A. SCHÄFFER.

ROTARY COOLER FOR CEMENT CLINKER.

APPLICATION FILED MAY 18, 1911.

1,049,610. Patented Jan. 7, 1913.

4 SHEETS—SHEET 1.

Fig. 1.

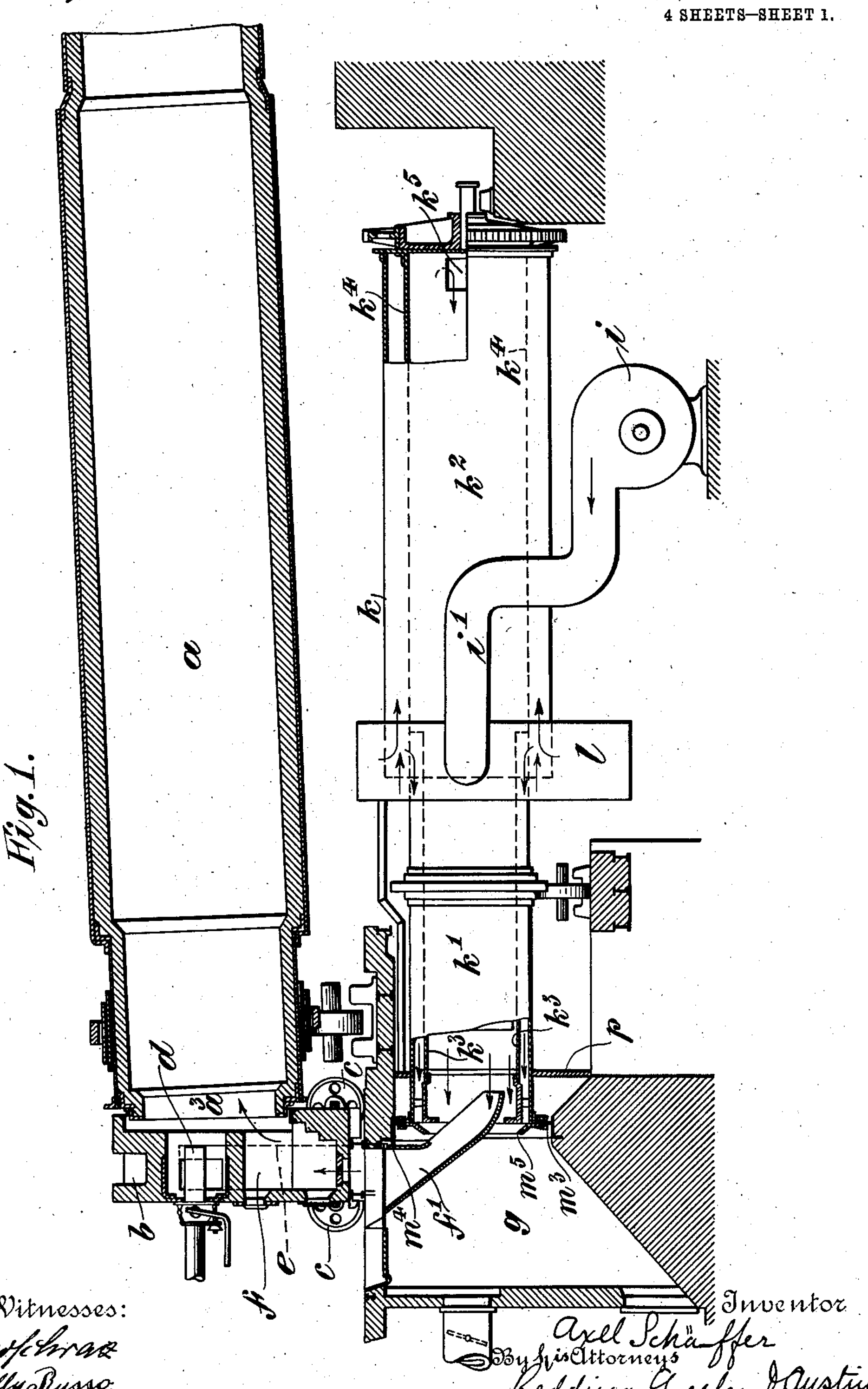

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Fig. 2.

