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A Hybrid Water/Nitrogen Mist Extinguishing Technology Used for Fire-Fighting Bomb Development

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Content

<u>Aerial Fire Fighting Dropping</u>

The effective Aerial dropping must be performed from an altitude no higher than 60 m (200 ft.) to eliminate the aerosol losses and increase fire extinguishing efficiency and accuracy.

However, such low flights are extremely difficult and dangerous, particularly at night.

Aerial Fire Fighting Effectiveness
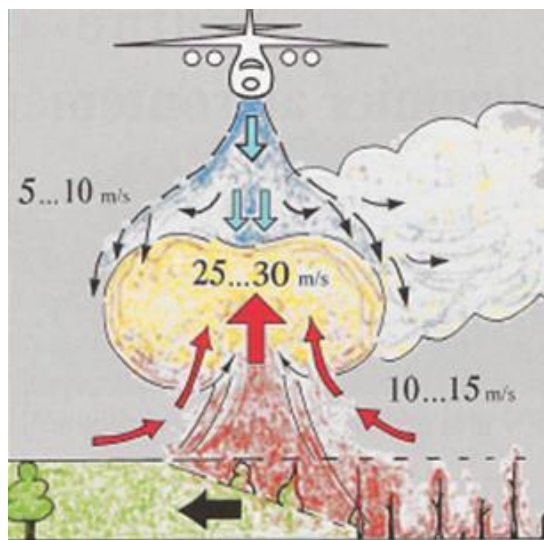
The effectiveness of fire fighting dropping is reduced
by ascending hot air and smoke over very hot areas.

**As a result of water evaporation, only a reduced amount of the
dropped fire-extinguishing mixture actually reaches the fire.**

The Idea of 'Bombing' a Fire isn't New

In 1947 the US Army Air Force developed a modified water tanks to be opened right above the fire by means of TNT charge.
The explosion ignited blazes
Accuracy was a limiting factor

Russian ASP-500 (400L) bomb.
On impacting the ground, the dispersing charge is actuated, forming a water-mist radial stream that 'sweeps' around the fire zone.
The explosion probably ignites blazes

Hybrid Fire Suppression Systems

Utilizes water and nitrogen as extinguishing media

Ultra-fine water mist(100-150 μm) Enlarged droplets surface (50 times)

The combined effect of cooling and blanketing results in effective rapid extinguishing of the fire.

Tenfold firefighting capability

Hybrid system

10 L = 100 L

Conventional methods

Hybrid Water Mist Research

The research was aimed at determining the time of effective extinguishing comparing its efficiency to other methods.


The hybrid extinguishing system was the most effective using a nitrogen powered water mist.

Only about 10 L of water was consumed, significantly less than in the case of conventional sprinkler and even standard water mist systems.

Hybrid Water Mist Research cont.

Wendong Kang et al. 2019, "**Experimental study on fire-extinguishing efficiency of protein foam in diesel pool fire**", Central South University, Changsha, China.

The influence of gas-liquid ratio, injection angles, volume flow rate and driving pressure on the fire extinguishing efficiency of Protein foam in diesel pool fire.
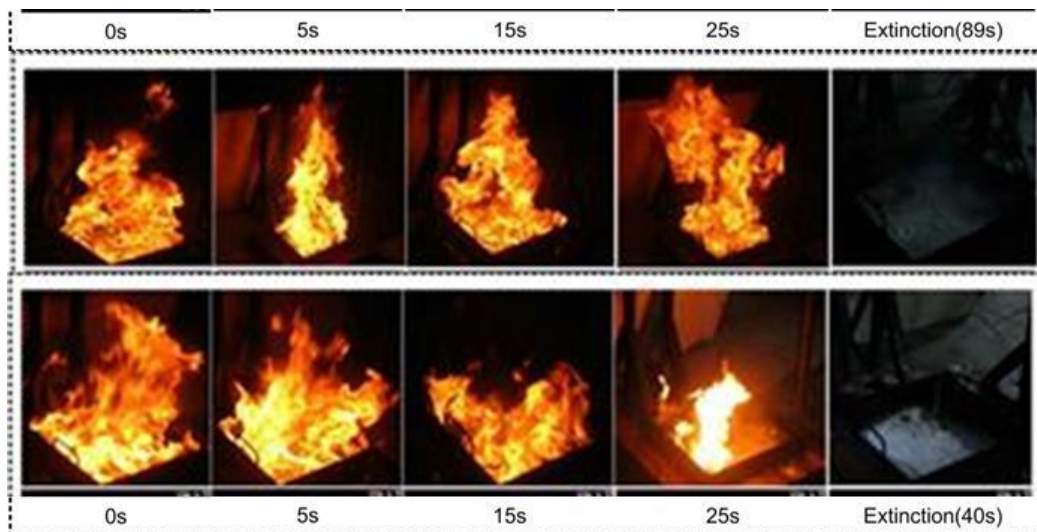
Gas-liquid ratio
12
Extinction
89 sec

