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(54) Security hot-sealing apparatus consisting of a non-homogeneous adhesive tape and a hot stamping device, and relative hot-sealing method

(57) An apparatus for hot sealing parcels or packages comprising a tape of adhesive thermoplastic material (3) and a device for affixing a thermoseal to the tape wherein said tape has intentional non-homogeneous areas formed in combination with the thermolabile characteristics of the tape (3) and with the temperature of said thermoseal in order to impair the integrity and the continuity of the tape only in the area where the mark (2) is stamped, and in order to promote the onset of preferential fracture lines in said area and to cause the tape to penetrate into the underlying substrate on which the seal is applied. The invention also provides a method of hot applying a seal by said apparatus.

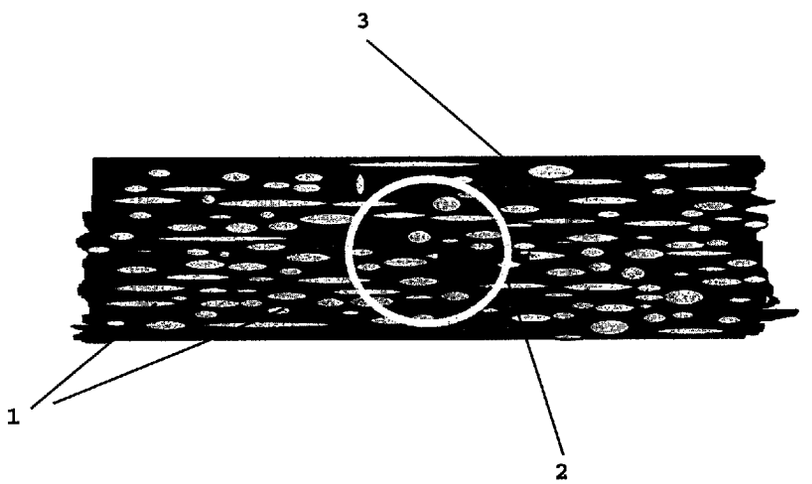

FIG.1

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Description

The present invention relates to the field of the systems for security sealing parcels and packages.

Security seals are means whereby a parcel or package cannot be opened and closed again, once sealed, without leaving a visible trace of the tampering. For this purpose, while stamps of sealing wax or lead overlying the closure line of the parcel were used in the past, adhesive tapes with overlaid embossing or indelible-ink stamps are mostly used today and applied above all by the most common, quick and easy methods.

In case of sealing wax stamp or other stamps of the disposable type, the method is of applying a seal with a stamp which becomes extremely fragile and is not removable from the sealed parcel without destroying the same. Such a result is the most desirable, however, the above old methods have the problem of the slow application which is not compatible any longer with the presently requested operation times. Reference has to be made, by way of example, to the duty performed by a Post Office.

Accordingly, the already described tape seals find large application as they are very functional, however, less secure since it is possible to tear the tape and then to close it without leaving a visible trace.

Another sealing type is a thermolabile tape in which a mark is hot impressed so as to stamp on the surface of the parcel the portion of the tape corresponding to the shown writing or image.

With reference to such a type of seals, the Italian Utility Model No. 218137 discloses a hot sealing device for parcels or packages including a metal seal which is heated to a constant predetermined temperature so as to hot impress the desired mark on an adhesive tape which is applied on the surface to be sealed at a suitable temperature of the stamp. By such a solution the mark is clearly visible from the outside, and the tape cannot be torn without leaving a trace. Furthermore, a number of seals may be applied with high speed and easiness.

However, also such a solution has not proved to be satisfactory as far as the security of the applied seal is concerned. Actually, by suitable measures, for example by cooling the surface of the tape by means of Freon in order to make the adhesive ineffective, it is possible, even if not easy, to remove as a whole the tape along with the mark impressed thereon, then to open the parcel and to apply the tape again without leaving any visible trace of the tampering. A further drawback is that such a thermosealing device is connected to the heating element by electric wires and then the use thereof is limited.

The present invention seeks to overcome the problems of the known thermosealing device described above and allows a quick, easy and secure sealing operation against the most sophisticated methods of removing the tape with the seal.

