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ROCKET WALL CONSTRUCTION

Filed Dec. 10, 1959

FIG. 1

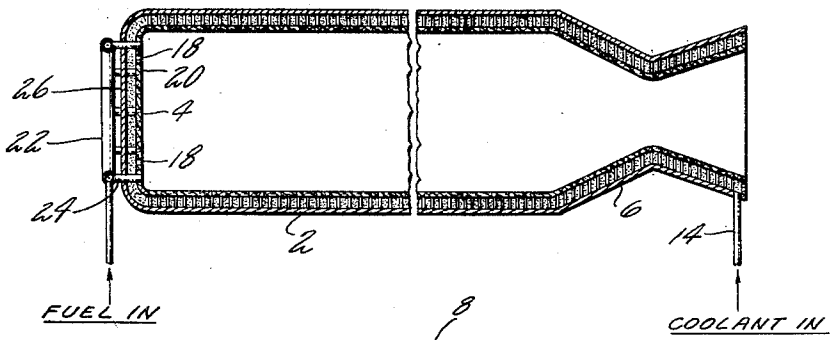


FIG. 2

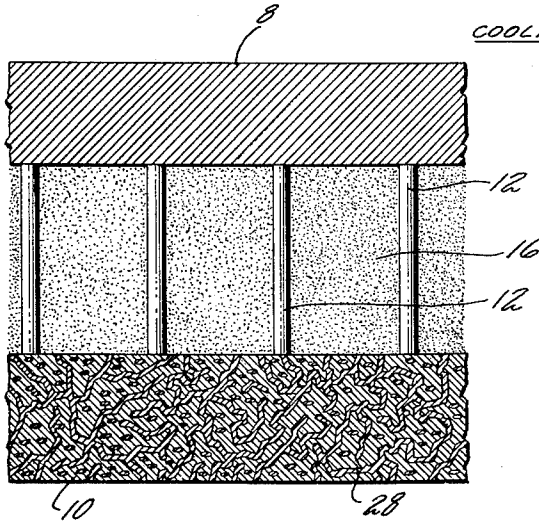
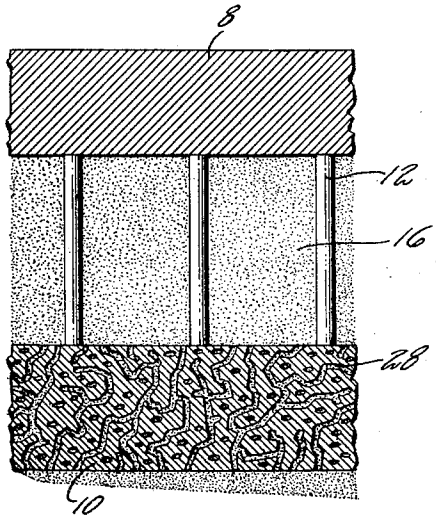


FIG. 3



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ROCKET WALL CONSTRUCTION

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The present invention relates to a rocket wall construction for use as the combustion chamber wall or as the wall for the nozzle.

One feature of the invention is a normally imperforate wall construction but which in the event of local overheating of the wall will become porous to allow a flow of coolant therethrough.

Another feature of the invention is a porous wall of high temperature material having the interstices filled with a material that will melt before the critical temperature of the high temperature material of the wall is reached. An other feature is the use of this porous wall as the inner element of a double element wall with a cooling space between the elements so that as the lower melting material is melted out of the wall the coolant between the wall elements will discharge through the porous wall for cooling the hot area.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawing which illustrates an embodiment of the invention.

FIG. 1 is a longitudinal sectional view through the rocket.

FIG. 2 is a sectional view on a larger scale of a portion of the rocket wall.

FIG. 3 is a view similar to FIG. 2 showing the effect of a "hot spot" on the chamber wall.

