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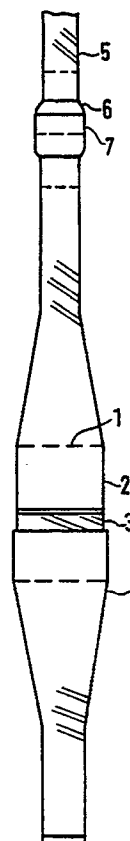
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S-103 62 Stockholm(SE)(54) **Exhaust pipe-silencer combination and a method of manufacturing the parts thereof.**

(57) The invention relates to a method of manufacturing parts for an exhaust pipe-silencer combination. According the method, the parts are formed of a metal strip by a helical seaming process. Outer tubes (1,3,4) of the silencer, which include a conical portion, are helically seamed beginning from a cylindrical portion having a larger diameter. The substantially conical portion is helically seamed so that the diameter thereof is diminished continuously and smoothly to correspond to the diameter of the parts of the exhaust pipe. Finally, a second cylindrical portion having a smaller diameter is formed. The invention is also related to an exhaust pipe-silencer combination, in particular for motor vehicles, in which both the exhaust pipe and an outer tube (2) of the silencer, as well as, of the outer tubes of the exhaust pipe and the silencer, outer tubes (1,3,4) most suitably conically changing in diameter, are of profiled, lock-fold jointed, helically-seamed tubing. The outer mantle of the silencer is partly formed by two separate parts (1,3) having substantially conical narrowing portions. The tube parts provided with the narrowing portions are connected to each other by the helically-seamed tube (2) having the diameter of the mantle of the silencer, utilizing the screw-threads of the profiling of the different parts.

**FIG. 1****EP 0 444 389 A1**

The invention relates to a method of manufacturing parts for an exhaust pipe-silencer combination, according to which method the parts are formed of a metal strip by a helical seaming process.

The invention also relates to an exhaust pipe-silencer combination, in particular for motor vehicles, which combination is made of a metal strip by a helical seaming process, in which both the exhaust pipe and an outer tube of the silencer having a diameter larger than the diameter of the exhaust pipe, as well as, of the outer tubes of the exhaust pipe and the silencer, the outer tubes most suitably conically changing in diameter, are of profiled, lock-fold jointed, helically-seamed tubing, in which the outer mantle of the silencer is partly formed of two separate parts having substantially conical narrowing portions, and which tube parts provided with the narrowing portions are connected to each other by a helically-seamed tube having the diameter of the silencer mantle, utilizing the screw-threads of the profiling of the different parts.

The combination of exhaust pipe and silencer according to the invention intends exhaust systems comprising exhaust pipes with silencers and tail pipes.

Exhaust systems comprising exhaust pipes and silencers have previously most commonly been made of steel tubing by welding various parts together. The outer part of the silencer has usually been made of a constant diameter tube, to the ends of which planar end flanges have been attached by welding. Consequently, a large number of different work stages are required in the manufacturing of an exhaust system with an exhaust pipe and silencer. The use of welded joints has restricted the use of materials more resistant to corrosion in exhaust pipes and silencers, because welded joints without expensive protective treatment constitute points highly susceptible to corrosion, and thus partly for this reason it has been uneconomic to use better materials offering good corrosion-resistance, such as, acid-resistant steel. Accordingly, one of the weakest parts of motor vehicles in resistance to corrosion has been the exhaust pipe and the silencer, and they have to be replaced either partly or totally several times during the service life of a vehicle.

It is previously known to make a certain part of an engine exhaust pipe, more specifically a short section extending from the exhaust manifold of the engine to a conventional exhaust pipe with a silencer, of hose-like, completely flexible metal tubing resembling helically-seamed tubing. The flexibility of such tubing is based on a yielding, moving seam, and not on the profiling. An entire exhaust pipe with a silencer has not been manufactured of such tubes, nor have they comprised any helically-

seamed portions changing, e.g. conically, in diameter.

A further previously-known construction of an exhaust pipe-silencer combination is disclosed in FI Patent 52761. In this prior art structure the exhaust pipe and the outer tube of the silencer as well as their connection parts are of profiled, lock-fold jointed, helically-seamed tubing, and the different parts of the combination have been attached to each other by means of the screw-threads provided by the profiling.

