Jan. 28, 1941. H. C. KARCHER 2,229,743

INSULATION AND LIKE STRUCTURES

Filed Dec. 1, 1937 2 Sheets-Sheet 1

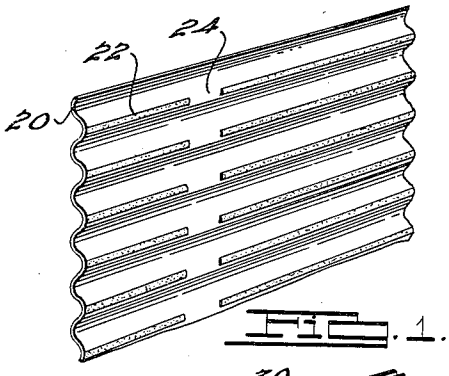


Fig. 1.

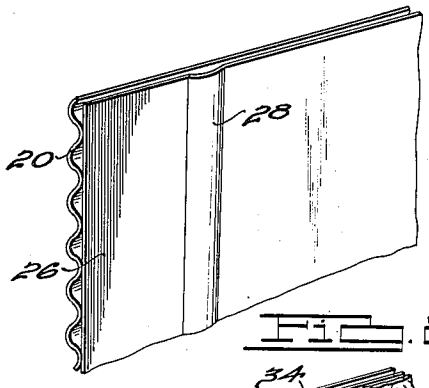


Fig. 2.

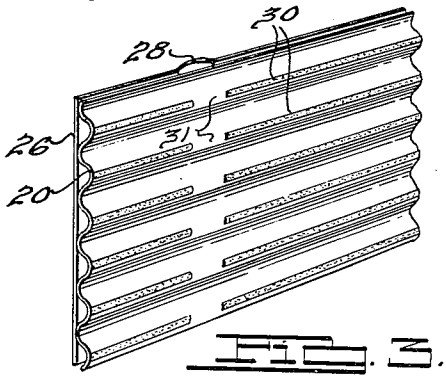


Fig. 3.

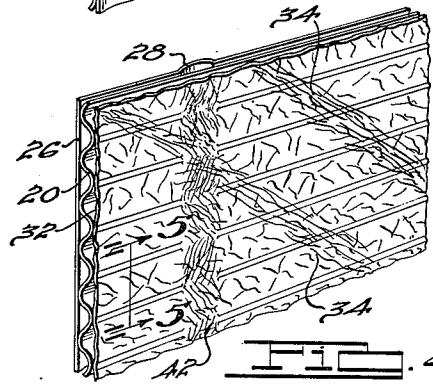


Fig. 4.

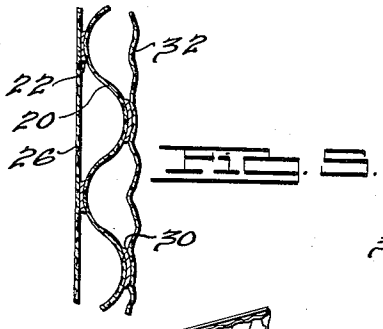


Fig. 5.

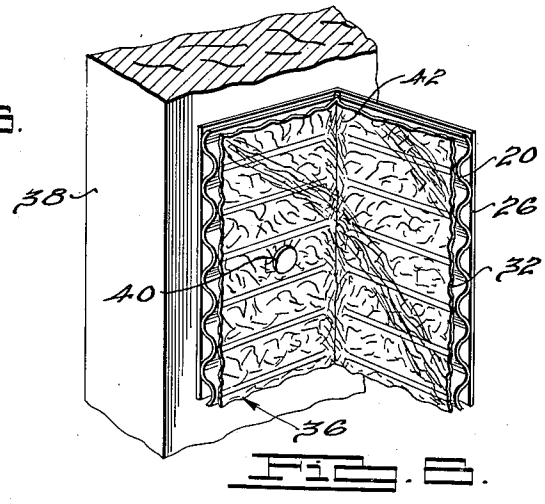


Fig. 6.

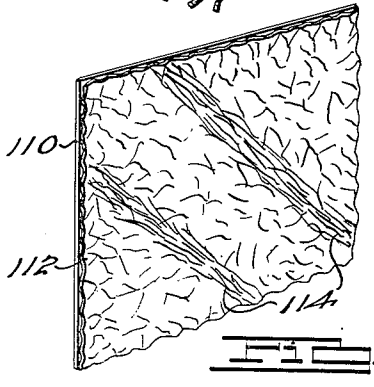


Fig. 13.

