

May 26, 1936.

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2,041,826

APPARATUS FOR INCREASING DRAFT IN FURNACES AND FOR PURIFYING FLUE GASES

Filed Aug. 9, 1934

2 Sheets-Sheet 1

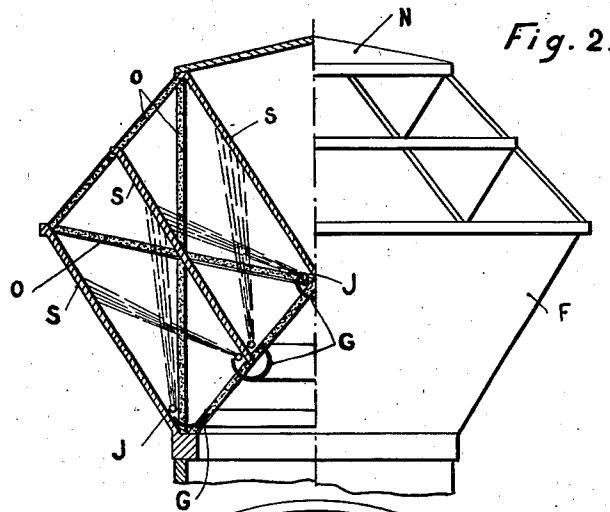


Fig. 2.

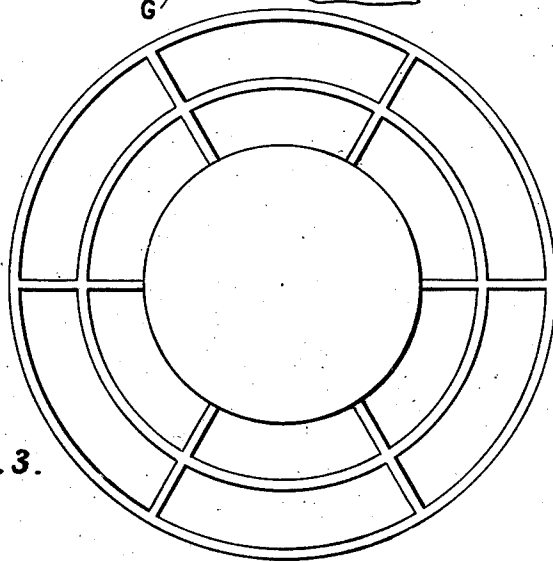


Fig. 3.

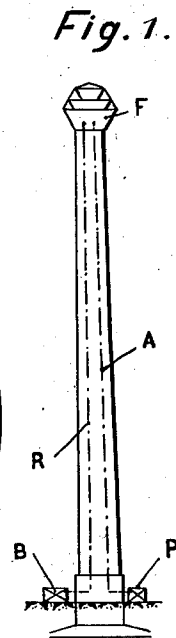


Fig. 1.

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2 Sheets-Sheet 2

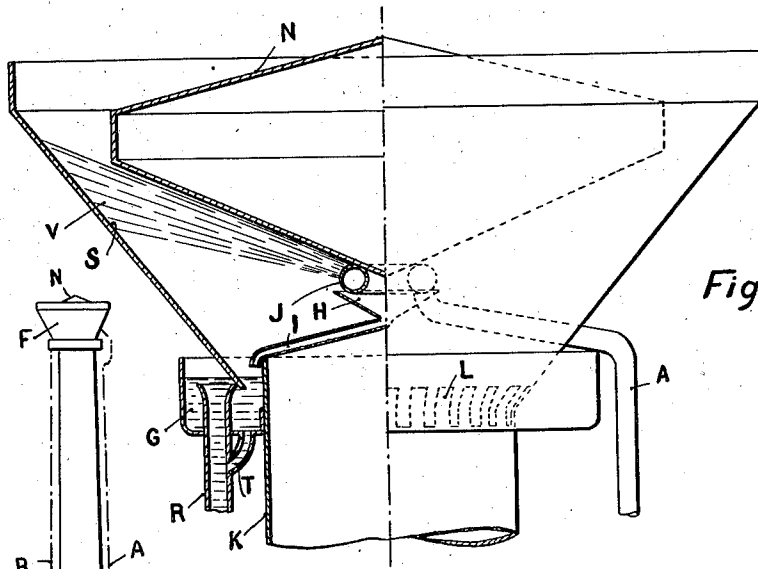


Fig. 5.