An object of the invention is to help to eliminate the drawbacks indicated above, and to provide an exhaust system comprising an exhaust pipe with a silencer in the manufacture of which no welded joints need to be used, which contributes to making it economic to use materials which are better than heretofore from the point of view of corrosion, such as, for example, acid-resistant steels, in exhaust systems with exhaust pipes and silencers. A further object of the invention is to provide a method of manufacturing the parts for the exhaust pipe-silencer combination by helically seaming suitably profiled tubing of a material web in such a manner that the different parts constitute a system in which a suitable exhaust pipe-silencer combination is achieved by combining parts of the system, for instance, for different types of motor vehicle. In accordance with the invention, the exhaust system comprising the exhaust pipe and the silencer is made of helically-seamed, suitably profiled tubing manufactured by machine from a strip by cold rolling for example.

When the tubing helically-seamed in accordance with the invention is profiled so as to be bendable, the pipes of the exhaust system can be bent into desired shape without any moulds or other tools, and there exists no risk of buckling. When an exhaust system of exhaust pipe and silencer is assembled from parts, the parts can be profiled so that the profile serves as a screw-thread by means of which the different parts of the entire exhaust system with an exhaust pipe and silencer can be joined together by screwing the parts more or less deeply one into another. In this manner is also achieved a wide range of possibilities to adjust the lengths of exhaust pipes and silencers. The profiling also increases the cooling surface and the breaking of sound waves in the exhaust system of exhaust pipe and silencer, which as a result of the profiling can be more uniformly distributed over the entire exhaust system. The silencer can thus be constructed so that the flow therein is very easy.

The exhaust pipe-silencer combination according to the invention is mainly characterized in that the inner part of the silencer is at least double, comprising an inner tube, which is composed of a cylindrical part and a conical part, and an outer

tube, which are of lock-fold jointed, profiled, helically-seamed tubing, and that the inner part of the silencer is clamped at its ends to the outer mantle of the silencer by utilizing the screw-threads formed by the profiling.

The method according to the invention is mainly characterized in that the outer tubes of the silencer, which include a conical portion, are helically seamed beginning from a cylindrical portion having a larger diameter, and that the substantially conical portion is helically seamed so that the diameter thereof is diminished continuously and smoothly to correspond to the diameter of the parts of the exhaust pipe, and a second cylindrical part having a smaller diameter is formed in the end. Other advantageous features of the invention are set forth in claims 2, 4-9.

The joining of the parts of the helically-seamed exhaust pipe-silencer combination to each other is a simple and fast operation by means of connecting pieces joined to the helically-seamed profiling, or by using the helically-seamed profiling directly as a connection element. Consequently, the use of an exhaust pipe-silencer combination enabling the parts thereof to be joined to each other according to the invention, having a module construction, and assembled from standard parts, makes it possible for spare part suppliers and/or manufacturers to keep smaller stocks, and as a result less capital need be tied up in the stock of parts.

The silencer of the invention, which comprises a straight part and a conical part, enables the silencing effect to be doubled. Moreover, the inner part of the silencer is small as compared with other silencer structures. The inner part is easy to attach to the conical parts of the silencer. It is also possible to attach, for instance, a catalytic converter as an inner part to these conical outer tube parts of the silencer. In the silencer according to the invention one of the conical parts is made of two conical parts disposed one within the other, whereby it serves as a thermal insulation and prevents any damage which shocks or bumps might cause. Further, the silencer according to the invention can be easily shaped, e.g. flattened to obtain a suitable shape, thereby providing larger ground clearance for instance.

The invention is described in more detail with reference to the embodiments shown in the Figures of the accompanying drawing, to which the invention is by no means restricted.

Fig. 1 shows an exhaust pipe-silencer combination according to the invention.

Fig. 2 shows the joining of the silencer to the pipes of an exhaust system and the structure of the inner part of the silencer.

Figs. 2 a and b show in end views the inner part of the silencer.

Fig. 3 shows the seam structure of helically-seamed tubing.

Figs. 4 a, b and c show possibilities of joining parts of an exhaust pipe-silencer combination to each other according to the invention.