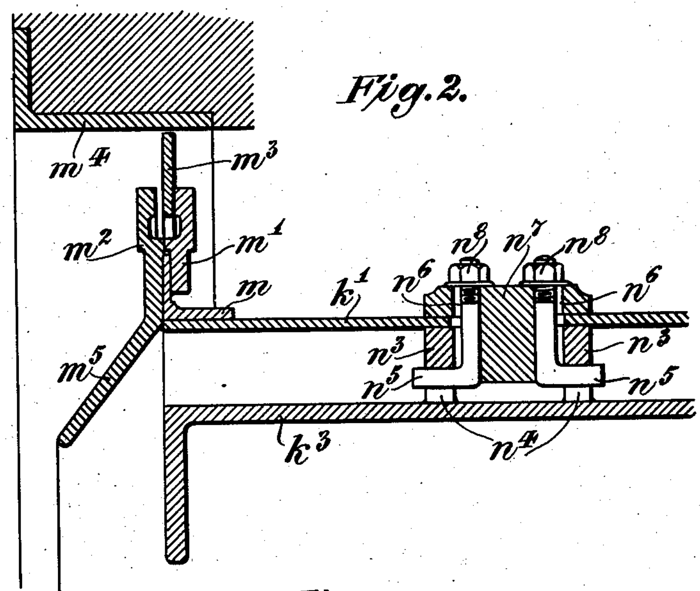


Fig. 3.

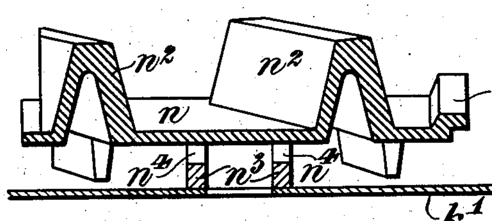


Fig. 4.

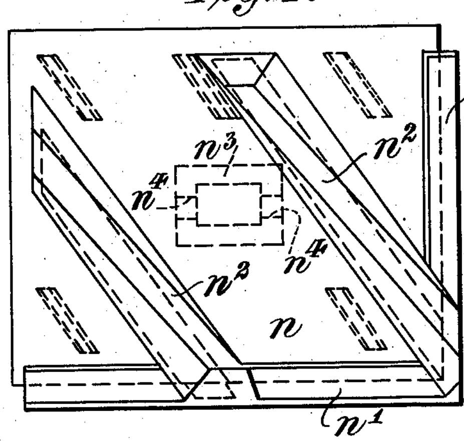
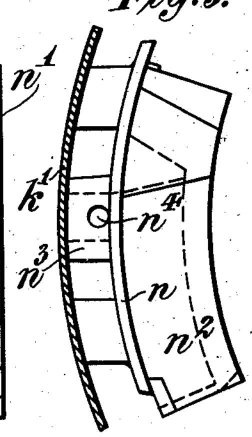


Fig. 5.



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4 SHEETS—SHEET 3.

Fig. 6.

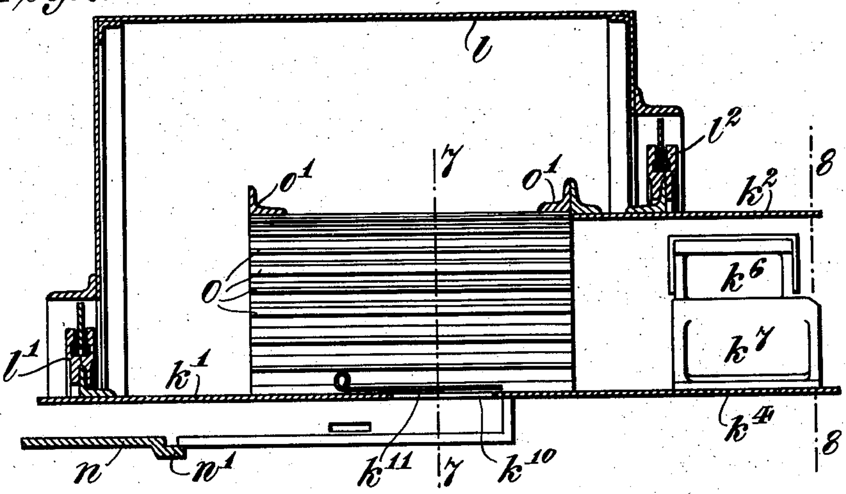


Fig. 7.

