No. 616,479. Patented Dec. 27, 1898.

R. H. MARTIN.

NON-CONDUCTING COVERING.

(Application filed Jan. 22, 1897.)

(No Model.)

Fig. 1.

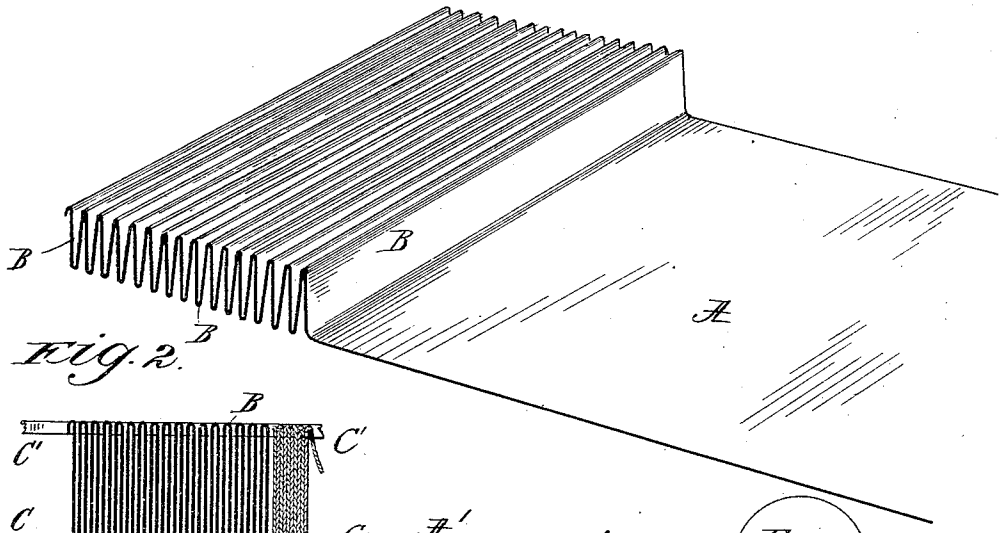


Fig. 2.

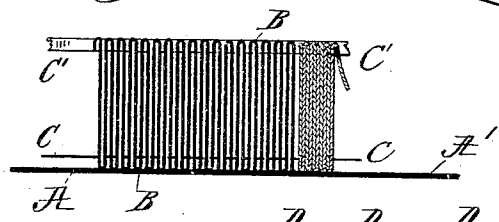


Fig. 3.

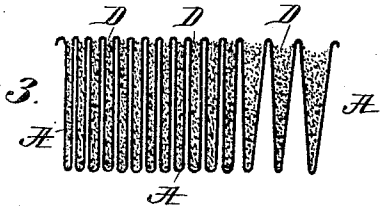


Fig. 4.

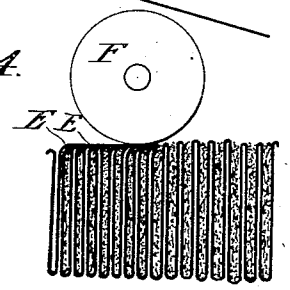


Fig. 5.

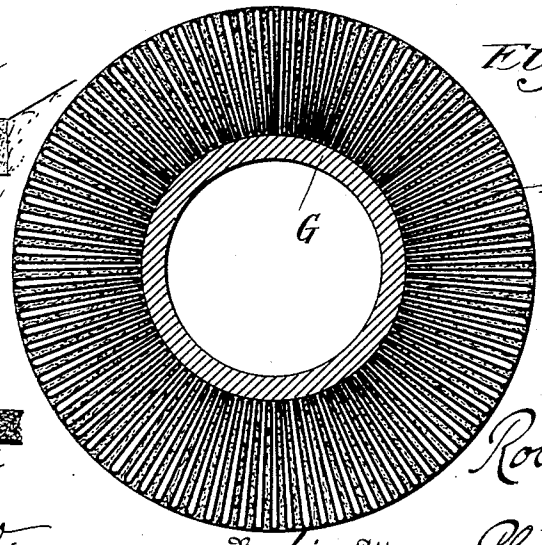


Fig. 6.

