Feb. 20, 1934. F. M. GLOYD 1,947,644

SHELL LINING FOR JORDAN ENGINES

Filed June 17, 1931 2 Sheets-Sheet 1

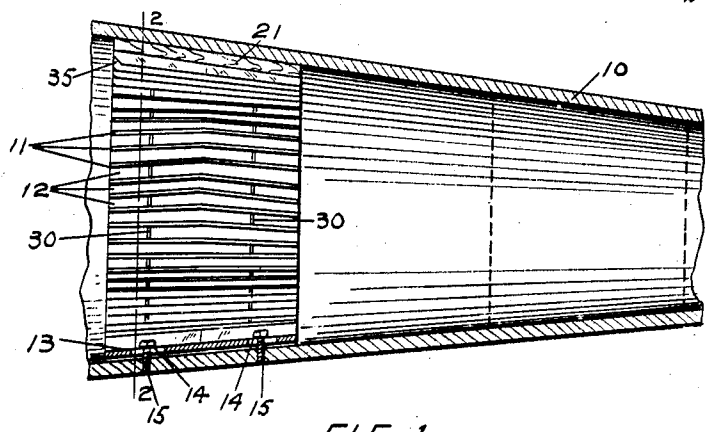


FIG-1

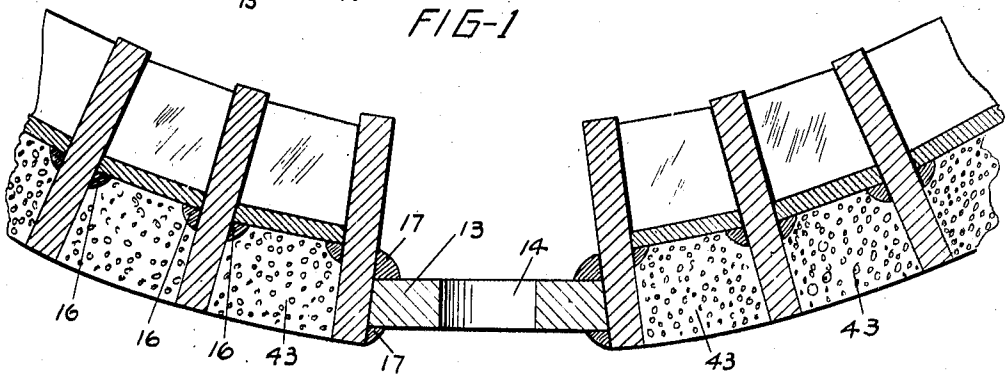


FIG-2

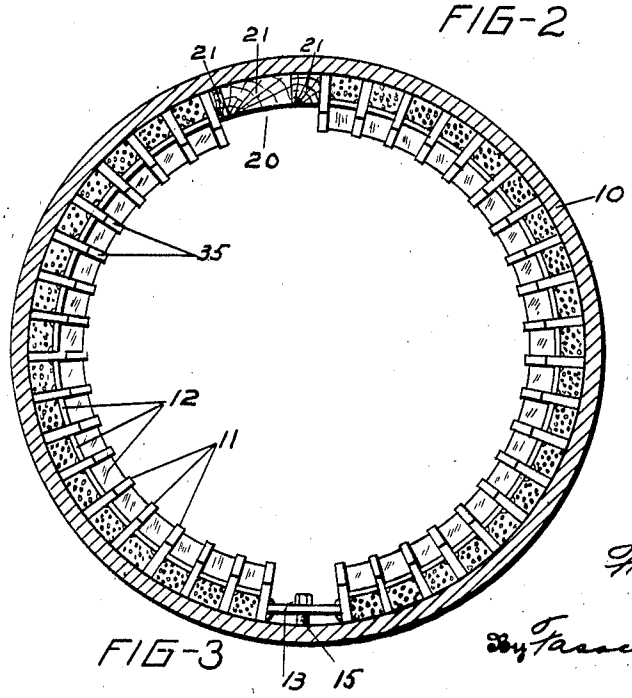


FIG-3

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SHELL LINING FOR JORDAN ENGINES

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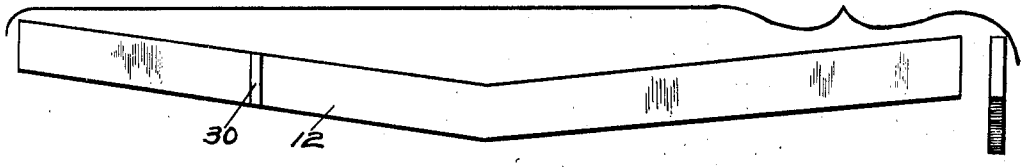