The exhaust pipe-silencer combination, as shown in Fig. 1, consists of several separate parts, made of helically-seamed tubing, and of connection pieces. An outer tube 2 of the silencer is cylindrical, and tubes 1 and 3 are joined thereto by means of double threads formed by a helically-seamed profiling. The tube 2 has a diameter slightly smaller than the diameters of the tubes 1 and 3. The tubes 1 and 3 consist of a short cylindrical portion and a conical portion, which as a narrower tube smoothly connects with exhaust pipes or tubes. According to the invention, the tubes 1 and 3 are formed by a helical seaming process in such a manner that from a material strip is first helically seamed the cylindrical portion, whose diameter is larger than those of the exhaust pipes, or tubes, of the exhaust system, and after that the diameter is being diminished so as to form a smooth conical or tapering portion, which ends when its diameter has reached the diameter of a tube part of the exhaust tubes. After that the helical seaming process is continued a suitable length, maintaining the diameter of the exhaust tube part. A tube 4, corresponding to the shape of the tube 3 and having a diameter slightly larger than the diameter of the tube 3, is screwed onto the tube 3 utilizing the double threads formed by the profiling of the helical seam. This outer tube 4 strengthens the silencer to prevent any damage which shocks may cause, and at the same time acts as a double thermal insulation together with the tube 3. The tube 1 of the silencer is connected to a tube, or pipe, 5 of the exhaust system by means of connection pieces 6 and 7. The tubes 1 and 5 are helically-seamed tubes, thus having a double-thread profiling. The connection pieces 6 and 7 are provided with double-thread portions by means of which they are attached to the double-thread profiling of the respective tubes 1 and 5. Otherwise the tubes 6 and 7 are smooth tubes. The joining of the parts is illustrated in Figs. 4 a, b and c in greater detail. The tube 3 of the silencer is connected to the exhaust system by a connection piece in a corresponding manner. Connection pieces can also be used for attaching other parts of the exhaust system to each other. The exhaust system is fixed to a vehicle by conventional attachment means.

As shown in Fig. 2, the inner part of the silencer is formed of an inner tube comprising a conical part 9 and a cylindrical part 11. A transverse guide plate 10 is disposed at the junction of the tubes 9 and 11, which plate is attached by

welding to an outer tube 8 of the inner part of the silencer. The guide plate 10 is provided with vane-like formations (not shown in the Fig.) giving rise to turbulence of the gases in the inner part of the silencer. The outer tube 8 of the inner part of the silencer is bent at its both ends against the respective part 9 or 11 of the inner tube so as to form at its ends a structure shown in Figs. 2a and 2b. The inner part of the silencer is attached at its ends to the conical portions 1 and 3 of the outer tube. The attachment is accomplished by means of the double threads of the helically-seamed profiling. The outer tube of the inner part of the silencer is provided with perforations to enable the circulation of gases. In addition, the inner tube 9,11 of the inner part of the silencer is provided with perforations over a short distance close to the transverse guide plate 10, also to improve the circulation of gases.

Fig. 3 shows a suitable seam structure 12 by which adjacent strip turns 13 and 14 are attached to each other. This seam 12 has proved to be absolutely gas-tight.

Fig. 4a shows two helically-seamed tubes 15 and 16 which can be screwed more or less deeply one into the other, utilizing the screw-threads formed by a profiling 18, in which case their diameters are, of course, slightly different in size. The tubes 15 and 16 can be screwed one into the other so that their seams 12 will be against each other. The tubes 15 and 16 are illustrated as being provided with an undulating profile of two crests, which may naturally equally well be of another shape and have one or more crests. The profiling has at least four tasks important in view of the invention, part of which have already been indicated above: firstly, the profiling serves as screw-threads by means of which the different parts of the exhaust pipe as well as the silencer may be attached to each other so that their lengths can be adjusted; secondly, the profiling makes the tubes suitably bendable without any risk of buckling; thirdly, the profiling increases the cooling surface and the breaking of sound waves, in some cases even to the extent that the inner part of the silencer becomes unnecessary; and fourthly, the profiling and partly the seaming increase the resilient properties of the exhaust system so that it will not easily fracture.

Fig. 4b illustrates the joining of the connection piece 6 to the profiled 18 double threads of the helically-seamed tube 16. The thread portions 17 provided in the connection piece correspond to the double-thread portions 18 of the helically-seamed tube.