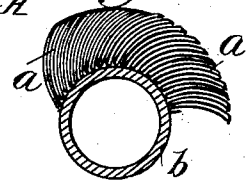


Fig. 7.

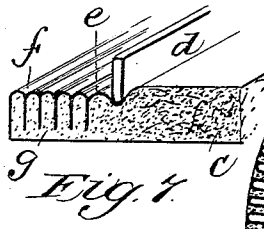
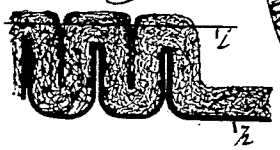


Fig. 8.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ROBERT H. MARTIN, OF NEW YORK, N. Y.

NON-CONDUCTING COVERING.

SPECIFICATION forming part of Letters Patent No. 616,479, dated December 27, 1898.

Application filed January 22, 1897. Serial No. 620,206. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. MARTIN, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Non-Conducting Coverings, of which the following is a specification.

My invention relates to improvements in non-conducting coverings and in the method of making the same.

Generally stated, it consists in forming the covering from a sheet of suitable material which is folded upon itself after the manner of "accordion-plaiting," the plaits being of any desired depth, so that the completed covering is made up of a succession of these plaits or folds, which are laid up side by side until a sufficient quantity or area is provided to make any length of sheet desired, the depth of the plaits or folds determining the thickness of the covering.

The invention also contemplates the employment of suitable means to attach and hold the several plaits or folds firmly together, so that they will not separate when being transported, handled, or applied to the surface to be protected, and it also contemplates the employment of non-conducting material in fibered, granular, or powdered form interposed between the several folds or plaits, being held therein in any suitable manner. When applied to the surface to be protected, the abutting edges of the covering may be attached and held together by cement, stapling, wrapping with bands, cords, or wires, or an exterior jacket or strip of suitable material, as now well understood in this art.

Having briefly stated the invention, I more particularly describe it as follows:

Referring to the drawings hereof, Figure 1 illustrates a perspective view of a sheet of material in which the plaits or folds are being formed. Fig. 2 illustrates an edgewise view of a sheet of material folded or plaited into the desired shape, the plaits being pressed against one another with adhesive material or other means for attaching them together. In this figure for the sake of clearness a portion of the plaits are not shown as quite in contact, although in the actual covering they will of course be so. Fig. 3 illustrates an edgewise view of the covering as made with non-conducting filling material located between the folds or plaits. Fig. 4 illustrates a material substantially the same as that shown in Fig. 3 and illustrating diagrammatically a method of attaching the edges of the folds together by passing a roller over them, which not only applies the cementing material, but also presses the edges of the plaits into close contact with one another and compels them to assume a smooth level position, correcting any irregularities in the folding or plaiting. Fig. 5 illustrates a sectional view of a pipe protected by a covering made under my invention in which the filling material is used. Fig. 6 illustrates the invention, the plaits being pressed or flattened into an angling position relative to the surface upon which they are applied. Fig. 7 illustrates the covering in the process of being made from a bat or felt of fibrous material. Fig. 8 illustrates another method of making the covering from a bat or felt of fibrous material.

Referring first to Figs. 1 and 2, *a* represents a sheet of any suitable material, preferably from two to three feet wide, more or less, and of indefinite length. It may be plain, corrugated, indented, perforated, or of any other preferred surface formation.