Such a result is achieved by the present invention by combining the temperature of the thermoseal with suitable thermolabile and not homogeneous characteristics of the used tape structure so that the chemical-physical state of the tape is changed by the stamp only at the area of the mark, and the integrity and the continuity of the tape is impaired so as to cause the tape to enter the underlying support and to prevent the seal from being completely removed even by resorting to cooling methods by Freon.

According to a further feature of the invention, a silicone paper substrate to be removed upon using the tape is applied during the manufacture in order to increase the fragility of the tape. The presence of a paper substrate allows the tape to be preliminarily tagged with a succession of labels of suitable size for sealing a cover.

The numbering of such labels will greatly increase the security as a progressive and/or series numbering indicates the right number designating a given cover which cannot be reproduced.

A convenient amount of air bells is distributed into the tape used for applying the thermoseal according to the invention. The volume per cent ratio to the material of the tape is determined in combination with the temperature of the applied thermoseal at which the evaporation of the air bells from the film, the hardening of the tape, and the penetration of the adhesive into the treated surface occur. Thus, the evaporation of the air bells causes the onset of preferential breakage lines in the area of the mark which are not formed again by the melting of the material due to the hardening of the thermoplastic material and prevent the seal from being completely removed unless by mechanical scraping.

Furthermore, according to the invention a metal plate thermoseal provided with a self-control device to keep the temperature at a constant level is used. Such a thermoseal is connected to the power supply by a non-wired connector so that it may be used without electric cables.

A first advantage is that the evaporation of the air bells along with the penetration into the thermoplastic substrate make the tampering method by cooling the seal, for example by Freon, ineffective as the sealed portion of the mark is integral with the surface of the substrate.

A second advantage is that the mechanical scraping necessary to completely remove the seal leaves a visible trace on the surface of the parcel with which it is than impossible to fraudulently tamper.

A third advantage is given by that the mark on the tape is very well visible.

A last advantage is given by the easiness and the rapidity of use of such a sealing apparatus which does not need any electrical connecting cables between the stamp and the power supply.

These and other advantages will be more readily apparent to anyone skilled in the art from the following description with reference to the accompanying not limiting drawings, in which:

Fig. 1 shows a view of an adhesive tape according to the invention on which a generic circular mark is hot impressed;

Fig. 2 shows a plug-in connection between a thermoseal provided with temperature self-control device and a bearing support for the power supply of the thermoseal;

Fig. 3 shows a diagram of the temperature vs. the characteristic resistance of the self-control device which the thermoseal of Fig. 2 is provided with;

Fig. 4 shows an adhesive tape provided with preliminarily tagged paper substrate according to the invention.

According to the invention the apparatus includes a tape consisting of a semitransparent film 3 of thermoplastic material carrying on one face a layer of adhesive material, preferably provided with a coloured pigment.
During the manufacturing of the tape, air bells 1 are blown into film 3 and remain captured in the thickness of the tape so as to cause a non-homogeneity.
The hot sealing apparatus of the invention also includes a thermoseal 5 carrying at the lower side a metal plate 4 for affixing the mark. Thermoseal 5 is provided with devices for controlling the temperature of plate 4 which ensure the desired temperature to be reached and kept by heating and control operations.
According to a particularly advantageous embodiment such a self-control device is a positive temperature coefficient device known per se the operation of which is controlled by the temperature/resistance diagram shown in Fig. 3 so as to keep the threshold temperature T1 of plate 4.
According to Fig. 2 such positive temperature coefficient device is embodied in the thermoseal 5 and is provided with a connector 6 for the connection to a corresponding socket 6' on the support 10. Support 10 is in turn provided with a 24/48 V power supply 7 and light emitting diodes (LED) 8 and 9 which indicate on/off operation and the achievement of the threshold temperature, respectively.
During the initial heating, thermoseal 5 is placed on support 10 connected to power supply 7, and connector 6 is plugged in socket 6' so that LEDs 8 and 9 are both lighting, thus indicating the connection to the power supply and a temperature which is still too low for sealing purposes, respectively.
As shown in Fig. 3, the positive temperature coefficient device has initially a very low resistance so that a very high current is flowing and then the desired temperature T1 of plate 4 is reached within short. Once temperature T1 is reached, the resistance of the positive temperature coefficient device increases only to supply the balance power to compensate the heat loss in the metal plate 4.
Afterwards, the power supplied by the positive temperature coefficient device is self-controlled by keeping the desired temperature T1 unchanged, thus causing LED 9 to switch off. Thermoseal 5 may then be removed from support 10 and the hot stamping may be carried out at the desired temperature.
According to the invention, temperature T1 of metal plate 4 is related to the thermolabile characteristics of tape 3 and the volume per cent amount of the blown air bells 1.
More particularly, regarding the thermolabile characteristic of tape 3, the temperature of the sealing plate 4 should be high enough to cause air bells 1 to evaporate and low enough not to cause the tape adjacent the air bells to excessively melt, with the result of re-establish the continuity of the material around the mark.
Accordingly, when plate 4 is superimposed to tape 3 applied on the surface to be sealed, the established temperature T1 is such that the chemical-physical characteristics of tape 3 change and the air bells 1 evaporate from the tape causing preferential fracture lines to be formed. The tape hardens without re-establishing, however, the continuity of the tape at the fracture lines. At the same time, the adhesive enters the surface of the parcel to be sealed so as to form the image of mark 2 which is shown, by way of example, in Fig. 1 in the form of a circular ring 2.
Advantageously, once finished the stamping, the onset of preferential fracture lines breaks the continuity of the tape and prevents the tape from being removed unless by mechanical scraping.
In the described embodiment, the characteristics of the material, the per cent amount of blown air, and the temperature of the sealing plate are combined as follows:

