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H. D. STUCK

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METHOD OF MAKING LININGS FOR JORDAN ENGINES

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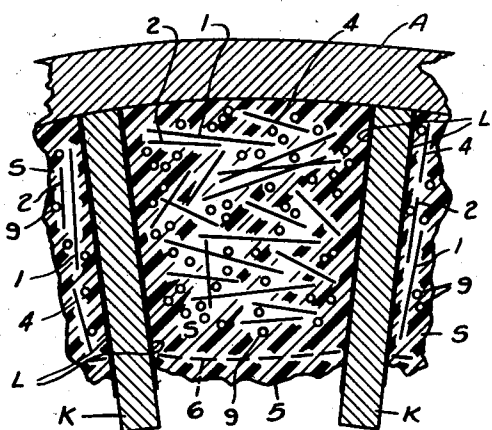


FIG. 1

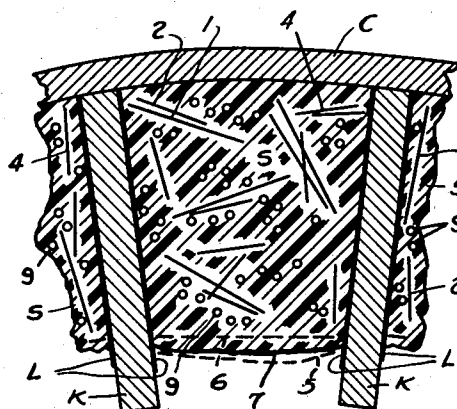


FIG. 2

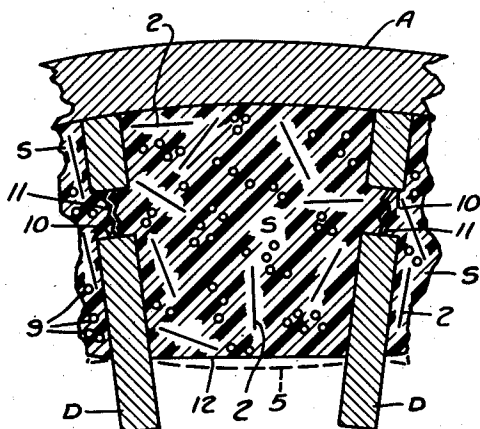


FIG. 3

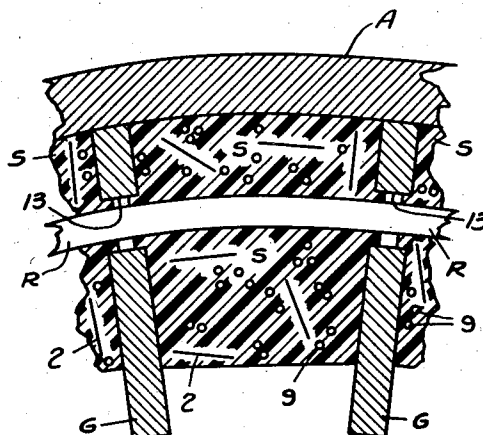


FIG. 4

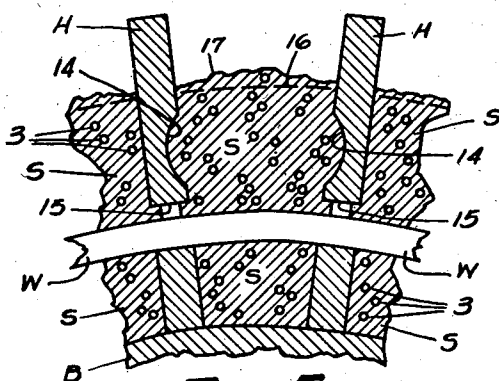


FIG. 5

INVENTOR
Harold H. Stuck
BY
Gardner W. Pearson
ATTORNEY

UNITED STATES PATENT OFFICE

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METHOD OF MAKING LININGS FOR
JORDAN ENGINES

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

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2 Claims. (Cl. 92—27)

1

This invention relates to what are known as Jordan engines used in the process of paper making. Such engines include a truncated conical plug from which project knives or bars which are generally straight, but may be of different shapes, and what is known as a shell inside of which the plug revolves, the shell having inwardly projecting cutting members or knives which are usually bent at an angle but project inward, the adjoining edges of the shell knives and the plug bars being so adjusted that they are very close together as the plug revolves at a very high rate of speed.

