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Vonnemann

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[54] **CONVERTER HOOD**

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[52] **U.S. Cl.** **266/35**
[51] **Int. Cl.** **C21c 5/42**
[58] **Field of Search** ..... 266/35, 36 P

[56] **References Cited**

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Primary Examiner—Gerald A. Dost
Attorney, Agent, or Firm—Walter Becker

[57] **ABSTRACT**

A converter hood having an upper set and a lower set of circularly located and alternately arranged distributing and collecting conduit sections which are connected to the outside of said converter hood and together with conduit means extending between and communicating with the upper and lower sets of conduit sections while forming therewith a cooling fluid circuit, the conduit means being divided into a plurality of groups of conduit means, some of the conduit means of each group leading upwardly from a section of the lower set to a section circularly offset thereto and pertaining to the upper set, and some of the conduit means of the respective same group of conduit means leading from the last mentioned section of the upper set to a section offset to the last mentioned section and pertaining to the lower set.

8 Claims, 6 Drawing Figures

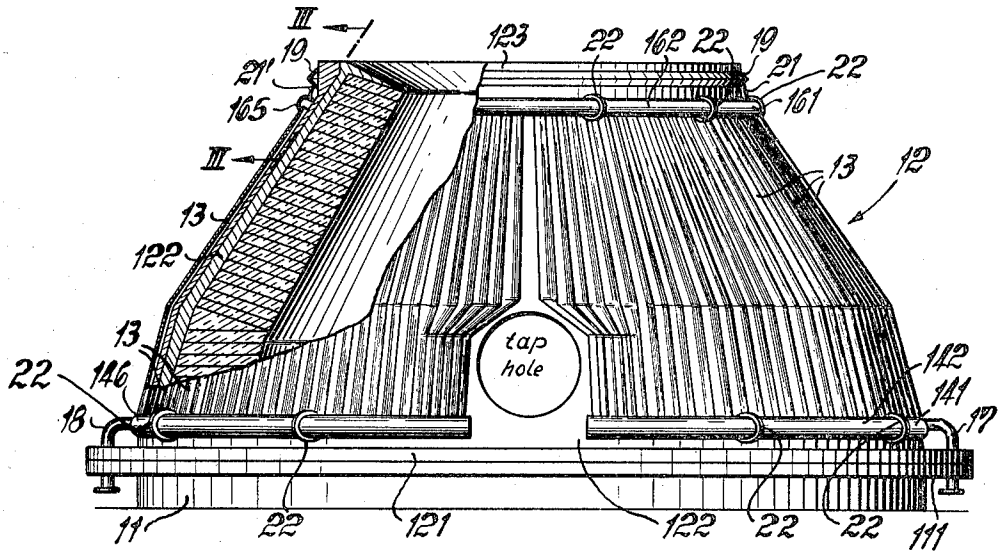


FIG. 1

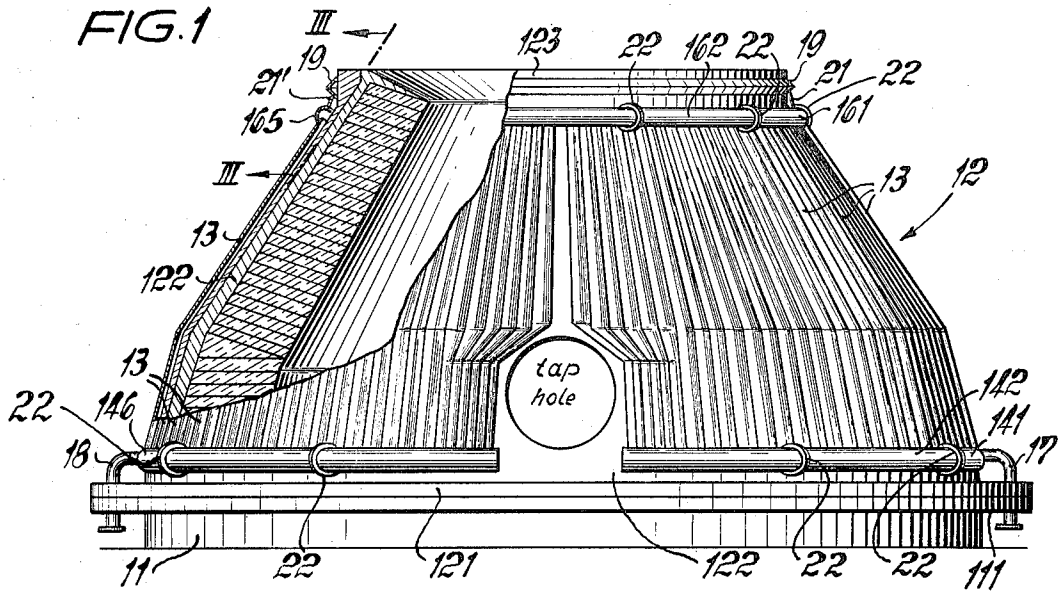

III
I
19
123
22
162
22
19
21
22
21
165
161
III
13
12
13
122
13
tap hole
142
22
146
141
18
17
11
22
121
122
22
22
111