- tape 3 is made of polystyrene resins, PVC or polyolefins;
- the per cent amount of blown air is about 40% vol. of the raw material used for the tape; and
- the temperature of the plate is about 200°C.

Advantageously, in case of a seal tampering attempt by cooling for example with Freon, the presence of the preferential fracture lines at the mark on the tape and the penetration of the tape into the surface of the sealed parcel prevent the tape from being completely removed as the adherence to the surface at that area prevails over the binding forces of the tape which have been expressly weakened.
Thus, the seal may only be removed by mechanically scraping the surface with the result of make the tampering evident.
In Fig. 4 there is shown an alternative embodiment in which the adhesive tape 3 is provided with a paper substrate 12 to be removed in use. As described above, the presence of such substrate 12 allows the adhesive tape to be preliminarily tagged with a succession of coupons, labels, etc., provided with a progressive and/or series numbering.

The present invention also relates to a method of

sealing parcel and packages by a thermolabile adhesive tape and a metal plate seal heated at a predetermined temperature.

The method, besides the steps of spreading the tape on the surface to be sealed and affixing a thermoseal to the tape, includes a preliminary step of intentionally forming non-homogeneous areas on the tape, and a step of establishing a temperature of the thermoseal in combination with the thermolabile characteristics of such tape, in order to cause the onset of preferential fracture lines from said non-homogeneous areas near the mark which are operating in case of a tape tampering attempt.

According to a preferred embodiment of the invention said step of forming non-homogeneous areas on the tape is carried out by blowing into the tape an amount of air bells of about 40% vol. of the raw material used for manufacturing the tape which is preferably formed of polystyrene resins, PVC or polyolefins, while said step of hot impressing is carried out at a temperature of the metal plate seal of about 200°C.

The present invention is described with reference to a preferred embodiment thereof but it is self-evident that modifications may be made by those skilled in the art without departing from the scope of the present industrial invention.

Claims

1. An apparatus for hot sealing parcels or packages comprising a tape of adhesive thermoplastic material (3) and a device for affixing a thermoseal to the tape by means of a preheated metal plate seal (4) which carries a raised mark (2) to be stamped on the surface of the parcel, characterized in that said tape has intentional non-homogeneous areas formed in combination with the thermolabile characteristics of said thermoplastic material of the tape (3) and with the temperature of said metal plate seal in order to impair the integrity and the continuity of the tape after affixing the thermoseal and only in the area where the mark (2) is stamped, and in order to promote the onset of preferential fracture lines in said area and to cause the tape to penetrate into the underlying substrate on which the seal is applied, thus preventing the tape from being completely removed from the substrate.