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INSULATION AND LIKE STRUCTURES

Filed Dec. 1, 1937 2 Sheets-Sheet 2

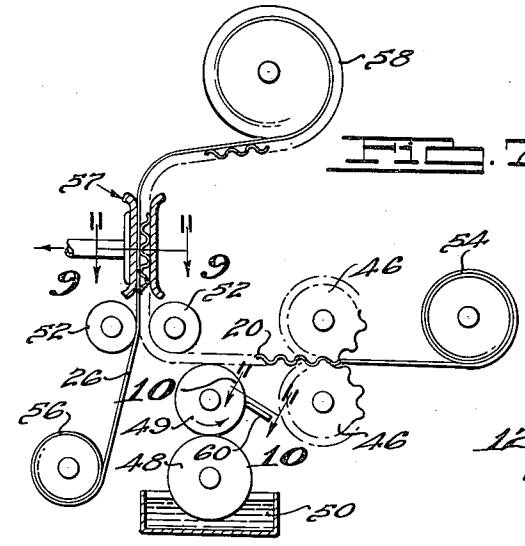


FIG. 2.

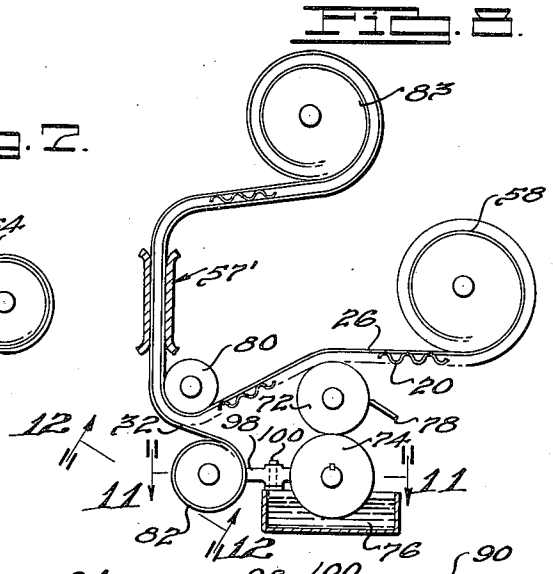


FIG. 8.

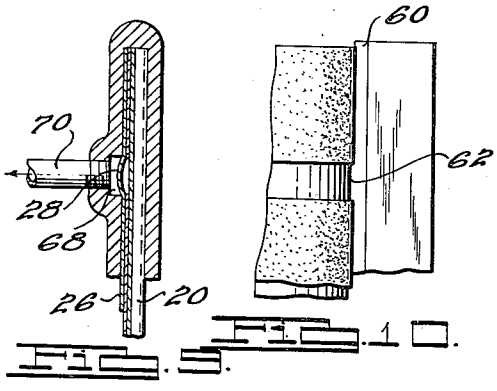


FIG. 9.

FIG. 10.

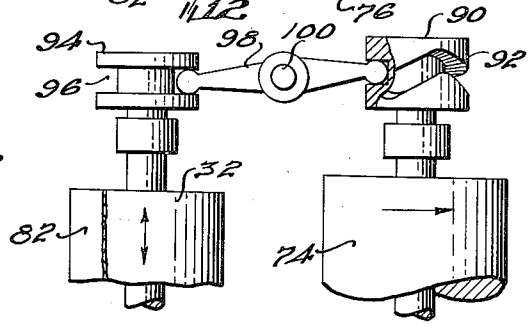


FIG. 11.

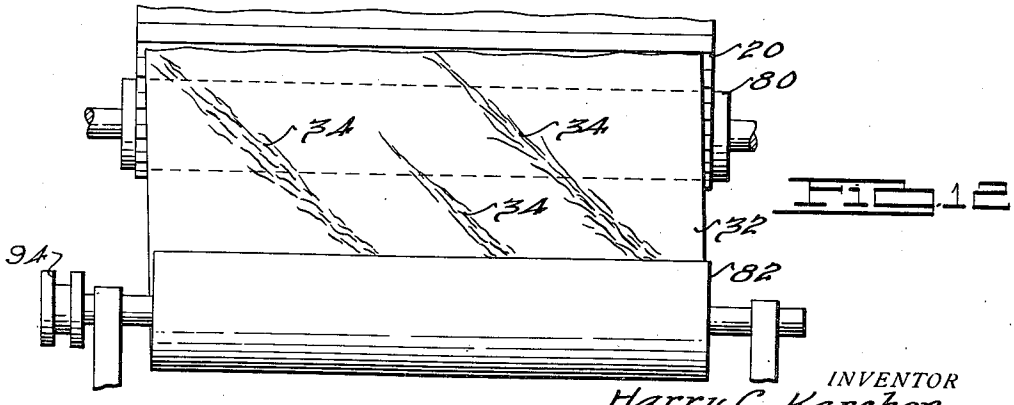


FIG. 12.

