This invention relates to an automatic bottle-hooding apparatus with a hooding sheet piece and a sealing tape, for example, for a milk plant.

An object of this invention is to provide a simply and reliably operated hydraulic bottle-hooding apparatus or bottle capper which requires less space for installation as well as less attendance for operation than any conventional bottle capper. In accordance with the concept of the invention the apparatus comprises in combination an endless conveyor means having recilinear sections of moving orbit or route and adapted to carry thereon bottles to be hooded over almost its whole moving orbit or route, means for recilinearly and continuously drawing out a band of hooding sheet pieces only by dint of movement of said bottles, means for cutting this band to form a sheet piece of a required length, means for pressing said sheet piece against the top portion of each of the bottles to be hooded, means for cutting and clamping a sealing tape, and means for winding said tape around the hooding sheet piece on said top portion of each of the bottles to bind the sheet piece with said tape, all said means being associated to operate synchronously.

Another object of this invention is to provide for this bottle-hooding apparatus means for pressing the hooding sheet piece against the top portion of each of the bottles to be hooded which comprises a ring with a central opening into which the top portion of each bottle covered with the hooding sheet piece can be inserted, said ring being carried by the apparatus so as to be movable vertically in a floating state for pressing the hooding sheet piece against the top portion of each bottle and leaving said portion after hooding is finished.

A further object of this invention is to provide for this bottle-hooding apparatus with a heat sealing tape a heating device comprising a casing containing therein a heating source, one side wall of which is conceived to receive a heat sealing tape along it, degree of concavity of said wall being decreased gradually toward one end from the other end where the sealing tape enters into said wall, whereby said sealing tape is pressed against and stuck onto the hooding sheet piece gradually strongly around the top portion of the bottle to be hooded.

A still further object of this invention is to provide also for a bottle-hooding apparatus a cutting and feeding arrangement for sealing tape which comprises rotating means for carrying a band thereof to be divided into a plurality of units of sealing tapes, rotating means with a cutter adapted to cooperate with said rotating means for cutting out each unit of sealing tape in turn from said rolled band and feeding them out in turn to a bottle-hooding apparatus and means for moving either of said rotating means axially by a distance equal to width of each unit of sealing tapes.

FIG. 1 is a general front elevation view of the whole apparatus of said embodiment,

FIG. 2 is a plan view of the same,

FIG. 3 is a side elevation view of the same,

FIG. 4 is a perspective view of a pressure applicator ring,
second conveyor means, respectively. Guidance of bottles is effected also by means of guide plates 15 and 19 fixed to the frame 17 of the first conveyor means and connected rigidly to outside plates of paired guide plates 20 and 21, respectively, which are also fixed to the frame 17 on both sides of the conveyor belt 8. A worm 22 is arranged rotatably on the frame 17 also along the passage of the belt 8 before the disc 13, seen in the moving direction of the belt 8, and is made to decrease in its tooth pitch gradually in the moving direction of the belt 8. This worm 22 serves to cause regular feed movement of the bottles in such a manner that as the worm 22 rotates it catches between its two adjacent teeth bottle one by one, whereby the rectilinear distance between a bottle leaving the worm and a next bottle in the line of feed is made equal to the peripheral length between the centers of two successive recesses 15 of the disc 13. It is, therefore, absolutely necessary to synchronize rotation of the worm 22, that of the disc 13 as well as that of the wheels 9 and 10 in case of operation of the whole apparatus.

It is to be noted that the second conveyor means consists of four sets of sprocket wheels 9, 10, and endless chain belts 11 in such a manner that four sprocket wheels 9 and four sprocket wheels 10 of equal diameter having equally spaced teeth are keyed to central shafts 23 and 24, respectively, tandem with an adequate distance therebetween and that four endless chain belts are spanned over these sprocket wheels 9 and 10, two upper belts being associated with the bottle top supporting mechanism while the other two lower ones being associated with the bottle supporting mechanism, as will be explained later on.

Around the second conveyor means several support columns 25 are planted in the bed 1 and support thereon a ceiling plate 26. A bracket 27 fixed on the ceiling plate 26 carries at its free end a reel 29 having a roll of hooding sheet piece band 28 of a material, such as polyethylene or paraffin paper or cellulose paper or the like. Two horizontal rail plates 30 and 31 of an oval ring shape are fixed tandem to all the columns 25. Below the rail plate 31 there is arranged on the bed 1 a cam body 32 which will be explained later on, too.

