Issue 2: Protecting the firefighter

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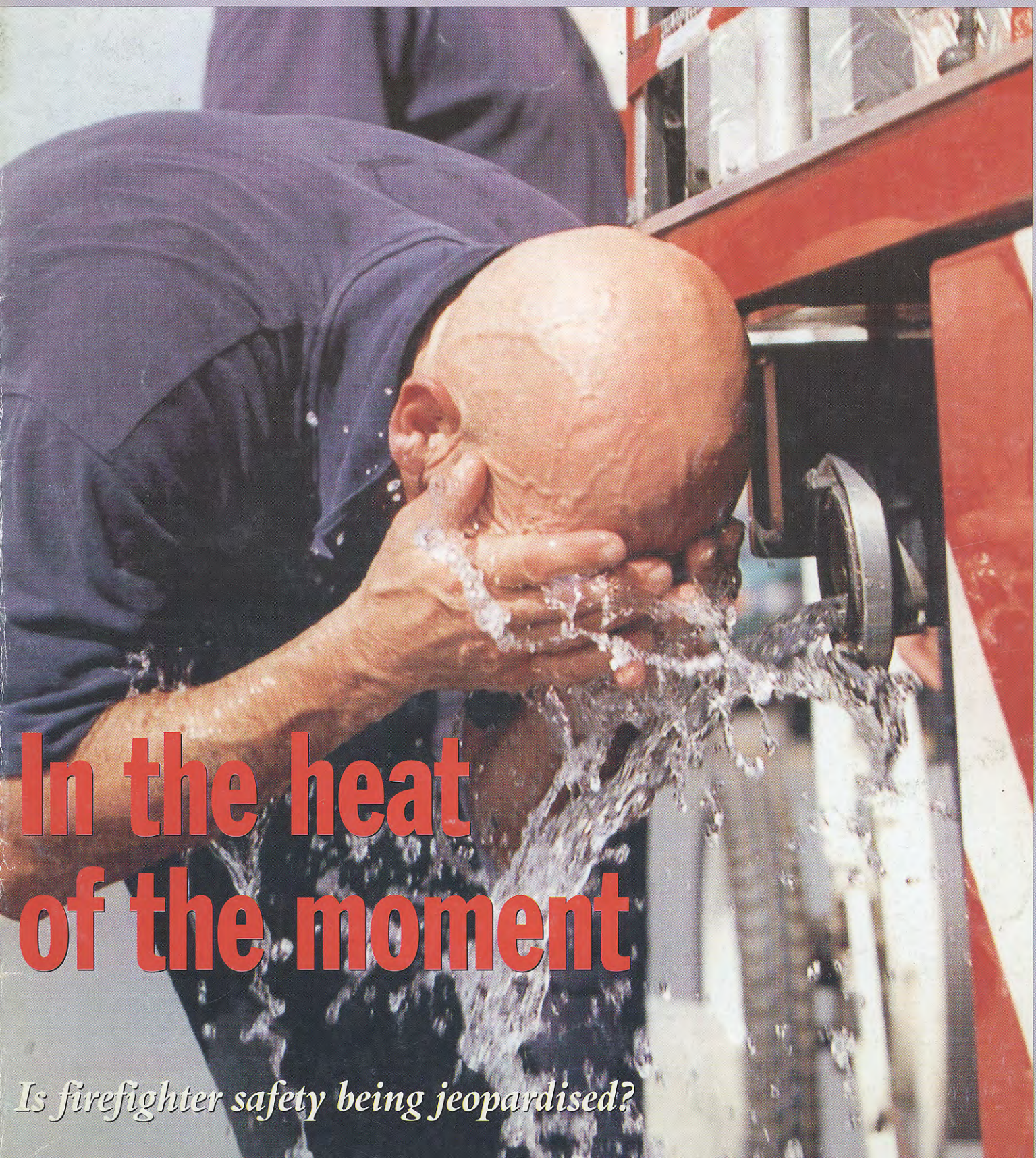
FIRE FOCUS

THE EUROPEAN JOURNAL FOR FIREFIGHTING AND FIRE PREVENTION



In the heat of the moment

Is firefighter safety being jeopardised?