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UNITED STATES PATENT OFFICE

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INSULATION AND LIKE STRUCTURES

Harry C. Karcher, Dearborn, Mich., assignor, by mesne assignments, to Lambert M. Payne, Detroit, Mich.

Application December 1, 1937, Serial No. 177,627

3 Claims. (Cl. 154—45)

This invention relates primarily to structures at least partially formed from paper or similar sheet material and while the invention is primarily concerned with the provision of such a structure adapted for use as heat insulation, certain features of the invention are capable of broader use and, accordingly, the invention is not to be understood as being solely restricted thereto.

Objects of the invention include the provision of a corrugated paper-like structure including a corrugated paper or like sheet to one face of which is adhered a more or less planular sheet of material which may also be paper or may be of some other material, the two being so secured together as to permit the assembly to be bent about a line extending transversely to the direction of corrugations in the corrugated elements without the necessity of providing the usual folding crease along such line; the provision of a structure including a corrugated paper or like element to each side of which is adhered an approximately planular sheet of material either or both of which sheets may also be formed of paper or any other suitable material and in which provisions are made for establishing a line of fold in the material transversely of the length of the corrugation without the necessity of providing the usual folding crease in the material; and the provision of a construction as above described permitting folding of a member including a corrugated paper or like element, about a line extending transversely to the length of the corrugation and which eliminates the disadvantages occasioned in such structures by employment of a conventional folding crease therein.

Other objects of the invention include the provision of a composite structure including a layer of paper or like material and a layer of metallic foil superposed one upon the other, the two being so constructed, arranged and secured together that changes in dimensions of the paper due to changes in the moisture content thereof and changes in the dimensions of the foil due to the changes in temperature thereof will not cause one layer to be separated from the other; the provision of a structure as above described in which the foil in its application to the paper or the like is provided with gathers or the like to effect the desired result; the provision of a structure as above described in which the paper or like layer comprises a corrugated sheet and in which the normal lines of contact between the foil and the corrugations along which the foil and the paper are adhered to one another are provided at spaced intervals with unadhered areas; the provision of a construction as above described in which a corrugated sheet of paper is provided on one side with a planular paper sheet covering and on the opposite side with a more or less planular metallic foil covering, the two coverings being adhered to the corrugated paper along the lines of corrugation of the latter and the lines of adherence being broken at spaced intervals by unadhered areas; the provision of a construction as last described in which the metallic foil is so constructed and arranged as to permit expansive or contractive movements thereof in addition to that provided by the unadhered areas; and the provision of a construction as above described in which the covering over the unadhered areas is in excess of that required to span the unadhered areas whereby to provide an excess material to permit variations in dimensions of the corrugated sheet in service without subjecting the cover to tensile strains in a direction parallel to the normal lines of contact between the cover and the corrugations of the corrugated sheets.

Further objects of the invention include the provision of a novel means and method of providing gathers or the like in a sheet of material to be secured as the covering to a corrugated sheet of paper or like material; and to provide a novel means and method of applying a covering to a corrugated sheet whereby an excess of area will be provided in the covering to permit expansive and contractive movements of the corrugated sheet without subjecting the covering to undue strains.

The above being among the objects of the present invention, the same consists in certain novel features of construction, combinations of parts, and certain novel steps of operation to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views:

Figure 1 is a fragmentary perspective view of a piece of corrugated paper or like material showing the interrupted lines of adhesive applied thereto;

Fig. 2 is a view of the corrugated sheet shown in Fig. 1 to which a sheet-like covering or single face has been applied, the covering being provided with an excess of material over the areas in which the adhesive has been omitted;

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Fig. 3 is a perspective view of the assembly shown in Fig. 2 looking from the opposite side and showing lines of adhesive applied to such side corrugated sheet for the reception of a covering on such side;

Fig. 4 is a view similar to Fig. 3 showing an additional covering member applied to the construction shown in Fig 3 to make it into a double face structure;

Fig. 5 is an enlarged, fragmentary, transverse sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary perspective view illustrating a piece of material such as shown in Fig. 4 bent along an unadhered area between the first covering member and the corrugated sheet so as to form an edge flange shown nailed to a wooden member which may be a house frame stud, rafter or other suitable object;

Fig. 7 is a more or less diagrammatic view illustrating apparatus by means of which corrugated paper or like material such as shown in Fig. 1 may be provided with a single face or covering such as shown in Fig. 2;

Fig. 8 is a view similar to Fig. 7 but illustrating further apparatus by means of which material such as shown in Fig. 2 may be provided with a second face or covering such as shown in Fig. 4;

Fig. 9 is an enlarged fragmentary transverse sectional view taken on the line 9—9 of Fig. 7, and illustrating one type of mechanism that may be employed for insuring an excess of material in a covering member over the unadhered area between it and the corrugated sheet member;