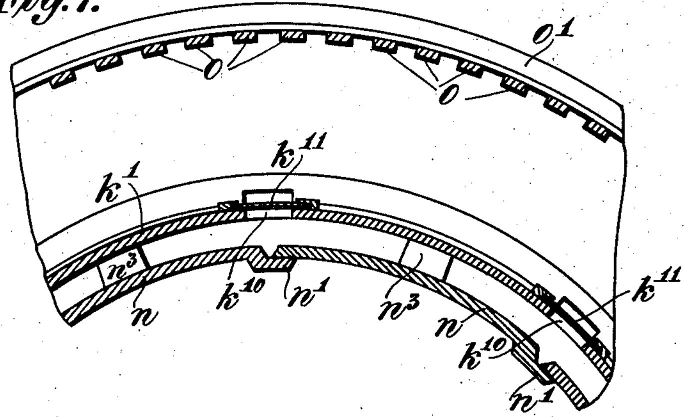
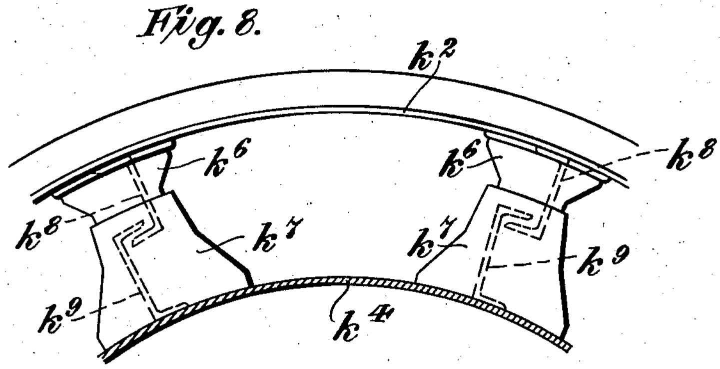


Fig. 8.



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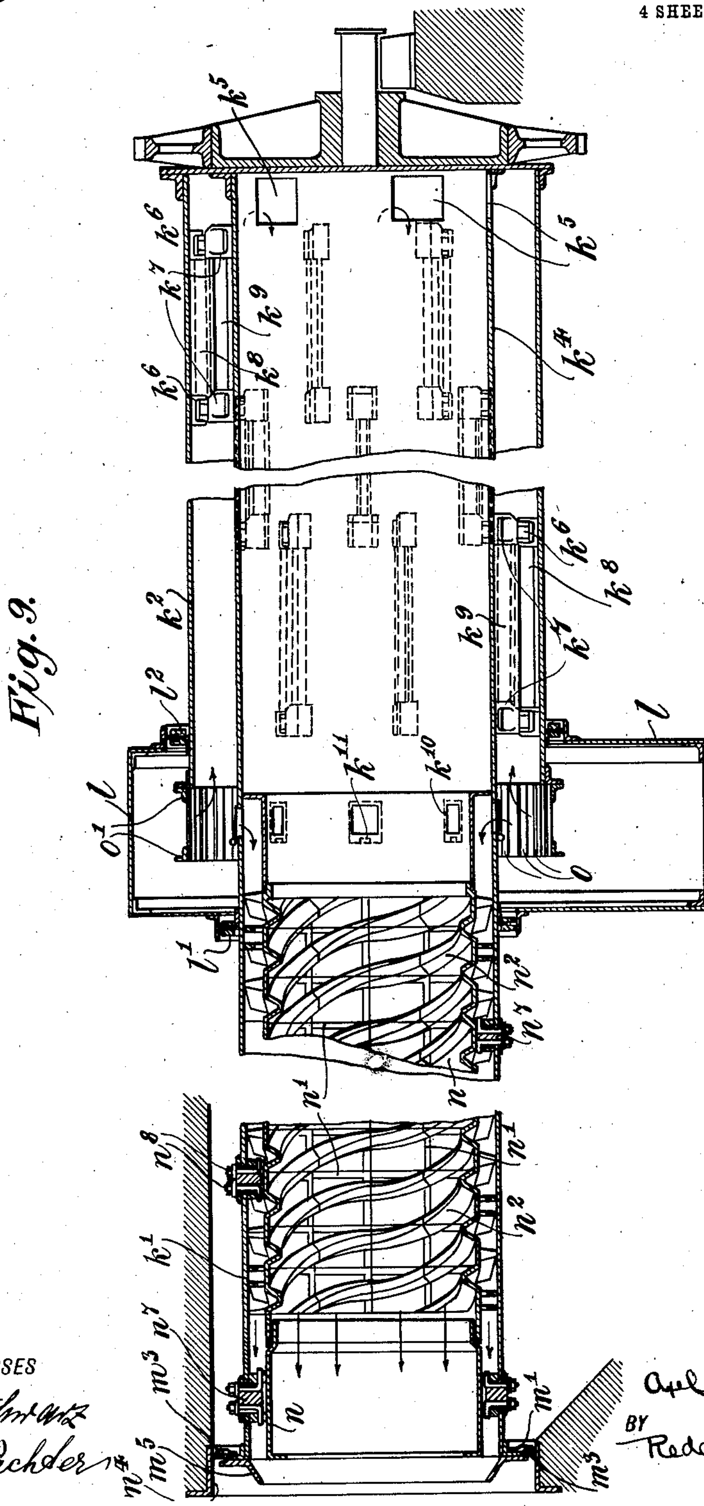
4 SHEETS—SHEET 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

