April 11, 1950 C. E. SLAUGHTER 2,503,518

PACKAGING BY EXTRUSION

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FIG. 1.

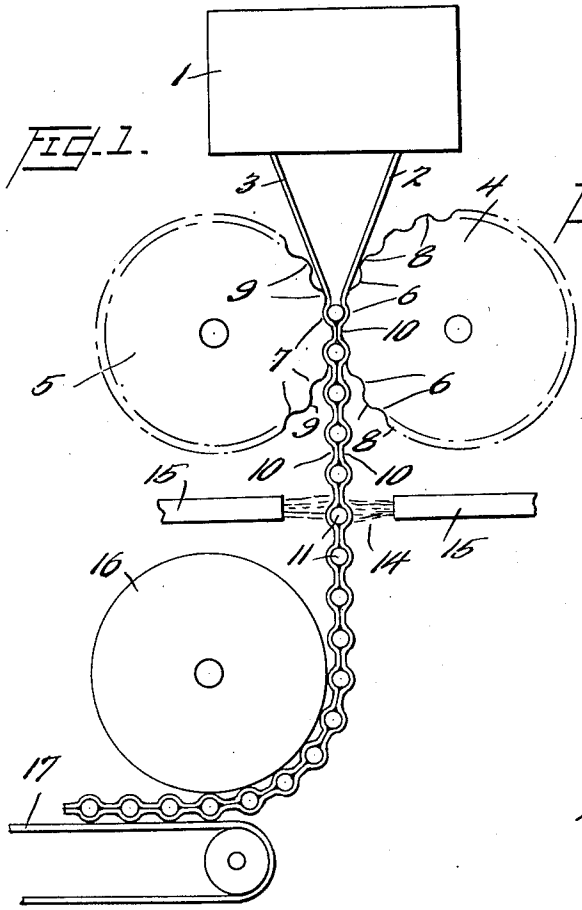

FIG. 2.

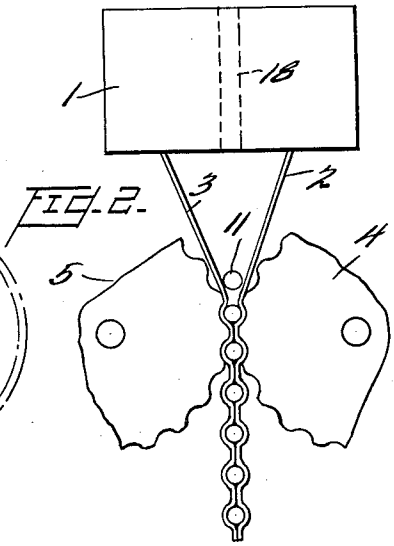

FIG. 3.

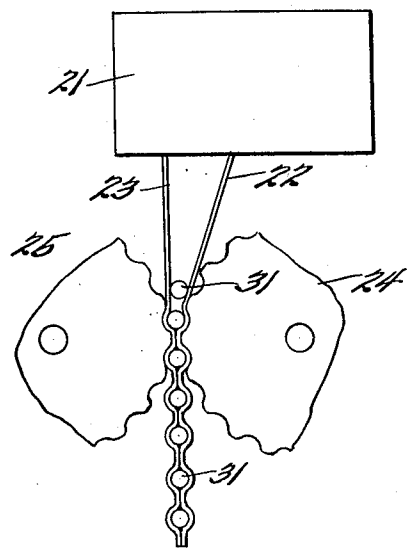

FIG. 4.

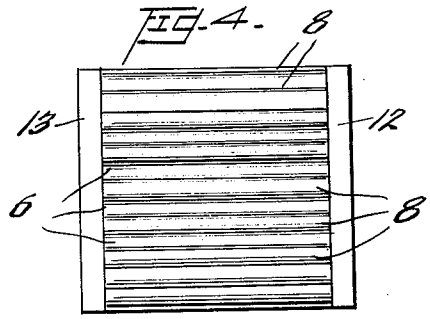

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FIG. 5.

