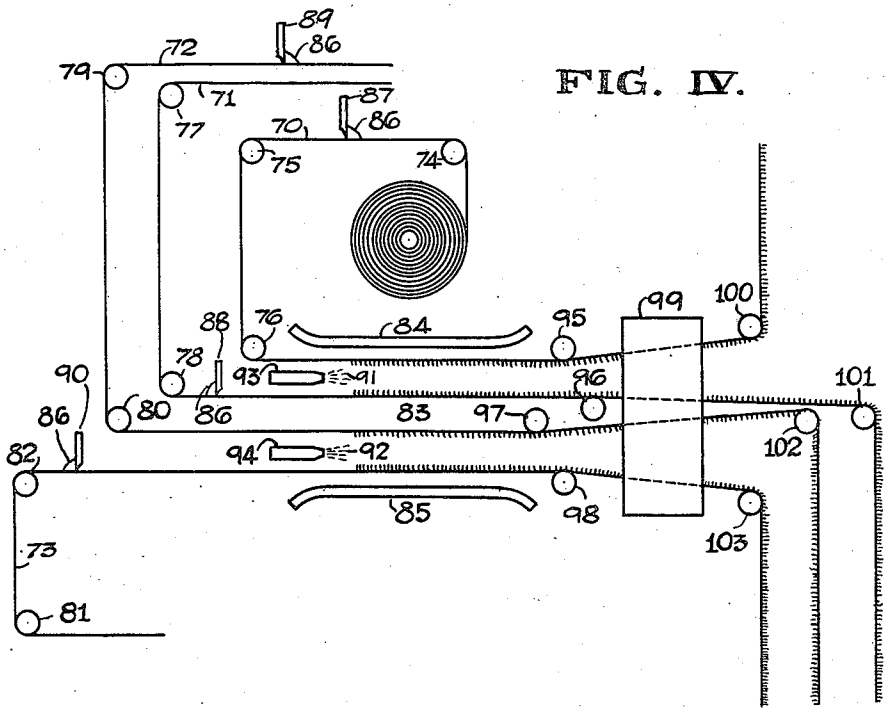


FIG. IV.



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UNITED STATES PATENT OFFICE

2,358,227

SIMULTANEOUS FLOCKING

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Application March 15, 1941, Serial No. 383,614

17 Claims. (Cl. 117—17)

This invention relates to an apparatus for and method of producing flocked textile fabrics by electrostatic methods.

According to my invention, two or more base fabrics may be simultaneously flocked between opposing electrodes of an electrostatic field producing apparatus with the result that production is speeded up and economies are effected in the cost of manufacture.

The electrostatic field may be created between the opposing electrodes by the impression of a high potential thereupon, and may be of either pulsating, alternating or direct current of alternating polarity.

The fibers used may be either of pile forming or of shorter lengths and may be fibers of poor electrostatic susceptibility, such as wool, mohair, cellulose acetate, casein wool, nylon and silk, or of naturally good electrostatic susceptibility, such as cotton and viscose. Fibers of poor susceptibility may, if desired, be treated as described in my copending application Serial No. 366,713 to improve their electrostatic response characteristic, but such treatment is not essential to the broadest concept of the present invention.

The base fabrics, prior to being positioned or passed between the electrodes, are coated with an adhesive coating which may be of solvent rubber cement or of resin, latex, pyroxylin, or other composition. The adhesive may be applied as by a spreading doctor blade, pressure rolls or other convenient means.

The opposing electrodes may be of any suitable shape and may be positioned horizontally or vertically or otherwise. If positioned horizontally, the flock fibers may be injected into the field between the fabrics as by a spray gun of conventional type, whereas in the case of vertically positioned electrodes the flock fibers may be sifted and dropped into the field between the fabrics as from a hopper.

As hereinafter described, I have discovered that flock fibers may be introduced between the adhesively coated surfaces of two or more base fabrics positioned facing each other in a high potential electrostatic field to accomplish simultaneous flocking of the coated fabrics without any adhesive discernible appearing on the tips of the deposited fibers, despite the fact that the fibers appear to move back and forth within the field between the coated surfaces before finally adhering to one of them.

It is an object of this invention to provide apparatus for and a method of simultaneously flocking a plurality of base fabrics in a high potential electrostatic field.

It is another object of this invention to simultaneously flock a plurality of base fabrics in a high potential electrostatic field of regularly alternating polarity.

Another object is to simultaneously flock a plurality of base fabrics in a pulsating high potential electrostatic field of regularly alternating polarity.

Another object is to provide apparatus for and a method of simultaneously flocking with pile forming fibers a plurality of base fabrics in a high potential electrostatic field.

