July 11, 1939. H. D. STUCK 2,165,947

GLUED JORDAN LINING

Filed Jan. 16, 1936 2 Sheets-Sheet 1

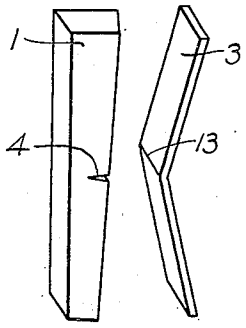


Fig. 1.

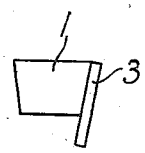


Fig. 2.

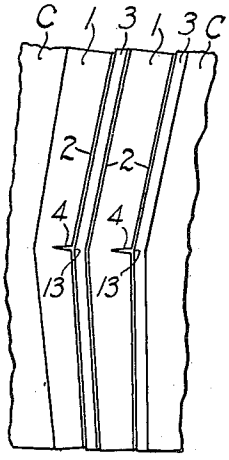


Fig. 3.

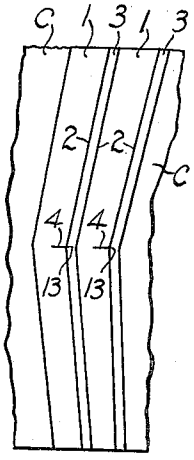


Fig. 4.

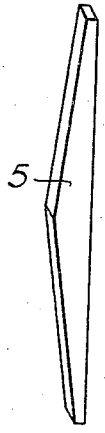


Fig. 5.

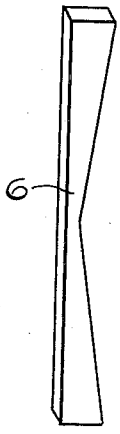


Fig. 6.

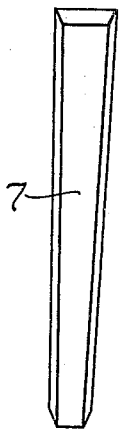


Fig. 7.

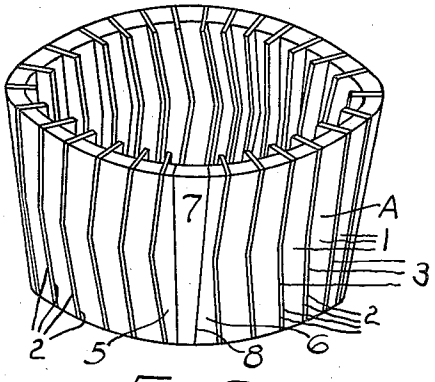


Fig. 8.

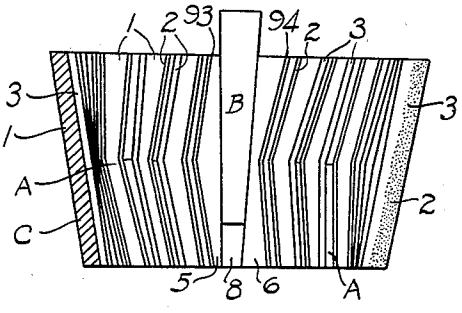


Fig. 9.

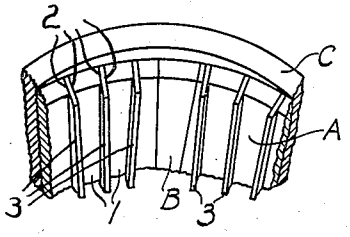


Fig. 10.

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GLUED JORDAN LINING

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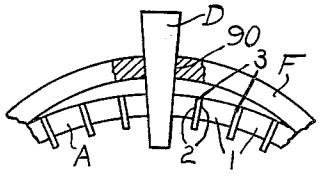


Fig. 11.

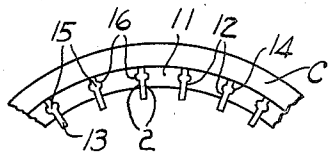


Fig. 12.

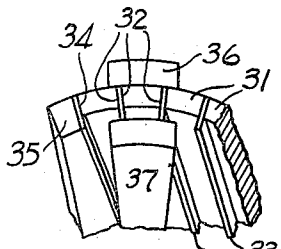


Fig. 13.

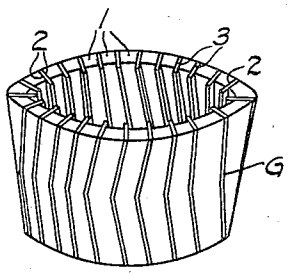


Fig. 14.

