A. E. ANDERSEN.

COOLER.

APPLICATION FILED DEC. 21, 1910.

1,038,511.

Patented Sept. 17, 1912.

2 SHEETS—SHEET 1.

Fig. 2.

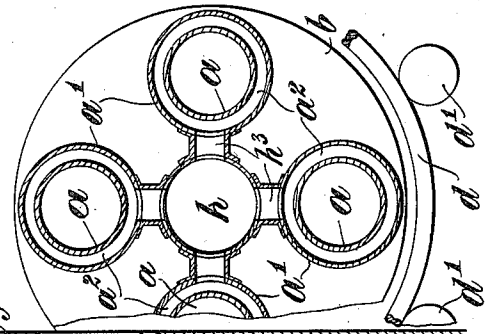
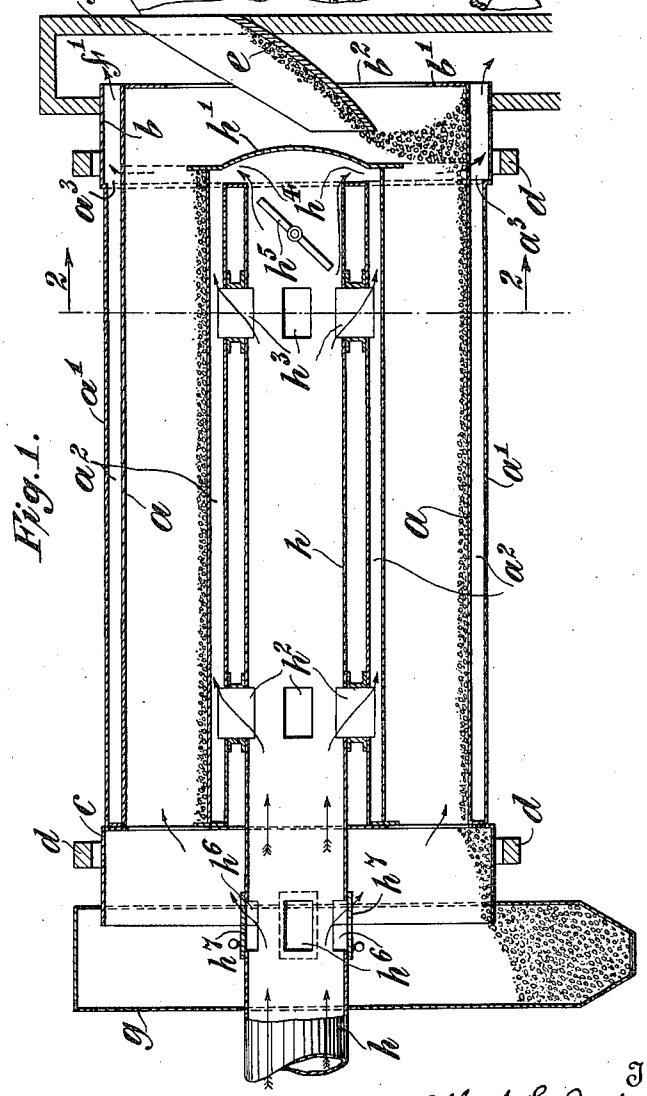


Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 4.

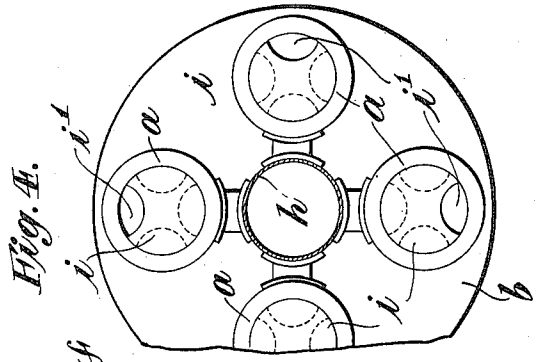
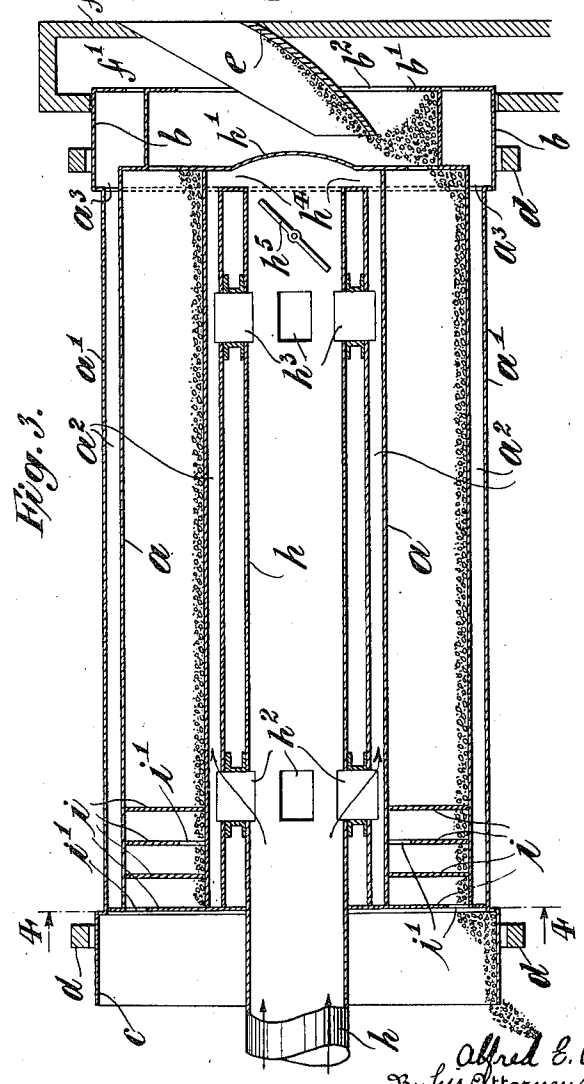


