No. 625,818. Patented May 30, 1899.

S. R. WAGG.

REFINING ENGINE OF JORDAN TYPE FOR GRINDING PAPER PULP.

(Application filed Sept. 14, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

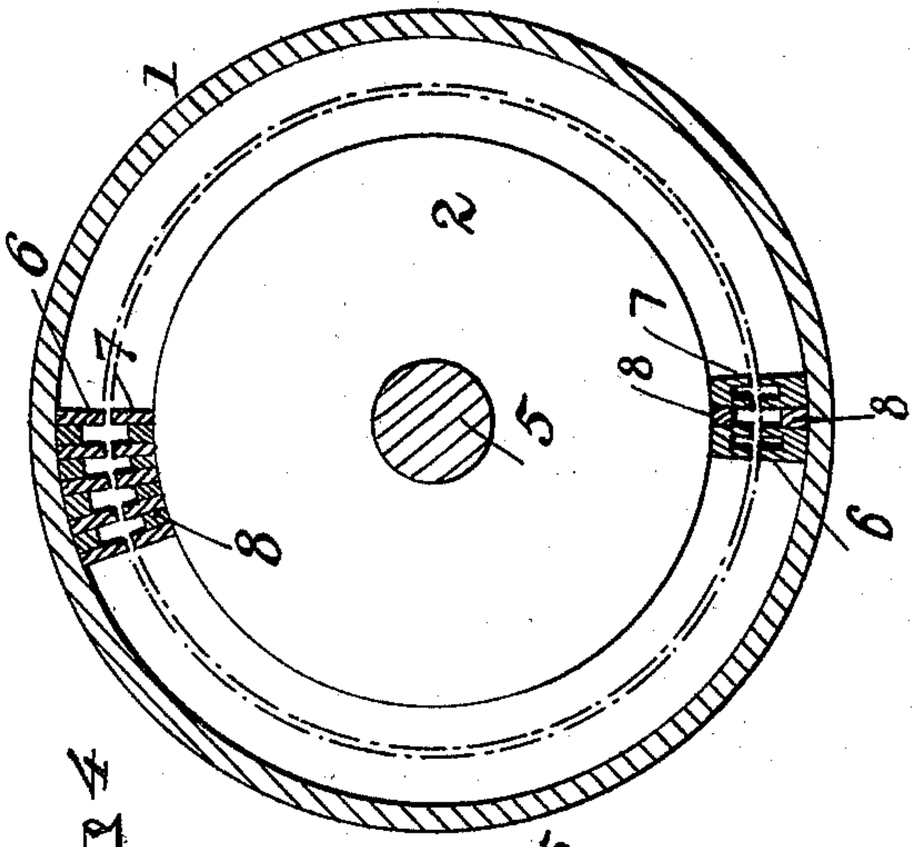
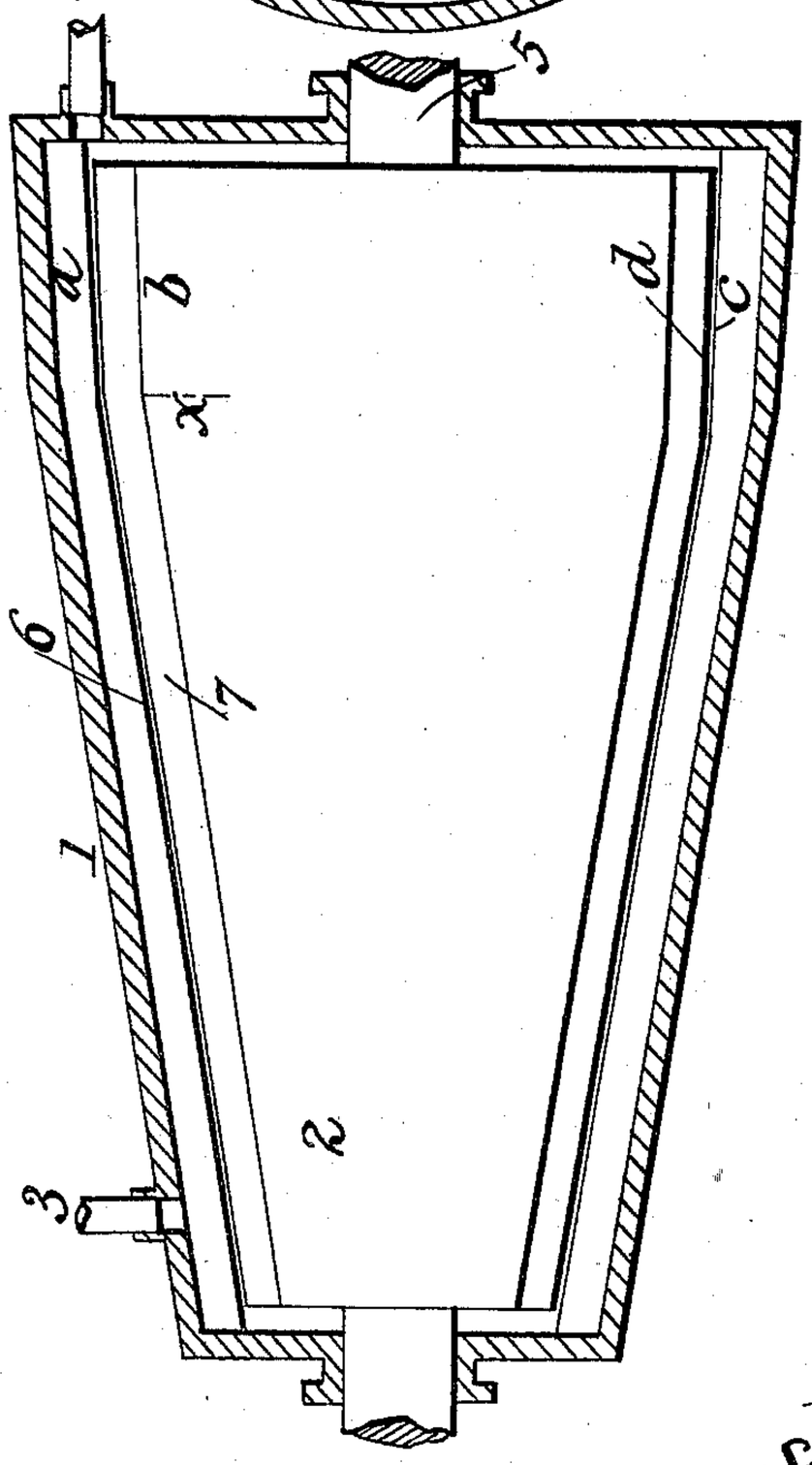