2. The apparatus of claim 1, characterized in that said tape (3) is made of polystyrene resins, PVC or polyolefins.

3. The apparatus of claim 1, characterized in that said non-homogeneous areas are formed of air bells (1) blown into the thickness of the tape (3).

4. The apparatus of claim 3, characterized in that the per cent amount of air blown into tape (3) is about 40% vol. of the raw material used for manufacturing the tape (3).

5. The apparatus of the preceding claims, characterized in that said tape (3) is manufactured on a silicone paper substrate (12) to be removed in use.

6. The apparatus of the claim 1, characterized in that said tape (3) is preliminarily tagged with a succession of coupons or labels for sealing purposes, said coupons or labels being provided with a progressive and/or series numbering.

7. The apparatus of claim 1, characterized in that the temperature of said metal plate seal (4) of thermoseal (5) is kept at a constant level (T1).

8. The apparatus of claim 7, characterized in that said constant level of temperature (T1) of plate (4) is about 200°C.

9. The apparatus of claim 1, characterized in that said thermoseal (5) includes a positive temperature coefficient device electrically connected by non-wired means (6, 6') to a support (10) connected in turn to a power supply (7) in order to keep the temperature of plate (4) at the constant level (T1).

10. The apparatus of claim 9, characterized in that said power supply (7) is 24/48 V.

11. A method of hot sealing parcels and packages by a thermolabile adhesive tape and a metal plate seal heated at a predetermined temperature, comprising the steps of spreading the tape on the surface to be sealed and affixing a thermoseal to the tape, characterized in that it includes a preliminary step of intentionally forming non-homogeneous areas on the tape, and a step of establishing a temperature of the thermoseal in combination with the thermolabile characteristics of said tape, in order to cause the onset of preferential fracture lines corresponding to said non-homogeneous areas near the mark after affixing the seal.

12. The method of claim 11, characterized in that said step of forming non-homogeneous areas on the tape is carried out by blowing into the tape a predetermined per cent amount of air bells.

13. The method of claims 11 and 12, characterized in that said tape is made of polystyrene resins, PVC, or polyolefins, said predetermined per cent amount of air bells blown in said blowing step being about 40% vol. of the raw material used for manufacturing the tape.

14. The method of claim 11, characterized in that the hot stamping is carried out at a constant temperature (T1) of said metal plate seal (4).

15. The method of claim 14, characterized in that said constant temperature (T1) of said metal plate seal (4) is about 200°C.