Another object is to simultaneously project untreated flock fibers of poor electrostatic susceptibility upon a plurality of adhesively coated base fabrics positioned between opposing electrodes.

An additional object is to simultaneously project flock fibers of good electrostatic susceptibility upon a plurality of adhesively coated base fabrics positioned between opposing electrodes.

These and other objects of invention will be manifest from the specification and claims and from the following description of the preferred embodiment illustrated in the drawings, wherein:

Figure I is a diagrammatic side elevational view of apparatus for simultaneously flocking two base fabrics in an electrostatic field established between a pair of vertically positioned opposing electrodes, and includes a schematic drawing of an electric circuit suitable for furnishing alternating current energy to the electrodes.

In Figure II is shown a schematic drawing of an electric circuit suitable for furnishing pulsating energy of alternating polarity to the electrodes.

Figure III is a diagrammatic side elevational view of apparatus embodying my invention in which a pair of fabrics is passed laterally through an electrostatic field established between horizontally positioned electrodes.

Figure IV is a diagrammatic side elevational view showing four base fabrics passing laterally through an electrostatic field established between horizontally positioned electrodes.

Referring to the drawings, in Figure I there is illustrated a pair of base fabrics 10 and 11 of cotton or other suitable material fed from supply rolls 12 and 13 and passed over guide rolls 14, 15, 16 and 17 to an electrostatic field 18 established between opposing electrodes 19 and 20. Prior to entering the field, an adhesive 21, which may be of solvent rubber cement or a resin, latex, pyroxylin or other composition, is

applied to the side of each base fabric 10 and 11 which faces the other at spaced separation within the field. The adhesive may be applied by conventional means, as by spreading or doctor blades 22 and 23.

The flock may be introduced into the field by any conventional means, as by hopper 24 positioned above the field and having screen bottom 25 of suitable mesh and rotating blade 26 for sifting the flock 27 and causing it to drop from the hopper into the field between the coated surfaces of the base fabrics, and receptacle 28 may be placed beneath the field for collecting the undeposited flock.

Electrical energy for the establishment of a high potential electrostatic field of alternating polarity and controlled frequency may be furnished by apparatus and circuit of the type shown schematically in Figure I, wherein a low voltage direct current motor 29, driven from any convenient source of low voltage direct current power P and whose speed is controlled by rheostat 30, is mechanically coupled to and drives a low voltage alternating current generator 31. The frequency of the low voltage alternating current produced by generator 31 is a function of the number of poles of the generator and the speed to which it is driven by motor 29, and the frequency desired for the electrostatic field is accordingly available through control of the speed of rotation. To convert the low voltage output of the generator to high voltage, the machine may be connected to the low side of a step-up transformer 32 through a suitable voltage control rheostat 33. The high side of the transformer may be connected to the electrodes 19 and 20, which may be of aluminum or other suitable material. One of the electrodes is preferably grounded. I have found voltages of from 30 to 100 kv. and frequencies of from 2 to 20 cycles per second to be especially suitable for the electrostatic field. Lower voltages may in some instances be used, depending upon the spacing of the electrodes and the particular flock, it being understood, of course, that the voltage must be sufficiently high to effect a translational movement of the flock particles.

In Figure II there is schematically shown apparatus and circuit for furnishing energy for the establishment of a pulsating high potential field of alternating polarity. In this circuit a low voltage alternating current line supply S is connected through voltage control rheostat 34 and reversing switch 35 to step-up transformer 36 and thence to mechanical rectifier 37, which may be driven by synchronous motor 38 at a speed in synchronism with the line current. When the reversing switch is not operated, the output of the mechanical rectifier 37 is a pulsating high voltage current which may be connected directly to the electrodes 19' and 20', one of which is preferably grounded. Voltages of the order of from 30 to 100 kv. are preferred.

By reversing the switch 35 at regular or irregular intervals, the mechanical rectifier 37 is caused to deliver a pulsating high voltage of correspondingly regular or irregular alternating polarity. I prefer to drive the reversing switch in timed relation with the alternations of the line supply, as for example through synchronous motor 35' and suitable reduction gearing, whereby the switching occurs only when the line voltage is passing through zero. For example, where a 60 cycle line frequency is to be converted into a 5 cycle electrostatic field frequency, the switch is thrown twelve times per second in timed relation with the line alternations.

Other known and conventional means of providing energy for establishing alternating, direct current of alternating polarity, or pulsating high potential fields may, of course, be used.

After passing through the field, the flocked fabrics 10 and 11 (Figure I) may be passed over guide rolls 39 and 40 to drying chambers 41 and 42, where the adhesive is set.