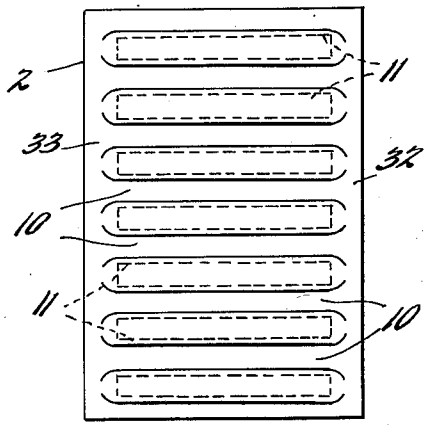


FIG. 6.

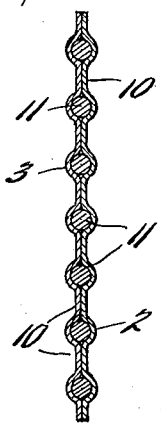


FIG. 7.

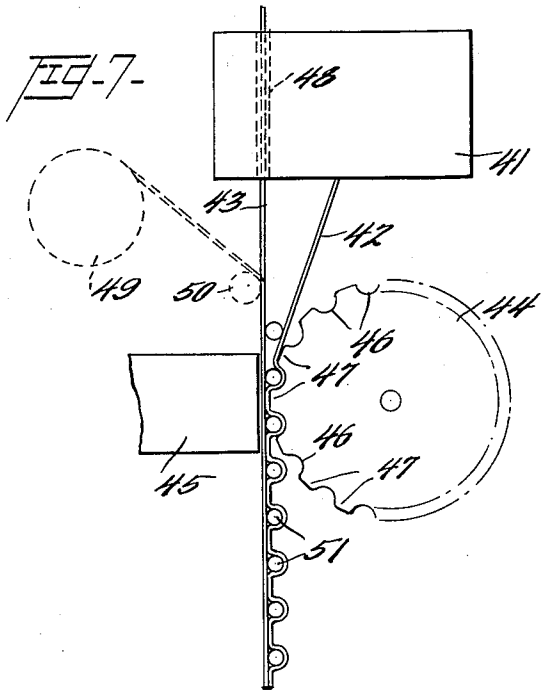
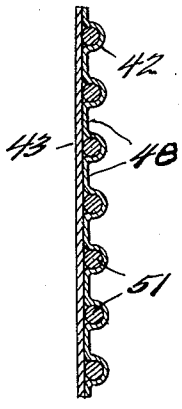


FIG. 8.



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2,503,518

PACKAGING BY EXTRUSION

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This invention relates to packaging by extrusion, and particularly to packaging elongated relatively thin articles such as steel drills, etc. within thermoplastic packaging material.

The packaging of elongated, thin, discrete articles such as steel drills, etc., to protect those drills and other articles, during merchandising, has offered difficulties in the art since for the most part they are wrapped in sheet material which cannot be sealed satisfactorily against liquids and gases to make such packages watertight or vapor-proof. Other methods of packaging such articles in which individual containers are manufactured from Celluloid or similar materials, are expensive, both from the standpoint of the package itself as well as from the standpoint of utilizing such cylindrical preformed containers in packaging operations since they are filled by hand.

Among the objects of the present invention is packaging elongated articles such as steel drills, etc., by simple and economical but effective methods.

Other objects include the packaged articles resulting from such methods.

Still further objects include machines and appliances for packaging such articles.

Still further and other objects and advantages of the present invention will appear from the more detailed description set forth below, it being understood that this more detailed description is given by way of explanation and illustration only, and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

In accordance with that more detailed description, there is shown in the accompanying drawings, in

Figure 1, a side elevation of a machine that can be utilized in carrying out the present invention; in

Figure 2, a side elevation of a modification of such machine; in

Figure 3, a side elevation of a further modification of the machine; in

Figure 4, a detail of one of the compression members of the machines of Figures 1–3; in

Figure 5, the article resulting from the methods of the present invention; in

Figure 6, a section through the article of Figure 5; in

Figure 7, a further modification of the machine shown in side elevation; and in

Figure 8, a longitudinal cross-section through

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the article produced by the machine of Figure 7.