Robots provide ultima for the firefighter

As firefighters are frequently left vulnerable when tackling tunnel infernos and fires in unpredictable environments, an often overlooked tool presents itself as a convincing alternative – removing firefighters from the risk and letting machines face the full force of flashovers. This issue we feature three prototypes

Prototype 1

The RoboGat is a prototype radio-controlled firefighting robot for rail and road tunnels. It is suspended to a monorail and operates telescopically with automatic clutch to the hydro pipe. It can function with or without an operator on board.

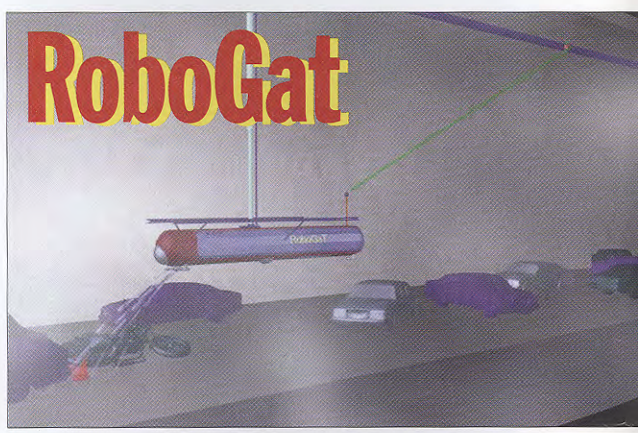
The problems of fires in rail and road tunnels have been seen in recent years, such as in the Channel Tunnel, Mont Blanc and Tauertunnel. What has emerged is that, in a confined environment like a tunnel, a fire not adequately opposed in its initial phases can quickly become uncontrollable. Unfortunately firefighters can only do so much and are restricted by difficulty of access because of traffic and platforms, problems of water restocking and difficult conditions due to intense smoke.

The robot is something between a fixed plant and a firefighting vehicle – a fireproof special cart running on a monorail fixed under the vault or to the wall of the tunnel.

This is because the recurrent situation in case of fire in a tunnel is air circulation blockage and the difficulty for the equipment aid to reach the fire, owing to the manoeuvering of vehicles. The robot can reach any point of the tunnel in a few minutes, thanks to four traction alternated from 10 HP which can reach up to 50 km/hr.

When the robot arrives in the fixed place it uses only one traction motor for the manoeuvre of approach and for small moves. Maximum speed can be higher, for example 80 km/hr, but this requires increased power in the motors and the generator.

For longer tunnels it is convenient to install two robots to shorten the times of intervention and to attack the fire from two sides.



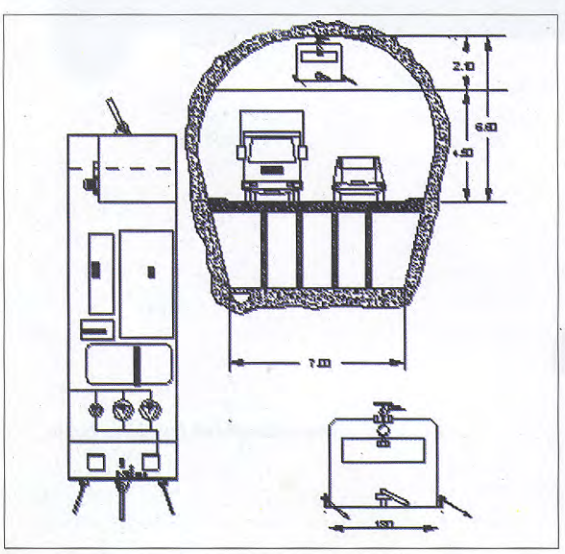
Under the box there is a quadrilateral articulated device that opens to carry wounded people etc. It also automatically drops air masks. Between the cart and the box is interposed an oleodynamic piston that allows the lowering of the box up to the centre road. This characteristic allows help for transporting wounded people and fighting the fire from the lower part, avoiding the smoke of the fire.