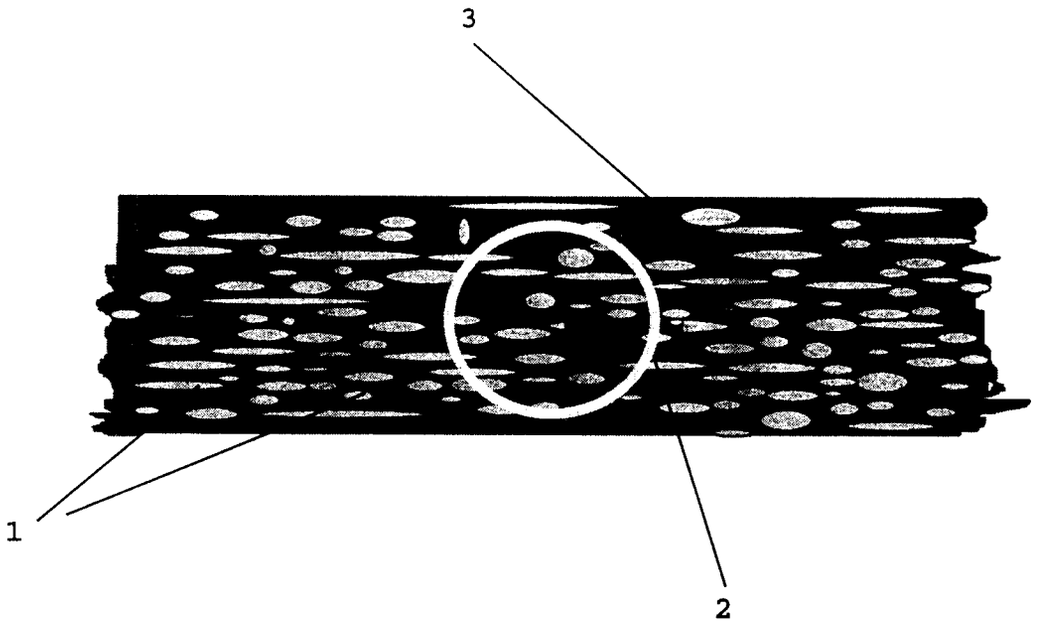

FIG.1

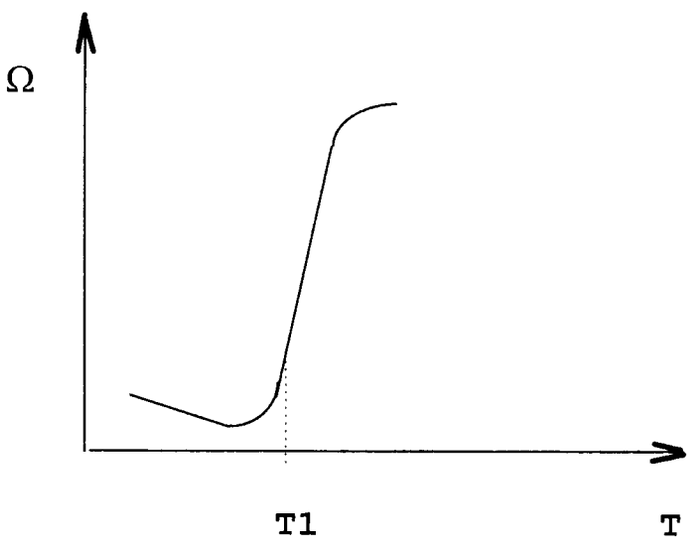

FIG.3

