H. NIEWERTH.

HEAT ACCUMULATOR.

APPLICATION FILED OCT. 21, 1913.

1,178,667.

Patented Apr. 11, 1916.

Fig: 1.

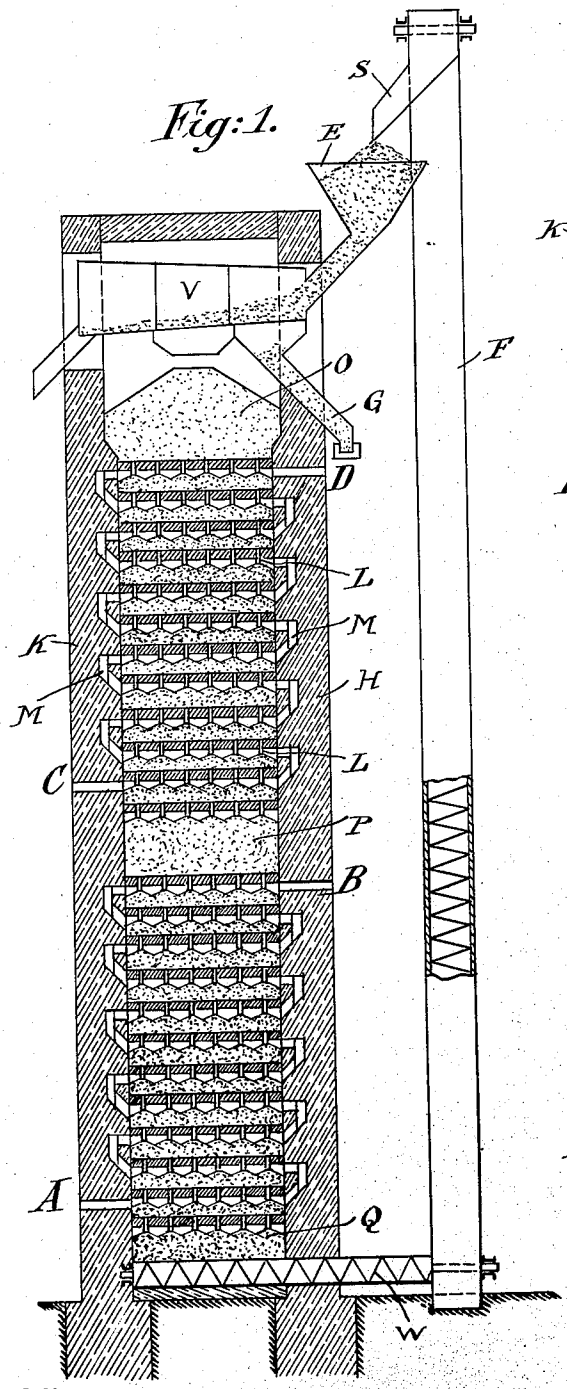


Fig: 2.

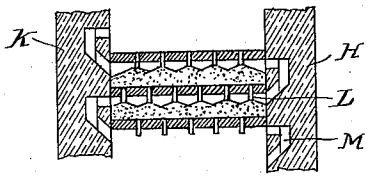


Fig: 3.

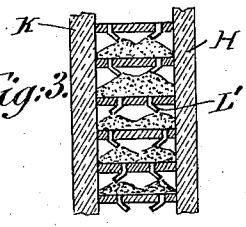


Fig: 4.

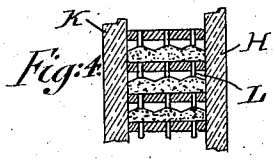


Fig: 5.

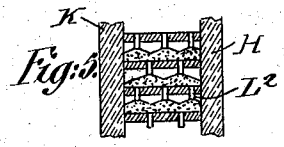
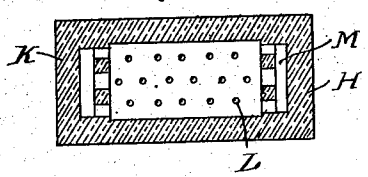


Fig: 6.



Witnesses:

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UNITED STATES PATENT OFFICE.