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ROTARY COOLER FOR CEMENT CLINKER.

1,049,610. Specification of Letters Patent. Patented Jan. 7, 1913.

Original application filed November 2, 1910, Serial No. 590,268. Divided and this application filed May 18, 1911. Serial No. 627,978.

To all whom it may concern:

Be it known that I, Axel Schäffer, a subject of the King of Denmark, residing in the city of Copenhagen, Denmark, have invented certain new and useful Improvements in Rotary Coolers for Cement Clinker, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof, this application being a division of application Serial No. 590,268, filed November 2, 1910.

This invention relates to rotary kilns such as are employed in the burning of cement and for other purposes, and particularly to the construction and relation to the kiln proper of the rotary cooler into which the cement clinker or product of the kiln is directed in order that it may be cooled somewhat before it is discharged and especially that the heat thereof may be utilized in heating the air which is to be used to support combustion in the kiln.

The invention will be more fully explained hereinafter with reference to the accompanying drawings in which it is illustrated and in which—

Figure 1 is a view partly in outline or elevation and partly in section showing so much of the rotary kiln with the cooler as is necessary to enable the invention to be understood. Figs. 2–8 are detail views illustrating features of construction of the cooler. Fig. 9 is a vertical longitudinal sectional view of the entire cooler.

The kiln *a*, which may be of any suitable construction, so far as this invention is concerned, but is preferably of the construction indicated, is supported for rotation and is rotated by any usual or suitable means. The clinker or product of the kiln is discharged at the discharge end a^8 of the kiln, through a movable hood or closure *b* which is shown as supported upon wheels *c* and as provided with a suitable nozzle *d* through which powdered, gaseous or liquid fuel may be introduced. This hood, which is arranged to fit somewhat closely about the discharge end of the kiln *a*, is preferably double walled, having lateral air channels, one of which is indicated in part by dotted lines, as at *e*, and a central chamber *f*, the lateral channels *e* and the chamber *f* being open at the bottom to communicate with an air or dust chamber *g* below the hood. The clinker or other material is discharged through the central chamber *f* into a chute *f'* by which it is directed into the cooler *k*. Air, heated in the cooler by absorption of heat from the clinker, passes upward into the kiln through the lateral channels *e* and, to some extent, through the central chamber *f*.