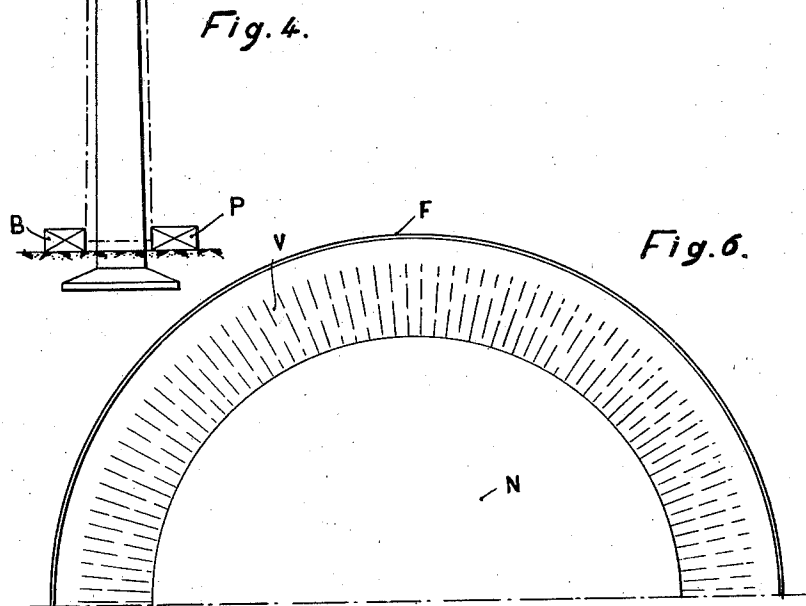


Fig. 4.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,041,826

APPARATUS FOR INCREASING DRAFT IN FURNACES AND FOR PURIFYING FLUE GASES

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Application August 9, 1934, Serial No. 739,178
In France August 16, 1933

6 Claims. (Cl. 261-126)

The invention relates to a device for eliminating impurities of chemical or physical nature as solid particles, from exhaust gases and smoke.

It is an object of the invention to position in the path of the gases or smoke to be cleaned means for creating a suction on these gases or smoke in addition to the draft which may be acting on the same.

It is, furthermore, an object of the invention to create this additional suction by injector action through the discharge of atomized liquid in the form of a sheaf at high speed into the path of the gases or smoke, whereby the core of said sheaf becomes the carrier of the gases or smoke and of the impurities contained therein.

Another object of the invention is to carry the gases and smoke with the impurities contained therein against impact surfaces by means of jets of atomized liquid spreading in the form of a sheaf whereby upon the impact of the mixture of gases or smoke and liquid particles upon said surfaces, the liquid and the impurities carried thereby will flow down on the impact surfaces while the purified gases and smoke will continue their escape in the opposite ascendant direction.

It is, furthermore, an object of the invention to provide a device of this character in which the impact action of the liquid carrier for the exhaust gases and smoke on the surfaces is enhanced by causing the atomized liquid to spread in the form of an annular sheaf from its point of origin to its point of impact on said surfaces, whereby the impact action is enhanced. The atomization of the liquid carrier and its conversion into a plurality of particles of substantially annular sheaf formation not only has the effect of distributing the liquid conveying and purifying means thoroughly through the gases or smoke, but also to facilitate the carriage of the whole mixture to the impact surfaces and the ensuing purifying action.

With these and numerous other objects in view, embodiments of the invention are illustrated in the accompanying drawings, wherein:

Fig. 1 is an elevation of a chimney provided with the device forming the subject matter of the invention;

Fig. 2 is an elevation and partly a section of this device;

Fig. 3 is a top plan view of the device illustrated in Figs. 1 and 2;

Fig. 4 shows in elevation a chimney provided with a modified embodiment of the device;

Fig. 5 shows this second embodiment partly in elevation and partly in section, and

Fig. 6 is a fragmentary top plan view of Fig. 5.