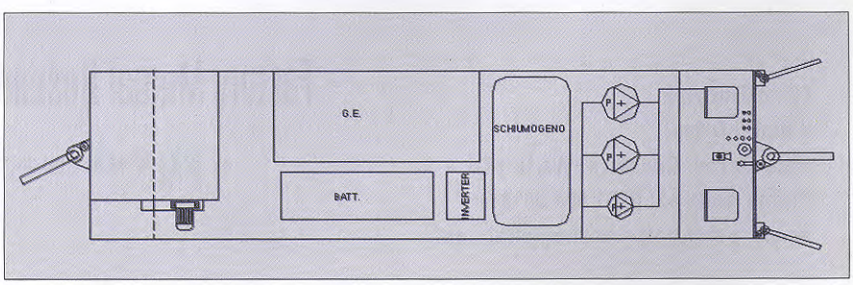
FIREFIGHTING MONORAIL

The monorail on which the robot runs is an extruded double-T shape, including a firefighting pipeline of 15 cm. The bar is self-cooling and is connected on both sides to a water reserve and a system of pumping.

The monorail for tunnels up to 12 km has a height of 30 cm and includes a pipe from 15 cm. For increased lengths the diameter of the pipe passes to 20 cm and the height becomes 35 cm. The hydraulic load is increased in departure to facilitate the increased losses of load. The fixing is feasible

PHOTOS:
ABOVE: A computer generated image of the robot in a road tunnel
BELOW LEFT: Rough diagram showing the dimensions of the robot
BELOW RIGHT: Rough side diagram of the robot's components
OPPOSITE LEFT: Detailed diagram of RoboGat's dimensions
OPPOSITE RIGHT: Close-up of a computer generated image of RoboGat





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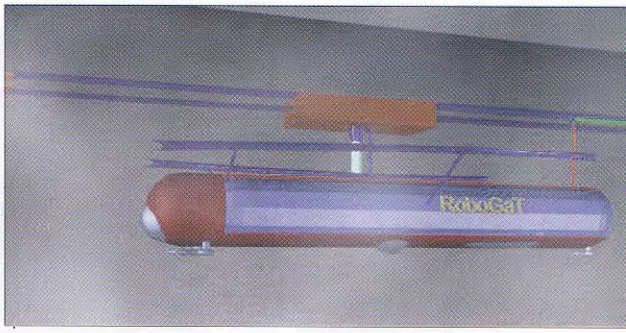

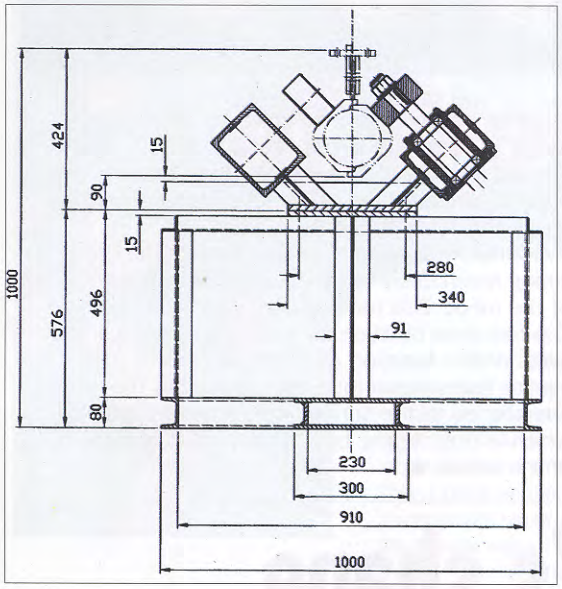

with a chemical fisher every four to five metres.

Ten cm rapid grafts are fitted onto the pipe every 40-50 metres and on the taking for the fixed hydrants. The rapid grafts have a broken-conic form to facilitate the joining with the male port on the extremity of the flexible pipe on board the robot.

The hydraulic joining takes place via an automatic arm (manipulating) that shows the position of the graft on the pipe through electromagnetic and geometric comparisons. The hose is 25-30 metres and is made in steel inox AISI 304 to parallel coils, able to withstand temperatures between -200°C and +700°C.

FIREPROOF

The mantle of the box and the carter of the cart are made with composite fireproof panels. They are: An external layer in mineral fibres resistant to temperatures of 1,000°C and the action of water; A double plate in steel inox with an interspace in which cooling water circulates; An inside layer of rock wool closed by inside panel with fire-resistant glass and a plant of external cooling with water shared out.

Firefighting equipment

The standard robot is equipped with two electro-pumps – one 20 HP and the other 10 HP to get at least 2,000 l/min to 7 bar or 3,000 l/min at 6 bar.

The robot has a reservoir of foam and a small reserve of water. The latter is used only for the possible cooling of the external mantle during the phase of approach to the fire and up to the moment in which it is inserted to the firepipe.

