CATALYTIC CONVERTER APPARATUS

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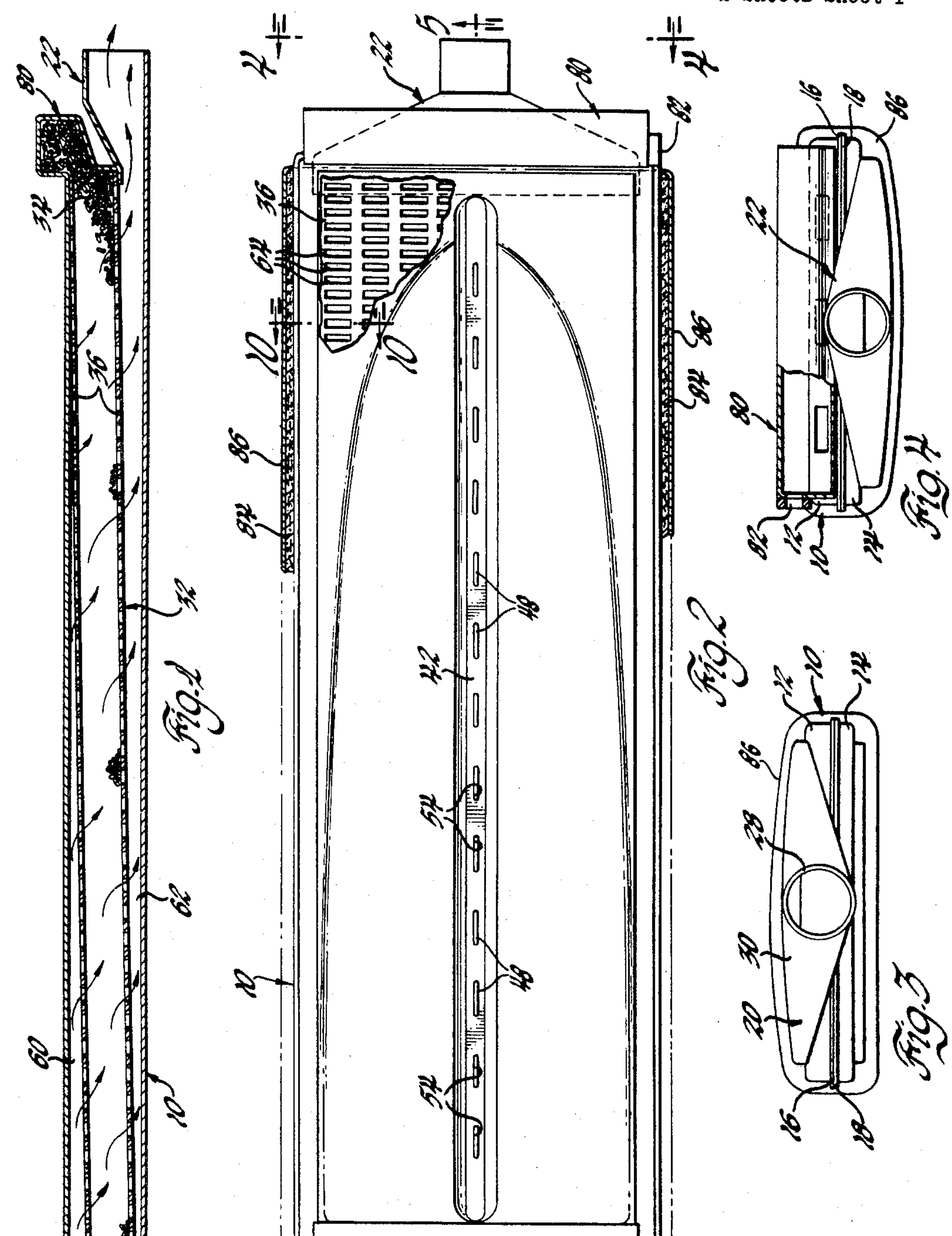