Fig. 10 is an enlarged fragmentary view taken on the line 10—10 of Fig. 7 and illustrating the apparatus employed for applying adhesive to the corrugated sheet shown in Fig. 1 so as to leave certain areas of the paper free of the adhesive;

Fig. 11 is an enlarged fragmentary view taken on the line 11—11 of Fig. 8 and illustrating the mechanism employed for oscillating one of the sheet material rolls so as to provide a gather in the material as it is applied to the corrugated sheet;

Fig. 12 is an enlarged fragmentary view taken on the line 12—12 of Fig. 8 and further illustrating the manner of providing the gathers in the sheet material; and,

Fig. 13 (Sheet 1) is a fragmentary perspective view of a solid sheet of paper to which a covering of sheet material has been applied so as to provide gathers in the sheet material.

Referring to Fig. 1 a piece of corrugated material is indicated at 20 in the condition it assumes immediately before receiving a substantially planular sheet covering or single face on one side thereof. The corrugated sheet 20 may and in most cases will be paper, although in the broader aspects of the invention it may be formed of any suitable non-metallic or fibrous material. For the sake of simplicity in the following description it will be referred to as being formed from paper but it will be understood that such reference is in a descriptive and not in a limiting sense. For the purpose of applying such single face or covering the high points of the corrugation on the side of the sheet 20 that is to receive the single face covering is provided with lines of adhesive 22 in accordance with conventional practice. However, in accordance with the present invention and contrary to conventional practice the lines 22 of adhesive are not continuous over the full length of the corrugations but are interrupted at intervals as at 24. Preferably, and particularly where the feature of the present invention is employed to provide a line of fold in the corrugated paper transversely of the length of the corrugations, areas 24 which are devoid of adhesive are preferably arranged in line across the corrugations of the sheet. Where it is later desired to bend the material along a line perpendicular to the corrugations in the sheet 20 the line or lines of areas 24 devoid of adhesive will extend in such direction, and when the line of bend is to be at an angle to the length of the corrugation and also to a line perpendicular thereto the lines of areas 24 will be directed accordingly. Where the unadhered areas are provided simply for the purpose of permitting a yielding between the covering and the corrugated board or paper, to compensate for variations of dimensions of these parts in service, then the unadhered areas 24 may be located at random as will be readily apparent. For the purposes of the present description, however, it will be assumed that it is desired to provide for bending of the finished product about a line extending perpendicular to the length of the corrugations in the sheet 20 and where any different arrangement is desired the changes required in the following explanation of the process and apparatus will be apparent to those skilled in the art.

Referring now to Fig. 2 a covering 26 is shown applied to the corrugated paper 20 illustrated in Fig. 1 to form a single face structure. The cover 26 will usually be a substantially flat paper sheet of the character commonly employed in connection with corrugated paper board, although it will be understood that in the broad aspects of the present invention the covering 26 may be formed of any suitable material such as paper, metallic foil, or other suitable substance or material. Preferably, but not essential in the broader aspects of the present invention, the covering 26 is so applied to the corrugated paper 20 that an excess of material in the cover 26 is provided over each line of cooperating areas 24 which are devoid of adhesive so as to form a gather or so-called loop 28. Such a gather or loop 28 is particularly desirable where it is desired to fold the corrugated paper board constituting the final product about the unadhered line below the loop 28 so as to provide, for instance, a flange. Such flange will ordinarily extend away from the nearest side of the assembly as illustrated in Fig. 2, as in such case it will be apparent that the excess material in the loop 28 will readily permit such folding without subjecting the covering 26 along the line of fold to an excessive tensile stresses. The last mentioned arrangement is particularly useful in place of the conventional folding scores provided in corrugated paper board to define a line of fold therein transversely of the corrugation. It has been found that the absence of adhesive over the areas 24 will so weaken the strength of the board transversely of the corrugations over this area that upon compressive stress being applied to the paper board in the direction of the corrugation the board easily bends along this line. This weakness occurs not only because the corrugations are not reinforced by the cover along this line, but also because the corrugations are stiffened by the adhesive which is lacking along this line. Particularly where the loops or gathers 28 are provided this bending as before mentioned does not subject the covering to excessive tensile stresses as in the case of conventional structures employing the usual scores, with the

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result that the final product is stronger than when equivalent bends are made by the conventional method. The above described feature also has this advantage over corrugated paper board with a score to provide a line of bend, that it remains constantly effective, while scores are liable to become obliterated where formed in sheets that are stored away in flat condition for relatively long periods of time.