It is necessary that the knives and bars in each case should be held firmly and resiliently but not too rigidly and because small particles of some tough materials get caught between the knives and bars, it is desirable that the knives and bars should be so attached as to yield slightly in some cases.

To accomplish the desired purpose, different kinds of separators or separating members of different materials have been used between the bars of a plug or the knives of a shell, the most common material being certain kinds of wood.

When I speak of knives, I usually include bars or any cutting or stroking members of a Jordan engine and while my invention is especially useful in making a transportable lining or jacket, it can be used in the Jordan at the paper mill.

Wood has the characteristic of some elasticity and will swell to make a drum tight fit as the Jordan is usually ground in and run a considerable time in water while the spaces between the adjoining cutting edges of the knives and bars are being brought together. The water acting on the wood swells it and makes a drum tight fit with no space between the contact faces of the knives and the wood to allow waste material and water to penetrate causing rust and irregularity.

While formerly the knives and wooden separators were installed or replaced in the shell at the paper mill, of late years bodily transportable linings of different types have been manufactured, of such a character that they can be made to measurements at the machine shop, shipped to the paper mill and installed in the shell either when the shell is first installed or when the lining has worn down or been broken by the entry of foreign matter which gets wedged between the knives and bars instead of moving through the channels between the knives and bars.

When the individual knives and wooden sep-

2

arators are assembled at the paper mill, they can be kept in place until they swell but if a lining is assembled at the machine shop and shipped to the paper mill, it must keep its shape and the various members must keep their positions down to a very small fraction of an inch during shipment.

This is difficult either with pre-cut wooden separators or pre-cut separators of any other material such as a plastic or such as shown in the patent to Bolton, No. 2,161,848. On the other hand, using melted metal in place of wood has the serious objection of being too rigid, it usually shrinks on cooling and the heat of the melted metal injures the temper of the cutting knives or bars.

The separators should not be too rigid like metal or cement nor too elastic like rubber. Metal and such other moldable materials are objectionable because they generally shrink on hardening.

This invention is a moldable plastic material which can be used as a separating member or material between the knives of a shell or the bars of a plug, or for a bodily transportable lining or jacket for a shell or plug.

Its principal characteristic is that it can be put in place while soft and it will expand until it is hard and will stay hard and will fit between adjoining knives or bars with a practically perfect fit. It will also fit the outside face of the plug or the inside face of a shell if shaped on a suitable form.

Any excess of expansion, which causes the material to swell into the channels between the knives or bars, can readily be reached, and cut down or smoothened, if desired, to permit the free flow of the stock. While some sort of removable strip might restrain the expansion, we find in practice that the exposed face hardens first and restrains the expansion to the circumferential directions which forces it against and into the adjacent knives or bars to make a perfect fit.

I accomplish my purpose by intimately mixing together certain materials which will produce internal gases such as are formed in making bread and pressing the product in place while it is soft, and allowing it to expand and then harden.

I find a reinforcing either by fibres or preferably by steel wool and stainless steel wool is desirable to prevent or reduce any tendency to crumble or crack and preferably the finished material is of such a character that it will not

shrink while being shipped dry, but when immersed in the liquid which passes through the Jordan engine will tend to swell and retain a perfect or drum tight fit.

When in use, the separating material or separators should not only fit the knives or bars snugly but should have an amount of resiliency much the same as wood, when the wood is soaked in a Jordan, to absorb the vibrations set up at the edges of the knives and to take up as far as possible any unusual shocks such as mentioned.

For different sizes of knives and Jordans the amount of expansion or swelling and the time of expanding with reference to the hardening should be controllable so that the pockets between the knives can be successively or progressively filled, the material in each pocket hardening rapidly enough to keep its place while other pockets are being successively filled.

Figs. 1, 2, 3, 4, and 5 are diagrammatic sectional views of two adjacent knives or bars with separating material between them taken on a plane perpendicular to the axis of a Jordan engine, the expansion of the plastic being exaggerated. This expansion must not be over six per cent by volume of the mass but three and one-half per cent, or one-thirty-second inch to the inch, is enough.