HERMANN NIEWERTH, OF BERLIN, GERMANY.

HEAT-ACCUMULATOR.

1,178,667. Specification of Letters Patent. Patented Apr. 11, 1916.

Application filed October 21, 1913. Serial No. 796,418.

To all whom it may concern:

Be it known that I, HERMANN NIEWERTH, a citizen of the German Empire, residing in Berlin, in said German Empire, have invented a new and useful Improvement in Heat-Accumulators, of which the following is a description.

My invention relates particularly to that form of accumulator in which the heat is stored up by means of minute particles, such as sand.

The present invention comprises a system which has a large thermal capacity, and also readily gives up its heat. The action of the accumulator can also be made continuous or alternating.

The apparatus shown in the drawings is a continuous apparatus. However, it may be made alternating by separating the lower half.

Figure 1 is a vertical longitudinal section of the apparatus, Fig. 2 is a vertical longitudinal section of a fragment thereof, Fig. 3 is a vertical transverse section of a fragment of the apparatus showing a different arrangement of pipes connecting the ovens. Fig. 4 is a vertical transverse section of a fragment of the apparatus shown in Fig. 1. Fig. 5 is a vertical transverse section of a fragment of the apparatus showing the sand pipes in still another relation. Fig. 6 is a horizontal section of the floor of an oven.

The apparatus comprises two superposed series of ovens, each series having a plurality of ovens arranged vertically. In the drawings twenty two ovens are shown, eleven in each series. The upper series serves to absorb heat from the gaseous products of combustion and the lower series serves to heat the cold air admitted. The number of ovens is immaterial, and they may be divided in any proportion.

There is a chamber Q, beneath the lowest oven, and a chamber O above the uppermost oven, which serve to hold the sand. Between the eleventh and twelfth oven is a similar chamber P, which serves to hold a larger part of the sand, and separates the upper part of the battery from the lower part, the sand operating as a closure, as well as a heat transferring medium. The sand also serves as an automatic valve in the containing ovens. This is a very important feature of the system.

In the chamber beneath the lowermost oven is a conveyer, such as an Archimedean screw W, which carries the sand to an elevator of any suitable type such as an Archimedean screw in pipe F that raises it to a sifting and cleansing means V of any suitable type, which is preferably above the accumulator. This sifting and cleansing means which is fed by means of pipe S and hopper E frees the sand from dust and coarse impurities, so that the sand is carried to the uppermost chamber O, while the dust and impurities are removed. The location of this sifting and cleansing means, as well as the character of the elevating means, may be varied.

The vertically arranged oven-bottoms are perforated in a regular manner for pipes L, which project to a given distance from the bottom of the oven underneath. The distance of the ends of these pipes from the bottom of the oven underneath depends on the following considerations: If sand is poured into the apparatus, it runs through these above-mentioned pipes to the bottom of the oven beneath, until the sand reaches the openings of the pipes, when the sand spreads out in all directions from the mouth of the pipe, and forms a cone, whose side elements are inclined from about 30 to 35 degrees to the horizontal. When this cone reaches the mouth of the pipe, the streaming of the sand stops. The length of the pipes and the distance between the bottoms of the ovens is so calculated, so that too much sand does not cover these oven-bottoms, and there is enough room to permit the passage of the gases over the sand, so as to permit an effective contact of the gases with the sand.

The workings of the system are as follows: When the accumulator is empty, the sand falls from above through the entire apparatus. First of all, the lowermost chamber Q, the one containing the Archimedean screw W, will be filled. When this point has been reached the flow of sand to the lowermost chamber Q, will cease; and the lowest oven will be filled in the manner previously described. This goes on until the entire apparatus is filled with sand. Then the

movement of sand ceases. When the Archimedean screw W and the elevator are operated, a renewed movement of the sand will result, proportionate to the rate of movement of the screw. The screw W and the elevator thus regulate the rapidity of the action of the apparatus.