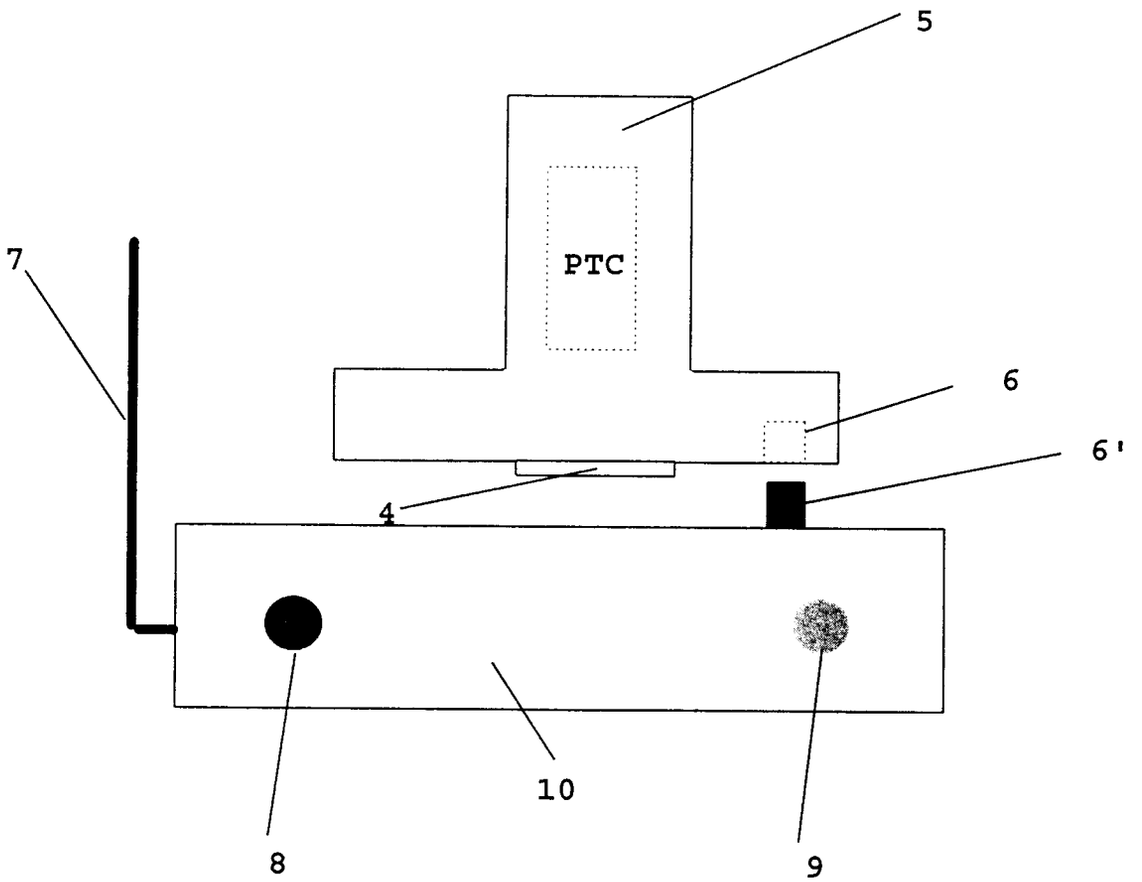

FIG.2

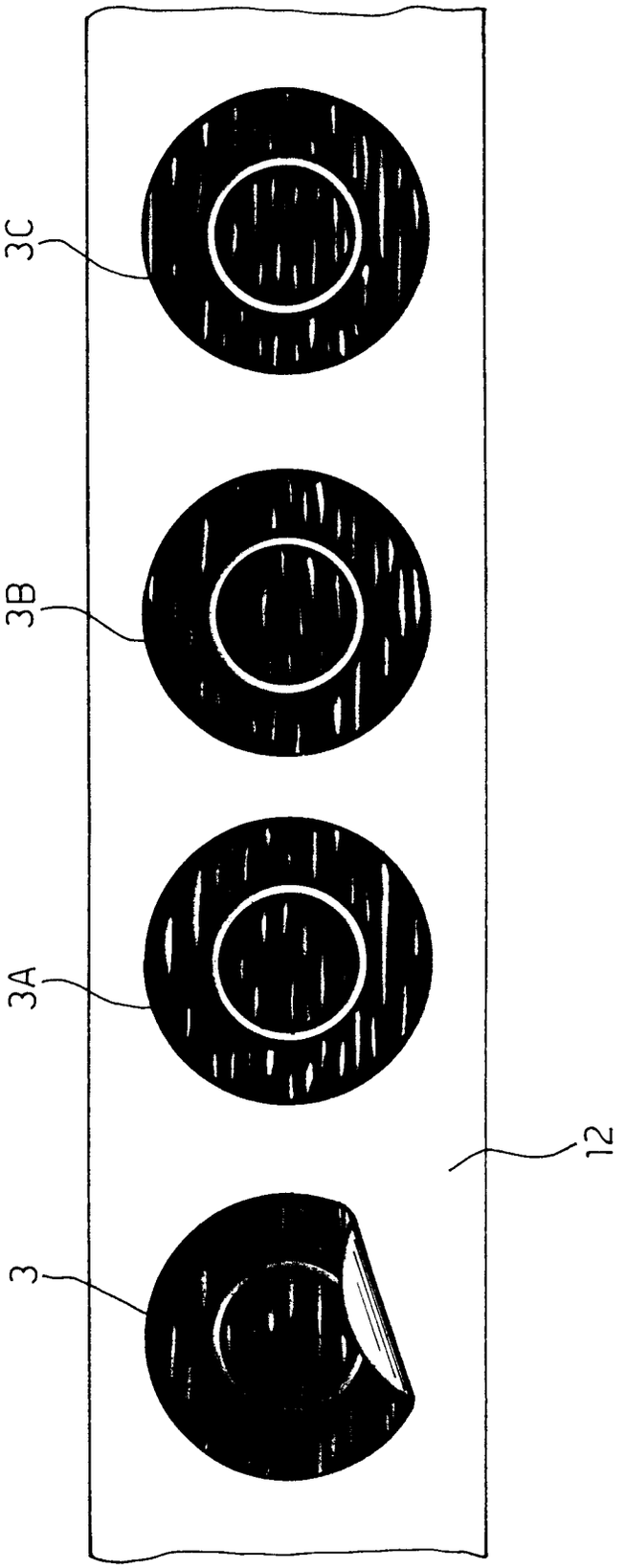

FIG. 4