FIG-4

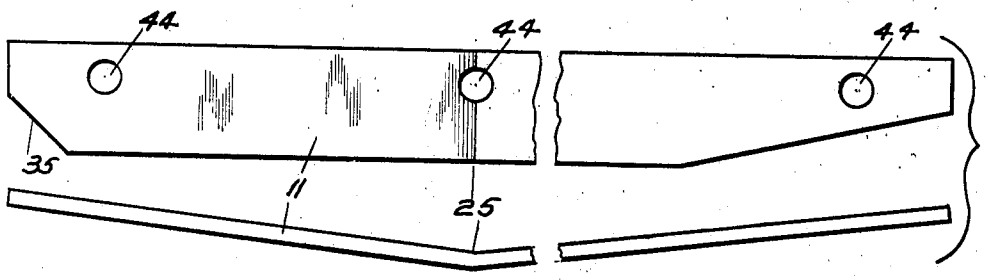


FIG-5

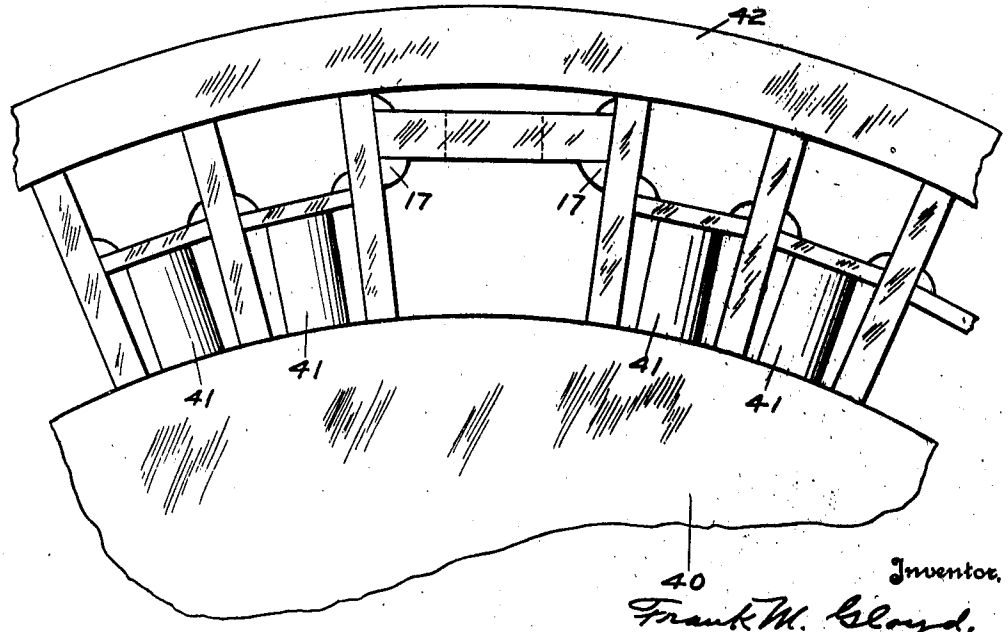


FIG-6

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UNITED STATES PATENT OFFICE

1,947,644

SHELL LINING FOR JORDAN ENGINES

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16 Claims. (Cl. 92—27)

This invention relates to apparatus for refining paper pulp, specifically apparatus known as the Jordan engine.

As the Jordan engine is well known to all persons engaged in or otherwise connected with the paper-making industry it will suffice to say that the "Jordan", as it is usually called, comprises a frusto-conical housing or shell, the inner wall of which is fitted with a plurality of bars or "knives" lying in planes radiating from the axis of the cone. A shaft whose axis is coincident with the axis of the cone carries a conical plug, the outer surface of which is fitted with knives lying in planes radiating from the shaft, which bars or knives are adapted, as the plug rotates, to coact with the knives carried by the shell, to refine the pulp as it passes through the shell from the smaller to the larger end thereof. The series of knives on the interior wall of the shell is called the shell lining.

As the knives of the shell lining soon wear out and must be replaced from time to time, it is desirable to provide means for removing worn out knives and putting in new ones with as little trouble, expense and loss of time as possible, and the principal object of my invention is to provide for easy, expedient and relatively inexpensive renewal of the shell lining. Another object is to assemble the knives outside of the shell, and unite them securely, so that the lining, or a certain portion thereof, can be inserted in the shell as a unit. By this means most of the expenditure of time and labor can precede the actual need for renewal of the bars, and shell linings can be kept on hand at the pulp mill ready to be inserted in the shell on short notice and keeping the engine out of service but a very short time.