Fig. 3.



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UNITED STATES PATENT OFFICE.

ALFRED E. ANDERSEN, OF COPENHAGEN, DENMARK, ASSIGNOR TO F. L. SMIDTH & CO., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

COOLER.

1,038,511. Specification of Letters Patent. Patented Sept. 17, 1912.

Application filed December 21, 1910. Serial No. 598,539.

To all whom it may concern:

Be it known that I, ALFRED E. ANDERSEN, a subject of the King of Denmark, residing in Copenhagen, Denmark, have invented certain new and useful Improvements in Coolers, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

Certain materials which have been subjected to great heat and must be cooled, such, for example, as nodules of iron ore, magnesite and caustic lime which has been burned in rotary kilns, suffer more or less injurious results when subjected to the action of ordinary coolers in which the material is repeatedly lifted and allowed to fall or in which it comes into too sudden contact with cold air or is cooled in the presence of an excess of air. Thus, the nodules of iron ore are liable to be broken up and to form dust when cooled in an ordinary cooler, and moreover under some conditions the nodules take up so much oxygen from the air as to offset to some extent the desirable reduction which has been accomplished. Magnesite and possibly other minerals which have been fused are also liable to be broken up to such an extent as to create dust not only through the mechanical action of the ordinary cooler, but also through sudden contact with cold air. Caustic lime, discharged hot from the rotary kilns in which it has been burned, may also take up carbonic acid from the air when cooled in the ordinary manner.

It is the object of this invention to overcome the objections which, for such materials as those referred to, are incident to the use of the ordinary coolers and to produce a cooler which reduces as much as possible the objectionable mechanical action of the ordinary coolers and also permits of indirect cooling of the material, either partly or wholly out of contact with the cooling medium.

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 in longitudinal section of a cooler constructed in accordance with the invention. Fig. 2 is a partial view in section on the plane indicated by the line 2—2 of Fig. 1. Fig. 3 is a view similar to Fig. 1 but showing a slightly different embodiment of the invention. Fig. 4 is a partial view in section on the plane indicated by the line 4—4 of Fig. 3.

Referring first to the embodiment of the invention shown in Figs. 1 and 2, the improved cooling apparatus comprises one or more drums *a*, preferably cylindrical, eccentrically disposed with respect to an axis of revolution. If several drums or cylinders *a* are provided, they should be symmetrically disposed about the axis of revolution. They are mounted at their ends in end housings *b* and *c* which may be provided with carrying rings *d* to rest upon rollers *d'* so that the entire structure may be rotated by any convenient means, not necessary to be shown herein. The housing *b* has a marginal flange *b'* around a central opening b^2, through which a chute *e* may be projected to deliver the material to be cooled into the housing *b*, from which it finds its way into the drums *a* through their open ends. The open end of the housing *b* is preferably inclosed by a wall *f* which forms a chamber *f'*, through which the air, heated directly or indirectly by exchange of heat with material to be cooled, may be conducted away. The housing *c*, which receives the cooled material from the open ends of the drums *a*, is preferably projected into a stationary casing *g* into which the material is discharged from the housing *c* and from which it may in turn be discharged into any desired receptacles, not shown.

Each of the drums *a* is surrounded by a jacket *a'*, a chamber a^2 being thereby formed between each drum and its jacket, which chamber is open at its discharge end, as at a^3, so that the heated air therein may be discharged into the housing *b* and thence into the chamber *f'*.