Gas-liquid ratio
20
Extinction
40 sec

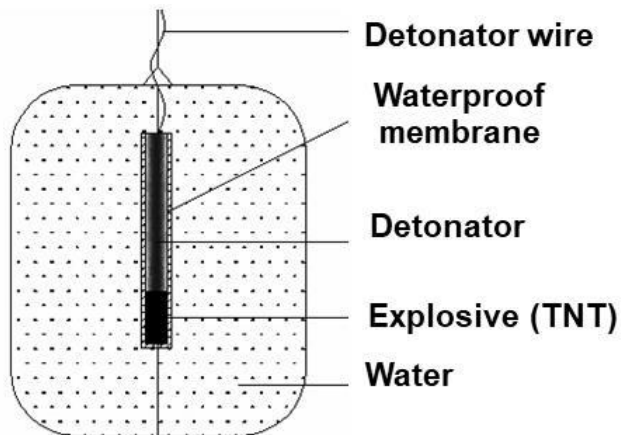Gas-liquid ratio of 20 yields the shortest extinguishing time.
Fire-extinguishing efficiency is highest at vertical injection.
Fire-extinguishing efficiency can be improved by an
increased flow rate and driving pressure.

Hybrid Water Mist Research cont.

LI Zheng and WANG Quan, 2011, "**Experimental Study of Explosive Water Mist Extinguishing Fire**", University of Science and Technology of China, Hefei, China.

Characteristic parameters of explosive water mist were calculated and its interaction mechanism between the fires was analyzed.

Detonator wire

Waterproof membrane

Detonator

Explosive (TNT)

Water

Before the explosion   Explosion   Fire extinguished

Explosion waves affect and increase the fire before explosive water mist extinguishes it.

The explosive water mist has a higher fire extinguishing efficiency than the existing methods.

Can we replace the TNT charge with nitrogen generator?
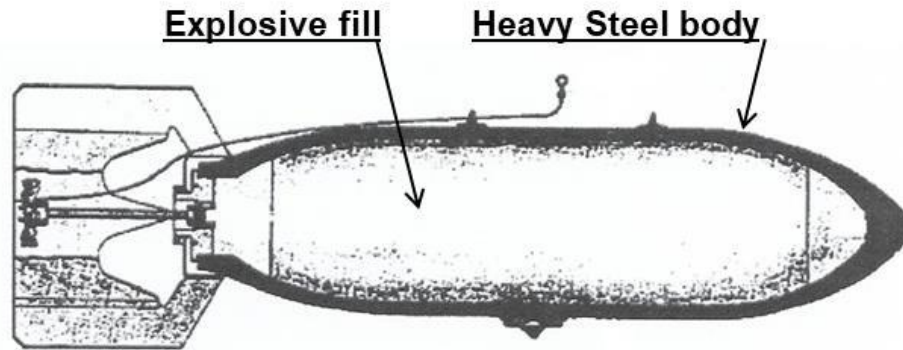
Car Airbag Mechanism
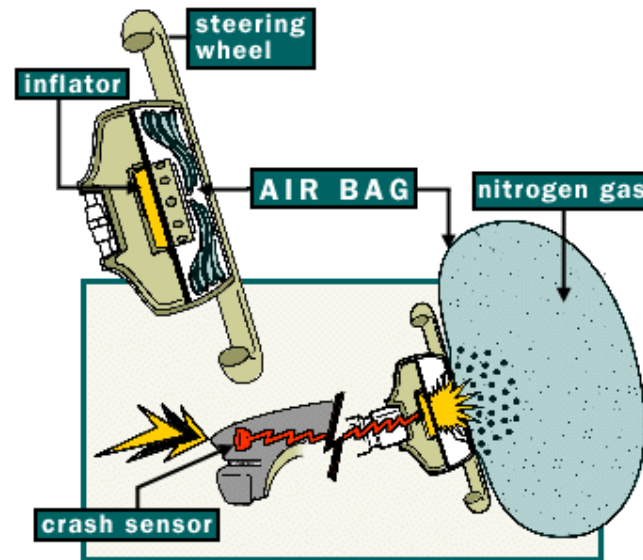
Once an accident occurs, the airbag control unit triggers the ignition of a gas generator propellant (Sodium azid) to rapidly inflate a fabric bag by nitrogen gas.
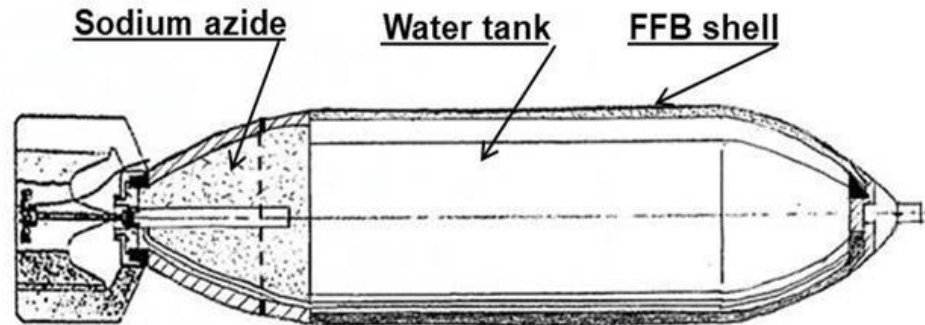
1 kg Sodium azid = 300 L nitrogen