Successful working processes to which a bottle to be hooded according to this invention is to be subjected while being transported by the second conveyor means are pressing of the band 28 against the bottle top, cutting of said band in a desired length, hooding and pressing of a cut hooding sheet piece onto the top portion of the bottle, cutting, clamping, winding, and heat sealing of a sealing tape onto the sheet piece around the top portion of the bottle.

Before explaining these working processes, the inventor will give a description of mechanisms for supporting bottles to be hooded during these processes as follows. These mechanisms consist substantially of that for the bottle bottom and that for the bottle top which both are adapted to support the bottle from above and below. The bottle bottom supporting mechanism, as shown in FIGS. 5 and 6, has a spindle 35 having at its upper end a circular bearer 34 fixed thereto to support the bottom of a bottle 33, which spindle is inserted into a sleeve 36 rotatably by means of journal bearings 37 and 38. Into a bore 39 in the lower portion of the spindle 35 a movable piece 41 having at its lower end a spherical follower 40 fixed thereto is inserted. This piece 41 is provided with a longitudinal slot 42 into which a pin 43 fitted transversely into the spindle 35 is inserted. The follower 41 is pressed always against the cam body 32 elastically by a spring 44 which is interposed between the bottom of the bore 39 and the top face of the movable piece 41. The sleeve 36 is provided with lateral slide grooves 45 being in engagement with the rail plate 31 which carries thus the sleeve 36 slidably. The sleeve 36 is provided at its upper end also with an inward projecti
tion 46 to the lower side of which an endless chain belt 11c, the third step belt of the second conveyor means, is connected, while to the upper side of which is fixed by a bolt 48 and a nut 49 a carrier 47 of a semicylindrical profile partly enclosing the bearer 34. The sleeve 36 is also with an endless chain belt 11d constituting the fourth (lower-most) step belt of the second conveyor means.

As shown in FIG. 7, the bottle top supporting mechanism has also a sleeve 51 inserted rotatably into a block 50 which is connected operatively with the second step chain belt 11b of the second conveyor means. This sleeve 51 encloses slidably therein a spindle 52 to the lower end of which is secured a cap cover 54 lined with a cushion layer 53 of an elastic substance, such as gum, etc. adapted to touch the bottle top. A pressure applicator ring 56 (FIG. 4) which serves to press loosely against the top portion of the bottle a hooding sheet piece 55 which has been cut from the band 28 by a cutting mechanism to be explained later on is adapted to be mounted onto the cap cover 54 at the beginning of the hooding process. This applicator ring 56 consists, as shown in FIG. 4, of a metal annular frame ring 57 which is fixed to a corresponding ring portion 58 of elastic substance, such as gum, having a central hole 58 of a profile approximately equal to that of the bottle top. This hole 58 is shown in the drawing as circular but may be of any other shape in accordance with the profile of a bottle to be hooded in this hooding apparatus. In order to increase flexibility of the inner side of the pressing ring 59 it is preferable to provide it with many radial slits 60 as shown in FIG. 4.

The block 50 has an inverted L-shaped extension piece 61 projecting upwardly, into whose eye piece 62 at its upper end the spindle 52 is inserted loosely which has a collar 63 fixed thereto, between which and the eye piece 62 a coil spring 64 is interposed. The spindle 52 can rotate by interposition of a ball bearing 65 between the spring 64 and the collar 63. The first (uppermost) chain belt 11a of the second conveyor means is connected operatively to the extension piece 61.

As mentioned above the bottle supporting mechanisms as a whole are adapted to be driven through four endless chain belts 11a, 11b, 11c and 11d which are driven synchronously altogether, with the result that the mechanism can be moved positively and reliably without any lateral movement.