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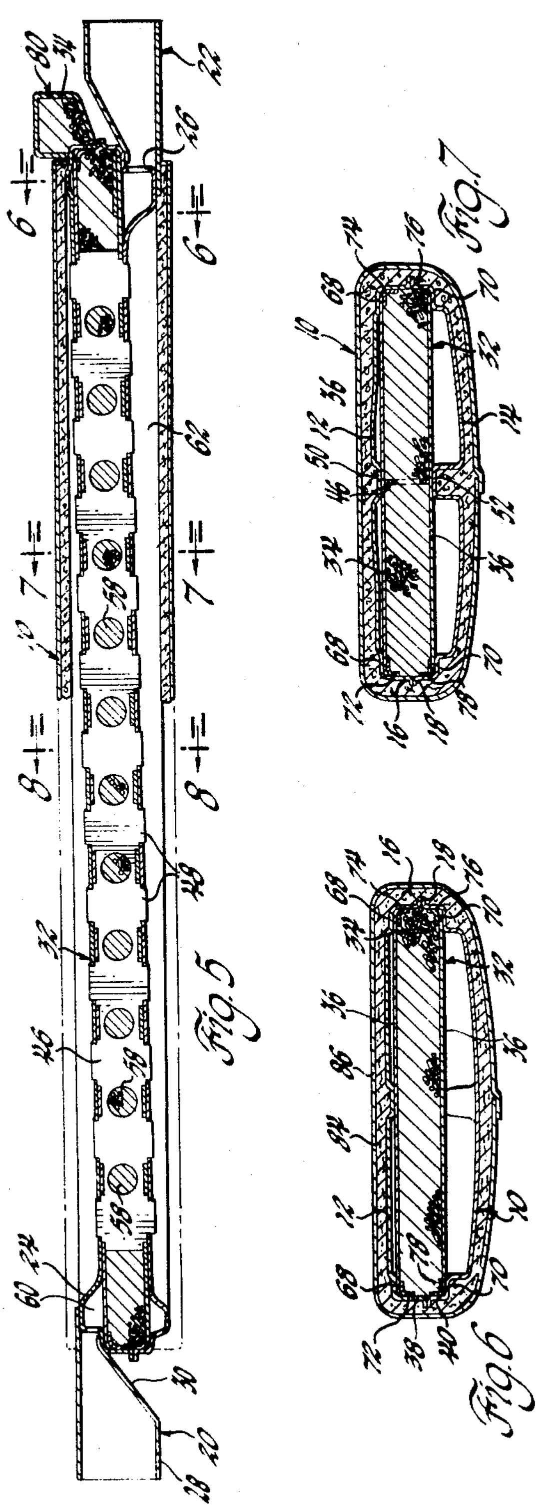

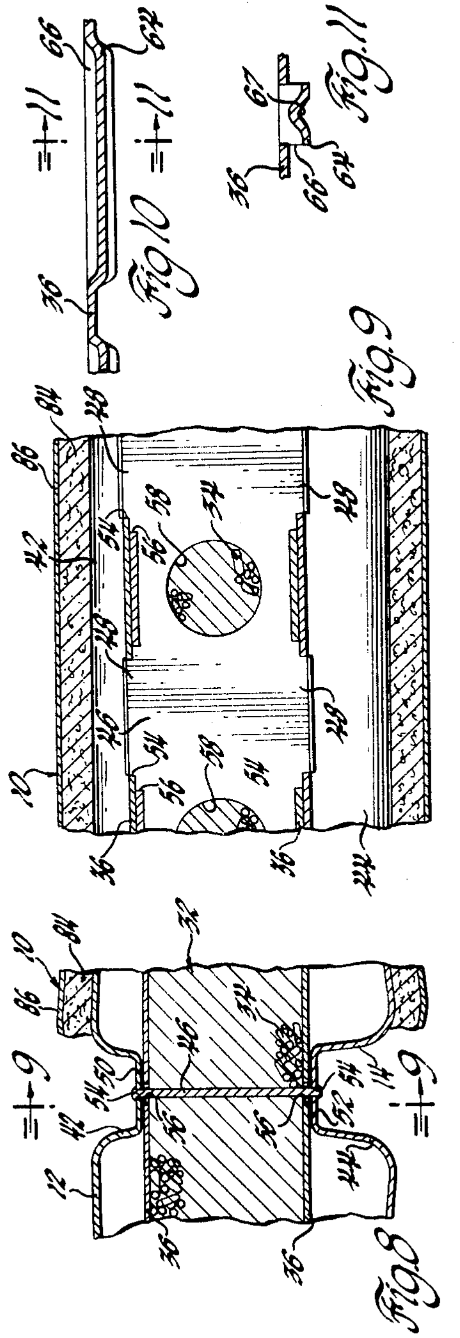

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CATALYTIC CONVERTER APPARATUS
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The present invention relates to a catalytic converter and more specifically to the form and construction of the converter which enables the same to be adapted to automotive applications.