Fig. 4c illustrates the joining of the connection pieces 6 and 7 to each other with relatively loose fitting. Both of the connection pieces have the thread portions 17 corresponding to the double

thread of the helically-seamed profiling.

The attachment of the parts of the exhaust pipe-silencer combination to each other by means of the connection pieces and/or the double threads of the helically-seamed profiling constitutes a gas-tight joint, thus preventing any leakage of gases therefrom.

The exhaust pipes and silencers according to the invention are very suitable for use as spare parts for different motor vehicles, because from e.g. standard-size parts it is possible to assemble easily exhaust systems of exhaust pipes and silencers of varying lengths, and to bend them into desired shape even without any tools.

The preceding description of the invention is merely exemplary with reference to the Figures of the drawing. However, it is hereby not desired to restrict the invention only to the examples illustrated in the Figures. Numerous modifications are feasible within the inventive idea defined in the following claims.

Claims

1. A method of manufacturing parts for an exhaust pipe-silencer combination, according to which the parts are formed of a metal strip by a helical seaming process, **characterized** in that outer tubes (1,3,4) of the silencer, which include a conical portion, are helically seamed beginning from a cylindrical portion having a larger diameter, and that the substantially conical portion is helically seamed so that the diameter thereof is diminished continuously and smoothly to correspond to the diameter of the parts of the exhaust pipe, and a second cylindrical portion having a smaller diameter is formed in the end.
2. A method according to claim 1, **characterized** in that preferably two outer tubes (1,3) of the silencer, having a conical portion, are manufactured, which tubes are identical with each other, and are attached to each other by means of a helically-seamed connection part having a constant diameter.
3. An exhaust pipe-silencer combination, in particular for motor vehicles, which combination is formed of a metal strip by a helical seaming process, in which both the exhaust pipe and an outer tube (2) of the silencer having a diameter larger than the diameter of the exhaust pipe, as well as, of the outer tubes of the exhaust pipe and the silencer, outer tubes (1,3,4) most suitably conically changing in diameter, are of profiled, lock-fold jointed, helically-seamed tubing, in which the outer mantle of the silencer is

partly formed of the two separate parts (1,3) having substantially conical narrowing portions, and which tube parts provided with the narrowing portions are connected to each other by the helically-seamed tube (2) having the diameter of the silencer mantle, utilizing the screw-threads of the profiling of the different parts, **characterized** in that the inner part of the silencer is at least double, comprising an inner tube, which is composed of a cylindrical part (11) and a conical part (9), and an outer tube (8), which are of lock-fold jointed, profiled, helically-seamed tubing, and that the inner part of the silencer is clamped at its ends to the outer mantle of the silencer by utilizing the screw-threads formed by the profiling.

in that the outer mantle of the silencer is adapted to be used for catalytic converter inner parts.

4. An exhaust pipe-silencer combination according to claim 3, **characterized** in that onto one of the parts (1,3) partly forming the outer mantle of the silencer is screwed a second tube (4) of the corresponding shape utilizing the double threads formed by the profiling of the helical seam, which tube (4) has a slightly larger diameter than said part (1,3) partly constituting the outer mantle of the silencer.
5. An exhaust pipe-silencer combination according to claim 2 or 3, **characterized** in that the parts of the combination are attached to each other utilizing the screw-threads (18) formed by the profiling, and/or by means of connection pieces (5,6) having double-thread portions (17).
6. An exhaust pipe-silencer combination according to any one of claims 2 to 4, **characterized** in that the inner part of the silencer includes a transverse guide plate (10) most suitably provided with vane-like formations with a view to increasing the efficiency of circulation of gases.
7. An exhaust pipe-silencer combination according to any one of claims 2 to 5, **characterized** in that the tubes (8,9,11) of the inner part of the silencer are provided with perforations spaced at intervals over a part or the entire length thereof.
8. An exhaust pipe-silencer combination according to any one of claims 2 to 6, **characterized** in that a pre-assembled silencer can be flattened with a view to providing larger ground clearance.
9. An exhaust pipe-silencer combination according to any one of claims 2 to 7, **characterized**