In the drawings, in Figs. 1 and 2, K, K represented inwardly projecting knives of a Jordan shell and L represents a lacquer which it is often desirable to have between the knives and the self-expanding separators such as S.

A represents part of a form in which the separating material is shaped, the full lines 5 on the inner side representing the final determined expansion of the separating material and the dotted lines 6 showing diagrammatically where it started.

Preferably the shell lining is assembled in such a form A and when such a lining is shipped, it is desirable to hold it together by metal straps such as C or to crate it in some other way and to smooth the exposed face as at 7 in Fig. 2.

However, as shown in Fig. 3, I find it desirable in most cases to use knives D through the walls of each of which are holes 10 into which the moldable material such as S can be forced as at 11. In that case, as the outside wall is held by the form, there is less tendency at the inner face 12 to project to 5 as the expansive force of the gas is partly dissipated at 11.

In Fig. 4, knives G are shown through which are holes 13 for a binding wire or rod R which goes through these holes 13, the moldable material S forming around them. In this case where such rods R are used, there is no need of lacquer L and in fact, the shipping straps C can be omitted entirely.

In Fig. 5 is shown a construction of a plug jacket with knives or bars H in which there are recesses 14, there being also holes 15 through each knife or bar for a holding wire or rod W. In this case the controlled expansible separating material S surrounds the wire W and also enters the recesses 14 thereby holding everything in place. B is an inside form, 16 the working face before and 17 after expansion.

While I can use various compositions and various means of producing a gas such as hydrogen, it is highly desirable that the resulting product should be tough and resilient and it is desirable that it should not be affected by the usual chemicals in the paper stock. I therefore find that an acid hardening plastic cement such as is known

in the trade as Haveg can be used and controlled about as follows:

Haveg cement is a pasty mixture of a special type of phenolformaldehyde resin with fillers such as silica or asbestos fibers, the amounts of each being determined for the purpose for which it is intended.

41-R Haveg is generally acid resistant while the 50-R is an alkali resistant.

Mix quickly in a mechanical stirrer one pound of #50-R Haveg and 15 grams phenolformaldehyde and add to this three pounds of 41-R and 37 c. c. sulphuric acid solution more or less as is necessary to control expansion of the mass and, while rapidly mixing, 6 grams of sisal fibre 1 cut about one inch long and six grams of steel wool, preferably four grams of stainless steel wool 4 and two parts of ordinary steel wool 2 cut about one-half inch long.

The 41-R uses as a filler finely ground silica. The material should be mixed and applied at a temperature above 60° F. and below 90° F. and in hot weather, it should be quickly used after mixing. The sulphuric acid acts upon the steel wool to free hydrogen gas 9 which causes the mixture to swell. This can be predetermined and regulated to be not over six per cent. See Figs. 1 and 2.

Other compounds which can be used are a phenolformaldehyde resin such as Haveg mixed with an acid digested fibre such as asbestos and a certain amount of ferrous material, preferably steel wool, iron or other metal grains or powder and an acid which will act on them to release a gas.

Such a composition is of the self-expanding type and its use does away with the wedging and squeezing required for planning and exactly cutting separators to fit but there are other compositions which are self-expanding and which after or during such expansion become hard and tough so that they will not be easily broken or shattered while the Jordan is running.

The main requirement of such a composition for use between the adjoining knives of a Jordan engine are that it can be installed when pasty or even liquid and will quickly develop a gas from a chemical reaction, which gas will cause it to expand or swell to make a perfect fit and which will then become hard or stiff enough so that the pockets between the knives can successively be filled. Preferably the amount of expansion should be predetermined, and it is important that when the material has hardened or set, it should have a certain resiliency and not be too rigid.

If it is of a material which will absorb or take up an undesirable amount of the liquid from the Jordan or if it is desirable to increase the resistance of the surface to wear, such surface can be covered with a wear resistant lacquer or with a wearing plate of wood or metal attached in any suitable way.