The hooding sheet piece 55 is put on the bottle top and pressed against the top portion of the bottle as follows:

The free end of the sheet piece band 28 is guided (by hand at the beginning of the operation of the apparatus but automatically thereafter) between each of the bottles fed through the disc 13 onto the bearer 34 and the cap cover 54 mentioned above from the reel 29 after passing between paired guide pieces 66, while as a result of movement of the endless chain belts the follower 40 of the bottle bottom supporting mechanism now supporting the bottle just referred to slides on the first cam projection 67, whereby the bottle is lifted and catches the free end portion of the band 28 between its top and the corresponding cap cover 54. As the chain belts move on, the follower 40 first mentioned also slides on the projection 67, whereby as mentioned above the bottle successive to the bottle first mentioned is lifted and catches also the band 28 between its top and the corresponding cap cover 54. The所述 mentioned bottle catches the band 28, the cutting mechanism 68 (FIGS. 1, 2, 3) begins to operate. This mechanism consists substantially of a bevel wheel 70 enclosed within a cover 69, a bevel wheel 71 meshing with said wheel 70 and a cutter 73 fixed to the shaft 72 of said wheel 71. The shaft 74 of the bevel wheel 71 is connected through a belt pulley mechanism or gearing mechanism (not shown) to one of the sprocket wheel
shafts 23, 24 that rotation of the shaft 74 is synchronized with movement of the chain belts 11 with the result that the cutter 73 cuts two bottles 22 at a time. Because, as mentioned above, when cutting operation of the cutting mechanism is effected the band 50 is caused always by two successive bottles and cap covers 54, the band is drawn out automatically and continuously from the reel 29 as the endless chain belts move. Furthermore, because according to this invention the band is drawn out rectilinearly along the rectilinear section c of the belt orbit, so that the houding sheet piece is of a square or oblong profile without being subjected to any distortion which can be seen in a conventional apparatus of this kind in which a houding sheet piece band is drawn out in a somewhat curved path.

After each sheet piece 55 is put on the bottle top it will be then pressed against the top portion of the bottle. This pressing process is effected substantially by means of the second cam projection 75 of the cam body 32 higher than the projection 67 and a pair of parallel plates 76 fixed to the column 23 and situated in correspondence to the projection 75. As shown in FIG. 8, when the follower 49 which pushes the bottle 33 to the cap cover 54 against the spring 84 (FIG. 7) slides on the cam projection 75, the bottle 33 is lifted again, while the pressure applicator ring 56 now being mounted onto the cap cover 54 is prevented from being lifted by the parallel plates 76, so that the ring 56 presses the sheet piece 55 against the top portion of the bottle 33.

Cutting, clamping of the sealing tape and winding of the sealing tape onto the sheet piece around the top portion of the bottle are performed in the embodiment apparatus shown over the curved section b and rectilinear section d of the route of the second conveyor means. For this purpose, each bottle top supporting mechanism is provided with means for cutting and clamping the sealing tape 77 which is drawn out from a reel 80 mounted on a support 79 on a supporting frame 78 secured to one of the columns 25, as shown in FIG. 3. This sealing tape is made from a cellophane paper coated on one side with a substance capable of becoming sticky by heating, such as thermoplastic synthetic resin.

FIGS. 9-12 show a mechanism for cutting and clamping the sealing tape. This mechanism comprises substantially movable parts secured swingably by a pivot 81 to the sleeve 51 mentioned above and adapted to be moved by fixed parts of the apparatus, such as cams. These movable parts consist substantially of a double armed lever 82 pivoted to the sleeve 51, and two double armed levers 89, 90 secured swingably by a pivot 87 to said lever 82. A coil spring 88 is interposed between a collar 87 at the free end of said pivot 87 and the lever 90 to press always said lever 90 elastically against the lever 89. All these levers 82, 89 and 90 are provided at their end ends with cutting edge portions 92 and 93 (see FIG. 12), so that these levers constitute a tape knife. The lever 89 is provided, furthermore, with a tape clamp 91 fixed thereto which confronts the cutting edge portion 92 so as to receive the cutting edge portion 93 between it and the portion 92. Thus, the levers 89 and 90 can swing relative to each other, so that the sealing tape 77 can be cut out between the edge portions 92 and 93 and at the same time can be clamped fast between the clamp faces 94 and 95 of the portion 92 and the tape clamp 91. The cutting edge portions 92 and 93 of the levers 89 and 90 are always pulled inwardly toward the top portion of a bottle 33 by springs 96 and 97, respectively, which are spanned between the sleeve 51 and the levers 89 and 90, respectively. As the lever 90 is situated below the lever 89 and extends across the latter, said lever 90 can swing together with the lever 89 counter-clockwise against the elastic forces of the springs 96 and 97, when the follower 86 is lifted by a cam not shown.

