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ARRANGEMENT FOR HEATING GASES FLOWING THROUGH SHAFTS

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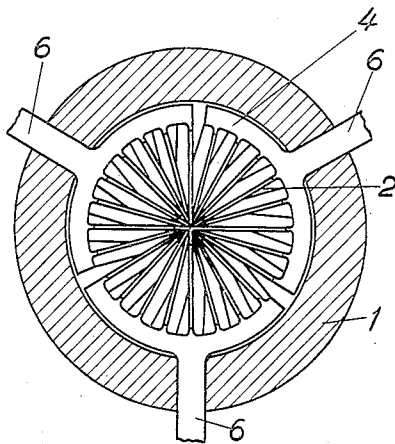


Fig. 1

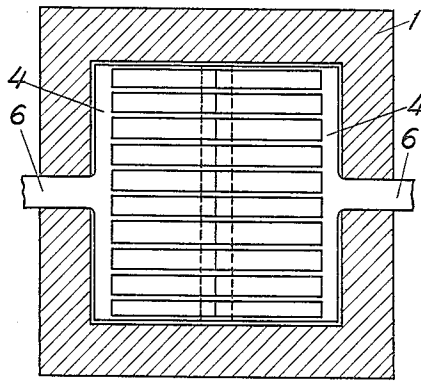


Fig. 3

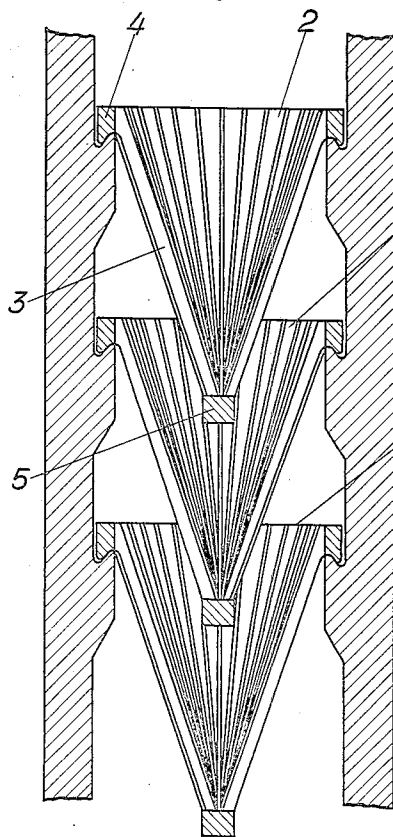


Fig. 2

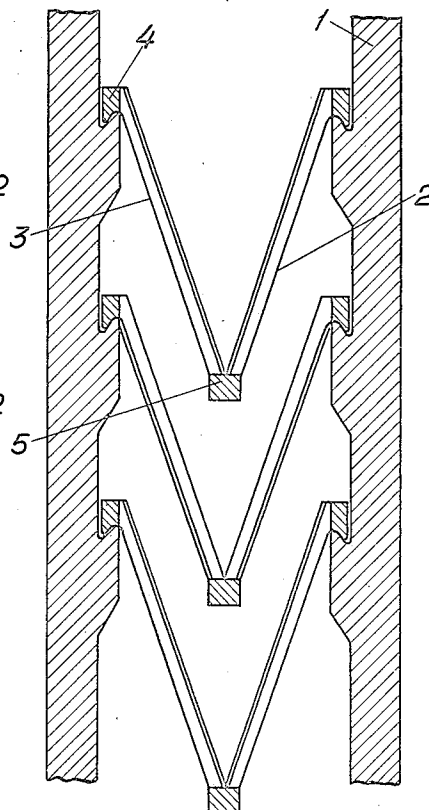


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ARRANGEMENT FOR HEATING GASES
FLOWING THROUGH SHAFTSLennart Högel, Vasteras, Sweden, assignor to All-
männa Svenska Elektriska Aktiebolaget, Vas-
teras, Sweden, a corporation of SwedenApplication June 7, 1933, Serial No. 674,645
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7 Claims. (Cl. 219—39)

For heating gases flowing through shafts to very high temperatures, generally for the purpose of accomplishing chemical processes such as carburetting carbon dioxide, hitherto only electrical arcs have been practically applied. The heating of gases by means of electrical arcs is, however, a very costly method in comparison with heating by means of electrical resistances, but this latter method involves very great difficulties as the heating temperature of the gas for certain processes lies at about 1100° or 1200° C., when the molecular strength of the resistance material begins to weaken. It has been proposed to arrange the resistance elements on shelves in the shaft in order to avoid the deformation of the material, but this means has the disadvantage that the flow of the gas in close proximity of the element is obstructed and therefore the transfer of heat will be less satisfactory.