When the cover is intended for application to surfaces which are either cold or not excessively hot, it is not necessary that the material should be incombustible or non-inflammable, and in which event ordinary building-felt, hair felt, or any similar material, preferably of a soft, porous, and flexible nature, may be employed. If, however, the covering is to be used upon highly-heated surfaces, then the material should preferably be of a fireproof or substantially fireproof character, such as asbestos paper, "fire-felt," so called, or the like. The sheet, of whatever character or thickness it may be, is transversely folded or plaited, as shown at B B, the plaits being of such depth as desired—say from a quarter of an inch to two inches—depending upon the desired thickness of the covering. This plaiting or folding operation continues until the thin sheet A has been transformed into an-

other sheet of a thickness determined by the depth of the plaits, and it may be of indefinite length. After the plaits are formed they are pressed together, as shown in Fig. 2, and in order that they may be held together and prevented from separation adhesive material may be applied to one or both sides of the sheet A prior to or during the plaiting operation, which will cause the several plaits to adhere firmly together when they are pressed against one another. With certain materials—as, for example, asbestos fiber or other fiber or sheet which contains size—mere wetting or dampening with the requisite pressure will sufficiently attach the plaits together, or they may be attached together by a cord, tape, wire, or equivalent means (shown at C, Fig. 2) thrust longitudinally through the plaits or set into a saw-kerf cut in their edges on one or both sides, as preferred, after the covering has been formed. In this latter event I prefer to employ a cord, wire, tape, or ribbon, which may be made of incombustible substance, such as asbestos, if great heat is to be encountered, or hemp, cotton, manila, &c., if heat is not to be contended with. I illustrate a tape at the upper side in Fig. 2, marking it C′. The covering in whatever form it is made may be attached to a base-sheet or foundation-piece, as shown at A′ in Fig. 2. It may be a paper or cloth fabric of asbestos, canvas, wire-cloth, or equivalent strengthening lining and finishing material.

In order to increase the porosity of the covering and to render the attachment of the several plaits more secure, I teazel or otherwise pull out or lift the fiber on the surfaces, one or both, of the sheet, so as to give them a flocculent character.

In Fig. 3 I show a construction in which, as shown at the right-hand end of that figure, suitable non-conducting filling material is inclosed within the folds or plaits. The filling material may be deposited upon the sheet either before or during the folding operation, and, if desired, it may be attached to the sheet by adhesive material or otherwise before the same is plaited. In this figure the material is shown at A, the same as before, and the filling material at D D, &c. If the covering, as before stated, is not to be subjected to great heat, then the filling material need not be incombustible, but any granular, fibrous, or pulverulent substance, preferably of low cost—such as hair or other animal or vegetable fiber, shoddy, sawdust, chaff, infusorial earth, &c.—may be used; but if the covering is to be applied to highly-heated surfaces, then an incombustible material, preferably mineral wool, asbestos fiber, carbonate of magnesia, various kinds of clays or earths, or the like, should be employed. In fact, any material may be used which will properly fulfil the desired end, depending upon the use to which the covering is to be put, and in order to attach the several plaits together when this filling material is employed I sometimes use the tapes or wires above referred to and sometimes apply adhesive material to the original sheet in such quantity that it will permeate more or less the filling material sufficiently to hold the plaits together, or I may treat the filling material itself with a suitable adhesive material which when subjected to the pressure employed to press the plaits firmly together will be squeezed out or exude sufficiently to attach the structure together as a whole. I sometimes, however, in order to not only attach the plaits together, but also to make their edges smooth and even and likewise bend them over so as to close the spaces between adjoining plaits, prefer to pass a roller somewhat forcibly over the edges of one or both sides of the plaits, as preferred, as shown in Fig. 4. This roller, which I illustrate diagrammatically, may have a suitable trough or equivalent receptacle located above it, which supplies adhesive material to it, and the roller preferably passes over the edges of the plaits in one direction only—as, for instance, from the left to the right—as shown in this figure; and in making its transit the adhesive material is applied in sufficient quantity to the edges of the plaits slightly in advance of the pressure of the roller so that the roller in its passage will bend forwardly and press downwardly the edges of the plaits, as shown at E E, Fig. 4, F being the roller, thus closing the chamber or space between adjoining plaits and inclosing the filling material within such folds and likewise giving to the covering a smooth, even surface, correcting any irregularity which may be in the plaits, as shown at the right-hand end of Fig 4. It will be observed that the filling material will be applied in the pockets or spaces on one side only of the covering—that is to say, the side which is uppermost during the plaiting operation. I prefer this construction, as shown in the drawings. It may, however, be applied by a reversal of the operation or in any other suitable manner to the pockets on the other side, if desired. When applied upon one side only, as shown, the plaits may be fastened together on their other sides which come in contact with one another in either of the manners above stated, and I call attention to the fact that it is only necessary to attach the plaits together at or near the surface which is outermost when upon the structure to be covered—that is to say, if the plaits are attached to the outer surface of a pipe or like structure the edges which are next to the pipe of course cannot expand. Therefore the application of adhesive material by the roller, as shown in Fig. 4, or the employment of adhesive material or tape or cords or wires, as shown in Fig. 2, and, indeed, any other means employed for holding the plaits together, are necessary only on one side. I frequently, however, for the purpose of having a structure which will not be easily