FIG. 2

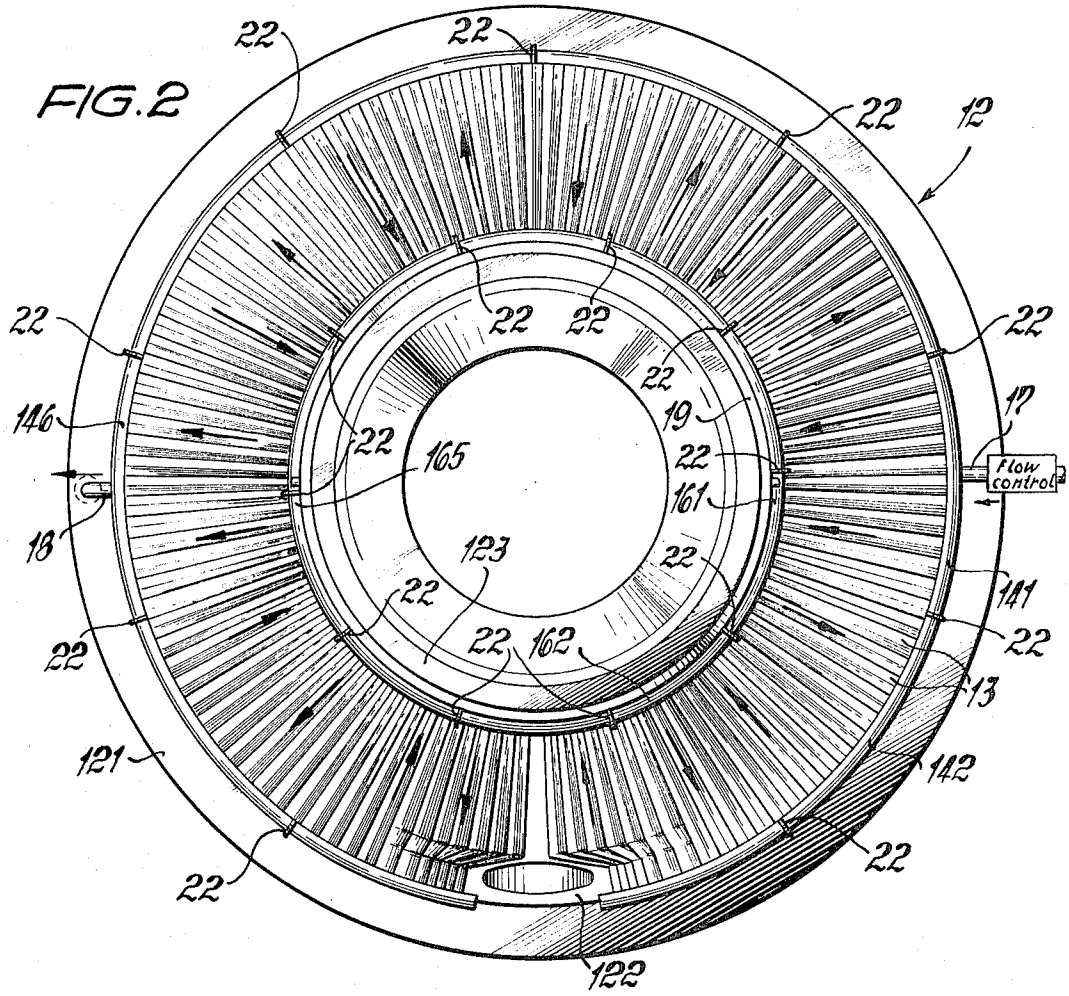

22
22
22
12
22
22
22
22
22
22
146
19
17
165
22
flow control
18
161
123
22
141
22
22
22
162
22
13
121
142
22
22
122