It is to be understood that in accordance with one phase of the present invention the areas **24** devoid of adhesive forming unadhered areas between the cover and the corrugated paper occur at more or less frequent intervals over the length of the corrugation and that in some cases at least it is preferable that the covering be looped as at **28** over each of these areas. This last is particularly true where the covering **26** is of a material or substance that has a materially different temperature co-efficient of expansion than the corrugated sheet, or where it is of such character that is expansive and contractive movements under the influence of variations in moisture content are materially different from that of the material from which the corrugated paper **20** is made, the loops in such case permitting movement of one member relative to the other without subjecting either to dangerous stresses.

The corrugated paper **20** with the covering **26** adhered thereto as illustrated in Fig. 2 may in many cases form a completed article of manufacture and be employed in the form shown in accordance with conventional practice. This is particularly true where the assembly is to be used for packing or like purposes although its use is not limited to packing purposes. In most cases, however, a second covering will be applied to the corrugated paper **20** on the side thereof opposite the cover **26** so as to form a double face structure.

In applying this second covering the high points of the corrugations of the paper **20** on the side thereof opposite the cover **26** are provided with lines **30** of adhesive as illustrated in Fig. 3. This adhesive may be applied in identically the same manner as illustrated in Fig. 1, that is, so as to leave areas **31** devoid of adhesive in line with, but on the opposite side of the corrugated sheet from the areas **24**, this alignment occurring particularly where the line is to be employed as a line of fold or bending in the final product, and a second covering identical to the covering **26** and formed from the same material as the covering **26**, or some other suitable material, may be applied in identically the same manner. This second covering may be applied so as to provide the loops **28** if desired, or it may be applied in completely flat condition with that portion overlying the areas equivalent to the areas **24**, simply remaining unadhered to the corrugated paper. However, a covering may be applied to the corrugated paper **20** so as to get the equivalent of the nonadhered and loop construction previously described in an entirely different manner and for the purpose of illustration the second covering is applied to the assembly shown in Fig. 2 in this further novel manner, in addition to the provision of the nonadherent areas **31**, to illustrate the same.

The second covering which is shown applied is illustrated in Fig. 4 at **32** and it will be noted that the surface of this covering is more or less crinkled over its entire area. In addition to such crinkling it is further provided with gather lines **34** which extend angularly with respect to the length of the corrugations in the paper **20**. The crinkled relation of the covering **32** is best brought out in Fig. 5 and the nature of the gather line **34** will best be understood during explanation of the method of providing them in the covering **32** which will later follow. It is sufficient to note at the present time that the crinkles in the covering **32** have the effect of providing an excess of the material in the covering **32** both longitudinally of and transversely of the corrugations in the paper **20**, the effect in this respect between corrugations for instance being similar to that which might be obtained by providing a sag in the covering **30** between the high points of adjacent corrugations in the corrugated paper **20**. This excess material in the covering **32** serves the same purpose as the loops **28** in the covering **26** but in addition serve to act in two directions perpendicular to each other, whereas the loops **28** act in one direction only. Likewise the angularly disposed gathers **34** provide excess material capable of permitting the covering **32** to give both in the direction of the corrugations in the paper **20** and in a direction perpendicular thereto, these gathers having an effect similar to the loops **28** where the loops are disposed angularly with respect to the length of the corrugations in the paper **20** and also to a line perpendicular thereto.

In the broader aspects of the invention the crinkles and the gathers **34** may be used independently of one another to obtain substantially the same ultimate effect, that is an excess of material in the covering **32** permitting variations in expansion and contraction of the sheet **20** and covering **32** in all directions without subjecting either the corrugated sheet **20** or the covering **32** to undue or unusual stresses. However, inasmuch as by the preferred method of applying the covering **32** both the crinkles and the gathers **34** will result in the covering **32**, it will ordinarily be preferable to use both in combination, either with or without the unadhered areas **24** and/or **31**.

As previously stated the covering **32** may be made of any suitable material of sheet-like nature, such as paper, metallic foil or the like, but in accordance with a more limited but highly important phase of the present invention the covering **32** is formed from bright metallic foil and the resulting structure employed particularly for heat insulating purposes. In such case the bright metallic foil serves to reflect radiated heat waves, provides a membrane resistant to the passage of moisture, prevents heat losses by convection through air currents which might otherwise flow through the space insulated thereby, and the spaces formed between the corrugated paper **20** and the coverings or facings **26** and **32** provide separated cells of dead air which aid in minimizing loss of heat by conduction through the structure. Additionally where one or more coverings such as the covering **32** is provided having crinkles in its surface the crinkles provide a more or less rough and uneven surface which has the effect of breaking up sound waves striking the same, and dissipating them, and for this reason the structure when thus formed also has a certain amount of sound insulation properties.