On the interior side are two fire water lances of 500 l/min with ranges of 30 metres and a monitor water/foam from 1,000- 2,000 l/min with a range of 40 metres. At the back is installed a monitor water/foam from 1,000 l/min. All the firefighting lances are motorised.

The box generally has two places for operating on board. Below there is a quadrilateral articulated device with a bench e/o stretcher, space for six places and relative masks for air which come out from a series of counters. The box can be lowered down to road level thanks to an oleodynamic piston so the robot can be used as a rescue or inspection vehicle.

APPLICATIONS

It is evident from the form and dimensions of the robot, as well as the position of the rail, that it can be adapted to the available space. For example, in the case of road tunnels with high ventilation as in the Frèjus, the firefighting monorail can be installed on the side wall or under the separator baffle of the ventilation next to the wall.

In the case of Mont Blanc, the ideal position is under the vault because the ventilation is under the roadway. In the specific case of the railway galleries the robot can be positioned high between the two outlines of the pantografis (double binary) or sideways.

The robot can be transformed in a system of intervention and automatic turning off, if under the tunnel a plant of fire revelation is set with thermosensible cables (a lot of tunnels are already equipped in this way). In such a hypothesis, when there is a fire, the automatic station shows the position and starts the robot so that, thanks to a specific PLC, the run and the point at which to lace to the water pipe is established. The infrared television camera finds the co-ordinates of the warmest points and communicates them to the PLC, which operates and directs the firefighting lances.

In this version, if opportunely miniaturised and simplified, the robot can also be installed in industrial sheds in substitution of the traditional fittings sprinklers, because it is surely more intelligent and has the ability to individualise the fire. Moreover, it has the big advantage in its simplicity of installation and the reduced encumbrance.

The principal advantages of the robot for tunnels are: Safeguarding firefighters in case of high temperatures and intense smoke; Rapidity of intervention; Resistance to high temperatures; Continuous water restocking; Simplicity of the laying-in work of the firefighting monorail; Possibility to derive the fixed hydrants from the pipeline of 15 cm; Possibility to put the equipment in longitudinal sense to contain the encumbrances; Possibility of complete automation through revelation of fire with thermosensible cables and aiming automatic firefighting monitors; Versatility (fireproof, transport of persons and wounded); Contained cost; and Base technologies adopted already tested with success in other sectors. ■

Thanks to ROBODYNE CYBERNETICS (Fractal shape changing robots), Domenico Piatti (RoboGat), Gembu II and sister journal *FIRE INTERNATIONAL*.
All products patented.

Fact file

TYPES:
- Robot 2000
- Robot 1200
- Robot 600

PATENTED
Particolare galleria FREJUS
FLOW l/min 2,000 at 6 bar, 1,200 at 7 bar, 600 at 7.5 bar

TRAVELLING SPEED
50 km/hr

POWER NOZZLES
2 x 1000 l/min, hose 26 mm, range 40 m, 2x 600 l/min, hose 18 mm, range 38 m, 2 x 300 l/min, hose 14, range 40 m

FIRE PUMPS
2 x 20 HP multi stadio, 1 x 10 HP, 2 x 15 HP multi stadio, 1 x 7.5 HP, 2 x 12.5 HP, multi stad, 1 x 5 HP

FOAM TANK
300, 300, 200

FIRE HOSE
6 cm x 25 m winding on, twin drum 6 cm x 25 m winding on, twin drum 3 cm x 20 m on winding drum

GUIDING TRUCK
2 with 4 wheels, 2 geared electric motor 10 HP and inverter; 2 with 4 wheels, 2 geared electric motor 10 HP and inverter; 2 with 4 wheels, 2 geared electric motor 7.5 HP and inverter

MONORAIL
Extruded shape rhombus with hole 15 cm; Height of rail 30 cm, Extruded shape rhombus with hole 15 cm; Height of rail 30 cm, Extruded shape rhombus with hole 4¼

WEIGHT
2,600 g, 2,400 g, 1,800 g

DIMENSIONS
Including monorail, Height = 1,100 mm, Width = 1,100 mm, Length = 6,000 mm; Height = 1,000 mm, Width = 1,000 mm, Length = 6,000 mm; Height = 900 mm, Width = 900 mm, Length = 5,000 mm