disintegrated, prefer to attach the plaits together throughout.

In Fig. 5 I illustrate my covering of the form shown in Fig. 3 as applied to a pipe. G is the pipe, and H is the covering.

In Fig. 6 I illustrate a form of the invention in which the plaited covering is subjected to a somewhat heavy pressure, as of a roller or equivalent surface, so that they are forced or bent into a curved or angular position relative to the surface upon which they are to be applied. This operation is performed upon the covering, preferably, while it is still fresh—in other words, before the adhesive material has set or hardened or before the application of the other means used to attach the several plaits together has been applied—so that the plaits may move upon one another and readily assume the curved position, and the exterior surface of this form of the covering may be made smooth and even and closely adhered together by application thereto of adhesive material in the manner shown in Fig. 4 or in any other preferred manner. This construction is peculiarly advantageous in making tubular covering for small-sized pipes, although applicable also to other forms, and it has the advantage of more easily and accurately fitting the cylindrical surface of the pipes than other forms. In this figure *a* illustrates the curved plaits, and *b* a pipe upon which the covering is applied. I show a section of the covering only.

In Fig. 7 I illustrate a covering made from a bat or felt of fibrous material, such as asbestos fiber, hair, or equivalent soft fibrous material. *c* is the bat or layer of felt, and *d* illustrates, as an example only, one method by which the fabric can be made. A ledger-blade or creasing-knife, which being actuated by suitable mechanism comes down upon the bat or felt, compresses a section of it and at the same time may be given a lateral movement—in this instance a movement to the left—so as to press downwardly and likewise laterally that portion or section of the fibrous material shown at *e*, and after the lateral movement is finished ribs or plaits of the fibrous material, as shown at *f*, may be formed, with a continuous sheet or plate like portion of the fiber (shown at *g*) underlying the ribs or plaits. The ledger blade or knife *d* may be then lifted, the material fed along, and the operation repeated. Making the covering in this way I prefer to apply adhesive material to the surface of the bat or felt and, if desired, to apply a size or equivalent adhesive material through the body of the fibrous mass, so that the ribs or plaits will become firmly attached together and the fibers held in position.

In Fig. 8 I illustrate another method of making the covering from a bat or felt of fibrous material. In it the felt, either with or without a base-sheet *h*, is plaited substantially the same as the sheets shown in Fig. 1, and the several plaits may be held together in any preferred manner. I show a wire *i* passing through the plaits as one way of doing this.

Many advantages flow from the use of my invention, some of which are as follows: The covering is inexpensive. It is an excellent non-conductor of heat or cold. It is light in weight. It can be transported flat or in the form of a large roll without waste of space. The customer can cut off from a continuous roll or piece of covering sections of exactly such width as desired to cover any given surface—cylindrical pipes or curved or flat surfaces. The covering all comes to him in the same shape and is without trouble adapted by him to the desired use, and also during application to the heated surface, especially pipes, the covering more readily adapts itself to the cylindrical form than any other thick sheet-like covering known to me.

The filling material may be applied to any desired extent, so that covering having quite widely differing characteristics may be made.

Upon application to any surface to be protected the covering is treated in the same manner as those heretofore in use—that is to say, it is laid upon or wrapped about the surface and the edges are abutted together and confined by cementitious material, the whole being suitably wrapped with bands, wire, or cord, or jacketed, as with canvas, or strips of canvas or paper may be placed over the joints.