The chimney A, Fig. 1, carries preferably at its top a plurality of conical elements S partly formed by an inner cone which is provided with a closing member N at its enlarged end and partly formed by frusto-conical tubular elements which are open at the top and bottom. These conical elements are maintained in fixed spaced coaxial relation with each other by a plurality of trusses preferably uniformly spaced circumferentially of the conical elements in the passages or interspaces left between the same. These trusses which may be formed of concrete or metal or of reinforced concrete comprise the beams O connecting points at the outer circumference of the conical elements, other beams connecting inner points of the conical elements, and transverse beams extending from the innermost point of the structure to the outermost point, and vertical beams extending from the top of the structure to the lowermost point, all of the beams of each truss structure being located in a radial plane of the entire assembly of conical elements. The exhaust gases or smoke flowing through the chimney, therefore, would be discharged from the chimney through the passages between these conical elements. In order to effect the purifying of the gases or smoke while traveling through these passages, the invention provides liquid means which have the double function of producing a suction effect on the gases flowing through these passages, and of projecting the gases mixed with the liquid particles against the conical elements S, whereby the impurities dissolved or carried undissolved in the fluid will be removed by trickling down on the conical surfaces S.

In order to create a suction on the gases flowing through the interspaces between the conical elements, one or more jets of a liquid in the form of an atomized wheat sheaf are discharged into said space in such directional relation to the conical surfaces to produce before and after the impact by proper reflection a general suction or draft effect on the flue gases.

Annular tubular members J are for this purpose supported adjacent the reduced parts of the conical elements, and these tubes are provided with a great number of small openings distributed over the surface of the tubes. These annular tubes J are in communication with a pump P which in Fig. 1 is shown at the foot of the chimney and which creates the force for discharging the jets of liquid from these annular tubes, a communicating pipe between the pump and the

annular tubes being indicated in Fig. 1. The liquid is, therefore, atomized owing to the force with which it is discharged from these apertures, and at the same time the jets are spread in the interspace between adjacent conical elements to assume the shape of annular sheaves continuous through 360°. These multiple jets projected against the conical elements S carry with them the gases or smoke and particularly the impurities contained therein and impel them against the conical surfaces, whereby a separation of the liquid and the solid particles and other impurities carried by the gases is effected inasmuch as this liquid and the material carried therein flows down on the conical surface elements. The gases or smoke freed from these impurities then escape from the chimney through the interspace between adjacent conical elements.

As shown in Fig. 2, each one of these conical surface elements serves as an impact surface, the central cone or cones being impacted from both sides by the atomized jets of cleaning liquid while the outer surfaces are impacted on one side only. It will also be noted in Fig. 1 that more than one of these annular tubes J is located in the interspace and that the spreading atomized jets of liquid discharged from the same intersect each other within these interspaces. The force created by the pump P for the discharge of the cleaning liquid for the annular tubes J is sufficiently great to have a suction effect upon the gases flowing through these interspaces carrying them in direction towards the conical elements and inducing there the separation of the impurities from the remaining gases.

The cleaning liquid flowing or trickling down the inclined surfaces S is collected in annular troughs or gutters G of which a plurality is arranged, one adjacent the reduced portion of each of the conical elements. Fig. 1, furthermore, shows that a return conduit R which is in communication with the entire series of gutters G conveys this liquid containing the impurities to the foot of the chimney where it may be collected in a tank B or the like.

In the embodiment illustrated in Figs. 4 to 6, the top F of the chimney also is equipped with a structure formed of an assembly of coaxial spaced conical elements maintained in fixed relation. But while in Fig. 1 a plurality of spaces between conical elements of this character are shown, Figs. 5 and 6 illustrate an embodiment in which a single interspace only is created between one conical element having a closure N at the top and another conical element S of a different angle so as to bring about a throttling action in the apparatus and also cause by the reflection of the liquid jet striking the surface at high speed a hydraulic closure or seal preventing the outer atmosphere from entering the interior of the apparatus in which interior a subatmospheric pressure prevails. Here also an annular tube provided with a number of discharge apertures is located adjacent the reduced portion of one of these conical elements and a pump P communicating with this annular conduit through the pipe A causes the discharge of a cleaning liquid from said annular tube J into the interspace between the conical elements with great force. Owing to the force of these numerous jets appearing in the form of a spreading sheaf V, the liquid projected towards the conical surface S exerts a suction effect in this interspace and carries with it the gases flowing through the interspace, at the