FIG. 3

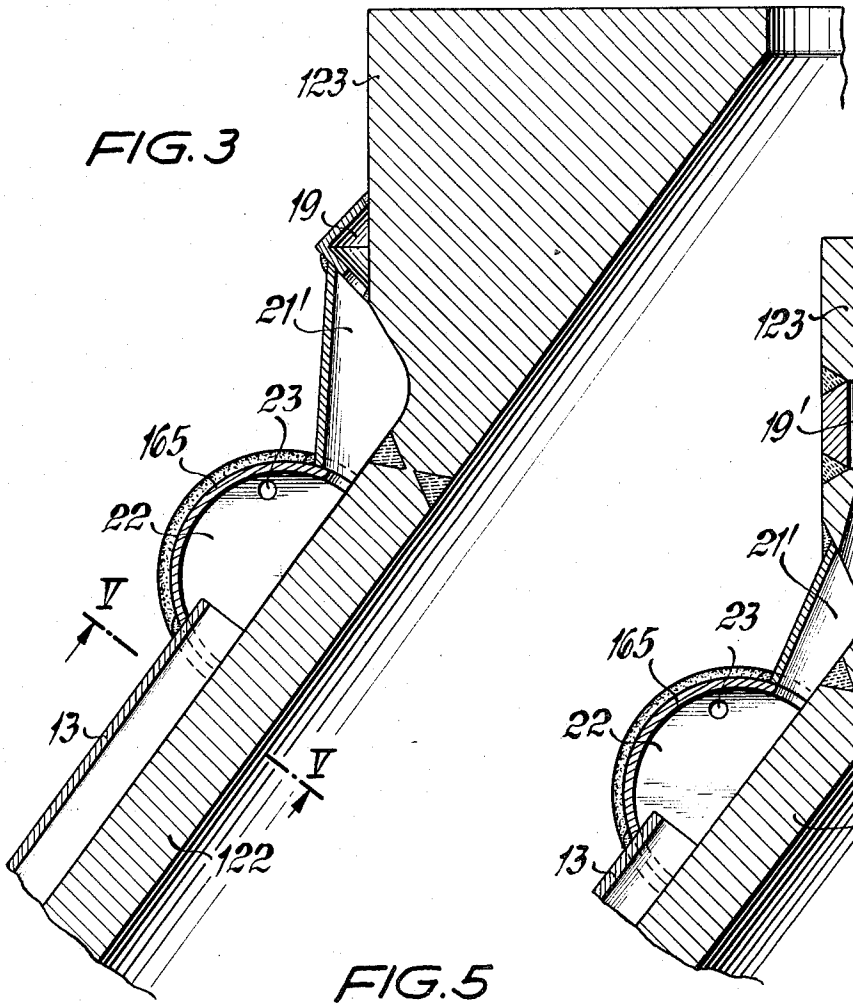


FIG. 4

FIG. 5

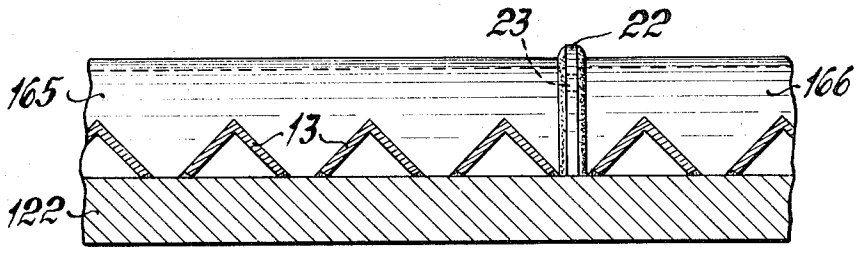
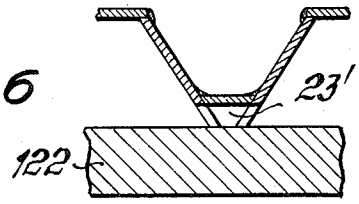


FIG. 6



CONVERTER HOOD

The present invention concerns a converter with a converter hood the circumference of which is provided with a plurality of cooling passages for passing cooling water therethrough, the cooling passages being connected through distributing and collecting means to inlet and outlet means respectively which extend through one or both supporting journals of the cover.

Ever since the introduction of refining of steel in conformity with the oxygen blowing method, considerable difficulties have been encountered to maintain the converter vessels for a longer period of time in proper and operation safe condition. After a relatively short time period of operation the converter mantle is within the region of the converter mouth considerably deformed thereby affecting the melting process. Such deformations of the converter mantle also bring about deformations in the supporting structure of the converter and also result in damage to the bearings and the transmission. The damage is caused by a strong and differing heating up of the converter mantle by the heat emanating from the slag and also by the heat given off when tapping the liquid steel.

In view of the strong heating up the strength of the steel sheet metal forming the converter mantle is reduced to such an extent that the pressure stresses occurring in the brick lining alone will bring about a deformation of the converter mantle. This deformation is furthermore increased by the uneven temperature distribution in the converter mantle which frequently results in the formation of tears in the converter mantle. In addition to interfering with the melting process proper, the deformation of the converter mantle within the region of the converter mouth greatly affects the withdrawal of dust from the waste gases because the waste gases which are discharged through the greatly deformed converter mouth are only partly caught by the waste gas hood the shape of which as originally adapted to the shape of the converter mouth is being maintained.

The above referred to drawbacks cannot be eliminated by providing an exchangeable converter top section because also the flanges for connecting the so-called converter hood will be deformed in view of the occurring high forces so that an exchange of the converter hood encounters considerable difficulties. As a further drawback, undesired idling times would be the result of a frequent exchange of the converter hood.

Therefore, it has been suggested to eliminate the temperature conditions in connection with such converters which are the cause of the above described drawbacks by providing a water cooling system for the converter hood. With the heretofore known converter hood cooling system, a cooling water pipe system extending around the converter hood and comprising a plurality of windings is arranged on the circumference of the converter hood, and the cooling water pipes are through a nest of pipes extending in vertical direction connected to feed water collecting pipes and return collector pipes for the cooling water.