The structure shown in Fig. 4 when the covering **26** is formed from paper and the covering **32** is formed from bright metallic foil is particularly adapted for heat insulation purposes in buildings and particularly residential buildings of the frame or brick veneer type. In such case the material is preferably made up in strips of a width approximately four inches wider than the spacing between the studs, joists, rafters and the

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like between which the material is to be located, and at least two lines of unadhered areas **24**, and preferably cooperating loops **28**, together with corresponding unadhered areas **31**, are provided, one located approximately two inches in from one edge of the strip and the other located a corresponding distance inwardly from the opposite edge of the strip. That portion of the strip outwardly of each of these loops is then bent at right angles to the main body portion of the strip, in either direction, to form a flange such as the flange indicated generally at **36** in Fig. 6. Where the strip is being applied between studs, such as the studs **38** in Fig. 6, a flange **36** is then applied against a side face of the stud and is secured thereto as by nails **40**, or other suitable fastening devices, it being understood that the corresponding flange formed at the opposite side of the strip of material is likewise flanged and secured to the opposed face of the next adjacent stud **38**. Preferably the flanges **36** are so secured to the studs **38** that the main body portion of the strip is located intermediate the outer and inner faces of the studs somewhat in the manner illustrated in Fig. 6, thus separating the air space between adjacent studs and between the inner and outer sheathings of the building secured by the studs into two separate spaces. Also it is preferable, but not essential, that the foil face be positioned toward the inside of the building or the like. This not only separates the air between the studs into two separate bodies, but also insures the bright aluminum covering **32**, as assumed in this case, as being bounded solely by air on its exposed face, which is conducive to optimum heat insulation performance thereof. The bending of the material to form such flanges causes the foil facing the crinkle along the line of bending as indicated at **42** in Figs. 4 and 6.

In manufacturing a product of the type disclosed in Fig. 2 apparatus of the character diagrammatically illustrated in Fig. 7 is employed. This apparatus includes a pair of cooperating corrugating rolls **46**, a pair of cooperating glue rolls **48** and **49**, respectively, the lower one of which extends into a bath **50** of suitable adhesive, and a pair of cooperating rolls **52**. A roll **54** of paper of suitable character and width required in the corrugated paper **20** is suitably mounted so that paper thereon may be withdrawn and passed between the corrugating rolls **46** which act to corrugate the paper in a conventional manner to form the corrugated paper **20**. The corrugated paper **20** from the rolls **46** passes over the upper roll **49** which applies adhesive to the high points of the corrugations on the corresponding side of the corrugated paper **20**, and the corrugated paper **20** is then led over one of the rolls **52** which may or may not have a corrugated face. A roll **56** of the required character and width for the covering **26** and of the desired material for the cover **26**, in this case considered to be paper, is suitably mounted and the paper therefrom is passed with the corrugated paper coming over the glue rolls between the rollers **52**. The rollers **52** may, if desired, be employed to press the paper from the roll **56** into contact with the high points of the corrugated paper which has just received adhesive from the roll **49**, but ordinarily a pressing mechanism indicated generally at **57** will be employed for this purpose and the rollers **52** employed simply to properly guide the corrugated paper **20** and covering at thereinto. The corrugated paper and the one sheet of covering thus applied after leaving the rolls **52** or pressing mechanism **57** is then wound up into a suitable roll **58**. As thus far described the construction is conventional.

As is well understood in the art, adhesive picked up by the roller **48** which is driven at a uniform peripheral speed with the roller **49** and usually at the same speed as the paper that is delivered from the corrugating rolls **46**, discharges adhesive upon the roll **49** and the roll **49** in rotating applies it to the corrugated paper. In order to predetermine the thickness of the coating of adhesive applied to the corrugated paper a scraper **60** is provided in conjunction with either of the rolls **48** and **49** but preferably the roll **49** so as to limit the thickness of the adhesive coating beyond the scraper **60** in the direction of rotation of the roller **49** which may be carried up into contact with the corrugated paper.

In accordance with the present invention, in order to provide the areas **24** devoid of adhesive the scraper **60**, as best illustrated in Fig. 10, at intervals over its length corresponding to the intervals between the desired areas **24**, is provided with a corresponding member of projection **62** each of the same width as the desired length of the areas **24** measured along the lines of corrugations in the paper **20**, and projections which contact the surface of the roll **49** so as to remove all of the adhesive therefrom over their width. Consequently the adhesive which is finally carried up into contact and transferred to the corrugated paper is interrupted axially of the cylinder **49** at each location where the areas **24** are desired to be located. Where this scraper construction, or any other construction capable of effecting the same result in the application of the adhesive to the corrugations is employed, it will, of course, be apparent that the covering delivered from the roll **56** will be adhered to the high points of the corrugations on the corresponding side of the corrugated paper at separated intervals over the length of the corrugations.