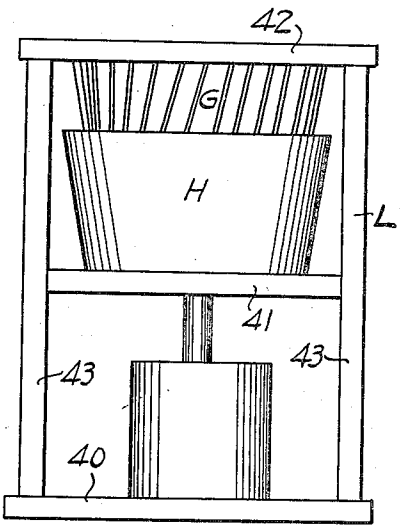


Fig. 15.

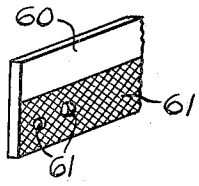


Fig. 16.

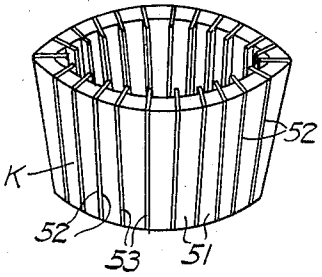


Fig. 17.

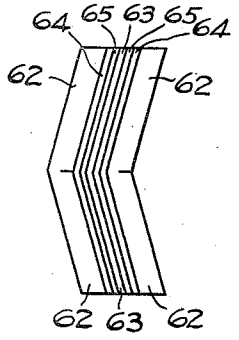


Fig. 18.

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Patented July 11, 1939 2,165,947

UNITED STATES PATENT OFFICE

2,165,947

GLUED JORDAN LINING

Harold D. Stuck, Lawrence, Mass., assignor to John W. Bolton & Sons, Inc., Lawrence, Mass., a corporation of Massachusetts

Application January 16, 1936, Serial No. 59,432

15 Claims. (Cl. 92—27)

This invention has to do with the lining of a Jordan engine shell which consists generally of a series of members usually including bent knives between which are separators, usually of wood, which are generally of key stone shaped cross section, wedge-shaped lengthwise, and cut part way across midway so that they can be bent to conform to the bend of the knives, together with cheek pieces usually of wood, often an anchor bar and, when in the shell, a wedge.

Formerly these members were shipped to the paper mill and with the aid of suitable forms, were assembled in a fixed Jordan shell, but more recently, they have been put together and held together in various ways, either as a split or a complete truncated cone, or as segments. In any case, these preassembled cones or segments are bodily transportable unitary parts which can stand shipping and handling. They have been held together by wires, jackets, staples in the ends and in many other ways, but never by glue or other adhesive alone. This invention is a preassembled lining or part of a lining held together by an adhesive only.

Its principal advantages are its simplicity, cheapness and ease of manufacture.

In order to fit the separators and the knives closely together before locking them in place, they have been assembled in a jig or form of the shape of the shell to be lined and forced together by wedges driven in radially or longitudinally before the parts are locked together.

I have found that it is not practical to put glue between the adjoining separators and knives without steady pressure held long enough for it to set as it will not adhere sufficiently to hold the assembly together while it is being shipped and while it is being installed in a permanent shell.

I find it is necessary to subject practically every individual separator, particularly if it is of wood, and each adjoining knife to a uniform and steady pressure of a predetermined amount for a predetermined time to squeeze and hold them together in order to allow the glue to set and to keep the parts in place. I also find it highly desirable to exert enough very great steady pressure on the separators, particularly if they are of wood, to uniformly compact the fibers as well as to take up all slack and to close all spaces.

This might be done by well-known methods of driving longitudinal or radial assembling wedges by striking with a hammer, but the concussion and unequal strains of this method are objectionable.

In co-pending application of applicant Harold D. Stuck and Philip A. De Nault on Process of making linings for Jordan engine shells, filed June 2, 1934, Serial No. 728,780, we have shown and described a process by which the lining can be built up of wooden separators and knives held together only by glue and to the extent of being disclosed therein, this invention is on one product of that process of successively squeezing the members as they are successively assembled to form the whole or part of a lining in the form of part of the circumference of a truncated cone, this application being on the product instead of the process.

This product can also be produced by the process described in my application for United States Letters Patent of Process of fitting Jordan shell linings, filed July 12, 1934, Serial No. 734,819, or by a division thereof on Machine for making Jordan shell linings, filed December 31, 1935, Serial No. 56,957, or by other methods, machines and devices as herein explained.

I also claim a lining or part of a lining in which the members are held together by an adhesive and have been compressed beyond their elastic limit so that the lining will not expand after it is removed from the form but will retain substantially its size and shape.

In the drawings, Fig. 1 is an isometric view of a bent knife and separator of a common type.

Fig. 2 is an end view of an assembly of one knife and one separator.