The heretofore known water cooling system for converter hoods, however, has a number of drawbacks which render the application of this water cooling system questionable. These drawbacks are due primarily to the manner in which the cooling water pipes are arranged on the converter mantle and also due to the water conducting system. The cooling water coils which extend primarily along horizontal planes and also the inlet and outlet connections which extend in vertical planes and are partly located above the cooling water coils create ideal conditions for the deposit of liquid slag. When knocking off pieces of accumulated slag, damage to the pipes and conduits can for all practical purposes not be avoided. Furthermore, pieces of the slag which drop out of the chimney onto the converter hood, may cause further damage. When leakage occurs due to damaged pipes and conduits, it becomes necessary as a rule to exchange the damaged pipe or conduit in its entire length which may amount to a multipe of the circumference of the converter hood. This is particularly difficult because the new pipe has to be precisely fitted to the converter hood on location. A screening or shrouding in particular of the distributor and collector pipes as well as of the feed-in and withdrawal conduits extending in vertical direction does not solve the problem involved because the screen or shroud cannot be welded to the converter mantle and the slag enters therebetween.

A further drawback of the heretofore known water cooling system consists in that the quantity of the cooling water which passes through the cooling pipes cannot be quickly enough adapted to the actual requirements and it is for this reason that always the maximum quantity of cooling water as needed at the highest thermal load has to be fed into the cooling system.

It is, therefore, an object of the present invention to provide a proper converter cooling system which will assure a trouble-free melting process over a longer period of time.

This object and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates a side view, partly in section, of a converter hood according to the invention.

FIG. 2 is a diagrammatic top view of the converter hood of FIG. 1.

FIG. 3 represents a section taken along the line III —III of FIG. 1.

FIG. 4 is an illustration similar to that of FIG. 3 but with a modified cooling ring associated with the converter hood.

FIG. 5 is a fragmentary sectioned view taken along the line V — V in FIG. 3.

FIG. 6 is a fragmentary sectioned view to show alternative connecting passage-forming means.

The converter according to the present invention is characterized primarily in that the circumference of the converter hood is provided with a plurality of cooling passages extending between the lower and the upper edge of the converter hood, the cooling passages being arranged adjacent to each other and in groups. One half of the cooling passages of each group is associated with a plurality of upper and lower distributing and collecting conduit sections which extend along horizontal planes over the circumference of the converter hood, the upper distributing and collecting conduit sections being offset with regard to the lower distributing and collecting conduit sections. One of the lower distributing conduit sections is associated with the inlet for the cooling water and the oppositely lo-

cated upper collecting conduit section is associated with the outlet for the cooling water.

That distributing conduit section into which the cooling water first enters the cooling system, is expediently symmetrically arranged with regard to one of the converter supporting journals so that the cooling water passed into the cooling system through the supporting journal will, on the one hand, via the shortest distance flow into the distributing conduits and thereby into the cooling system while, on the other hand, a uniform distribution of the cooling water flow over the front and the rear half of the converter hood is obtained. From the distributing conduit, the cooling water passes through the cooling pipes or passages connected to the distributing conduit in upward direction and flows into the conduit sections which form the upper closure of these cooling passages and which are located in offset arrangement with regard to the distributing conduit while extending along horizontal planes and for the first group of cooling passages form the collecting conduit section and for the subsequent cooling passages form the distributing conduit section. The cooling water then flows off toward the sides and through the next following cooling water passages again flows downwardly. The flow of the cooling water continues with alternating direction of flow through the respectively next lower and upper conduit sections which are located in offset arrangement with regard to each other until the cooling water passes into the last two upper conduit sections which are arranged symmetrical with regard to the second supporting journal. From these two upper conduit sections the cooling water flows off through the last group of cooling pipes or passages into the collecting conduit section to which is connected the outlet passage for the cooling water, said outlet passage being provided in the second supporting journal. To obtain a uniform design of the cooling system, the cooling pipes may at the bottom and at the top lead into the same number of horizontal conduit sections serving as distributing and/or collecting conduit sections. The same flow of the cooling water will also be obtained when the two upper conduit sections which are arranged symmetrically to the distributing conduit sections at the inlet side and when the two upper conduit sections which are arranged symmetrically to the collecting conduit sections at the outlet side are combined to a continuous conduit section.

The cooling system according to the present invention is superior to the heretofore known converter hood cooling systems in many ways. The cooling system according to the present invention assures a trouble-free operation of the converter over longer periods of the melting process.