In Figure III there is illustrated a pair of base fabrics 43 and 44 fed from supply rolls 45 and 46 and passed over guide rolls 47, 48, 49, 50, 51 and 52 to the electrostatic field 53, established between horizontally positioned electrodes 54 and 55. An adhesive 56 is applied to each fabric by conventional means, as by doctor blades 57 and 58, before the fabrics are passed into the field with their coated surfaces facing each other at spaced separation. The flock 59 may be injected into the field between the coated surfaces, as by spray gun 60 of known type. Upon leaving the field, the flocked fabrics 43 and 44 may be passed over the guide rolls 61 and 62 to drying chamber 63 and thence over guide rolls 64, 65, 66 and 67 to the roll up of the finished fabric. The flocked fabrics may be beaten or brushed as at 68 or 69 to remove any excess flock.

In Figure IV there are illustrated four base fabrics 70, 71, 72 and 73, passing over guide rolls 74, 75, 76, 77, 78, 79, 80, 81 and 82 to electrostatic field 83 established between horizontal electrodes 84 and 85 and coated with adhesive 86 by conventional doctor blades 87, 88, 89 and 90. Flock fibers 91 and 92 may be injected into the field between the coated fabrics by spray guns 93 and 94 of known type. Upon leaving the field the flocked fabrics may be passed over guide rolls 95, 96, 97 and 98 to drying chamber 99 and thence over guide rolls 100, 101, 102, and 103 to the roll up of the finished fabric. Prior to the roll up, any excess flock may be removed as by beating, brushing, suction or other convenient means. The arrangement shown in Figure IV is merely illustrative of one manner of flocking more than two base fabrics simultaneously. Other arrangements may, of course, be used, including other conventional means of applying the adhesive and of injecting the flock fibers into the field.

When the flock fibers are introduced into the high potential electrostatic field between the adhesively coated surfaces of the spaced apart base fabrics positioned therein, simultaneous flocking of the fabrics occurs. Excellent results are obtained in an electrostatic field of regularly alternating polarity of from 2 to 20 cycles per second using either untreated fibers of poor electrostatic susceptibility, such a wool, mohair or cellulose acetate, or fibers of good electrostatic susceptibility. Excellent results are also obtained with either type of fiber in a pulsating field of regularly alternating polarity the preferred frequency of which is on the same order, namely, from 2 to 20 cycles per second. Good results are also obtained in a direct current field of alternating polarity with fibers of good electrostatic susceptibility, either naturally or by treatment.

No effort will be made herein to present a theoretical explanation of the phenomena which occur when the flock fibers are introduced into the high potential electrostatic field between the coated surfaces. In the alternating field, fibers appear to rain back and forth between the fabrics in synchronism with the alterations of polarity,

but for some reason or reasons when the flocked fabric is examined the exposed tips of the embedded fibers are seen to be free of adhesive. It is believed that the fibers which move back and forth are comprised of those which are repelled by the reversal of polarity before making contact with the adhesive and of those which are prevented from lodging in the adhesive by other fibers already deposited therein. That is to say, it is believed that fibers which reach the adhesive are lodged therein and are not thereafter removed by the ensuing action of the electrostatic forces of the field.

In the case of the pulsating field, good results are obtained, as hereinbefore indicated, provided the fibers are of good electrostatic susceptibility. In such a field, fibers also appear to rain back and forth between the coated fabrics, and examination of the face of the flocked fabrics reveals no adhesive upon the tips of the fibers. It is believed that the fibers which move back and forth in the unidirectional field are those whose lodgment in the adhesive is prevented by previously deposited fibers, and that these fibers become charged with the same polarity as the fabric and are consequently repelled therefrom.

Whatever the explanation, I have found that simultaneous flocking of spaced apart adhesively coated surfaces may be accomplished with entirely satisfactory results.

Having described my invention but wishing to be limited only by the claims, I claim:

1. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a pulsating high alternating potential electrostatic field between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the opposing electrodes with the coated sides of each pair of base fabrics facing each other and introducing flock fibers into the field, whereby the base fabrics are simultaneously flocked.

2. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a pulsating high alternating potential electrostatic field between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the opposing electrodes and introducing flock fibers into the field adjacent the coated surfaces, whereby the base fabrics are simultaneously flocked.

3. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a pulsating high alternating potential electrostatic field between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes with the coated surface of each fabric facing the coated surface of another at spaced separation and introducing flock fibers into the field between the coated surfaces, whereby the base fabrics are simultaneously flocked.

4. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a high potential electrostatic field of alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes with their coated sides facing and introducing flock fibers into the field adjacent the coated surfaces, whereby the plurality of base fabrics is simultaneously flocked.

5. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a high potential electrostatic field of regularly alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another at spaced separation and introducing flock fibers into the field between the coated surfaces, whereby the base fabrics are simultaneously flocked.

6. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a pulsating high potential electrostatic field of regularly alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another at spaced separation and introducing flock fibers into the field between the coated surfaces, whereby the base fabrics are simultaneously flocked.

7. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesive coated base fabrics with flocked fibers of poor electrostatic susceptibility, including the steps of establishing a high potential electrostatic field of regularly alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another fabric at spaced separation and introducing flock fibers of poor electrostatic susceptibility into the field between the coated surfaces, whereby the base fabrics are simultaneously flocked.

8. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics with flock fibers of poor electrostatic susceptibility, including the steps of establishing a pulsating high potential electrostatic field of regularly alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another fabric at spaced separation and introducing flock fibers of poor electrostatic susceptibility into the field between the coated surfaces, whereby the base fabrics are simultaneously flocked.

9. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics with flock fibers of good electrostatic susceptibility, including the steps of establishing a high potential electrostatic field of regularly alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another at spaced separation and introducing flock fibers of good electrostatic susceptibility into the field between the coated surfaces, whereby the plurality of base fabrics is simultaneously flocked.

10. In the manufacture of flocked textile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics with flock fibers of good electrostatic susceptibility, includ-

ing the steps of establishing a pulsating high potential electrostatic field of alternating polarity between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the electrodes so that the coated surface of each fabric faces the coated surface of another at spaced separation and introducing flock fibers of good electrostatic susceptibility into the field between the coated surfaces, whereby the plurality of base fabrics is simultaneously flocked.

11. In the manufacture of flocked textile fabrics, the method of continuously simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a high potential electrostatic field of alternating polarity between opposing electrodes, continuously passing a plurality of adhesively coated base fabrics simultaneously through the electrostatic field and introducing flock fibers into the field adjacent the coated surfaces, whereby the base fabrics are simultaneously flocked.

12. In the manufacture of flocked textile fabrics, the method of continuously simultaneously flocking a plurality of adhesively coated fabrics, including the steps of establishing a high potential electrostatic field of regularly alternating polarity between opposing electrodes, passing a plurality of adhesively coated base fabrics simultaneously through the electrostatic field with the coated surface of each fabric facing the coated surface of another at spaced separation and introducing flock fibers into the field adjacent the coated surfaces, whereby the base fabrics are simultaneously flocked.

13. In the manufacture of flocked pile fabrics, the method of simultaneously flocking a plurality of adhesively coated base fabrics, including the steps of establishing a high alternating potential electrostatic field between opposing electrodes, positioning a plurality of adhesively coated base fabrics between the opposing electrodes with the coated sides of each pair of base fabrics facing each other and introducing pile forming flock fibers into the field and between the fabrics, whereby the base fabrics are simultaneously flocked.

14. An apparatus for the simultaneous flocking of a plurality of base fabrics, including opposing electrodes, means for establishing a pulsating high alternating potential electrostatic field between the opposing electrodes, means for applying an adhesive coating to each of a plurality of base fabrics, spaced apart means for positioning the plurality of adhesively coated base fabrics between the electrodes and means for introducing flock fibers into the field between the coated surfaces to flock them.

15. An apparatus for the simultaneous flocking of a plurality of base fabrics, including opposing electrodes, means for establishing a pulsating high alternating potential electrostatic field between the opposite electrodes, means for applying an adhesive coating to one side of each of a plurality of base fabrics, spaced apart means for positioning the plurality of adhesively coated base fabrics between the electrodes with the coated surface of each fabric facing the coated surface of another at spaced separation and means for introducing flock fibers into the field between the coated surfaces to flock them.

16. An apparatus for the simultaneous flocking of a plurality of base fabrics, including opposing electrodes, means for establishing a high potential electrostatic field of alternating polarity between the opposing electrodes, means for applying an adhesive coating to each of a plurality of base fabrics, spaced apart means for positioning the plurality of coated base fabrics between the electrodes and means for introducing flock fibers into the field between the coated surfaces to flock them.

17. An apparatus for the continuous simultaneous flocking of a plurality of base fabrics, including opposing electrodes, means for establishing a high potential electrostatic field of alternating polarity between the opposing electrodes, means for applying an adhesive coating to each of a plurality of base fabrics, spaced apart means for continuously moving the coated base fabrics between the electrodes with coated surfaces opposed, means for introducing flock fibers into the field between the coated surfaces to flock them and means for drying and setting the adhesive.

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