In many cases where the character of the adhesive is such as to wet the corrugated paper, the mere act of securing the covering paper from the roll **56** thereto will, when the assembly is dried, have the effect of producing the loops **28** due to drying out and consequent contraction of the corrugated paper lengthwise of the corrugations. Where the character of the adhesive is not such as to effect this result, or in cases where more positive means are desired to provide the gathers or loops **28**, suitable means may be provided for this purpose. While any suitable means may be provided for this purpose the pressing device **57** may be readily modified to effect this result. As best indicated in Figs. 7 and 9, the device **57** constitutes a slotted member disposed on the discharge side of the rolls **52** and through which the corrugated paper with its covering from the roll **56** is passed on the way to the roll **58**, the width of the slot being such as to press the paper **20** and covering **26** together. The member **66** at intervals corresponding to the desired spacing longitudinally of the corrugations between the areas **24** is provided internally on that face opposing the covering **26** from the roll **56** with a groove **68** extending in the direction of movement of the paper therethrough. Each groove **68** is connected by means of a pipe or tube **70** with a suitable source of suction so that as the paper passes therethrough it will draw the covering **26** away from the corrugated paper **20** over the area **24** as illustrated in Fig. 9 to form the loops **28**.

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Where the covering 26 is formed of paper the adhesive 50 may be of any of the usual types of adhesive employed for this purpose and of which the most commonly employed is sodium silicate. Sodium silicate will usually be employed but in some instances it may be preferable to employ a non-drying or resilient type of adhesive of a suitable character a number of different types of which are now found on the open market. The use of the non-drying adhesive is particularly advantageous in connection with metallic foils because the latter are usually resistant to the adhesive effects of a drying type of adhesive, and additionally in extreme cases of contraction or expansion of either the corrugated sheet 20 or of the coating 26 the non-drying adhesive may yield sufficiently to prevent rupturing of the foil which might otherwise occur.

As previously mentioned the corrugated paper may be provided with a covering or facing on both sides applied thereto in the same manner as the covering 26 as above described. On the other hand both sides of the paper 20 may be provided with a covering such as 32, but for the purpose of illustrating both in the present instance it is assumed that the covering or facing 26 is applied to one side of the paper 20 and the covering or facing 32 applied to the other.

In applying the covering 32 apparatus of the general type shown more or less diagrammatically in Fig. 8 is preferably employed. Referring to Fig. 8 it will be noted that the roll 58 has been transposed to serve as the feeding roll in this case, the corrugated paper 20 with the covering 26 applied thereto being fed over a pair of adhesive rolls 72 and 74 so as to apply adhesive to the uncovered face of the paper 20. The lower roll 74 projects into a bath 76 of suitable adhesive and, as previously mentioned, where the covering 32 is of metal foil this bath may be either sodium silicate or of a suitable non-drying nature. Likewise a scraper 78 cooperates with the roll 72 to limit the thickness of the coating of adhesive to be transferred to the high points of the corrugations on the exposed face of the corrugated paper being unrolled from the roll 58, and such scraper will preferably be substantially identical to the scraper 60 previously described particularly where it is desired to provide a line of adhesive to be applied to the high points of the cooperating corrugations of the paper 20 in this case as illustrated at 30 in Fig. 3. The corrugated paper with the covering 26 thereon and provided with the adhesive as above described is then led under a roller 80 and in passing under the roller the covering 32 is applied thereto from a roll 82. The corrugated paper 20 with the two coverings 26 and 32 applied thereto is then led up between the opposed faces of the pressing device 57', corresponding with the device 57 previously described, except that no grooves equivalent to the grooves 68 are assumed employed in this case, which presses the covering 32 against the opposed corrugations of the paper 20 and the assembly is then led to the roller 83 upon which it is wound.