The present invention refers to an arrangement by means of which the heating of gases flowing through a shaft is effected by means of freely hanging electrical resistance elements round which the gas is flowing without obstruction. The heating then can be driven almost up to such a temperature that the material is stressed to its yield point under its own weight. The elements are composed by commercially obtainable resistance material, preferably consisting of metal or metal alloys of which of course the types most heat resisting and most insensible to the chemical influences of the gas should be chosen. Nickel-chromium-iron alloys have proved to be particularly suitable especially in carburetting carbon dioxide, when the oxidizing effect of the gas or gas mixture is very feeble at the temperatures in question.

In the accompanying drawing two forms of arrangements of the invention are illustrated.

Fig. 1 is a transversal sectional view of a circular shaft with a three-phase arrangement of the electrical resistance and Fig. 2 shows a longitudinal sectional view of the same with three such resistances.

Fig. 3 is a transversal sectional view of a square shaft with a resistance for direct current or single phase current and Fig. 4 shows this shaft in a longitudinal sectional view also with three resistances.

In all the figures, 1 designates the shaft and 2 the electrical resistances which consist of resistance elements 3 such as rods, bars or the like fixed to an upper part 4 attached to the inner circumference of the shaft, and a lower freely hanging part 5, embodying a certain weight.

This means enables the resistance elements to expand in the longitudinal direction of the shaft retaining their position relative to each other, and the heating may therefore be driven as high as the tenaciousness of the material permits.

In Figures 1 and 2 an arrangement is shown in which the upper part 4 is arranged round the whole inner circumference of a circular shaft and the resistance elements 3 are joined in a point in the part 5, which may be cylindrical, as the drawing shows, or shaped as a cone, a ring or the like.

The arrangement shown in Figures 1 and 2 may be used not only with circular, but also with any other sectional form of the shaft. In square shafts the arrangement shown in Figures 3 and 4 may be used advantageously. Here the upper part consists of two rods 4, attached to opposite sides of the shaft, and the resistance elements 3 are placed in two planes, which are joined in the form of a V at the lower rod shaped part 5.

The resistances are hung at suitable distance above each other. The drawing only shows three resistances, but the number must of course be adapted in accordance with the heating requirements.

By dividing the upper part 4 into two or more parts each with the same number of resistance elements and each part provided with a terminal 6, the resistances may be used for different kinds of current. By dividing it into two parts the resistance will be suitable for single phase or direct current. This dividing makes it possible to connect several units in series or in delta or star for use with three phase current. By dividing the resistance into three parts each resistance may be directly connected to a three-phase system, whereby the lower part 5 forms the neutral point of the system.

The resistance elements are shown in the drawing as bars of rectangular section. In this form the elements should preferably be oblique, for instance as the wings of a fan, in order to bring the flow of gas into closer contact with the resistance elements. The arrangement would especially in round shafts cause a rotating or whirling movement along the central line of the shaft. In order to avoid this very undesirable movement, the elements of each resistance may be inclined in the opposite direction to the elements of the next preceding one. The elements of each particular resistance may also be inclined in different directions for the same purpose. By inclining the elements in different directions a more intimate mixing of the different

constituents of the gas is obtained which will advantageously influence the chemical process.

I claim as my invention:

1. Electric heating means for gases comprising
5 a shaft adapted to be traversed by a gas current
and strongly inclined grid-like metal resistance
elements comprising downwardly converging bars
substantially covering the cross-sectional area
of said shaft and extending to the center line
10 thereof.

2. Electric heating means for gases comprising
a shaft adapted to be traversed by a gas current
and inclined resistance bars suspended in said
shaft and converging downwardly to form a grid-
15 like structure substantially V-shaped in vertical
section, said bars having rectangular cross-section
with the largest dimension substantially
parallel or slightly inclined to the longitudinal
direction of said shaft substantially covering the
20 cross-sectional area of the shaft.

3. Electric heating means for gases comprising
a shaft adapted to be traversed by a gas current
and heating resistance bars suspended from the
walls of said shaft and forming a grid-like structure,
25 substantially V-shaped in vertical section.

4. Electric heating means for gases comprising
a shaft of substantially circular cross-section
adapted to be traversed by a gas current, and
heating resistance bars each suspended from the

peripheral wall of said shaft and all converging
downwards and connected together at their lower
ends at the axis of the shaft.

5. Electric heating means for gases comprising
5 a shaft adapted to be traversed by a gas current,
and a plurality of groups of heating resistance
bars each group being independently suspended
from the walls of said shaft and all said
bars converging downwards to form several grid-
like structures, one above the other and each
10 substantially covering the cross-sectional area
of the shaft.

6. Electric heating means for gases comprising
a shaft adapted to be traversed by a gas current,
and several groups of resistance bars arranged
15 one above the other and converging from the
sides towards the centre of the shaft, a heavy
body holding together the lower ends of the bars
in each group, said bars being of rectangular
cross-section, the largest dimension of which is
20 slightly inclined to the longitudinal direction of
the shaft alternatively in either direction.

7. Electric heating means for gases, comprising
a shaft adapted to be traversed by a gas
current, heating resistance bars suspended from
25 the walls of said shaft and converging downwards,
and a heavy body holding together the lower
ends of said bars.

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