The hot gases are led in through C. These hot gases are either by-products or the direct results of combustion. These gases flow through the upper eleven ovens, by means of the lateral openings M shown, until they emerge through the pipe D. The sand in the accumulator rapidly abstracts the heat of the gases, so that the gases leaving D are cooled. These heated gases must sweep through the upper eleven chambers, as the draft is so arranged, and besides, the chamber P between the upper and lower parts of the battery, which contains a large amount of sand, acts as a closure or valve, and does not permit any descent of the heated gases.

Now the air to be warmed is allowed to enter, by means of A, into the battery of the lower eleven ovens, passes through them, as above explained, and emerges in a heated condition through B. The upper battery is traversed by hot gases, whereby the sand therein is heated. The lower battery of ovens, which are traversed by the air to be warmed, would, however, not be changed without further action. If, however, the Archimedean screw W and the elevator are operated, all the sand in the apparatus is set into motion, the very warm sand of the upper battery of ovens enters the lower battery, whereby the air traversing the lower battery is heated at the expense of the heat of the sand, which has entered from the upper battery. This sand is thereby cooled and is cold when it enters the chamber connected to the Archimedean screw.

If the screw and elevator are properly regulated, as well as the passage of the hot and the cool gases, then there is cold sand and cold air near A, for the temperature of the sand rises and is highest at B, as well as the temperature of the air. The sand at A, however, has given its heat to the blast of air. The reverse condition prevails at C. The sand adjacent thereto in the uppermost part is the warmest, and is coldest at D, where the heated gases emerge, so that the heat of the gases is used effectively. The outwardly emerging cooled sand is raised by the elevator, and used again. Cold air enters at A and leaves the apparatus at B highly heated, while heated gases enter at C and leave the apparatus at D in a cooled condition. This is the ideal cycle for continuous operation.

As the pipes through which the sand streams are preferably arranged one above the other, the sand which has been uppermost in one oven will be lowermost in the oven beneath. This permits a long use of the sand and the rapid and effective abstraction of the heat of the heated gases, and, on the other hand, a rapid and effective communication of this heat to the air.

Through the streaming and agitation of the sand the creation of a crust is prevented. Impurities which enter the sand in spite of this, are removed by the sieve and cleansing means.

In Fig. 3 the pipes L′ through which the sand falls from one oven to another are bent below the horizontal partitions, in some of the ovens their bent ends projecting toward each other and in other ovens away from each other whereby the sand is differently distributed in the respective ovens.

In Fig. 5 the sand pipes L^2 connecting the ovens are vertical but disposed in staggered relation.

Other materials may be used instead of sand, as for instance, pulverized fire brick, or pebbly or basic substances, etc.

If continuous operation is not desired, the lower part of the apparatus is removed, and a correspondingly greater number of pieces of apparatus are set up, so that their action can be reversed.

In accumulators to be operated at stated periods, the streaming of the sand may be checked or controlled by mechanical means.

What I claim and desire to secure by Letters Patent is:

1. In a heat accumulator, a series of superposed and communicating receptacles, means for passing minute refractory particles through said receptacles, means for heating said particles while they pass through said receptacles, and means for cleansing said particles of dust and impurities, during the movement thereof.

2. In a heat accumulator, a series of superposed and communicating receptacles, means for passing minute refractory particles through said receptacles, a second series of superposed communicating receptacles underneath said first series, a large chamber intermediate said first and second series and communicating with both of said series, means for passing minute refractory particles through said first series into said intermediate chamber, and from said intermediate chamber into said second series, and means for passing gases into and out of each said series of chambers separately.

3. In a heat accumulator, a series of superposed and communicating receptacles, means for passing minute refractory particles through said receptacles, a second series of superposed communicating receptacles underneath said first series, a large chamber intermediate said first and second series and communicating with both of said series, means for passing minute refractory particles through said first series into said inter-

mediate chamber, and from said intermediate chamber into said second series, and means for passing gases into and out of each said series of chambers separately.

4. In a heat accumulator, a plurality of superposed receptacles, pipes leading between said receptacles, and means for passing minute refractory particles through said receptacles and pipes so that any movement of the minute particles through said receptacles takes place through said pipes, the length of said pipes intermediate said receptacles being less than the distance intermediate said receptacles.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

HERMANN NIEWERTH.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.