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RESERVE CO. PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

An Improved Manufacture of Moulded Articles of Rubber and other Curable Plastic Materials.

We, ST. HELENS CABLE & RUBBER COMPANY LIMITED, a British Company, of St. Helens Works, Slough, Buckinghamshire, PERCIVAL WILLIAM CLEPHAN, of "The Elms," Trading Estate, Slough, Buckinghamshire, and ALFRED JOSEPH ENSOR, of 42, Yeading Lane, Hayes, Middlesex, both British Subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement :—

Moulds made of rubber and of other substances having a similar capacity for large elastic deformation have been used primarily because their possession of the possibility of considerable stretching or distortion of shape provides a peculiarly advantageous procedure for the removal of a moulded or cast article from the mould. In many cases a one-piece mould of such material is practicable for shapes which include undercut and re-entrant parts which would require a mould of rigid material to be sub-divided into sections. This deformability of the mould has, however, the disadvantage that if the mould is used for the shaping of materials which require a substantial pressure to bring them to fit the mould, then the mould undergoes a change of shape and dimensions and does not accurately reproduce the desired form in the moulded article.

In accordance with the present invention an improved manufacture is provided which overcomes this difficulty and provides moulds which retain, at least in some very useful degree, the advantage of local distortion or stretching to permit withdrawal of the moulded article and also give sufficient accuracy of reproduction of dimensions for many cases where moulding under pressures (which may be high) is essential. These conditions are, for instance, found in moulding unvulcanised rubber or rubber-like materials.

The improved manufacture makes use of the

property that rubber has substantially zero value of volumetric compression, that is to say it has a substantially infinite modulus of volumetric elasticity.

In this improved manufacture a mould is produced by pressing round the pattern a body of unvulcanised rubber compound, which at the end of the pressing is substantially completely enclosed within rigid boundaries. The pressure is retained during vulcanising, after which the mould is opened and the pattern is removed, leaving an accurate impression in the vulcanised rubber. The term "opening the mould" as used herein includes the separation of the mould from the pattern by cutting it into two or more parts. The rubber body bearing this impression is then used with similar complete rigid enclosure as a mould. The material to be moulded is inserted in sufficient quantity to fill the mould space and the mould is then closed under pressure thus bringing the enclosed material to the shape of the mould. The pressure is then maintained during the heat treatment necessary to cure the moulded article so that it retains its shape and dimensions when removed from the opened mould.

The enclosing of the rubber mould within rigid boundaries may, in some cases, limit the flexibility of the mould which is available for helping the removal of the moulded article and accordingly, it will frequently be necessary to use moulds in two parts and in some cases in more than two parts. The rigid enclosure of the mould can in many cases be conveniently provided by surrounding the rubber mould material by a cylinder of metal closed at the two ends by the plates of a hydraulic press. A circular cylindrical wall, such as a short length cut from a steel pipe, has the advantage of minimum deformability under internal pressure. The required pressure on the rubber during shaping may be several hundred pounds per square inch.

[Price 2s. 8d.]

The following example of the making of a mould and the using of it for producing a moulded article in rubber will illustrate the invention. In this description reference will be made to the accompanying drawings, in which Figure 1 is a diagrammatic drawing, partly in cross-section of the mould and Figure 2 is a perspective view of the moulded article (a cornice piece detail for a motor-car body). A pattern 1 representing exactly the article to be moulded (Figure 2) is provided in some sufficiently hard material, for instance metal or a suitable close-grain timber. A steel cylinder 2 of substantially larger diameter than the maximum dimensions of the pattern 1 is taken and placed on one of the plates 3 of a press. In the lower part of this cylinder is placed a slab 4 of unvulcanised rubber compound of appropriate constitution and condition, such as a piece cut from a sheet of the required thickness. The pattern 1 is laid in the middle of the cylinder, preferably as shown with its maximum dimension horizontal, and a second slab 5 of rubber is placed over it so as to fill the cylinder 2 and project a little above it. The other plate 6 of the press is then brought into contact with the upper surface of the rubber and pressure is applied to the required extent to force the rubber to close down tightly round the pattern 1. Heat is then applied to the press plates 3 and 6 and maintained for a sufficient length of time to vulcanise the rubber compound. The face 7 of the lower slab of rubber 4 in the cylinder 2 is treated with french chalk or other suitable material for the purpose of ensuring that the two parts of the mould do not unite during pressing and vulcanising. Accordingly, after the completion of the vulcanising and the separation of the press plates 3 and 6, the upper slab 5 of rubber can be removed, being separated from the pattern 1 by stretching and deformation if necessary. The pattern 1 is then taken out of the lower part of the mould. In an alternative procedure the two slabs 4 and 5 are allowed to unite during vulcanisation and the mould is divided into two parts, to separate it from the pattern, by cutting.