The cooler *k* is generally cylindrical in shape, is mounted upon suitable bearings so as to rotate and may be rotated by any suitable means. In the construction shown in Fig. 1 of the drawings, the portion *k'* of the cooler adjacent to the end at which it receives the hot clinker from the chute *f'* is preferably smaller in diameter than the other portion k^2. The portion *k'* of the cooler has an inner shell k^3, a passage for air being thereby formed between the inner and outer shells, as hereinafter described more particularly. The portion k^2 also has an inner shell k^4, a passage being formed thereby between the inner and outer shells for the passage of the hot clinker, so that the hot clinker may pass from the interior of the inner shell k^4 through an opening or openings k^5 near the end thereof into the passage between the inner and outer shells and thence in a forwardly direction to the forward end of the outer shell k^2 from which it passes into a stationary, annular receiving shell *l* which surrounds the cooler at the point where the forward portion *k'* and the rear portion k^2 meet. The receiver *l* is shown as connected by a pipe *i'* with a blower *i* and the air which is thus supplied under pressure finds its way, as hereinafter described, partly through the passage between the inner and outer shells k^4 and k^2, into the inner shell k^4, partly into the inner shells k^3 and k^4 and partly into the passage between the forward shells *k'* and k^3, being finally delivered at the forward end of the cooler from which part of the air may pass forward through the chute *f'* and the chamber *f* into the kiln and part into the dust chamber *g* and thence upward through the passages *e* in the hood or closure through the injector around the fuel tube *d* into the kiln. The air which is supplied under pressure from the blower *i* or other source is therefore kept for a suitable time in contact with the hot clinker and absorbs heat therefrom so that the clinker is cooled before it is finally discharged and the air is heated before it is admitted into the kiln.

The details of the construction of the cooler, with its double walls, are shown in Figs. 2–9. As shown in Fig. 2, the outer shell k' of the forward section of the cooler has secured thereto an annular angle iron m to which are secured two cast iron rings m' and m^2. Between the latter is placed loosely a steel ring m^3 which fits somewhat closely within an angle ring m^4 which is built into the masonry which forms the wall of the dust chamber g. This construction therefore forms a comparatively tight joint to prevent the escape of air at this point while it also permits free rotation of the cooler and longitudinal movement of the end of the cooler under expansion and contraction. The cast iron ring m^2 has a conical flange m^5 which catches such material as may spill over the end of the inner shell k^3 and direct it into the space between the inner and outer shells k^3, k', from which it passes eventually into the receiving shell l. The flange m^5 also prevents the material from falling upon the ring m^4, where it might cause rapid wear between the ring m^3 and the ring m^4 and consequent leakage of air. The inner wall or shell k^3 of the forward portion of the cooler is made up of a series of liner plates n, (as may also be the inner wall k^4 of the rearward portion of the cooler) which are formed, as shown particularly in Figs. 3, 4 and 5, so that they may be replaced readily and whenever required, shall have a suitable radiating surface and shall also have obliquely disposed ribs to feed the clinker toward the rear end of the cooler. Each plate may be formed on two of its sides with offset flanges n' to overlap the adjacent edges of the next plate and is also formed with obliquely disposed hollow ribs n^2 which facilitate the radiation of heat from the clinker and also cause the clinker to travel toward the rear end of the cooler. On the outer side of each plate are formed spacing blocks or plates n^3 preferably formed in a rectangle with holes n^4. Bolts n^5 having their ends turned at a right angle as shown in Fig. 2 so as to enter the holes n^4 in the spacing blocks n^3 pass through holes n^6 in a washer or filling plate n^7 and receive outside of the washer or filling plate the nuts n^8. Each liner plate n has but one of such rectangular spacing plates or blocks so that the liner plate is free to expand and contract in all directions without shearing the securing bolts. Furthermore, by the construction described the bolts may be inserted from the outside of the cooler so that if any bolt should break off it may be replaced from the outside of the cooler while the cooler is hot with a minimum loss of time.

The rearward portion k^2 of the cooler might have its inner wall formed of liner plates constructed and supported as shown in Figs. 2–5 but in Figs. 6 and 8 a different arrangement is illustrated. In this construction the outer shell is supported on the inner shell by blocks k^6 and k^7 which are secured to the outer shell and the inner shell respectively and rest one upon the other. The relative position of the two shells is further maintained by channel irons k^8 and k^9 shown in dotted lines in Fig. 8, which are oppositely placed and interlock as shown and are longitudinally disposed in the space between the shells for the purpose of agitating and distributing and therefore promoting the cooling of the material which passes through such space, the opposite angle irons being secured to the inner and outer shells respectively.