Fig. 1.



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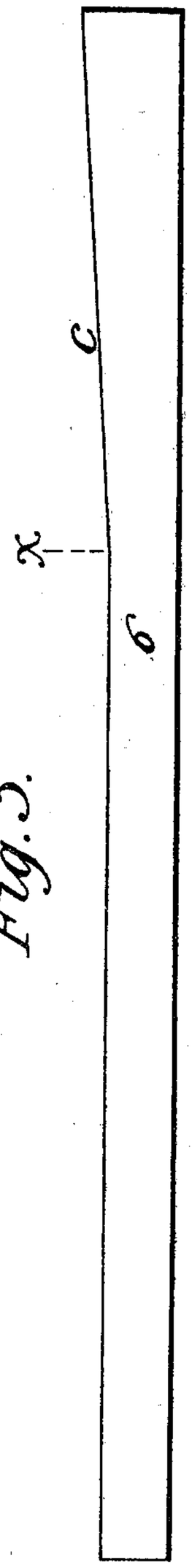

Fig. 3.

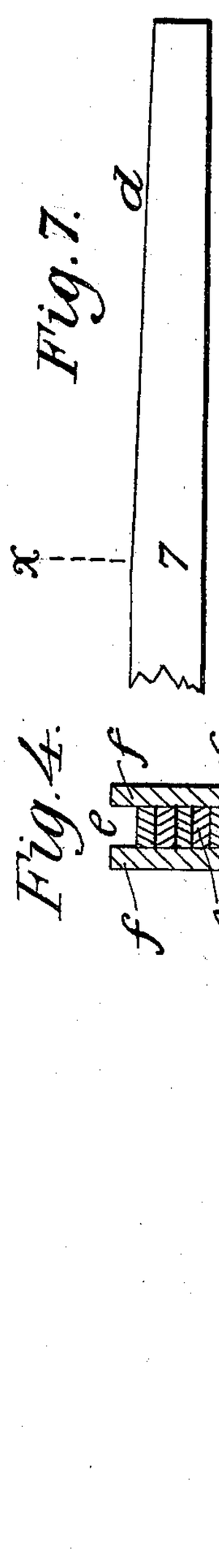

Fig. 7.

Fig. 4.

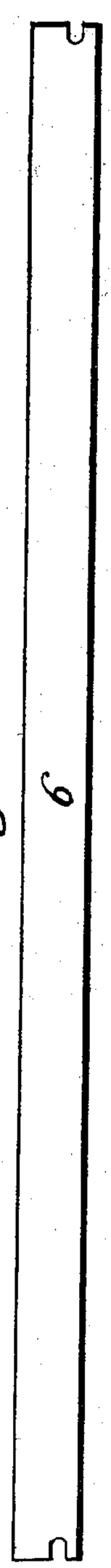

Fig. 5.

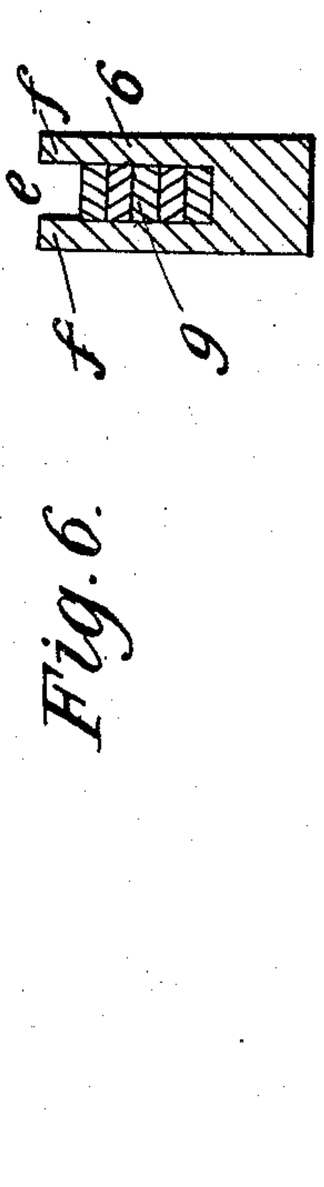

Fig. 6.

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UNITED STATES PATENT OFFICE.

SOLOMON R. WAGG, OF APPLETON, WISCONSIN.

REFINING-ENGINE OF JORDAN TYPE FOR GRINDING PAPER-PULP.

SPECIFICATION forming part of Letters Patent No. 625,818, dated May 30, 1899.

Application filed September 14, 1897. Serial No. 651,617. (No model.)

To all whom it may concern:

Be it known that I, SOLOMON R. WAGG, a citizen of the United States, residing at Appleton, in the county of Outagamie and State of Wisconsin, have invented new and useful Improvements in Refining-Engines of the Jordan Type for Beating and Brushing Paper-Stock, of which the following is a specification.

My invention relates to a refining-engine of the Jordan type for beating and brushing paper-stock.

It is an object of my invention to improve this form of engine to the end that the pulp may be subjected to the usual grinding or beating action of the knives common to this form of engine and before leaving the cylinder be submitted to a somewhat gentler or "brushing" action of the knives.

It is a further object of my invention to provide an improved form of blade or bar for use in engines of the Jordan or of similar type.

Referring to the drawings, Figure 1 is a longitudinal sectional view through the cone-cylinders. Fig. 2 is a vertical sectional view through the cylinders. Fig. 3 is a view in side elevation, showing one of my improved blades or bars. Fig. 4 is a cross-sectional view of the same, enlarged to show wood-strip filling. Fig. 5 is a view in side elevation, and Fig. 6 a cross-sectional view, respectively, of my improved blade as it would be applied to a straight-cylinder or Holland engine; and Fig. 7 is a view in side elevation, showing one end of my improved blade for use on the inner revolving cylinder.