In order to cut and clamp the sealing tape 77, the double armed lever 89 only is made to swing, as shown by chain line in FIG. 9, through lift of its follower 85 being in cooperation with cam 83 which is arranged in a fixed portion of the apparatus. At the same time the follower 84 of the double armed lever 82 slides on a cam 83' also arranged on a fixed portion of the apparatus, so that the lever 89 can swing about the pivot 87 without causing the lever 82 to swing about the pivot 81. At the beginning of operation of the cutting and clamping mechanism, the free end portion of the sealing tape 77 is guided by hand into and through a space between the swinging cutting edge portion 92 and the cutting edge portion 93 of the lever 90 which remains by the spring 97 in its normal position touching the houding sheet piece 55 on the top portion of a bottle 33. When the follower 85 leaves the cam 83 and, consequently, the lever 89 swings clockwise by means of the spring 96, the sealing tape 77 is cut by the cutting edge portions 92 and 93 and, at the same time, is clamped between the faces 94 and 95 of the portion 92 and the tape clamp 91.

Immediately after this cutting and clamping operation has finished, a pinion 98 keyed to the sleeve 51 (see FIG. 7) begins to mesh with a rack (not shown) fixed to and arranged on a fixed portion of the apparatus with its longitudinal axis running along the rectilinear section d of the route of the second conveyor means. As shown in FIGS. 7 and 10, the spindles 52 loosely inserted into the sleeve 51 is provided with a longitudinal groove 119 which the front end of a set screw 120 screwed into the sleeve 51 transversely is fitted loosely, so that the sleeve 51 can move axially relatively to the spindle 52 but cannot rotate relatively to the spindle 52. Thus, the sleeve 51, the spindle 52 and a bottle 33 are adapted to rotate altogether by means of the above mentioned pinion and rack gearing mechanism as the second conveyor means move.

As the bottle 33 rotates and advances on the rectilinear section d of the route of the second conveyor means as shown by arrows in FIG. 13, the sealing tape 77 is wound onto the houding sheet piece 55 around the top portion of a bottle 33. As shown in FIG. 13, when an antecedent bottle 33a which has been wound with the sealing tape 77 almost by one turn which was guided by a portion 102 of one side wall 104 of a heating device 101 which will be explained later on in detail, approaches said device 104 the cutting and clamping mechanism belonging to the following bottle 33b operates as follows. The sealing tape 77 as shown which has been guided automatically into the gap between the two cutting edge portions. The rear end portion of a unitary sealing tape is guided by a suitable guiding means, such as a hook 99 fixed to the block 50 (FIG. 7) which can rotate relatively to the sleeve 51.

Just before the bottle 33b occupies the position shown in FIG. 13 the cutting and clamping mechanism belonging to this bottle must be lifted up while holding the sealing tape 77 as before, in order for the rear end portion of said tape to cross the front end portion of the same and overlap over the latter portion directly. For this purpose a cam not shown is arranged on a fixed portion of the apparatus along the rectilinear section d of the route of the second conveyor means. When the follower 86 slides on this cam just before the bottle 33b occupies the above mentioned position, the lever 82 carrying the lever 89 thereon swings about the pivot 81 counter-clockwise and is lifted on along the top portion of the bottle 33b, resulting in giving a free space in the portion of the sealing tape 77 around the top portion of the bottle 33a, because the levers 90 and 89 are prevented from swinging about the pivot 87 by springs 96 and 97, respectively, so far as the lever 82 can swing about its pivot 81. While the cutting and clamping mechanism of the bottle 33a is passing above the heating device 101 in the lifted state mentioned above, the overlapping por-
tions of the front and rear end portions of the unitary sealing tape are heated and stuck together. Thus, the hooding sheet piece 55 is bound fast with the unitary sealing tape 77. After leaving the heating device the cutting and clamping mechanism of the bottle 33a is lowered down on account of absence of the above mentioned cam and three of the above mentioned 83 and 83' and arranged at a suitable distance from the latter, respectively, on a fixed portion of the apparatus, in cooperation with the followers 85 and 84, effect counterclockwise swinging of the lever 89 only, resulting in releasing the front end of the unitary sealing tape 77.