In accordance with the present invention, steel drills and other elongated relatively thin articles are packaged within sheets of extruded thermoplastic resinous material, the material being chosen from the standpoint of waterproofness, vapor-tightness, resilience, etc. The desired articles as discrete entities are placed between the sheets which are to provide the covering or casing for protecting such articles, at least one of the sheets being an extruded thermoplastic resinous material. And the sheets are then hot pressed together or treated in any other way to form a sealed compartment for each of the articles between the attached sheets so that each article is separately packaged, a multiplicity of such articles being contained between the sheets, the sheets being sealed to each other surrounding each individual article. Most desirably the sheets of material are both extruded thermoplastic resinous materials and the sealing is effected by heat sealing the sheets to each other surrounding each of the articles such as drills. While it is preferred to use two sheets of extruded thermoplastic resinous material, one of the sheets such as a backing sheet may be a waterproofed or otherwise treated preformed sheet of material other than an extruded plastic and the second or top sheet is then of extruded thermoplastic resinous material. In such event, the backing sheet may be of paper, cardboard, cloth, textile of any type, etc., preferably treated such as by waterproofing, the backing sheet being of a material which in conjunction with the thermoplastic resinous material may be sealed together as by hot sealing with the thermoplastic resinous material adherent or actually welded to the backing sheet.

By any of these expedients there is produced a continuous flat article consisting of two sheets of material, one at least of which is an extruded thermoplastic resinous material completely covering and encasing the elongated articles such as steel drills which are to be packaged. Any number of such drills can be packaged in this way, and the sheeting carrying such encased drills or other articles, may be cut in any desired way to segregate individual protected drills or to produce an entity containing a number of drills which may be all drills or similar articles of the same type or may be a group of drills of different sizes sold as an entity in the sheeting as an article as described.

In carrying cut this invention, at least one of the sheets of encompassing or encasing material,

is an extruded thermoplastic resinous material having the desired properties with respect to waterproofness, vapor-tightness, adherence to the backing sheet, etc. which is desired in connection with the particular article. Such sheet may be extruded from the thermoplastic resinous material while the latter is hot and extruded in the usual manner from an extrusion die to produce an extruded sheet of the desired size or width, in juxtaposition to the backing sheet which as noted above, may be of any desired material but preferably is also an extruded thermoplastic resinous sheet, the two sheets being extruded in juxtaposition and the articles to be packaged being placed intermittently between the sheets immediately after the extrusion operation while the extruded sheets are still hot from the extrusion step and at a temperature sufficient to be self-sealing under pressure. In this way, the sealing of the extruded sheet to the backing material preferably a second extruded sheet is carried out immediately after the extrusion with the extruded sheet so that merely upon compression, the two sheets adhere rigidly together and in some cases as further explained below, there is actual welding of the thermoplastic resinous material to the backing sheet, the joint being formed completely about the article contained within the sheet so that the article is protected completely. Such operations may be readily carried out economically and simply by various methods as further illustrated below.

Referring to Figure 1, an extrusion die 1 of the conventional type is utilized to extrude thermoplastic resinous material such as polyethylene, or a polyvinyl derivative, or a cellulose derivative, in the form of two extruded sheets 2, 3. While separate extrusion dies and machines may be utilized for extruding the sheets 2 and 3, more desirably, a single extrustion die with two extrusion orifices is employed since in this way uniformity of extruded material and synchronism of the sheets is readily attained.

The sheets 2, 3 as extruded and while still hot from the extrusion step are carried between compression members 4, 5 provided with peripheral channels or grooves 6, 6 and 7, 7 respectively, and protuberances 8, 8 and 9, 9 respectively, between the grooves or channels 6 and 7. The compression members are mounted for rotation about their horizontal axes and may be in the form of cylindrical members having the peripheral grooves or channels and protuberances set forth above. The compression members 4 and 5 are mounted in correlation so that as they rotate, their peripheries approach each other as shown at 10 with sufficient space between the protuberances 8, 8 and 9, 9 to permit the sheets 2 and 3 to pass therebetween under compression which seals the sheets at such points; while the channels 6, 6 and 7, 7 respectively, coact together to produce a space within which articles 11, 11 are received between the sheets 2 and 3 and as the latter pass between the compression members 4 and 5, the article 11 is sealed within the sheets between two compressed areas 10, 10. The articles are fed intermittently between the sheets 2 and 3 so that a continuous chain of articles sealed within the sheets 2 and 3 is produced. The sealing operation as noted is carried out by the compression members 4 and 5 while the sheets 2 and 3 are still hot enough from the extrusion step to unite firmly at the areas where they are compressed together. A welded joint is thus obtained.