Catalytic converters are generally well known devices in which the exhaust gases from an internal combustion engine are mixed with air and passed through a chemical or catalyst bed where the unburned hydrocarbons are oxidized or converted to substantially non-toxic compounds prior to discharge into the atmosphere. In view of the increasing smog problem that has developed in recent years, particularly in large cities, there has been a resurgence of interest in the catalytic converter as a means for substantially reducing the discharge of unburned hydrocarbons into the atmosphere.

With the renewed interest in the catalytic converter, there has arisen the problem of developing a converter which is commercially feasible both as to cost and its adaptation to an automobile. In adapting such a converter to present day low profile automobiles, there is the problem of the relatively limited space available underneath the car. The space problem is particularly aggravated by the catalytic converter which operates at temperatures as high as 1,200° F.

Specifically, the present converter construction is of a very flat design with the details of the invention being directed to the structural and design features which make the flat design feasible.

In particular, the present invention utilizes a uniquely canted or inclined catalyst bed which takes advantage of the variations in quantitative flow through the bed as the air proceeds longitudinally of the converter so as to permit the use of a small vertical displacement type of converter.

Further structural innovations have been developed for strengthening or rigidifying the very flat converter construction which would otherwise be structurally too weak for practical utilization.

The details as well as other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

FIGURE 1 is a diagrammatic view of the converter;

FIGURE 2 is a partially sectioned plan view of the converter;

FIGURES 3, 4 and 5 are views, respectively, along lines **3—3**, **4—4** and **5—5** of FIG. 2;

FIGURES 6, 7 and 8 are views, respectively, along lines **6—6**, **7—7** and **8—8** of FIG. 5;

FIG. 9 is a view along line **9—9** of FIG. 8;

FIG. 10 is a view along line **10—10** of FIG. 2;

FIG. 11 is a view along line **11—11** of FIG. 10.

The converter is indicated generally at **10** and includes a pair of generally shallow dish-shaped casing members **12** and **14** which are adapted to be joined along oppositely facing flanges **16** and **18**. The casings may actually be joined by any suitable welding process. As best seen in FIGS. 1 and 2, substantially identical exhaust gas and air inlet and outlet members are shown at **20** and **22** and are suitably secured to enlarged portions **24** and **26** respectively of upper and lower casing members **12** and **14**.

Inlet member **20** includes a reduced cylindrical portion **28** which terminates in or is suitably joined to a sharply

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flaring portion **30** which extends substantially throughout the width of casing **12**. Thus, the air and exhaust gas mixture which enters through portion **28** is introduced within the container substantially throughout its width whereby the gases are adapted to flow over the full width of the catalyst bed.

The catalyst bed container is indicated generally at **32**. While the construction of the converter is readily adaptable to catalysts of many types and shapes, it has been particularly adapted for use with catalyst particles **34** which are cylindrical in shape and about 1/16 of an inch in diameter and an average of 1/4 of an inch long. It will subsequently be seen that the construction of grid members **36** of catalyst bed **32** are particularly designed to accommodate this type of catalyst particle.

The actual catalyst container is defined by the vertical side walls **38** and **40** of casings **12** and **14** and the upper and lower grid members **36**. The grid members are of identical construction and are secured to the casing members by identical means; therefore, the construction of only one of these members will be discussed in detail.

Before further referring specifically to the construction of the converter, it is important to note that catalytic converter of the type being considered is subjected to a wide range of temperatures which over a very short period of time may vary from below freezing to a temperature in the catalyst bed of 1,200° F. It is immediately apparent that with such a wide range of temperature variations, occurring over a relatively short period, the construction of the converter must take into account the inevitable expansion of materials which will occur when utilizing a metal converter as contemplated.

To better understand the structural significance of certain of the details which are about to be described, it would be helpful for illustrative purposes to indicate that a converter of the type contemplated would be approximately 30 inches long, 10 inches wide and approximately 3½ inches high. Thus, and this may best be seen by referring to FIGURES 2 through 5, the subject converter may be three to four times as wide as it is high and three times as long as it is wide. This very flat converter construction would generally tend to be structurally weak particularly if the converter casing materials are made of the necessarily thin gauge metals utilized to keep down weight and cost. It is contemplated that the casings and other converter elements would preferably be made of 20 gauge (.037 inch) type 302 stainless steel.

The subject converter has been constructed in a unique manner to achieve a very thin or flat design with relatively light gauge metals and which design nevertheless has the requisite strength to withstand anticipated wear.