In case a hooding sheet piece 55 is made from a sheet coated with a substance capable of becoming sticky by heating, the sealing tape can be heated from the beginning of its entrance into the heating device and can be stuck thereby to the hooding sheet directly.

As shown in FIGS. 16 and 17 the above mentioned heating device generally denoted by 101 comprises a casing 102 consisting preferably of an insulating material and enclosing therein electric resistance heating wires 103 as well as a guide plate 102' integral with the casing 102. One side wall 104 of the casing 102 is made concave and degree of concavity 105 of this wall decreases gradually toward one end of said wall from the other end where the sealing tape 77 enters into said wall 104, as shown by sections A, B and C in FIG. 18. As mentioned above a bottle covered with a sheet piece 55 embraced by unitary sealing tape 77 rotates with said tape 77 moving along the side wall 104 in a direction as shown by an arrow P and advances at the same time in a direction as shown by an arrow Q. Length of the unitary sealing tape must be somewhat larger than the peripheral length of the top portion of the bottle, preferably one half of the later length. The slacked free end portion of the unitary sealing tape 77 is guided correctly by the wall 104 during movement of the bottle 33 and is overlapped over the front end portion of the tape wound already around the top portion of the bottle.

The unitary tape is pressed against the hooding sheet piece 55 gradually strongly owing to gradual decrease of concavity 105 of the wall 104, resulting in reliable pressing especially, on overlapping end portions of the unitary tape.

The bottle which has been sealed completely in the manner as mentioned above must be released from the pressure applicator ring 56. Detachment of this ring 56 from the bottle 33 is effected in a manner inverse to that in which the ring 56 is mounted onto the top portion of the bottle. As shown in FIG. 19, when the follower 40 slides on an inclination face connected to a cam recess 106 of a cam body 107 arranged on the bed 1 near the disc 14, the bottle 33 is lowered down gradually, while a pair of parallel plates 168 which are fixed to one of the columns 25 and so positioned in correspondence with the cam inclination and recess 106 as to come below the applicator ring 56 hinder lowering down from the ring 56 and can bring the ring 56 onto the cup cover 54 which has been separated from the bottle top when the follower 40 slides on the recess 106. The bottle 33 is brought then by means of the guide plate 19 into a recess 16 of the disc 14 from the bearer 34 to be transported thereby by the first conveyor means.

FIG. 20 shows an example of a feeding and cutting arrangement for sealing tape, in which 109 denotes a roll 109b of a band which is to be cut longitudinally into a plurality of units of sealing tape. This band roll 109 is carried onto a reel whose spindle 111 is supported rotatably on a U-shaped frame 110. A rack 112 fixed to the frame 110 meshes with a pinion 113 to move up and down by rotation of the pinion 113 which can be driven by a handle (not shown) manually. If the pinion 113 is rotated in a direction as shown by an arrow e then the rack 112 and, consequently, the frame 110 are lifted in a direction as shown by an arrow f. Degree of lift of the frame 110 can be read on a scale 114.

A guide roller 115 connected integrally with a rotary cutter 116 is carried rotatably in a frame 117 which is pressed in a direction as shown by an arrow g. The roller band 109 is fed by roller 118 interposed between the frame 117 and a part fixed to the frame of a bottle-hooding apparatus (not shown). The guide roller 115 is pressed, therefore, always against the roller band 109 so that when the roller 115 and the rotary cutter 116 are rotated by suitable means the unit sealing tape 77 of a width w is cut from the rolled band 109 and fed out by the roller 115 in a direction as shown by an arrow h. When the first unit sealing tape is cut away completely from the rolled band, the frame 110 is lifted by a distance w equal to the width of the unit sealing tape by means of the pinion 113 and rack 112 mechanism, while the roller 115 and the rotary cutter 116 are so moved against the elastic force of the spring 118 as not to hinder lifting from the rolled band 109. Then, when the roller 115 again comes into contact with the rolled band, continuous cutting of the rolled band and automatic feeding of the second unit sealing tape are realized as mentioned above.

According to this cutting and feeding method a sealing tape of a desired width optimum for using purposes can be used for a longer time and a sealing tape rolled band can be prevented from tumbling which can occur in case of a sealing tape of a very small width.