Still another object of my invention is to firmly support the knives and prevent their vibrating when the Jordan is in action.

I shall now proceed to describe my invention in detail, with the assistance of the accompanying drawings, in which,

Fig. 1 illustrates a portion of the shell of a Jordan equipped with one section of a three-part lining embodying my invention;

Fig. 2 shows on a larger scale a portion of the lining seen in Fig. 1 on the section line 2—2 of Fig. 1;

Fig. 3 is a sectional view of the casing and lining on line 2—2 of Fig. 1;

Fig. 4 shows one of the strips or webs which unite the knives of the shell lining;

Fig. 5 shows a knife, and

Fig. 6 illustrates a method of assembling the parts of a lining.

Now referring more particularly to Figs. 1 and 3 the shell of a Jordan is shown at 10. In the present case the shell lining is composed of three annular sections, inserted end to end in the shell 10, only one of which sections is shown in Fig. 1.

The zones supposed to be occupied by the other two sections are indicated with dotted lines. The lining comprises a series of radially disposed knives 11, united by metal strips 12. At one point in the series two knives are united by a wider and thicker strip, 13, which strip has longitudinal slots 14 to receive screws 15 whereby the lining is anchored in the shell to prevent rotation of the lining. As is more clearly shown in Fig. 2, the edges of the strips 12 are welded to the sides of the knives 11 at points intermediate the edges of the knives. The welds are shown at 16—16—16 etc. The strip 13 is also welded to the knives, as at 17—17 etc. Preferably the welding is done with an electric arc, although it may be done by other well known means, and in the process of welding fillets of metal are built up in the corners, which are indicated at 16 and 17. While the knives and other parts are usually made of iron or steel, they may, for special reasons, be made of other metals.

The series of knives forms a little less than a complete circuit, one or more knives and the associated strips 12 being omitted to form a space 20. After the lining is in place in the shell, and secured with the screws 15, wooden wedges 21 are driven into the space 20, which wood swells when it gets wet and expanding the lining slightly makes it very tight in the shell.

Referring now to Fig. 5 it will be seen that the knife 11 is bent at 25, converting the knife into a very obtuse angle. As the knives are of uniform thickness, and as the diameter of the lining is less at one end than at the other, because of the conic form of the casing, it follows that the necessary conicity is imparted to the lining by making the strips 12 of gradually narrowing width. Obviously, the strips 12 must be angular in plan, to accommodate the angularity of the knives. It is not essential, however, that the knives be bent; in some cases it may be preferable to leave the knives and the strips straight. Nor is it necessary to make the lining in sections; if desired a single lining may be made the full length of the shell.

For the purpose of retarding the passage of pulp through the Jordan I provide a system of baffles 30, located in the spaces between the knives. Preferably, I arrange these in annular rows in al-

ternate order. That is, the baffles in one annular row are in alternate spaces, and the baffles in the other row are in the intervening spaces. I find a convenient way of securing the baffles in place is to weld them to the strips 11 before the latter are welded to the knives. In Fig. 4 a baffle is in place on the strip in the zone of one annular row of baffles. The baffles for one-half of the strips of a lining are welded in this position, and those for the other half of the strips are welded in a zone a corresponding distance from the other end of the strip.

Fig. 5 is a composite view, illustrating the manner of constructing knives for different sections of a complete shell lining. As indicated in the lining shown in Fig. 1, the outer corner of each knife is sheared off at an angle of about 45°, which is also shown at 35 in Fig. 5. The outer corners of the knives of a section of lining to serve at the small end of the shell are also sheared off, as at 36 in Fig. 5. The corners of the knives at the small end of sections for the large end of the shell, and of the large end of sections for the small end of the shell, are left intact, i. e., the corners are not sheared off; nor are corners at either end of knives in the middle section sheared off. Preferably the distance between knives is slightly less in the section for the large end of the shell, than in the middle section, and the spaces in the middle section are slightly narrower than in the sections serving at the small end of the shell, and, as is obvious, the number of knives in the sections diminishes as the sections become smaller in diameter. These matters are subject to variation, however, and are not related to my invention.