Referring first to FIG. 1, the rocket has a substantially cylindrical wall 2 defining the side walls of the rocket, a head 4 at one end of the cylindrical wall 2 and a nozzle 6 at the other end. The nozzle has the usual convergent-divergent configuration and in the arrangement shown, the nozzle wall is a continuation of the chamber wall. The wall 2 is made up of an outer shell 8 of high strength high temperature material and an inner wall 10 also of high strength material. The inner wall is held in concentric relation to the outer wall and spaced therefrom by radially extending spacer elements 12. As shown in FIG. 1, coolant is admitted through a duct 14 into the space 16 between the inner and outer shells and this coolant which forms one of the propellants is discharged into the combustion chamber through nozzles 18 in the inner element 20 of the end wall 4 of the rocket.

The other propellant which may be the fuel is delivered to a manifold 22 and thence through tubes 24 extending through both the inner element 20 and the outer element 26 of the end wall 4. The inner ends of the tubes 24 constitute nozzles for the propellant.

The inner shell 10 is made of a high temperature material that is sufficiently porous so that passages are formed through the wall to permit coolant from the space 16 between the inner and outer shells to flow through the shell 10 and discharge into the combustion chamber. One example of a material that would be suitable for the shell 10 is a plurality of stacked layers of woven stainless steel cloth welded together to provide desired strength and porous properties. This shell 10 is normally made impervious to the cooling fluid by filling the porosities or

interstices of the material with another material 28 that has a melting point somewhat lower than the critical temperature of the material forming the shell 10. For example, the interstices of the stainless steel cloth layers could be filled with aluminum which has a high thermal conductivity and which melts at a temperature below the critical temperature of the stainless steel mesh. It will be understood that the porous shell 10 may be made of other suitable materials and impregnated with another different material having a substantially lower melting temperature.

Under normal operation of the rocket, the filler material for the porous wall 10 will remain in place and cooling of the wall 10 may be accomplished by the rapid conduction of heat through the shell 10 to the coolant flowing through the space 16. However, if a hot spot occurs within the combustion chamber or nozzle and begins to overheat an area of the inner shell 10, the filler material in this shell will be melted out in the overheated area so that this material will be blown out of the interstices or porosities by the pressure of the coolant such that coolant will then flow through the porous wall to cool the wall and to provide a cooling film over the surface of the wall 10.

In order that the filler material may be blown out by the coolant, the latter must be under a pressure higher than the pressure within the combustion chamber or the nozzle itself. Since it is common practice to use as a coolant one of the propellants in a liquid fuel rocket, the pressure within the space 16 will be at a pressure above that within the combustion chamber by the arrangement shown, since in order for the coolant to flow through the injection nozzles 18, the pressure upstream of the injection nozzles must be higher than that downstream of the nozzles or within the combustion chamber. One coolant that might be used for this purpose could be liquid hydrogen or liquid oxygen in which case the propellant in the manifold 22 would be the other of these two substances.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. A rocket wall construction including an outer impervious shell, an inner shell spaced from said outer shell to provide a coolant space therebetween, said inner shell being in direct contact with combustion gases in the rocket, said inner shell being porous and the pores thereof being filled at least in part with a low melting heat conductive metallic material thereby normally to prevent escape of the coolant through the porous shell, said pores in said inner shell providing passages from the coolant space to the inner surface of the inner shell when the inner shell becomes excessively hot and the low melting material is melted out of the pores, and a coolant in said coolant space at a pressure higher than the operating pressures within the rocket.

2. A rocket wall construction including spaced outer and inner walls defining therebetween a coolant space, the inner wall being in direct contact with combustion gases within the rocket and having a plurality of passages therethrough, a low melting heat conductive metallic material filling said passages, at least in part, the low melting material having a lower melting point than the critical temperature of the material of the inner wall, and a fluid

coolant in said coolant space at a higher pressure than the operating pressure within the rocket for a flow of coolant through the passages and onto the inner surface of the inner wall when the inner wall becomes excessively hot and the low melting material is melted out of the passages.

3. A wall construction as in claim 2 in which the passages through said inner wall are provided by the inner wall being porous.

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