Another composition which I may use is made up of small strips of wood and sisal fibres together with an adhesive such as dextrin or casein mixed with an alkaline powder such as alkaline sodium bicarbonate and an acid producing powder such as what is known as niter cake or sodium acid sulfate. These can be mixed with powdered silica, powdered asbestos or other filler in such proportions that the sodium acid sulfate or free sulphuric acid will act on the sodium bicarbonate to release carbon dioxide CO₂ in the right amount not over six per cent of the mass

5

and at the right time after the paste has been pressed into position. See 3 in Fig. 5.

In some cases it is desirable to use a lacquer between the self-expanding composition and the knives as shown at L in Fig. 1 to protect the metal from corrosion.

I claim broadly to be the inventor of the process which consists of building a lining for a Jordan shell or Jordan plug which consists of assembling the cutting members or stroking members, such as knives or bars, to form a hollow truncated cone either complete or split and then of preparing a pasty mixture, which might have a base or foundation of various materials such as silica, asbestos, wood or other similar materials, with a material to bind it together, and including an acid and a base with which the acid will combine to release a gas which will be released and dispersed in the form of minute bubbles or globules throughout the mass, the mass being introduced between adjoining knives before such gas releasing reaction takes place so that the whole mixture will expand or swell to make a perfectly tight joint between its faces and the adjoining faces of the knives or bars and of allowing it to set or harden after expanding or swelling with the gas trapped for the time being.

I also claim to be the inventor of the product, which product would be such a mixture either when mixed and before application, or after it is mixed and installed between knives and hardened but with minute bubbles or globules of gas dispersed throughout the mass.

I also claim such a product while in the Jordan engine if and when such gas has been displaced by air, water or other liquid.

If recesses are left in the knives or if wires such as shown in Fig. 4 are used, the time of hardening or setting can be considerable. This time of hardening or setting can be controlled by the kind and amount of the ingredients.

My preferred mixture or composition is described herein, including what is known as Havel or other similar phenol formaldehyde resin with a filler of silica or asbestos, which is believed to be a magnesium silicate, sulphuric acid, and a comminuted ferrous material with which the acid can combine to release hydrogen gas. Other acids such as nitric with comminuted zinc might be used to release a gas, or other gas producing compounds such as sodium bicarbonate and sodium acid sulphate together with some adhesive such as dextrin could be mixed with silica, asbestos, wood or any material strong and elastic enough to properly separate and support the knives and to resist the wear and action of the chemicals in a Jordan engine.

The fundamental feature of this invention is making a separating member for a Jordan engine by taking an inert base which may be comminuted or broken up into small particles so that it can be mixed with two other materials which when put together will react to release a gas when the mixture is put in place between the knives of a Jordan engine, the composition or mixture being so prepared that such gas will be released and be disseminated as bubbles or glob-

6

ules whereby the separating member will swell or expand not over six per cent by volume to make a tight fit. The material should be of such a character that when it sets or hardens, it will not shrink but will stay in place. It is believed that before and as soon as the material is put in place, the release of the gas starts and continues until the setting or hardening and it may be that after awhile when in the Jordan, the original gas is replaced by air, but applicant includes air in the term gas which is dispersed through the separating member and the following claims are drawn with that in mind. The base might include some material to bind it together or the base material might be of a kind to bind itself.

I claim:

1. The method of making a section of alining for a Jordan engine which consists of positioning cutting knives firmly in spaced relation but not touching, each knife with one of its edges in contact with the conical part of a form; of pressing a freshly prepared pasty mixture of phenol formaldehyde resin with a filler of silica, steel wool and a solution of sulphuric acid between the adjoining knives and against the conical form before the acid has acted on the mixture to complete the formation of bubbles of gas; and of then leaving the mixture in place while such gas is forming and is dispersed throughout the mass and until the mass has hardened between the cutting knives and the form.

2. The method of making a section of a lining for a Jordan engine which consists of positioning cutting knives firmly in predetermined spaced relation, each knife with one of its edges in contact with the conical surface of a form; of pressing between adjacent knives and against the conical surface of the form, a freshly prepared pasty mixture of ingredients which react to form a hardened mass, said mixture including ingredients which react to form bubbles of gas in said mixture; and of then leaving the mixture in place while such bubbles of gas are forming throughout the mass and until the mass has hardened between the cutting knives and the form.

HAROLD D. STUCK.

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