The cooling water pipes extending along vertical planes and the distributing and collecting conduits mounted directly on the converter hood do not form a surface which makes it possible for the slag to accumulate in large pieces. Inasmuch there are always provided several cooling pipes which are located adjacent to each other and through which the cooling water passes in the same direction while conveying the cooling water to one and the same collecting conduit section and the same distributing conduit section, it is possible to shut off any cooling water pipe which might be damaged, for instance, by pieces of slag dropping out of the chimney without materially affecting the cooling effect of the cooling system.

With the converter hood cooling according to the present invention it is possible in an advantageous manner to form also the conduit sections which extend along horizontal planes and which serve as distributing and/or collecting conduits by welding open profiles, for instance, preferably longitudinally sectioned tubes onto the converter hood. Aside from the fact that with distributing and collecting conduits arranged in this manner a penetration of slag behind this part of the cooling system will be prevented, it will be appreciated that due to the direct heat transfer also in this part of the cooling system the cooling effect is greatly improved.

For the cooling conduits welded in a manner known per se onto the converter hood, expediently relatively inexpensive angle irons are employed which have proved most resistant against damage by slag falling thereupon.

Due to the specific shape of the converter hood, the cooling passages extending between the upper and lower edge of the converter hood are located somewhat closer together toward the mouth of the converter hood with the result that a correspondingly increased cooling is effected in this area. The increasingly effective cooling in the direction toward the mouth of the converter takes care in an ideal way of the increasing heat load occurring in the direction toward the converter mouth. The fact that the distance between the cooling passages increases in the direction toward the lower edge of the converter hood brings about that the space for the tap hole can be created solely by an angling off of the cooling passages leading toward this space and by placing the cooling passages which are in the vicinity of this space closer together. This in turn results in a more intensive cooling in this area as it is needed in view of the higher thermal load.

According to a further development of the invention, the closure ring at the mouth of the converter hood which closure ring is exposed to particularly high heat stresses has associated therewith an additional cooling ring which is preferably acted upon directly by the cooling water which rises in the first group of cooling pipes and from which the cooling water is then discharged by the last mentioned group of cooling pipes. Changes in temperature of the cooling water passing through this cooling ring are a good indicator for the temperature conditions on the converter. Inasmuch as the cooling water which passes through this cooling ring reaches the outlet of this cooling ring in a minimum of time, there is obtained in an advantageous manner the possibility of controlling the throughflow quantity of the cooling water by means of the temperature of the cooling water at the outlet of this cooling ring while taking into consideration the temporary temperature conditions in and at the converter. The fact that the quantity of cooling water can be controlled in conformity with the temporary temperature conditions creates the possibility of a considerable saving in cooling water because it is no longer necessary to feed the coding system continuously with the quantity of cooling water which would correspond to the highest possible thermal stresses.

It has proved expedient to shortcircuit the conduit sections following each other and serving as collecting and/or distributing conduit sections with considerably smaller throughflow cross section than the throughflow cross section of the cooling passages extending in vertical direction. In this way cooling water cannot accumu-

late in the dead chambers at the head of the conduit sections and heat up beyond the boiling point so that an explosion-like formation of steam will be prevented. Since, however, the cooling water which is present in the dead chambers at the head of the conduit sections forming the lower distributing and collecting conduit sections, will, as a rule, take part in the circulation of the cooling water, it is not necessary to short-circuit these conduit sections. The limitation of this step to the conduit sections forming the upper distributing and collecting conduit sections simplifies and reduces the costs for the installation of the converter hood cooling.