Pins such as 8 are preferably inserted in the lower slab or projections are provided at some point on the inside of the enclosing cylinder to form a corresponding hole or recess in the upper part of the mould whereby this is located when the mould is used for the purpose of producing a moulded article. To make such an article a quantity of unvulcanised rubber compound just sufficient to fill the mould is placed in the mould space in the lower part of the mould. The upper part of the mould is then applied and the complete mould is inserted in the press by which it is closed and then heated so as to vulcanise the compound in the mould. On

removal from the press the mould is opened and the moulded rubber article is removed. When necessary, precautions are taken to prevent adhesion between the moulded article and the mould; the inner surfaces may, for example be treated with french chalk before the mould is filled.

In some cases it may be practicable to use a single slab of rubber for the mould. This may occur when the pattern has a fairly large flat surface which can then be put in direct contact with a plate of the press which forces the pattern into a single slab of rubber.

It will be recognised that the exercise of judgment is necessary in placing the pattern in the most advantageous position in the mould, although in many instances this is not of great importance. It is found that the line of division between the parts of the mould adjusts itself to suit the form of the pattern, it does not result in the production of a flat plane of division between the parts of the mould.

Other materials than rubber may be moulded in these rubber moulds. Properties of the material required for suitability are that there should be no appreciable diminution of volume of the material during moulding and that the material should be cured under pressure to produce the finished article for removal from the mould.

The term "rubber" used herein for describing the mould is to be read as covering not only vulcanised natural rubber of various grades, including ebonite, but also synthetic rubbers and other rubber-like substances which possess the properties herein indicated. The material for the mould will usually contain compounding ingredients by which in well known manner its properties may be modified in desired ways. These will, in many cases, include ingredients which assist heat conductance through the body of the mould from the heating surfaces to the cavity.

In the preceding description the use of the improved mould has been described for compression moulding. It is also applicable to transfer and injection moulding, a passage or passages for feeding the mould being formed in the body of rubber and suitable external feeding arrangements being provided.

What we claim is:—

1. A method of manufacturing an article of rubber or other curable plastic material which comprises pressing round a rigid pattern of the article a body (or bodies) of unvulcanised rubber compound which at the end of the pressing is substantially completely enclosed within rigid boundaries, vulcanising the rubber in the enclosure formed by said boundaries while still under pressure, opening the mould thus formed, removing the

5 pattern and then using the mould, enclosed in the same or a similar rigid enclosure, to manufacture the article, the mould being closed under pressure to shape the article and maintained under pressure during the curing of the article.

10 2. A method of manufacturing an article of rubber or other curable plastic material which comprises moulding the article in a mould formed by pressing round a rigid pattern of the article a body (or bodies) of unvulcanised rubber compound which at the end of the pressing is substantially completely enclosed in rigid boundaries and vulcanising the rubber in the enclosure formed by said boundaries while still under pressure, the mould being enclosed during the moulding process in the same or a similar rigid enclosure and maintained under pressure during the moulding and curing of the article.

15 3. A method of manufacturing an article of rubber or other curable plastic material which comprises pressing round a rigid pattern of the article a body (or bodies) of unvulcanised rubber compound which at the end of the pressing is substantially completely enclosed within rigid boundaries comprising a hollow metal cylinder closed at both ends by the plates of a press, vulcanising the rubber in the enclosure formed by said boundaries while still under pressure, opening the mould thus formed, removing the pattern and then

using the mould, enclosed in the same or a similar rigid enclosure, to manufacture the article, the mould being closed under pressure to shape the article and maintained under pressure during the curing of the article.

4. A method of manufacturing an article of rubber or other curable plastic material which comprises moulding the article in a mould formed by pressing round a rigid pattern of the article a body (or bodies) of unvulcanised rubber compound enclosed in a hollow metal cylinder, the ends of which are closed by the plates of a press by means of which pressure is applied to the rubber compound, and vulcanising the rubber while so enclosed, the mould being enclosed during the moulding process in the same or a similar cylinder and maintained under pressure by the plates of a press, applied to the ends of said cylinder, during the moulding and curing of the article.

5. A method of manufacturing an article of rubber or other curable plastic material substantially as described with reference to the accompanying drawings.

Dated this 25th day of January, 1950.

R. L. CLEAVER,

Agent for the Applicants,

Surrey House, Temple Place, London, W.C.2.

PROVISIONAL SPECIFICATION

An Improved Manufacture of Moulded Articles of Rubber and other Curable Plastic Materials.

60 We, ST. HELENS CABLE & RUBBER COMPANY LIMITED, a British Company, of St. Helens Works, Slough, Buckinghamshire, PERCIVAL WILLIAM CLEPHAN, of "The Elms," Trading Estate, Slough, Buckinghamshire, and ALFRED JOSEPH ENSOR, of 42, Yeading Lane, Hayes, Middlesex, both British Subjects, do hereby declare the nature of this invention to be as follows:—

65 Moulds made of rubber and of other substances having a similar capacity for large elastic deformation have been used primarily because their possession of the possibility of considerable stretching or distortion of shape provides a peculiarly advantageous procedure for the removal of a moulded or cast article from the mould. In many cases a one-piece mould of such material is practicable for shapes which include undercut and re-entrant parts which would require a mould of rigid material to be sub-divided into sections. This deformability of the mould has, however, the disadvantage that if the mould is used for the shaping of materials which require a substantial pressure to bring them to fit the

mould, then the mould undergoes a change of shape and dimensions and does not accurately reproduce the desired form in the moulded article.