Fig. 3 is a fragmentary inside view of a form with several knives and separators assembled before being pressed together and Fig. 4 is a view of the same after being pressed together.

Figs. 5, 6, and 7 are isometric views of what are known as cheek pieces and a wedge such as are also used as members to separate the knives.

Fig. 8 is an isometric view of a complete split lining.

Fig. 9 is a vertical sectional view of a split lining after it is assembled and as its members are being pressed together in a form.

Fig. 10 is a fragmentary isometric view of a number of members assembled in a form as they appear after a longitudinal squeezing wedge had been driven in, and Fig. 11 is a similar view showing the parts while a radial squeezing wedge is being driven in.

Fig. 12 is a fragmentary end view of a modified type of lining in a form.

Fig. 13 is a fragmentary isometric view of

certain parts of a machine for assembling the knives and separators.

Fig. 14 is an isometric view of an unsplit lining.

Fig. 15 is a diagrammatic elevation showing another machine for assembling the lining.

Fig. 16 is an isometric view of one type of knife.

Fig. 17 is an isometric view of an unsplit lining with straight knives and separators.

Fig. 18 is a diagrammatic view of a bent knife assembled with separators, the parts being held together by two different kinds of glue.

Fig. 1 shows at 1 the usual separator or wood of keystone shape in cross section and of wedge shape longitudinally, partly cut through at 4 so that it can bend and fit the outside angle 13 of a bent knife 3, as shown in Fig. 3. Fig. 2 is an end section showing the usual transverse keystone shape of the separator as contrasted with the cross section of knife 3.

Fig. 3 also shows how a plurality of knives 3, 3 and separators 1, 1 are assembled in a form C with glue or some other suitable adhesive indicated by 2 and 2 between them. The separators must be bent at 4 and in this view the spaces between the separators and knives is exaggerated to show the contrast with the squeezed construction shown in Fig. 4.

The really loose assembly shown in Fig. 3 is shown in Fig. 4 as squeezed together so that the spaces between the members are closed up tight and the adhesive is spread evenly and thoroughly so that if the members are held together long enough, it will set and hold them permanently together.

In Figs. 5, 6 and 7, 5 represents what might be called a male cheek piece, 6 a female cheek piece and 7 a wedge. These are well-known parts of a Jordan lining, the cheek pieces 5 and 6 being used to compensate for the angularity of the bent knives so that a wedge such as 7 or B can be driven longitudinally into a split such as 8, shown in Fig. 8, to fit a lining such as A to the permanent Jordan shell.

Fig. 9 shows one method of squeezing and compacting an assembly of bent knives 3, wooden separators 1 with the adhesive 2 and 2 between them, together with cheek pieces 5 and 6, which may also be attached to adjoining knives, as by an adhesive 93 or 94, which are the last knives before a split such as 8.

B is a squeezing wedge or manufacturing wedge while 7 is a fitting wedge used after the lining or section of lining is made. The wedge B is used in making a preconstructed lining such as A, by being driven in longitudinally in a well-known way by means of a mallet or battering ram and kept in position until the adhesive sets when it is driven out.

One objection to this method is that, as shown in Fig. 10, there is a tendency for the assembly such as A to buckle in or move away from the form C.

This tendency is still greater where the special form F is used, such form having one or more radial holes such as 99 through which a radial wedge D is driven from the outside as shown in Fig. 11. In this method of construction, the tendency to buckle is greater than in the method shown in Fig. 9.

To counteract this tendency, I may use knives 13 with projections or irregularities indicated at 15 which register with and fit corresponding irregularities 16 in the separators 11. These irregularities as shown in Fig. 12 may be projecting ribs from the knives fitting corresponding grooves in the separators such as shown in patent to A. L. Bolton on Self-supporting lining for Jordan engine shells, issued September 27, 1927, No. 1,643,368.

These irregularities, together with the layers of adhesive such as 12 and 14 between the members, help to counteract any tendency of the squeezing by wedges or otherwise to distort inwardly the assembly.

However, without using such irregularities, this lining can be constructed by the method shown and described in application for United States Letters Patent by Harold D. Stuck et al. on Process of making linings for Jordan engine shells, filed June 2, 1934, Serial No. 728,780, which is substantially as follows:

A relatively small number of separators 31 and knives 33 with adhesive such as 32 and 34 between them are held together, as by jaws 36 and 37, as shown in Fig. 13, while pressure in a circumferential direction is applied by the member 35 until the adhesive has set. After one lot of members has been thus held together, the jaws 36 and 37 are released and the assembly is moved over to the right. Other members with adhesive are then added, the jaws 36 and 37 are clamped upon them and the added members are then pressed together and against the adjoining members by the member 35.