It will be obvious that the clinker flowing into the forward end of the cooler from the chute f' will be moved rearward by the obliquely disposed ribs on the inner surface of the shell k^3. From the forward portion of the cooler the clinker will be discharged to the inner shell k^4 of the rearward portion k^2. When discharged thereon, the clinker will become so piled that an inclined floor will be formed and an unbalanced force will be constantly tending to push the same rearwardly during the revolution of the cooler. From this inner shell k^4 the material is fed constantly through the ports k^5 into the annular space between the shells of the rearward portion k^2 of the cooler. A similar effect will be produced therein and the clinker will be moved forwardly under the action of the incoming clinker as would be a stream of fluid on which an unbalanced force is acting.

The joint between the forward section and the rearward section of the cooler is constructed as shown particularly in Figs. 6 and 7. A cylindrical grate, consisting of grate bars o and supporting angle iron rings o', forms an extension of the outer shell k^2 of the rear portion of the cooler forwardly, overlapping the rear end of the forward portion k', so that the material, which has escaped from the interior of the shell k^4 through the openings k^5 and has been carried forward through the space between the inner shell k^4 and the outer shell k^2, is delivered to the grate or separator o, the smaller particles passing through the grate between the grate bars, into the chamber formed by the surrounding shell l, from which the material may be removed continuously, while the larger particles pass through the open forward end of the cylindrical grate from which they may be received in a separate compartment. In the rearward end of the forward section k', preferably within the portion covered by the grate o, are openings k^{10} which are controlled by adjustable sliding gates k^{11}, so that by opening these gates more or less a larger or smaller portion of the air which is forced into the chamber l may escape therefrom into the space between the inner and outer shells of the forward portion of the casing and pass longitudinally through the same until it escapes into the dust chamber g, while the remainder of the air passes backward through the space between the inner and outer shells of the rear portion of the cooler in a direction opposite to that of the movement of the burned material within, and passes thence through the openings k^5 into the interior of the rear portion of the cooler and forward through the whole length of the cooler into the dust chamber g. The joints between the shell l and the forward and rearward portions of the cooler, as at l' and l^2 respectively, may be constructed in the same manner as the joint at m at the forward end of the cooler, as shown in Fig. 2 and heretofore described with reference thereto. If desired, a supplemental diaphragm p may be placed between the forward portion of the cooler and the surrounding masonry to further check the leakage at the joint m.

It will be obvious that various changes in details of construction and arrangement may be made to suit different conditions of use without departing from the spirit of the invention.

I claim as my invention:

1. The combination with a chamber into which the material to be cooled is discharged from above, of a rotary cooler projected into the chamber, means to form a relatively tight joint between the cooler and the surrounding wall of the chamber and a conical flange on the end of the cooler to direct the material falling from the end of the cooler away from said joint.

2. The combination with a chamber into which the material to be cooled is discharged from above, of a rotary cooler projected into the dust chamber and comprising an inner shell and an outer shell with a passage between and a conical flange on the end of the outer shell to direct the material falling from the end of the inner shell into the passage between the inner and outer shells.

3. The combination with a chamber into which the material to be cooled is discharged from above, of a rotary cooler projected into the chamber, two annular plates secured to the cooler and a loose annular plate placed between the plates on the cooler and fitting against the surrounding wall of the chamber.

4. In a device of the character described, the combination of an outer cylindrical shell, an inner cylindrical shell composed of separate plates each having a spacing block, and bolts extended through the outer shell and engaging the spacing block.

5. In a device of the character described, the combination of an outer cylindrical shell, an inner cylindrical shell composed of separate plates each having a hollow spacing block with a lateral hole, an angle bolt extended through a relatively large opening in the outer shell and engaging the spacing block and a washer covering said opening and supporting the bolt.

6. In a device of the character described, the combination of an outer cylindrical shell and an inner cylindrical shell composed of separate plates each having obliquely disposed ribs.

7. In a device of the character described, the combination of an outer cylindrical shell and an inner cylindrical shell forming an annular passage therebetween, means to supply material to the inner shell and the annular passage, and obliquely disposed hollow ribs on the inner shell to cause material in the shell and in the passage to move.

8. In a device of the character described, the combination of an outer cylindrical shell, an inner cylindrical shell, spacing blocks secured to said shells respectively, and interlocking angle irons secured to said shells respectively.

This specification signed and witnessed this third day of May A. D., 1911.

AXEL SCHÄFFER.

Signed in the presence of—
ERNEST BOUTARD,
P. HOFMAN-BAUZ.