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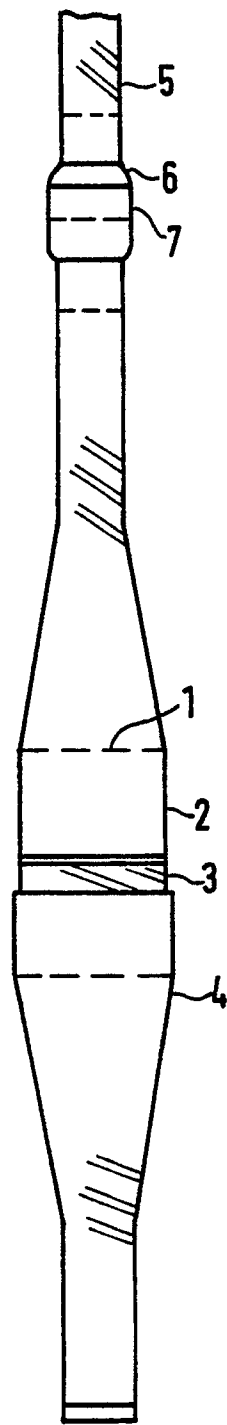


FIG. 1

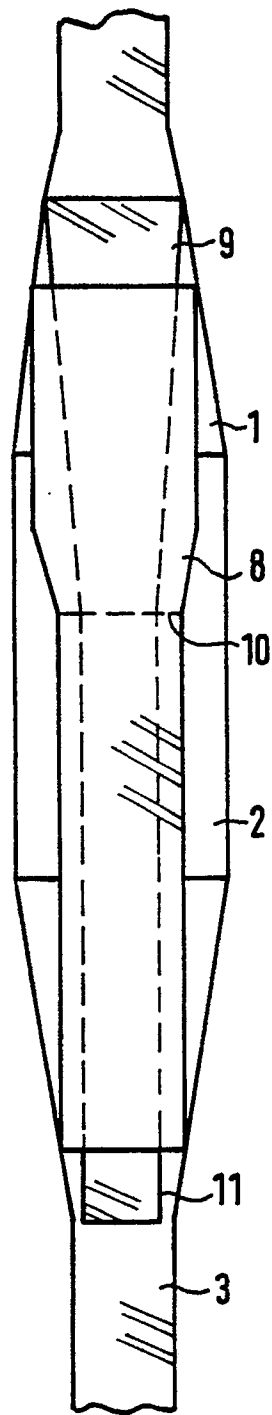


FIG. 2

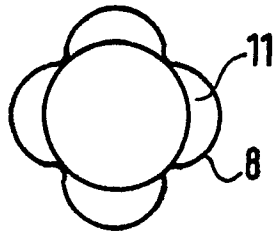


FIG. 2a

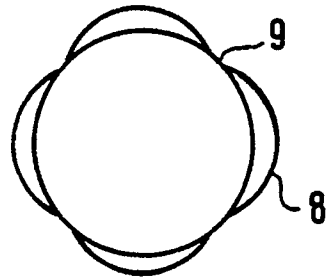


FIG. 2b

FIG. 3

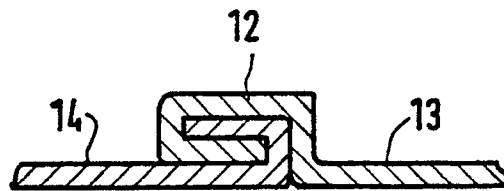
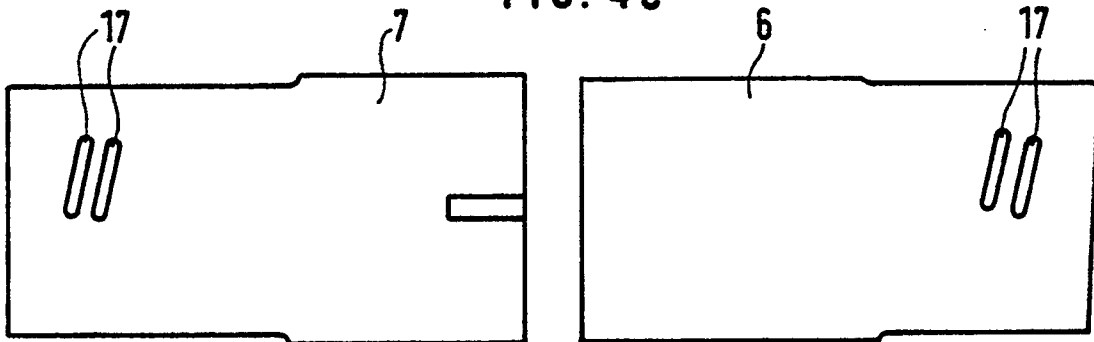