The compression members may be identical and take the form as further shown in Figure 4, where the cylinder has the indicated channels or grooves 6, 6 and the intermediate protuberances 8, 8 between the grooves and alternating therewith. The ends of the cylindrical compression members 4 and 5 have flattened areas 12, 13 of a diameter equal to that of the diametral distances between the protuberances so that the flattened ends 12 and 13 on each of the compression members 4 and 5 would also coact to cause side sealing of the sheets 2 and 3 longitudinally of the sheets to completely seal the edges thereof.

The articles 11, 11 may be fed intermittently between the extruded sheets 2 and 3 either manually or by automatic machinery. After passing the compression members 4 and 5 the chain of encased articles within the heat sealed sheets may pass into a cooling zone to produce rapid cooling or setting or rigidifying of the thermoplastic material depending on the particular material employed and such cooling zone for example, may consist of a curtain of coolant 14 from the distributor 15 which applies coolant to both sides of the packaged article and produce rapid cooling or setting or rigidifying thereof. The chain of articles may then be taken around a wheel 16 onto a conveyor belt 17 and may then pass to conventional cutting zones not shown, either to segregate a single article from the chain or to cut lengths of the chain of articles to produce a group or multiplicity of articles encased within the sheeting and available as an entity containing such multiplicity of articles.

The degree of adhesion of the thermoplastic material to the encased article may be readily controlled. In cases like that of steel drills and similar articles where it is not desired to have any substantial close or tight adhesion or welding of the thermoplastic to the metal, the drills or similar articles may be precooled before being fed between the extruded sheets and where the articles are precooled in this way, no substantial adherence will be obtained, particularly when the speed of operation of packaging is carried out at a high rate. On the other hand, where with some articles adherence of the encased article to the thermoplastic is desired or is immaterial, the articles will not be precooled, and may even be warmed if desired so that adhesion of the thermoplastic to the article does take place.

These operations may be applied to any elongated articles. While steel drills have been particularly mentioned, other elongated articles may be similarly packaged including discrete lengths of tubing, whether of metal, paper, cardboard, etc., or discrete lengths of rod, cigarette holders of various types, etc. In any case the two films or sheets at self-welding heat from the extrusion die are passed through a pair of gear-shaped rolls or otherwise treated as herein set forth which roll or rolls applies just sufficient pressure to press the two films together to form a true bond between such sheets or films of material, completely sealing the articles within such sheets or films.

The films or sheets of extruded material may be of any desired thickness or thinness and width for the particular purposes in hand. Polyethylene and similar materials are particularly effective as a packaging material when used in this way and relatively thin wall sheets can be employed in operations as set forth herein. Other types of thermoplastic materials may be utilized although most desirably thermoplastic synthetic resinous materials are employed including cellu-

lose derivatives such as the esters and ethers for example, cellulose acetate, cellulose nitrate, cellulose acetate butyrate, ethyl cellulose, benzyl cellulose, etc.; vinyl polymers and copolymers including polymerized vinyl acetate, polymerized vinylidene chloride, and copolymers of vinyl chloride and vinyl acetate; polymerized styrenes; methacrylate and methyl methacrylate resins; polyethylenes, nylon type resins, etc.

One expedient that may be utilized in supplying the articles between the extruded sheets is illustrated in Figure 2. In this case the die 1 having two extrusion orifices through which the sheets 2 and 3 are extruded in the manner set forth above in the description of Figure 1, is provided with a passageway 18 running transversely through the die to within the space between the sheets 2 and 3 which are being extruded so that articles may be intermittently dropped into the passage 18 and fall down between the sheets 2 and 3, the intermediate feeding of such articles being thus readily carried out. The operation of Figure 2 otherwise may be the same as that illustrated above in connection with Figure 1.