In most of the methods just described, the assembly such as A must be split as the pressure is applied in a circumferential direction, through a split such as 8. Of course, this split can be filled by a wedge member, if desired, before shipping, and naturally is filled by a wedge member such as 7, when fitted to a Jordan shell.

By the method shown and described in application for United States Letters Patent by Harold D. Stuck on Process of fitting Jordan shell linings, filed July 12, 1934, Serial No. 734,819, and by application of Harold D. Stuck on Machine for making Jordan shell linings, filed December 31, 1935, Serial No. 56,957, an unsplit lining, such as shown at G in Fig. 14, can be built up of bent knives 3 with separators 1 held together by layers of adhesive 2 and 2.

In Fig. 15 is shown diagrammatically this method of assembling. A press L with a base 40, columns 43, 43, and a top plate 42 carries a plunger 41 which may be operated hydraulically or by screw pressure and carries a form H in which the uncompressed or unsqueezed assembly G is placed or built up with the top ends protruding. Plunger 41, carrying form H, is now lifted by tremendous pressure against top plate 42 with the result that the assembly G is forced down into the form H, the pressure being spread equally all around the circumference. It is there held until the adhesive has set.

In Fig. 17 is shown an assembly K of straight knives 53 and unbent woods 51 of wedge shape with no cut such as 4, and between them the layers of adhesive 52 and 52. Such an assembly can be built by any of the methods described and as the separators 51 are all of wedge shape, any one of them can be used as a wedge by omitting the adhesive, and there is no need of any cheek pieces such as 5 and 6.

By using a press of great power, either hydraulic or screw, such as L, the separating members can be squeezed with such pressure that if they are made of wood, their elastic limit may be reached so that when the pressure is removed,

they do not expand and the entire assembly will retain its compressed size and shape. If made of wood, it may be air dried, having perhaps 20 per cent moisture, or kiln dried, having perhaps 5 per cent.

Kiln drying is preferable if the adhesive is of the varnish or Bakelite types which should be subjected to heat because if there is too much moisture in the wood and the temperature is raised above 212° Fahrenheit, an explosion may result. For that reason, certain types of enamel adhesive cannot conveniently be used with wood, but the separators may be made of Bakelite, any composition of cement or even metal instead of wood.

If the separators are made of the customary wood, a cement or adhesive which will stick to the wood can be helped to stick to the metal by roughening the lower part of a knife **60**, as shown at **61** in Fig. 16.

Another method of fastening a separator **62** of wood or other material to a knife **63** is to apply a coat of adhesive **64**, which will cling, to the wood, and to apply to such coat, a coat of adhesive **65** which will cling to adhesive **64** and which will also cling to the metal of a knife **63**, as shown in Fig. 18.

I claim:

1. A bodily transportable preassembled lining for a Jordan engine shell which consists of bent knives between which are bent separators attached to the knives by an adhesive.

2. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of bent knives between which are bent separators attached to the knives by an adhesive.

3. A bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators attached to the knives by an adhesive.

4. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators attached to the knives by an adhesive.

5. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators compressed beyond their elastic limit attached to the knives by an adhesive.

6. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators of closely compressed wood attached to the knives by an adhesive.

7. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators of wood compressed beyond its elastic limit attached to the knives by an adhesive.

8. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives having irregularities and separators between the knives having irregularities which register with those in the knives and being attached to the knives by an adhesive.

9. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives having a projection on each side and separators between the knives having depressions corresponding with and which register with the projections on the knives, the separators being formed of wood compressed beyond its elastic limit and being attached to the knives by an adhesive.

10. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives having a rib on each side and separators between the knives having grooves corresponding with and which register with the ribs on the knives, the separators being formed of wood compressed beyond its elastic limit and being attached to the knives by an adhesive.

11. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of interlocking bent knives and bent separators attached together by an adhesive.

12. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of bent knives between which are bent separators attached to the knives, each by a layer of adhesive which sticks to a separator and to a layer of a different adhesive which sticks to an adjoining knife.

13. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives between which are separators attached to the knives, each by a layer of adhesive which sticks to a separator and to a layer of a different adhesive which sticks to an adjoining knife.

14. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of knives and separators between the knives, the part of the knives adjoining the separators being roughened and covered with a layer of an adhesive which sticks to the knife and to a different adhesive which sticks to an adjoining separator.

15. A section of a bodily transportable preassembled lining for a Jordan engine shell which consists of bent metal knives between which are bent wooden separators attached to the knives, each wooden separator having a layer of wood glue which sticks to it and which sticks to another layer of metal glue which sticks to the adjoining metal knife.

HAROLD D. STUCK.