70 In accordance with the present invention an improved manufacture is provided which overcomes this difficulty and provides moulds which retain, at least in some very useful degree, the advantage of local distortion or stretching to permit withdrawal of the moulded article and also give sufficient accuracy of reproduction of dimensions for many cases where moulding under pressures (which may be high) is essential. These conditions are, for instance, found in moulding unvulcanised rubber or rubber-like materials. The improved manufacture makes use of the property that rubber has substantially zero value of volumetric compression, that is to say it has a substantially infinite modulus of volumetric elasticity.

75 In this improved manufacture a mould is produced by pressing round the pattern a body of unvulcanised rubber compound, which at the end of the pressing is substantially completely enclosed within rigid bound-

daries. The pressure is retained during vulcanising, after which the mould is opened and the pattern is removed, leaving an accurate impression in the vulcanised rubber.

5 The rubber body bearing this impression is then used with similar complete rigid enclosure as a mould. The material to be moulded is inserted in sufficient quantity to fill the mould space and the mould is then closed under pressure thus bringing the enclosed material to the shape of the mould. The pressure is then maintained during the heat treatment necessary to cure the moulded article so that it retains its shape and dimensions when removed from the opened mould.

10 The enclosing of the rubber mould within rigid boundaries may, in some cases, limit the flexibility of the mould which is available for helping the removal of the moulded article and, accordingly, it is frequently necessary to use moulds in two parts and in some cases in more than two parts. The rigid enclosure of the mould can in many cases be conveniently provided by surrounding the rubber mould material by a cylinder of metal closed at the two ends by the plates of a hydraulic press. A circular cylindrical wall, such as a short length cut from a steel pipe, has the advantage of minimum deformability under internal pressure. The required pressure on the rubber during shaping may be several hundred pounds per square inch.

25 The following example of the making of a mould and the using of it for producing a moulded article in rubber will illustrate the invention. A pattern representing exactly the article to be moulded is provided in some sufficiently hard material, for instance metal or a suitable close-grain timber. A steel cylinder of substantially larger diameter than the maximum dimensions of the pattern is taken and placed on one of the plates of a press. In the lower part of this cylinder is placed a slab of unvulcanised rubber compound of appropriate constitution and condition, such as a piece cut from a sheet of the required thickness. The pattern is laid in the middle of the cylinder, preferably with its maximum dimension horizontal and a second slab of rubber is placed over it so as to fill the cylinder and project a little above it.

30 The other plate of the press is then brought into contact with the upper surface of the rubber and pressure is applied to the required extent to force the rubber to close down tightly round the pattern. Heat is then applied to the press plates and maintained for a sufficient length of time to vulcanise the rubber compound. The face of the lower slab of rubber in the cylinder was treated with french chalk or other suitable material for the purpose of ensuring that the two parts of the mould do not unite during

pressing and vulcanising. Accordingly, after the completion of the vulcanising and the separation of the press plates, the upper slab of rubber can be removed, being separated from the pattern by stretching and deformation if necessary. The pattern is then taken out of the lower part of the mould.

70 Pins are preferably inserted in the lower slab or projections are provided at some point on the inside of the enclosing cylinder to form a corresponding hole or recess in the upper part of the mould whereby this is located when the mould is used for the purpose of producing a moulded article. To make such an article a quantity of unvulcanised rubber compound just sufficient to fill the mould is placed in the mould space in the lower part of the mould. The upper part of the mould is then applied and the complete mould is inserted in the press by which it is closed and then heated so as to vulcanise the compound in the mould. On removal from the press the mould is opened and the moulded rubber article is removed.

80 In some cases it may be practicable to use a single slab of rubber for the mould. This may occur when the pattern has a fairly large flat surface which can then be put in direct contact with a plate of the press which forces the pattern into a single slab of rubber.

85 It will be recognised that the exercise of judgment is necessary in placing the pattern in the most advantageous position in the mould, although in many instances this is not of great importance. It is found that the line of division between the parts of the mould adjusts itself to suit the form of the pattern, it does not result in the production of a flat plane of division between the parts of the mould.

90 Other materials than rubber may be moulded in these rubber moulds. Properties of the material required for suitability are that there should be no appreciable diminution of volume of the material during moulding and that the material should be cured under pressure to produce the finished article for removal from the mould.

95 The term "rubber" used herein for describing the material of which the mould is made is to be read as covering not only vulcanised natural rubber of various grades, including ebonite, but also synthetic rubbers and other rubber-like substances which possess the properties herein indicated. The material for the mould will usually contain compounding ingredients by which in well known manner its properties may be modified in desired ways. These will, in many cases, include ingredients which assist heat con-

100 ductance through the body of the mould from the heating surfaces to the cavity. In the preceding description the use of the improved mould has been described for compression moulding. It is also applicable

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to transfer and injection moulding, a passage
or passages for feeding the mould being
formed in the body of rubber and suitable
external feeding arrangements being pro-
5 vided.

Dated this 26th day of January, 1949.

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Agent for the Applicants.
Surrey House, Temple Place, London, W.C.2.

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