Referring now to FIGS. 2 and 6–8, it will be seen that both of the casing members **12** and **14** are longitudinally depressed substantially throughout their lengths adjacent the casing center line to provide longitudinally and inwardly extending strut members **42** and **44**. By thus providing the longitudinal struts on each of the casing members, it is apparent that the converter longitudinal beam load capacity is greatly strengthened.

A longitudinally extending support member **46** is provided to further strengthen the converter construction and is adapted to be secured to the casing strut members **42** and **44**. The configuration of support member **46** is shown in FIGS. 5 and 9 and includes a plurality of longitudinally spaced tab portions **48**. As best seen in FIGS. 2 and 8, walls **50** and **52** of each of the longitudinal struts **42** and **44** is suitably apertured along the casing center line to provide a plurality of slots **54** which correspond in shape and number to tabs **48** on support member **46**. In assembling the converter, tabs **48** project through the casing slots **54** after which the tabs are welded in the area of the slots to secure support member 46 to the casings. In order to permit tabs 48 to extend therethrough, grid members 36 are also suitably slotted at 56, as shown in FIG. 9.

Holes 58 are provided in member 46 to reduce the weight of the member and also to insure gas flow through the member. Canting or inclining catalyst bed container 32 relative to the longitudinal axis of converter 10 is a very important aspect of the present invention. By inclining container 32 gas inlet chamber 60, defined by casing 12 and upper grid 36, is of a progressively decreasing volume while outlet chamber 62, defined by lower grid 36 and casing 14, is of an increasing volume in relation to gas flow from the inlet end to the outlet end of converter 10. Inasmuch as gas flow through inlet and outlet gas chambers 60 and 62, respectively, progressively decrease and increase from the inlet to the outlet ends of the converter as the gases pass through the catalyst bed, the inclined bed construction may be utilized. It is apparent that inclining the catalyst bed reduces the overall height of the converter by taking advantage of the aforenoted inverse volume requirements of gas inlet and outlet chamber 60 and 62.

The tapered or inclined gas chambers or passages 60 and 62 also provide a constant gas velocity throughout their lengths which results in better gas distribution through the catalyst bed. To facilitate the canted or inclined construction of the catalyst bed container 32, as best seen in FIG. 1 longitudinal strut 42 of upper casing 12 tapers in depth from a maximum proximate the entrance of the converter to a minimum at the exhaust end of the converter. On the other hand, strut 44 of bottom casing 14 tapers in the opposite sense proceeding from a minimum proximate the entrance of the converter to a maximum adjacent the exhaust end of the converter. The bottom walls 50 and 52 of the longitudinal struts 42 and 44 are maintained in a parallel relationship with respect to each other even though they are inclined with respect to the longitudinal axis of converter 10.

Referring particularly to FIGS. 2, 6 through 8, 10 and 11, the construction and mounting of the grid members 36 will now be considered in greater detail. The grid material is generally the same type and size of stainless steel stock as that used in casings 12 and 14, supra. As the air and gas mixture enter inlet chamber 60 above the catalyst bed it must, in moving longitudinally of the converter, flow through the bed and outlet chamber 62. Accordingly, grids 36 must be suitably slotted or perforated to permit the longitudinally flowing air to effectively pass through the catalyst bed as illustrated by the arrows in FIG. 1. At the same time, the grids must be slotted or perforated in such a way as to retain the catalyst particles. These requirements have resulted in the unique grid construction shown in the aforenoted figures.

A plurality of longitudinally extending rows of depressed portions 64 are formed in grids 36 so as to provide a plurality of air openings 66 extending transversely of the converter air flow. Depressed portions 64 of grid 36 are formed by a punching process whereby these portions are partially severed and depressed relative to the grid surface through the action of a suitable punching member. In partially severing and depressing grid portions 64, air openings 66 must be limited in size to prevent the catalyst particles from being lost therethrough. Accordingly, with the size particles suggested for illustrative purposes, supra, the size of openings 66 is limited to approximately .020 inch.

In order to strengthen the depressed portions 64 of grid 36 and to thereby prevent distortion of openings 66, these portions are indented, as seen in FIG. 11, to provide a generally arcuate cross section as indicated at 67. By thus strengthening portions 64 it is insured that through continued use the air openings 66 will not become distorted from their original size.