A further modification is illustrated in Figure 3 in which the die 21 extrudes sheets 22 and 23 in juxtaposition, one of the sheets being extruded in substantially horizontal position, the articles 31 being fed in any of the manners set forth above in describing Figures 1 and 2, to the space between the juxtaposed sheets 22 and 23. The latter with the articles therebetween in intermittently spaced relation pass between the compression members 24 and 25 of the same character as that illustrated above in connection with Figure 1, rotating at a speed synchronized with that of extrusion so that a chain of articles is produced with the articles 31, 31 encased or enveloped between the heat sealed sheets 22 and 23. The particular manner of operation of Figure 3 will follow analogously to that of Figures 1 and 2 with respect to the manners of operation, the materials employed, the manner of inserting the articles to be enveloped, etc.

From these operations as noted, an endless chain of enveloped or encased articles is produced consisting of sheets of material at least one of which is an extruded thermoplastic resinous material, the sheets being heat sealed to each other surrounding each drill or article between them from which endless chain of encased articles, sections may be cut as illustrated in Figure 5, showing a multiplicity of articles 11, 11, desirably in uniform parallel relation intermittently spaced from each other within the enveloping sheets 2 and 3 which have been heat sealed between the articles at 10, 10 and along the edges of the sheet as shown at 32 and 33. From such section of enveloped or encased group of articles, individual articles may be severed by cutting through the portions 19 between the individual articles.

In the methods and apparatus as described above, the more desirable phase of the invention is explained in which at least two sheets of thermoplastic resinous material are extruded simultaneously, most desirably from a single extrusion die. However, it is not essential that both sheets be extruded materials but a single sheet of extruded thermoplastic resinous material may be extruded and caused to adhere to a preformed backing sheet, which latter may be paper, cardboard, cloth, or any textile material, etc., preferably treated so that it is waterproof, or vaportight, or has the properties desired; or such preformed sheets or web may be of thermoplastic material. As shown in Figure 7, an extrusion die 41 extrudes hot thermoplastic resinous material as an extruded sheet or web 42 while a backing sheet 43 is supplied in juxtaposition to the extruded sheet 42. Such backing sheet may be supplied as a continuous web passing through the die as through a passage 48 therein, or such backing web may be obtained from a roll or bolt thereof 49 passing over the idling roller 50 into juxtaposition with the extruded sheet 42. The articles 51, 51 are inserted between the juxtaposed sheets by any of the methods explained above in connection with Figures 1 to 3 and the assembly then passes between compression members 44 and 45. While the compression members may be of the type illustrated in connection with Figure 1 above, it is not essential to use two gear-shaped rolls, but one of the compression members 44 may be of the type illustrated and described above in Figures 1 and 4, while the other compression member 45 may be a smooth surface against which the compression member 44 operates carrying peripheral grooves 46, 46 within which the articles 51, 51 are received together with the sheets 42 and 43, while the protuberances 47, 47 compress the sheets 42 and 43 together, and since the extruded thermoplastic resinous sheet 42 is still hot from the extrusion operation, a true bond is formed under compression of the sheets between the compression members 44 and 45, and depending on the choice of thermoplastic and backing member, actual welding of the material together is obtained to produce a true bond. The resulting article as it emerges from the compression members may be subjected to a coolant if desired or necessary depending on the materials employed as illustrated above in connection with Figure 1 and is then taken off the machine in any desired way. The resulting article is as illustrated in section in Figure 8, an article in which the extruded thermoplastic sheet 42 is bonded to the backing sheet 43, the latter being substantially flat while the thermoplastic sheet 42 has been bonded to the backing sheet 43 at points 48, 48, intermediate between the articles 51, 51, encased or enveloped within the superposed sheets.

Where the packaging is applied to tools or other metal articles such as drills, etc., the thermoplastic material utilized for extrusion purposes may be an oil-filled material such as oil-filled ethyl cellulose, etc. Such oil-filled material is produced by milling a desired oil such as a lubricating oil into the synthetic resin. The oil is held within the material and over substantial periods of time, with changes in temperature, minute quantities of the oil are exuded from the surfaces of the material. Tools packaged in containers made from such oil-filled resinous material are thus given protection against rusting. Consequently the oil-filled resinous materials may be utilized in producing the extruded sheets by any of the methods set forth above.