It will be obvious to those who are familiar with this art that if desired an irregular shape may be given to the covering by increasing the width of the folds or plaits in certain places as compared with others, so that the covering may be offset somewhat from the surface to be protected; also, so that under certain circumstances it may be adapted to fit irregular surfaces, and, furthermore, that it is not essential that the sheet of material from which the covering is made should be a completely-fabricated product before forming plaits. It may be more or less in the fibrous condition—as, for instance, a bat or layer of fiber more or less confined may be treated in substantially the same manner as the completely-fabricated sheet.

I do not limit myself to the details of construction shown, since it will be evident to those familiar with this art that various modifications may be made therein without departing from the essentials of the invention.

I claim—

1. A non-conducting covering made of a sheet or bat of fibrous material plaited or folded upon itself so that the edges of the plaits extend across the covering from side to side and form its outer surfaces, the sides of the several plaits being in contact with each other and with adjacent plaits and attached together, for the purposes set forth.

2. A non-conducting covering made of a layer of soft, porous, fibrous material plaited or folded upon itself so that the edges of the

plaits extend across the covering from side to side, are presented outwardly therefrom and form its outer surfaces, filling material placed between the plaits, and means to hold the plaits together in contact with each other and with the filling, for the purposes set forth.

3. A non-conducting covering made of a layer of soft, porous, fibrous material plaited or folded upon itself so that the edges of the plaits extend across the covering from side to side, are presented outwardly therefrom and form its outer surfaces, filling material placed between the plaits, and adhesive material to hold the plaits together in contact with each other and with the filling material, for the purposes set forth.

4. A non-conducting covering made of a layer of soft, porous, fibrous material plaited upon itself so that the edges of the plaits extend from side to side of the covering, are presented outwardly therefrom and form the entire outer surfaces thereof, the sides of the plaits being attached together and to the adjoining plaits at the edges of the plaits on the side of the covering which is not in contact with the heated surface, for the purposes set forth.

5. A non-conducting covering made of a sheet or bat of fibrous material folded or plaited upon itself so that the plaits are substantially at right angles to the plane of the covering and the edges whereof form its outer surfaces, filling material between some of the plaits, the outer edges of such plaits being turned over and attached to adjoining plaits, thus confining the filling material, for the purposes set forth.

6. A non-conducting covering made of a sheet or bat of fibrous material folded or plaited upon itself so that the plaits are substantially at right angles to the plane of the covering and the edges whereof form its outer surfaces, filling material between some of the plaits, adhesive material in the filling material, the edges of the plaits forming one continuous smooth surface, for the purposes set forth.

7. A non-conducting covering comprising an unbroken sheet or bat of flexible, fibrous material folded upon itself in plaits which when in position on the surface to be protected, are in contact with each other laterally and with the adjacent plaits throughout the covering, and are substantially at right angles to the said surface, for the purposes set forth.

8. A non-conducting covering composed of a sheet of soft, porous, fibrous material, the fibers of one or both surfaces of which are in a loosened or unconfined condition, the same being folded into plaits at substantially right angles to the plane of the covering so that their edges form the outer surfaces of the covering, said plaits being attached to each other and to the adjoining plaits sidewise, for the purposes set forth.

9. A non-conducting covering made of a sheet or bat of fibrous material folded or plaited upon itself at substantially right angles to the plane of the covering, the sides of the adjoining plaits being in contact and attached together, and the whole attached to a base-sheet of suitable material, for the purposes set forth.

10. A non-conducting covering composed of a layer of soft, porous, fibrous material folded or plaited upon itself, the plaits resting upon and supporting each other laterally and being bent or inclined relative to the surface upon which they rest, and secured together side by side as by adhesive material, for the purposes set forth.

Signed at London, England, this 11th day of January, A. D. 1897.

ROBERT H. MARTIN.

Witnesses:

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HERBERT D. JAMESON.