At the rear end of the cooler an air pipe *h*, which may be connected with a fan or other source of air or other cooling medium under pressure, is projected through the stationary casing *g* and is carried forward centrally between the jacketed drums *a*, its forward end being closed by a plate *h'*. At intervals along its length the tube *h* is provided with ducts h^2, h^3, h^4 which communicate with the chambers a^2 between the drums *a* and their jack-

ets so that the air or other cooling medium which is supplied through the tube h is delivered to the jackets of the drums through which the heated material travels and thereby indirectly absorbs heat from such material. A damper, as at h^5, may be placed in the tube h so as to control somewhat the distribution of the cold air and especially to prevent the immediate contact of the cold air with those parts of the drums which are highly heated by contact with the hot material discharged into the cooler. The tube h may also have openings h^6, provided with adjustable slides h^7, through which, if desired, a regulated quantity of the cooling medium may be admitted directly into the housing c and thence into the drums a, the cooling of the material being thus effected by direct contact with the cooling medium. When the openings h^6 are closed, however, the cooling of the material is effected indirectly and without actual contact with the air.

The embodiment of the invention shown in Figs. 3 and 4 is generally similar to that shown in Figs. 1 and 2, and like parts in the several figures are identified by like letters of reference. The discharge chamber g of the construction shown in Fig. 1, however, is omitted from the construction shown in Fig. 3, the material which is received by the open ended housing c from the drums a being directly discharged from such housing into any suitable receptacles. To prevent the immediate access of cold air to the drums a from the open housing c, the rear ends of each drum are provided with cross walls i which have marginal openings i' in different relative positions. In the revolution of the drum about the axis of revolution the opening i' in some one of the cross walls i will be closed by the material which lies upon the lower side of the drum and the direct access of cold air to the interior of the drum will thereby be prevented without interfering seriously with the travel of the cooled material outward through the openings in the cross walls and from the drums into the housing c.

It will now be understood that when the apparatus is rotated and heated material is delivered thereto at one end while air or other cooling medium is supplied through the central pipe h, the material to be cooled, which is discharged through the chute e into the housing b passes thence into each drum a, as, in the course of its revolution, it reaches the lowest point, and then travels slowly through such drum, in the continued revolution of the cooler, to the housing c whence it is discharged. The inflowing material will become so piled in that drum which is receiving the same that an inclined floor will be formed by the material and an unbalanced force will be constantly tending to push the same through the drum during the revolution of the same. The heated material, in its travel through the drums a, is not lifted and dropped but travels always in contact with the wall of the drum which is cooled externally by the cooling medium in the jacket a^2, so that an exchange of heat takes place between the heated material and the cooling medium. As already explained, the cooling of the material is carried on indirectly and out of contact with the cooling medium unless the cooling medium is purposely admitted to the interior of the drums.

The apparatus has been described herein as a cooler for heated material, but obviously it provides for an exchange of heat between materials of different temperatures and might be used for the heating of one material as well as for the cooling of another material. In fact, the air or other cooling medium employed when heated by absorption of heat from the hot material, may be conducted away from the apparatus and its heat may be made to serve some useful purpose.

Obviously the construction and arrangement of the apparatus may be varied to suit different conditions of use and the invention, therefore, is not restricted to the precise constructions shown and described herein.

I claim as my invention:

1. A cooler comprising a longitudinal drum revoluble about an axis to which it is eccentric, housings by which the drum is supported, a jacket about the drum, means to deliver to the drum through one of the housings the material to be cooled, a central pipe for the cooling medium extending throughout the length of the drum, and a plurality of ducts extending therefrom into the jacket of the drum intermediate the ends of the latter.

2. A cooler comprising revoluble end housings, longitudinal drums carried by said housings and symmetrically disposed about the axis of revolution, means to deliver to said drums through one of said housings the material to be cooled, jackets about said drums and a central pipe connected with said jackets intermediate their ends to supply a cooling medium.

3. A cooler comprising a longitudinal drum revoluble about an axis to which it is eccentric, housings by which the drum is supported, a jacket about the drum, means to deliver to the drum through one of the housings the material to be cooled, a central pipe connected with said jacket intermediate its ends to supply a cooling medium, and means to admit a limited quantity of a cooling medium to said drum.

4. A cooler comprising a longitudinal drum, a revoluble end housing by which the drum is supported for revolution about an axis to which it is eccentric, means to deliver

to the drum through the housing the material to be cooled, a jacket about the drum, means to supply to the jacket a cooling medium, a plurality of partitions disposed interiorly of the drum adjacent its discharge end, a duct in each of said partitions so disposed as to be out of register with the duct of the adjacent partition whereby discharge of the cooled material is permitted while the admission of air is limited.

This specification signed and witnessed this 29th day of November A. D., 1910.

ALFRED E. ANDERSEN.

Signed in the presence of—

CARL V. HENNIGES,

HANS CHR. NIELSEN.