same time effecting a separation of the impurities by impact on the conical wall S. The liquid flows downward on this conical surface S and discharges into an annular gutter G from which a return pipe R causes the liquid to return to a vat or container B at the foot of the chimney. The atomization of the cleaning liquid and its violent dispersion in the interspace also effect agitation of the gases or smoke flowing through the same, thereby facilitating the segregation of impurities from the same; a funnel shaped element H located beneath the annular tube J serves for collecting the water trickling down at the discharge portion of the jets and a short pipe I extends from the reduced end of this funnel H into the annular trough G which surrounds the body K of the chimney near the top thereof. The conical surface S may extend to the bottom of this trough-shaped member where it is supported, and the water flowing down on this surface enters the gutter through a series of submerged notches L cut into the reduced portion of this conical element. To facilitate the return of the cleaning fluid through the pipe R immediately upon the arrival of used cleaning liquid at the bottom of the annular trough G, a by-pass pipe T extends from the bottom of the gutter into the pipe R, while the latter is continued above the bottom of the gutter, as shown.

I claim:

1. In a device for freeing exhaust gases and smoke from impurities, the combination of a plurality of conical elements, means for maintaining them in fixed spaced coaxial relation, a plurality of annular apertured tubes each associated with one of the conical elements, and means for discharging at high speed sprays of atomized liquid through the apertures of said tubes with sufficient force to create a suction of the gases in the passage between adjacent conical elements and with sufficient force to carry with them the said gases flowing in said passages to project them against each of said conical elements while at the same time commingling with said gases by intersection in the common part of the sprays.

2. In a device for freeing exhaust gases and smoke from impurities, the combination of a conical element, a frusto-conical element spaced from said conical element and coaxial therewith, an annular tube having a plurality of small apertures surrounding the lower part of the conical element, and means for discharging at high speed sprays of atomized liquid through the apertures of said tube with sufficient force to create in the core of said sprays a suction on the gases flowing in the passage between the conical element and frusto-conical element and with sufficient force to carry with them the gases flowing through the passage and to project them against the frusto-conical element and means adjacent the reduced portions of the conical elements for collecting the liquid with impurities dissolved or undissolved running down on the conical surfaces subsequent to the impact thereon.

3. In a device for freeing exhaust gases and smoke from impurities, the combination of a plurality of conical elements, means for maintaining them in fixed spaced coaxial relation, means for discharging jets of fluid from points adjacent the reduced portions of said conical elements in direction towards other conical elements, said discharging means propelling the jets of fluid with sufficient force to create a suction between the conical elements, and means

adjacent the reduced portions of the conical elements for collecting the fluid running down on the conical surfaces subsequent to the impact thereon.

5 4. In a device for freeing exhaust gases and smoke from impurities, the combination of a plurality of conical elements in fixed spaced coaxial relation, annular tubes adjacent the reduced portions of said conical elements, said tubes being provided with a number of fine apertures, and means for projecting a liquid from said tube and through said apertures, whereby said liquid is atomized in the space between said conical elements and creates a suction in said space, and 10 means for collecting the liquid and impurities carried thereby trickling down from said conical elements.

5 5. In a device for freeing exhaust gases and smoke from apertures, the combination of a plurality of conical elements maintained in fixed spaced coaxial relation, annular tubes, one in each space between two adjacent conical elements, said tubes being provided with a great number of fine apertures, means for forcing a 20 liquid through said annular tubes and through said apertures, whereby said liquid is spread out in the space between adjacent conical elements in the form of an annular sheaf impacting with its broadened base upon the respec-

tive conical element, and creating a suction in the space between said conical elements, and means for collecting the liquid containing the impurities running off said conical elements.

6. In a device for freeing exhaust gases and 5 smoke from impurities, the combination of a plurality of conical elements, means for maintaining them in fixed spaced coaxial relation with the spaces between said conical elements in the path of the gases or smoke to be freed from im- 10 purities, a plurality of annular tubes in each of the spaces between adjacent conical elements adjacent the reduced portions of said conical elements, each of the tubes being provided with a great number of apertures, and means for forc- 15 ing liquid in atomized form through said tubes and apertures into the space between adjacent conical elements as an annular sheaf, the annular tubes in the interspaces being located rela- 20 tively to each other in such manner that the sheaves of several tubes intersect each other in the interspace between adjacent conical elements and impact the conical surfaces confining said spaces, and collecting gutters adjacent the reduced portions of said conical elements adapt- 25 ed to gather the liquid running down the conical elements.

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