<u>Fire Fighting Bomb Structure</u>
Similar to the conventional air bomb

Explosive fill   **Heavy Steel body**

The heavy high fragmentation steel body will be replaced by biodegradable or aluminum parts.

Sodium azide   **Water tank**   **FFB shell**

The explosive fill will be replaced by the Sodium-azide propellant and a bulk of water.

Fire Fighting Bomb - Opened

Explosion
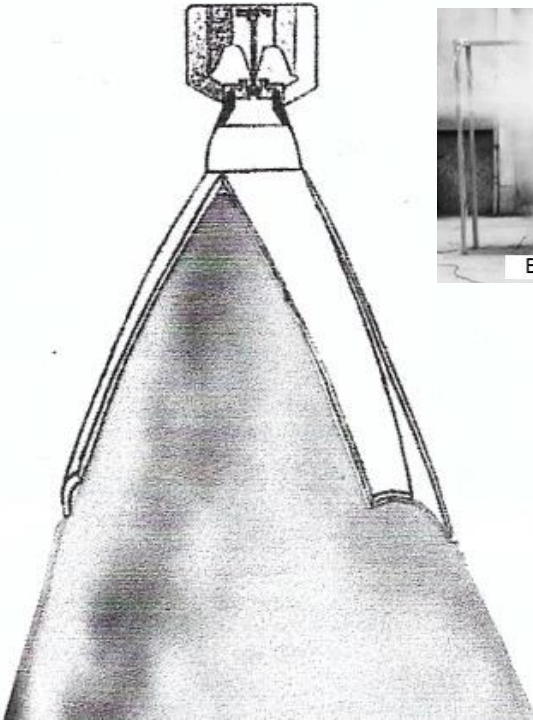
When the required threshold has been reached, the control unit will trigger the ignition of a gas generator propellant.

Once the required gas pressure is exceeded, the FFB case disintegrates creating an ultra-fine water mist cone similar to explosive water mist.

Resulting in effective rapid extinguishing using significantly less water as compared to conventional methods.

The Effective FFBs Dropping

The FFB can be dropped from any appropriate altitude and can be activated at the most effective distance above the fire.

This eliminates aerosol losses completely and increases the fire extinguishing efficiency.

FFB Fire Extinguishing Efficiency

Erickson S-64 Air-Crane

747-400 Supertanker

200 L (water) FF bomb
External body + propellant = 50 kg
Total weight = 250 kg
10,000 kg (L) = 40 bombs

FFB efficiency - similar to HFES
safe side = 8
Fire-fighting capability
200 L = 1600 L
1600 x 40 = 64000 L

A medium category, low cost, firefighting aircraft has been virtually converted into a super heavy category aircraft, which is very expensive and difficult to operate.

Fire Fighting Bombs Cluster

Firefighting bombs will be clustered
and dropped in vertical position.

**Very accurate target impact due to the helicopter's
ability to hover exactly above the targeting point of fire.**

<u>Conclusions</u>

❑ **The most effective extinguishing system is the hybrid system using a nitrogen powered water mist.**

❑ **The opened FFB will release a huge aerosol cone resulting in effective rapid extinguishing, while using significantly less water as compared to conventional methods.**

❑ **The FFB can be dropped from any appropriate altitude, and can be activated at the most effective distance above the fire.**

❑ **The FFB vertical dropping yields very accurate target impact .**

Thank you

contact details

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