Referring now to the drawings in detail, the mantle surface of the converter hood 12 which by means of flanges 111, 121 is connected to the converter vessel 11 has arranged thereon cooling passages 13 which extend in vertical planes. These cooling passages 13 are formed by angle irons welded to the mantle 122. At the lower and at the upper end of the converter hood 12 the cooling passages 13 lead in groups into conduit sections 141 respectively, 161 respectively which extend along horizontal planes and which serve as distributing and collecting conduits, the conduit sections 141 respectively, 161 respectively consisting of hollow profiles welded to the mantle 122. In this connection the following associations have been made.

One half of the cooling passages of each group is associated with a lower distributing or collecting conduit section 141 while the other half of the same group of cooling passages is associated with an upper distributing or collecting conduit section, the upper distributing or collecting conduit section being offset with regard to the lower distributing or collecting conduit section. One of the lower disributing conduit sections, namely that distributing conduit section which is arranged symmetrically with regard to the supporting journal of the converter vessel has associated therewith the cooling water inlet 17, whereas the oppositely located collecting conduit section 146 has associated therewith the cooling water outlet 18. In this way a forced guiding for the cooling water is obtained as indicated in FIG. 2 by the respective arrows. The closure ring 123 has associated therewith an additional cooling ring 19, 19' which is short-circuited with two upper conduit sections 161, 165. Reference numerals 21 and 21' represent short circuit lines between the upper annular passage and the designated cooling ring means 19, 19'. Reference numerals 146 and 166 designate the passage section of the lower, respectively the upper annular passage means.

The successive conduit sections 141, 142, respectively and 161, 162 respectively designate lines that are interconnected by bores 23 provided in the conduit walls which bores will prevent an overheating of the cooling water in the dead space of the conduit sections which is adjacent to the walls or partitions 22. If the conduit sections do not abut each other, they are connected by means of connecting passages 23' in FIG. 6.

It is, of course, to be understood that the present invention is, by no means limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A converter hood, especially for use in connection with a converter for refining steel, which includes: an upper set of alternately arranged successive distributing and collecting conduit sections circularly surrounding the upper portion of said hood and being connected thereto, a lower set of successive alternately arranged distributing and collecting conduit sections vertically spaced from said upper set and surrounding the lower portion of said hood while being connected thereto, the distributing and collecting conduit sections of said upper set being respectively circularly offset with regard to the distributing and collecting conduit sections of said lower set, a plurality of conduit means arranged on the outside of said hood and establishing communication between the conduit sections of said lower and said upper set and together therewith forming a cooling fluid circuit for passing cooling fluid therethrough for cooling said hood, said cooling fluid circuit including fluid inlet means for connection with a source of cooling fluid and also including fluid outlet means for releasing heated-up cooling fluid, said conduit means being divided into a plurality of groups of conduit means, some of the conduit means of each group in conveying direction for the cooling fluid to be passed therethrough leading upwardly from a section of the lower set to a section circularly offset thereto and pertaining to the upper set, and some of the conduit means of the respective same group of conduit means in conveying direction for the cooling fluid to be passed therethrough leading from said last mentioned section of said upper set to a section offset to said last mentioned section and pertaining to said lower set.

2. A converter hood according to claim 1, in which one half of each group in each section of the lower set communicates with one but a different section of said upper set.

3. A converter hood according to claim 1, in which the successive distributing and collecting conduit sections of at least one of said sets are short-circuited with regard to said conduit means by bores having a diameter considerably less than the inner diameter of said conduit means.

4. A converter hood according to claim 3, in which only the distributing and collecting conduit sections of said upper set are short-circuited with regard to said conduit means.

5. A converter hood according to claim 1, which includes open profiled members welded to said converter hood and forming said distributing and collecting sections.

6. A converter hood according to claim 1, in which said conduit means are formed by open profiles.

7. A converter hood according to claim 1, in which the upper end of the converter hood has a mouth and a closure ring at said mouth, and in which a cooling ring is associated with said closure ring, said cooling ring communicating with said cooling fluid circuit.

8. A converter hood according to claim 1, which includes adjustable control valve means associated with said cooling fluid inlet means.

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