As already noted, due to the extreme temperature variations to which the converter is subjected, grids 36 are mounted upon casings 12 and 14 so as to provide a floating catalyst bed. In other words, grids 36 are not rigidly fixed to casings 12 and 14. Upper and lower casings 12 and 14 are respectively formed to provide flange portions 68 and 70. Angle brackets 72, 74, 76 and 78 are suitably secured to the sidewalls of the respective casings adjacent flanges 68 and 70. As best seen in FIGS. 6 and 7, grid members 36 are loosely supported between the flanges 68 and 70 and adjacent angle brackets whereby the grids may move relative to the casings and brackets to accommodate expansion and contraction of the grid material due to the aforenoted temperature variations. In thus loosely mounting the grid members undue stressing of the converter casings are avoided. Tab slots 56 of grid members 36 are also made oversize in relation to tabs 48 of support member 46 to permit grid expansion without restraint by adjacent and supporting structures. In order to accommodate the intended canted or inclined disposition of catalyst bed 32, flanges 68 and 70 as well as angle brackets 72, 74, 76 and 78 are likewise inclined in parallel relation to struts 42 and 44.

Inasmuch as there is a gradual attrition or wearing of the catalyst particles due at least in part to the mutually abrading relationship of the particles occasioned by vehicle induced vibrations, it is desirable to provide means whereby the catalyst bed may be automatically supplied with additional catalyst particles. To this end, a catalyst particle reservoir 80 is secured to upper casing 12 proximate the exhaust end of the converter. Reservoir 80 openly communicates through suitably apertured casing 12 and upper grid 36 with catalyst bed 32. As the volume of the bed tends to be diminished by the aforenoted particle attrition, additional particles within reservoir 80 will pass into the bed and restore or maintain the requisite bed particle volume. Due to the canted or inclined construction of the catalyst bed and the location of the reservoir near the highest end of the bed and further due to the normal vibrations which occur, upon a diminution of the catalyst bed volume, particles 34 would tend to move toward the lower end of the bed permitting the supplementary particles in reservoir 80 to move into the bed area. An opening 82 is provided in reservoir 80 to permit the refilling of the reservoir with catalyst particles as the need develops over a period of extended converter use.

In order to insulate converter 10 from the vehicle body on which it is mounted, it is intended to wrap the main body of the converted with a suitable insulating material 84. For illustrative purposes, the converter may be covered with an insulating material such as aluminum silicate which is encased by a suitable aluminum wrapping 86. Inasmuch as the matter of insulation is more critical in the area of the converter closest to the vehicle body, it is preferred that the insulation be thicker on top of cover casing 12 than would be the case along the lower casing 14.

I claim:

1. A catalytic converter having a gas inlet opening and a gas outlet opening formed in spaced end walls thereof, said gas inlet opening being disposed to one side of a longitudinal plane passing through the center of said casing and said gas outlet opening being disposed on the other side of said plane, said converter comprising spaced first and second elongated casing members respectively located on opposite sides of said plane, a catalyst bed having perforated grid members located between said casing members, a longitudinal strut formed on each of said casing members for stiffening the latter, each strut having a wall inclined to said longitudinal plane for maintaining said catalyst bed in an inclined plane whereby said catalyst bed cooperates with said first and second casing members to define oppositely

tapered inlet and outlet gas flow chambers respectively communicating with the gas inlet and outlet openings.

2. A catalytic converter having a gas inlet opening and a gas outlet opening formed in spaced end walls thereof, said gas inlet opening being disposed to one side of a longitudinal plane passing through the center of said casing and said gas outlet being disposed on the other side of said plane, said converter comprising spaced first and second elongated casing members, a first strut member formed in said first casing member, said first strut member serving to stiffen said first casing member and being defined by a depressed portion that tapers from its deepest point proximate the gas inlet end of the converter to its shallowest point proximate the gas outlet end of the converter, a second strut member formed in the second casing member, said second strut member serving to stiffen said second casing member and being defined by a depressed portion that tapers from its shallowest point proximate the gas inlet end of the converter to its deepest point proximate the gas outlet end of the converter, an elongated catalyst bed, said catalyst bed comprising a pair of spaced perforated grid members extending between said first and second casing members, each of said strut members extending from

its associated casing member towards said catalyst bed so as to maintain the latter in a plane inclined to said longitudinal plane whereby said catalyst bed cooperates with said first and second casing members to define oppositely tapered inlet and outlet gas flow chambers respectively communicating with the gas inlet and outlet openings.

3. A catalytic converter apparatus as set forth in claim 2 in which each of said grid members is supported for expansion and contraction by one of said casing members.

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