The numeral 1 indicates the outer and 2 the inner cone-shaped cylinder of a refining-engine. The outer cylinder is provided with an inlet 3 at its smaller end and an outlet 4 at its opposite or larger end. The inner cylinder 2 is suitably journaled in the ends of the outer cylinder 1 on a shaft 5, which is connected with suitable driving mechanism. (Not shown.) From a point indicated by *x* on the drawings the angle of inclination of the walls of the cylinders is lessened to the outer or larger ends of the cylinders, or, in other words, they are inclined to extend more nearly parallel with a common axis. The point of variation in the inclination of the walls is at a greater or less distance from the outer or larger ends of the cylinders, according to the length of cylinders employed, and the angle of inclination may be greater or less, as the requirements of the case may require or experience dictate. For example, the dimensions I employ are as follows: The inner cylinder 2 is five feet long, its smaller end being twelve inches in diameter. Beginning at the smaller end the wall of the cylinder is inclined at an angle of ten degrees for four feet of its length. From this point to its larger end, a distance of one foot, the wall of the cylinder is inclined at an angle of about six degrees. The outer cylinder is of course larger; but its lines of inclination are parallel with those of the inner cylinder. I have indicated this reduced inclination of the walls by *a* on the outer cylinder 1 and *b* on the inner cylinder 2. The outer cylinder 1 carries on its inner surface a series of blades or bars 6, which extend longitudinally of its length and are located at intervals around its entire inner circumference. The inner cylinder carries on its outer surface a like series of blades or bars 7. These blades are secured in the well-known manner to the cylinders and a filler 8, such as wood, is employed between them, as shown in Fig. 2. Near the larger ends of the cylinders the two sets of blades are inclined to correspond with the inclination of their respective cylinder. This inclination of the blades is shown at *c* on the blades of the outer cylinder 1 and at *d* on the blades of the inner cylinder 2. As shown in Fig. 1, these blades are formed in two parts and joined together at their meeting-point at *x*. I deem it preferable, however, to form the blades of a single piece of steel or other suitable metal, as hereinafter mentioned, as shown in Figs. 3 and 7. The usual means employed on engines of this description are used on this device for adjusting the inner cylinder laterally to bring the two series of blades into proper relation with each other.

In practice the inner cone-cylinder revolves about three hundred times per minute, and as the pulp passes in at the inlet 3 it is engaged by the rotating blades and is beaten and drawn out between the two series of blades. By such beating the fibers are drawn down to the proper length for forming a sheet of paper and discharged at the outlet 4, and here it must be borne in mind that if the cyl-

inders are straight the beating is uniform throughout, and it is a well-known fact that in the best methods of making paper, as in the manufacture of paper for Government bank-notes, the pulp is beaten (not brushed) in the old Holland engine, that has been in use for two centuries, until it is almost short enough to make paper. Then the cylinder-roll is adjusted from a "beat" to a "brush"—that is, so the blades of the cylinder rub or strike the plates or stationary bars lightly and easily. This is called in the art "brushing," and by this means a better-finished stock is produced. In using the Jordan engine the stock is taken from the Holland beater when about one-half or two-thirds done and the beating is completed in the Jordan engine. Now by substituting my improved refining-engine I get the usual beating effect up to the point indicated at *x* on the drawings, where the angle changes and the pulp is engaged by the blades or bars set at an angle of six degrees, and thereby secure the brushing effect by reason of the change in the angle of inclination of the blades. To further illustrate, it is apparent that the blades or bars set at an angle of ten degrees will grind harder or at a greater pressure than those at an angle of six degrees. Thus in my device the pulp when it enters the engine is submitted to a cutting pressure of about fifteen pounds and until it reaches the section *b*, when this cutting pressure is reduced to about eight pounds, so that by such approximate variation in the inclination of the beating-surfaces I obtain as a result a combined beating and brushing effect in the same engine.