It will be noted that in applying the covering 32 to the corrugated paper 20 it is applied thereto at a point where the corrugated paper 20 is bent around the roll 80. Consequently where the central line of thickness of the corrugated paper 20 remains at the same length, when the paper is straightened out there will be an excess in the length of the covering 32 on the corrugated paper which thus provides for an expansion of the corrugated paper in a direction perpendicular to the length of the corrugations without placing the covering 32 under tension in this direction. However, as previously described in order to additionally provide against the possibility of variations of dimensions of both the corrugated paper 20 and of the covering 32, particularly where the covering 32 is formed of metallic foil, from subjecting these parts to undue stresses, means are provided for crinkling the surface of the covering 32 and providing the gather lines 34 therein. Briefly this is accomplished by axially reciprocating the roll 82 during the withdrawal of the covering 32 therefrom and its application to the corrugated paper 20. The effect of this axial reciprocation of the roll 82 is particularly brought out in Fig. 12 wherein it will be noted that in the position of the parts shown the roll 82 has been reciprocated to the right of its transversely aligned position with the roll 80 and that this movement of the roll 82 to the right has caused the gather lines 34 to appear in the covering 32, these gather lines 34 being angularly disposed with respect to both the axis of the roll 82 and the direction of movement of the covering 32 therefrom. The particular angle of the gathers 34 will, of course, depend upon the amount and rate of the reciprocatory movements of the roll 82 as well as the distance between the axes of the rolls 80 and 82. As will also be understood the lines of gather 34 will extend in one angular direction during movement of the roll 82 axially in one direction and will extend in the opposite angular direction when the axial movement of the roll 82 is reversed. These gather lines 34 will be appreciated as being composed of ripples or corrugations in the covering 32 occurring as a result of the tendency to warp the covering 32 in the plane of its thickness. Additionally it will be found that the lines of gather 34 will occur usually in spaced groups in the manner illustrated in Fig. 12 and it will also be found that a certain amount of crinkling of the covering 32 will occur between the various gather groups during the formation of the gather groups 34 and particularly upon reversal of the reciproctary movement of the roll 82. The rolling of the final product onto the roll 83 will have the effect of shortening this face of the product, and increase the amount of slack material in this face, the tendency of which is also to produce a certain amount of additional crinkling of the material particularly when formed from metallic foil.

Although any suitable means may be employed for effecting axial reciprocation of the roll 82 and even manual means may be provided with satisfactory results, in Fig. 11 one suitable means is shown by way of illustration. This means comprises a member 90 fixed to the shaft of the roll 74 and provided with a peripheral cam track 92 in its surface, the cam track 92 being circumferentially continuous and providing consecutively oppositely angularly offset portions. The corresponding end of the shaft of the roll 82 is provided with a member 94 fixed thereto and this member is peripherally provided with a circumferential circular groove 96. A doubled arm lever 98 is mounted midway between its ends upon a fixed vertically extending pin 100 and one end of the lever 98 is received in the cam groove 92 and the opposite end in the groove 96. As will be appreciated, rotation of the member 90 will cause oscillatory movement of the double armed lever 98 the opposite end of which engaging in the groove 96 of the member 94 will automatically

effect reciprocatory axial movement of the roll 82 and the covering 26 carried thereby.

As previously mentioned there may be instances within the broader principles of the present invention where it is desired to apply a coating particularly of metallic foil, such as bright aluminum foil, to the surface of a solid sheet of paper or paper board, or other flat sheet-like material and it will readily be appreciated that in the event such material is of a relatively stiff character and relatively unyielding it is important that some means be provided to eliminate the danger of rupturing the foil upon variations in the dimensions of the foil due to temperature changes or variations in the dimensions of the sheet due to changes in moisture content. It will be readily understood that in such cases if the foil is of the character of the covering 32 previously described, that is either crinkled or provided with the lines of gather 34 or both, in the manner above described or in any other suitable way, the desired result will be obtained. Such a sheet or board of paper or like material is illustrated in Fig. 13 at 110, the metallic foil covering at 112, and the covering 112 is of crinkled formation and provided with lines of gather 114 similar to the lines of gather 34 previously described. It will be appreciated without further explanation that the covering 112 may be applied to the paper 110 in substantially the same manner as illustrated and described in connection with Figs. 8, 11 and 12.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. In combination, a corrugated sheet of paper, an approximately planular sheet of material overlying a face of the first mentioned sheet and directly adhered to the first mentioned sheet along the high points of the corrugations on the corresponding face thereof, the lines of adherence between the two sheets being substantially continuous and being interrupted substantially only at points on a line extending transversely of the lengths of said corrugations at which it is desired to later bend said sheets.

2. In combination, a corrugated sheet of paper, an approximately planular sheet of material overlying a face of the first mentioned sheet and directly adhered to the first mentioned sheet along the high points of the corrugations on the corresponding face thereof, the lines of adherence between the two sheets being substantially continuous and being interrupted substantially only at points on a line extending transversely of the lengths of said corrugations at which it is desired to later bend said sheets, and an excess of material in the second mentioned sheet along said line formed by interruption of said lines of adherence.

3. In combination, a sheet of corrugated material, lines of adhesive applied to the high points of the corrugations of the paper on at least one side thereof, said lines of adhesive being substantially continuous and being interrupted substantially only at points lying on lines extending transversely to the lines of said corrugations along which it is desired to later bend said sheet, a substantially planular sheet of flexible material secured directly to the first mentioned sheet by said lines of adhesive, and loops formed in the last mentioned sheet over said lines of interruption of adhesive.

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