FIG. 4c



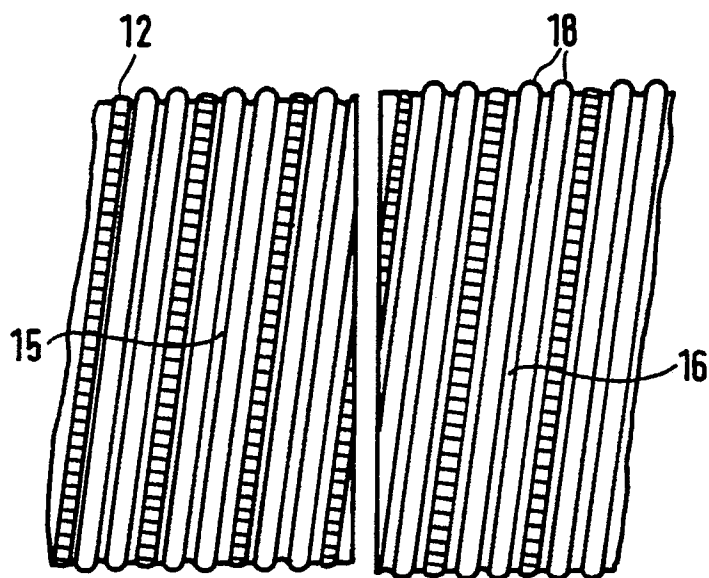


FIG. 4a

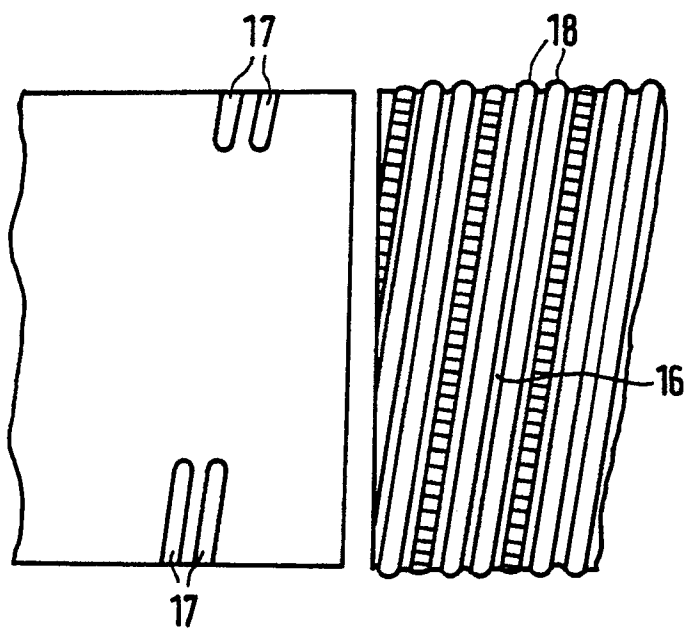


FIG. 4b



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EUROPEAN SEARCH REPORT

Application Number

EP 90 85 0084

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-3745632 (MALKKI) * the whole document *	1	F01N7/18
A		2, 3, 5, 7, 8	
D	& FI-B-52761 ----		
A	AU-B-465816 (EMBURY) * page 2 * * page 7, paragraphs 2 - 6; figures 18-22 * ----	1, 3	
A	DE-A-2623153 (BAUMANN) ----		
A	FR-A-2398179 (BAUMANN) ----		
A	FR-A-567798 (INTERNATIONAL SILENCER COMPANY) ----		
A	DE-A-1476638 (WALKER MANUFACTURING COMPANY) ----		
A	US-A-4475623 (GERBER) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F01N F16L B21C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 OCTOBER 1990	Examiner FRIDEN C.M.
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