I do not confine myself to the form or number of angles in the blade, as it is obvious the angle may be more or less acute and that there may be one or more variations in the angle of inclination of the walls of the cylinders and the blades or bars without departing from the spirit of my invention.

A similar result to that obtained by my improved engine has been accomplished by using two Jordan engines and by passing the pulp through the first at a beating pressure and through the second at a brushing pressure. My one engine accomplishes the same result and at very much less cost.

In Figs. 4 and 6 I have shown cross-sections of my improved construction of blade or bar. The blades usually employed are about one-eighth of an inch thick. In my improved blade the thickness is slightly increased and is grooved at *e* to form two integral blades *f f*. This form of blade may be used on both cylinders to extend entirely around them or it may be used in connection with the common form of blade. In Fig. 2 I have shown both constructions in use, the blades extending around only a portion of the cylinders. By employing this form of knife I get more beating edges within a given space, and the work of a cylinder in one revolution is nearly doubled. This bar can be used on a Holland engine employing straight cylinder-rolls, as indicated by the blade in Fig. 6, as well as in the form of conical cylinder shown. By preference the bottom of the groove *e* is circular in cross-section, as shown in Fig. 4, which construction tends to strengthen the blades *f;* but it may be straight, as shown in Fig. 6. In order to prevent these grooves from filling up with the pulp, I provide a filler, which is made from a number of thin strips of wood glued together and cut to a sufficient width to firmly fit in the grooves when driven therein. The grooves are filled to within about one-fourth of an inch of their outer surfaces, the remaining portion being left clear to provide cutting edges. This filling is shown more clearly in Fig. 4, in which *g* indicates the successive layers of wood. The space left unfilled will not fill with the pulp, but in operation will clear itself and preserve a working edge of full efficiency at all times. As the blade wears down a strip of the filling is pulled out, and this is continued till the blades are worn out.

It is a fact well known to the trade that fast and hard beating deprives stock of much of its strength as compared with stock beat more slowly and carefully. To in a measure obviate this, I provide at more or less frequent intervals a bronze or brass bar to act in combination with the steel bar or blade in common use, and as they work and wear away the bronze bar, being softer than the steel, wears away more rapidly and is as a result inclined to be a trifle shorter. By this construction when the steel blades or bars are working "hard" the bronze bars will work easy, affording, as it were, a brush, with the result that the stock will be stronger and tougher and will fold better. I may make each alternate blade of soft metal.

It will be understood by those skilled in the art that the blades on the outer stationary cylinder may be made in two or more parts for the sake of convenience in handling instead of being formed integral, as shown, and that such blades could, if desired, be set to extend in a zigzag direction, as is commonly done, instead of in straight lines, as shown. Such constructions are well known and in general use and forming no part of this invention are not herein illustrated. Mention of them is made, however, to show that such modifications in construction may be employed without departing at all from the scope or spirit of the invention as set forth in the claims.

Having thus described my invention, what I claim is—

1. A refining-engine of the Jordan type comprising two concentric cone-shaped cylinders the taper of the opposing walls of which is less at the discharge than at the inlet end, substantially as and for the purpose described.

2. In a refining-engine of the Jordan type, the combination with the outer stationary and inner revolving cone-shaped cylinders, of a

series of blades carried by said cylinders, having near the larger or discharge end thereof a less degree of inclination than at the smaller or inlet end, substantially as and for the purpose set forth.

3. In a refining-engine of the Jordan type, the combination with an outer stationary cone-shaped cylinder having the portion of its wall near the larger end extending in a line more nearly parallel with its axis than does the remaining portion, and an inner revolving cone-shaped cylinder having a similar configuration of wall, of blades carried on the inner surface of said stationary cylinder, and on the outer surface of said revolving cylinder, the longitudinal lines of the working surfaces of which are parallel with the walls of the cylinders, substantially as and for the purpose set forth.

4. In a refining-engine the combination with the outer stationary and inner revolving cylinder, of blades carried thereby, the blades on the same cylinder having different degrees of hardness, substantially as and for the purpose described.