I shall now describe a method of assembling and integrating the parts of my lining, referring to Fig. 6, in which a frusto-conical jig or form 40 is provided of the size and shape required of the interior of the finished lining. Secured to the periphery of this form is a plurality of studs 41, having flat ends whereon to lay the strips 12. By this means the strips are held in the proper positions with reference to the knives. The knives are set with their edges against the form and held in place with one or more stout iron rings 42. If necessary a wedge can be inserted between one of the rings 42 and each of the strips 12, to hold the strips to the studs 41 until enough of the welding is done to keep the strips in place. The use of rings for this purpose leaves abundant opportunity to weld the strips to the knives, and, as is plain, all of the assembling and welding can be done in a shop, even far away from the Jordan in which the linings are to be used.

If desired the parts can be welded in a continuous line from one end to the other of the knives, in which case the structure will be exceedingly stiff and strong. In fact, the strips will become in effect webs joining the knives, similar to the web joining the top and bottom flange of an I beam. It is to be observed, though, that where the knives and strips are angular, as in the drawings, the strain on the welds is very much reduced. In such cases, it is sufficient if welds an inch long be placed at intervals of two or three inches. After the welding is finished and the lining is removed from the form 40, the outer interknife spaces are filled with a plastic material of some kind adapted to harden in situ and afford lateral support for the knives. For this purpose ordinary concrete, made of hydraulic cement, sand and water, is satisfactory, a material being preferred that is practically unaffected by moisture. This cement is shown at 43 in Fig. 2. Not only does this cement filling lend great lateral support for the knives, but it effectually prevents vibration of the knives. To prevent the cement falling out of the spaces during shipment of the linings holes 44 are punched in the knives, into which the cement flows, forming "keys" to keep the cement in the spaces.

While I have illustrated and described what I at this time regard as the preferred exemplification of my invention, it is not to be understood that I am limited in the practice of my invention to the embodiment shown, as various modifications are possible without departing from the spirit or exceeding the scope of the appended claims.

What I claim as my invention and desire to protect by Letters Patent, is as follows:

1. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges.

2. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, one of said strips being broader than the others and having apertures for the passage of screws whereby to secure the lining to the shell wall.

3. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, said series forming less than a complete circuit, thereby leaving a longitudinal space to receive a wedge whereby to expand the lining in the shell.

4. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, said series forming less than a complete circuit, thereby leaving a longitudinal space to receive a wedge whereby to expand the lining in the shell, one of said strips being wider than the others and having apertures to receive screws whereby to secure the lining to the shell wall.

5. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, the spaces between the knives outside of said strips being filled with a material, put in as a plastic to harden in situ, adapted to give lateral support to the knives.

6. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, the spaces between the knives outside of said strips being filled with a material, put in as a plastic to harden in situ, adapted to give lateral support to the knives, apertures in the knives receiving enough of the material to act as keys and keep the material from falling out of the spaces.

7. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives united by webs intermediate the edges of the knives, the spaces between the knives outside of the webs being filled with a material, put in as a plastic to harden in situ, adapted to give lateral

support to the knives and prevent the knives vibrating.

8. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives united by webs intermediate the edges of the knives, the webs being sufficiently tapered to give to the lining the desired conicity.

9. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives united by webs intermediate the edges of the knives, the webs being sufficiently tapered to give to the lining the desired conicity, and means for securing the lining in the shell to keep it from turning therein.

10. A shell lining for a Jordan engine comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, each knife being bent at one point to form a very obtuse angle, the separating strips being correspondingly angular in plan.

11. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives united by webs intermediate the edges of the knives, each knife being bent at one point to form a very obtuse angle, the webs being correspondingly angular in plan.

12. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, and a baffle in each interknife space.

13. A shell lining for a Jordan engine, comprising a series of radially disposed metal knives separated by metal strips whose edges abut and are welded to the sides of the knives intermediate their edges, the welds being made at the sides of said strips that face outward.

14. A shell lining for a Jordan engine, comprising a series of radially disposed knives, and means for uniting said knives into a self-contained unit and for supporting the knives laterally, said means comprising comparatively thin webs connecting the knives and concrete which fills half of the space between the knives.

15. The method of integrating the parts of a shell lining for a Jordan engine, which method comprises assembling the parts in a group having the size and shape it is necessary for the lining to have to fit the shell, holding the parts in the described position while exposing the portions thereof which will be covered by the shell when the lining is in place therein, and welding the parts together while they are so held.

16. The method of integrating the parts of a shell lining for a Jordan engine, which method comprises assembling said parts around a form, holding them thereto with a ring, and welding the parts together while so held.

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