In any case where adhesion of the plastic sheets to the articles is not sought, as set forth above, the extruded sheets of plastic may be made of a width less than the length of the articles, for example, polished metal rods, so that an end of each of such articles extends beyond one side of the plastic sheets in the packaged articles, while the inner end of each article is encased within the superposed plastic sheets. In this case, each article can be readily taken hold of and withdrawn from the package.

Having thus set forth my invention, I claim:

1. The method of packaging steel drills which comprises continuously extruding hot thermoplastic resinous material to form two extruded continuous flat sheets in juxtaposition, inserting steel drills intermittently between said continuous, extruded flat sheets immediately after extrusion as the advancing sheets are being formed and while the extruded sheets are still hot enough to be self-sealing under pressure, and compressing said sheets against each other at areas surrounding each drill while the sheets are still hot from the extruding operation to seal the sheets to each other about each drill.

2. The method of packaging steel drills which comprises continuously extruding hot, oil-filled thermoplastic resinous material to form two extruded continuous flat sheets in juxtaposition, inserting steel drills intermittently between said continuous extruded flat sheets immediately after extrusion as the advancing sheets are being formed and while the extruded sheets are still hot enough to be self-sealing under pressure, and compressing said sheets against each other at areas surrounding each drill while the sheets are still hot from the extruding operation to seal the sheets to each other about each drill.

3. The method of packaging elongated relatively thin rigid articles which comprises continuously extruding hot thermoplastic resinous material to form two extruded continuous flat sheets in juxtaposition, inserting such elongated articles intermittently between said continuous, extruded flat sheets immediately after extrusion as the advancing sheets are being formed and while the extruded sheets are still hot enough to be self-sealing under pressure, and compressing said sheets against each other at areas surrounding each of the articles while the sheets are still hot from the extrusion to seal the sheets to each other about each article.

4. The method of packaging steel drills which comprises continuously extruding hot thermoplastic resinous material from a single extrusion die having two extrusion orifices to form two extruded continuous flat sheets in juxtaposition, inserting steel drills intermittently between said continuous, extruded flat sheets immediately after extrusion as the advancing sheets are being formed and while the extruded sheets are still hot enough to be self-sealing under pressure, and compressing said sheets against each other at areas surrounding each drill while the sheets are still hot from the extruding operation to seal the sheets to each other about each drill.

5. The method of packaging articles which comprises continuously extruding hot thermoplastic resinous material from a single extrusion die having two extrusion orifices to form two extruded continuous flat sheets in juxtaposition, the die having a passage therethrough leading to the space between the extrusion orifices, intermittently passing discrete rigid articles to be packaged through said passage to a position between the extruded continuous advancing flat sheets as the latter are being extruded, and compressing said sheets against each other at areas surrounding the articles while the sheets are still hot enough from the extrusion step to heat seal them to each other under pressure.

6. The method of packaging articles which comprises continuously extruding a hot thermoplastic resinous material to form an extruded continuous flat sheet in juxtaposition to a continuous preformed sheet of material which is capable of welding to the hot thermoplastic, inserting rigid articles intermittently between said continuous advancing flat sheets immediately after extrusion while the extruded sheet is still hot enough from the extrusion step to weld to the preformed sheet under pressure, and compressing the sheets against each other together at areas surrounding each article while the extruded sheet is still hot to heat seal the sheets to each other about each article.

7. The method of claim 3 in which a coolant is applied to said compressed sheets.

8. The method of claim 5 in which a coolant is applied to said compressed sheets.

9. The method of claim 3 in which the elongated articles are precooled to a temperature at which the plastic will not adhere to them before being inserted between said sheets.

10. The method of packaging articles which comprises continuously extruding a hot thermoplastic resinous material to form an extruded continuous flat sheet in juxtaposition to a continuous preformed extruded sheet of thermoplastic resinous material which is capable of welding to the first mentioned thermoplastic, inserting rigid articles intermittently between said continuous advancing flat sheets immediately after extrusion while the first extruded sheet is still hot enough from the extrusion step to weld to the preformed sheet under pressure, and compressing the sheets together at areas surrounding each article while the first extruded sheet is still hot to heat seal the sheets to each other about each article.

CHARLES E. SLAUGHTER.

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