5. In a refining-engine, the combination with the outer stationary and inner revolving cylinder carrying at intervals on their inner and outer surfaces, respectively, hard-metal blades, of blades of softer metal interposed between such hard-metal blades, substantially as and for the purpose set forth.

6. In a refining-engine, the combination with the outer stationary and inner revolving cylinder, of alternately-arranged steel and brass or bronze bars carried on the inner and outer surfaces, respectively, of such cylinders, substantially as and for the purpose set forth.

7. In a refining-engine, the combination with the outer stationary and inner revolving cylinder, of blades carried by said cylinders having grooves in their middle extending longitudinally of their length, to present two cutting edges, substantially as and for the purpose described.

8. In a refining-engine the combination with the outer stationary and inner revolving cone-shaped cylinder having the portion of the walls near their larger ends inclined at a less angle than in the remaining portion, of blades carried by said cylinders, the longitudinal lines of the working surfaces of which are parallel with the walls of the cylinders and having a groove in their middle extending longitudinally of their length, to present two cutting edges, substantially as described.

9. In a refining-engine, the combination with the outer stationary and inner revolving cylinder, of blades carried by said cylinders having grooves therein, as described, and a filler secured in said grooves.

10. In a refining-engine, the combination with the outer stationary and inner revolving cone-shaped cylinder having the portion of the walls near their larger ends inclined at a less angle than in the remaining portion, and carrying on their inner and outer surfaces, respectively, hard-metal blades the longitudinal lines of whose working surfaces are parallel with the walls of the cylinders, of blades of softer metal interposed at intervals between such metal blades, substantially as described.

11. As a new article of manufacture, a blade for refining-engines having the same width in vertical longitudinal section from one end to a point near the opposite end, and from this point gradually increasing in width upward, whereby to present a cutting-surface having different degrees of inclination, substantially as described.

12. As a new article of manufacture, a blade for refining-engines having the same width in vertical longitudinal section from one end to a point near the opposite end, and from this point gradually decreasing in width downward, whereby to present a cutting-surface having different degrees of inclination, substantially as described.

13. As a new article of manufacture, a pair of blades for the outer and inner cylinders, respectively, of a refining-engine, having the same width in vertical longitudinal section from one end to a point near the opposite end, the blade for the outer cylinder gradually increasing in width upward, and the blade for the inner cylinder having a corresponding decrease in width downward, from this point, substantially as described.

14. As a new article of manufacture, a blade for beating and refining engines having a groove in its cutting-surface extending longitudinally of its length, substantially as described.

15. As a new article of manufacture, a blade for beating and refining engines having a groove in its cutting-surface extending longitudinally of its length, and a filler secured in said groove.

16. As a new article of manufacture, a blade for beating and refining engines having a groove in its cutting-surface extending longitudinally of its length and a filler for said groove comprising strips or layers of wood secured therein, substantially as described.

17. As a new article of manufacture a blade for refining-engines having the same width in vertical longitudinal section from one end to a point near the opposite end and from this point gradually increasing in width upward, a groove in its cutting-surface extending longitudinally of its length, and a filler for said groove comprising strips or layers of wood glued together and secured in said groove substantially as described.

18. As a new article of manufacture a blade for refining-engines having the same width in vertical longitudinal section from one end to a point near the opposite end and from this point gradually decreasing in width downward, a groove in its cutting-surface extending longitudinally of its length, and a filler for said groove comprising strips or layers

of wood glued together and secured in said groove, substantially as described.

19. As a new article of manufacture, a pair of blades for the outer and inner cylinders, respectively, of a refining-engine, having the same width in vertical longitudinal section from one end to a point near the opposite end, the blade for the outer cylinder gradually increasing in width upward, and the blade for the inner cylinder having a corresponding decrease in width downward and a groove in the cutting-surface of each blade extending longitudinally of its length, and a filler for said grooves comprising strips or layers of wood glued together and secured in said groove, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

SOLOMON R. WAGG.

Witnesses:
J. S. PERKINS,
FREDERICK E. G. WAGG.