The foregoing description has been given in detail without thought of limitation since the inventive principles involved are capable of assuming other forms without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. Bottle-hooding apparatus comprising, in combination, a hooding material magazine containing an elongated strip of hooding material; an endless conveyor movable through an orbit; bottle bottom supports spaced substantially uniformly along said conveyor; bottle top supports movable with said conveyor and each aligned with their respective bottle bottom supports, means for guiding bottles to be hooded onto said bottle supports at a first point in said orbit; means for guiding hooded bottles from said bottle supports at a second point in said orbit a relatively short distance in advance of said first point; means operable, in synchronism with said conveyor, to maintain said bottle supports spaced from bottle tops on said bottle supports over an initial portion of said orbit following said first point; means operable, in synchronism with said bottle, means operable, in synchronism with said conveyor, as each bottom support and its associated top support leaves said initial portion of said orbit to effect relative movement of said associated bottom and top supports toward each other to grip said strip between the top of a bottle, on the bottle support, and the associated top support, to draw said strip from the magazine; cutting means capable, immediately after and while said strip is gripped between a pair of successive bottles and their associated top supports, to sever said strip between the successive bottles to form a hood piece of a predetermined length; and means operable, in synchronism with said conveyor, to press each severed hood piece over the top of its associated bottle.

2. Bottle-hooding apparatus as claimed in claim 1, including a sealing tape magazine containing an elongated strip of sealing tape; tape clamping means and tape cutting means on each bottle top support and respectively operable to clamp the leading edge of the sealing tape and to sever the trailing edge of sealing tape in advance of the respective bottle top support; cam means operable to actuate the tape cutting means on one cutting means of a bottle top support clamps the leading edge of the
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3. Bottle-hooding apparatus as claimed in claim 1, in which said hood piece pressing means comprises an annular element engageable over the hooded top of each bottle; means supporting said ring for vertical movement relative to bottles on said supports; means operable, in synchronism with said conveyor, for moving said ring downwardly over each hood piece as the latter has been severed to press the same over the associated bottle top; and means operable thereafter, and in synchronism with said conveyor, to move said annular element vertically upwardly out of pressing relation with the hood piece.

4. An automatic bottle-hooding apparatus according to claim 3, wherein each annular member is mounted loosely onto a respective bottle top support; and guide means associated with said conveyor and arranged to engage each annular member for moving the same vertically relative to the associated bottle.

5. An automatic bottle-hooding apparatus according to claim 1, wherein said endless conveyor means consists of four sets of endless conveyors in vertically spaced relation and trained about sprocket wheels rotatable on vertical axes, the respective sprocket wheels of the endless chain conveyors being coaxial, two upper sets carrying the bottle top supports, and the two lower sets carrying bottle bottom supports.

6. An automatic bottle-hooding apparatus according to claim 2, wherein said means for cutting and clamping the sealing tape comprises substantially two double-armed levers connected swingably relative to each other and pivoted to a fixed portion of a bottle top support, one of said levers being provided at its one end with a cam follower and at its other end with a cutting edge portion and a tape clamp, while the other of said levers being provided at its one end with a cam follower and at its other end with a cutting edge portion adapted to cooperate with the first mentioned cutting edge portion and to touch the tape clamp.

7. An automatic bottle-hooding apparatus according to claim 6, wherein said two levers are so interconnected that said first mentioned lever can swing relatively to and independently from said second mentioned lever whose movement is accompanied always with that of said first mentioned lever.

8. An automatic bottle-hooding apparatus according to claim 2, wherein said means for cutting said strip operates in a first rectilinear section of said orbit, while said means for winding said tape is actuated in a second rectilinear section of said orbit.

9. Bottle-hooding apparatus as claimed in claim 8, including bottle transport conveyor means guiding bottles to said first point and receiving bottles from said second point; said rectilinear sections of said endless conveyor extending substantially perpendicularly to said transport conveyor means.

10. A heating device for an automatic bottle-hooding apparatus with a heat sealing tape comprising a casing containing therein a heating source, one side wall of which is concaved to receive a heat sealing tape along it, degree of concavity of said wall being decreased gradually toward one end from the other end where the sealing tape enters into said wall, whereby said sealing tape is pressed against and stuck onto the hooding sheet piece gradually strongly around the top portion of the bottle to be hooded.

11. A heating device according to claim 10, wherein said casing is made of an electrically insulating material, while said heating source is an electric resistance.

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