

# **TITLE OF INVENTION: SHEAR-THICKENING FLUID BASED SYSTEM AND METHOD THEREOF**

**Presented By: Chinmay Kendurkar  
Inventor in Automobile Engineering**

# IPR STATUS

This invention is filed for complete specification to Indian patent office.

Below are the application details:

1)Application number = 201721004316

2)Priority date = 06/02/2017

## TECHNICAL FIELD OF THE INVENTION

Automobile crash protection system with use of Impact Resistant Fluids.



# THE PROBLEMS

01

As cars are becoming more and more compact, space needed for absorption for impact is not readily available.

02

To overcome this, cars are nowadays made with flexible panels and rigid structure which absorb the impact by deforming themselves, thus incurring extensive damages to the vehicle.

03

While cars are certainly capable of absorbing and dispersing blunt-force shock, significant damage are the consequence of considerable forces.

# 04

There is therefore a need to provide a new, efficient, and technically advanced impact resistance system that not only absorbs the unknown impacts of considerable forces occurring in real-time on the object but also reduces the damages that may occur due to such impacts of considerable forces.

# 05

This invention not only improves on the safety of the occupants, but also results in significant decrease in vehicle damages.

A narrow street between brick buildings, viewed from a low angle looking down the road. The entire image is overlaid with a semi-transparent red color. The text 'INTRODUCING STF' is centered in white, bold, sans-serif font.

# INTRODUCING STF

# SHEAR THICKENING FLUIDS (STF)

- Shear Thickening Fluids , also called dilatants, are fluids which do not have a constant viscosity but instead, the viscosity varies with shear force applied.
- In simple words, viscosity increases as the force applied on it increases i.e. the fluid becomes solid for the time force is applied and that too instantaneously (with no time lag).

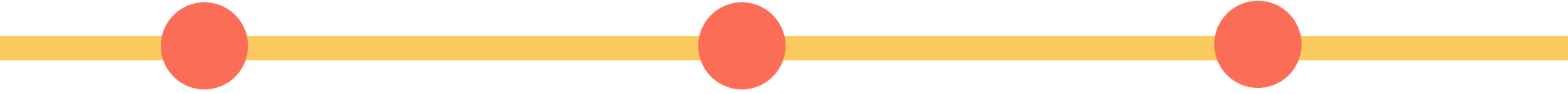


# OTHER MATERIALS

- Magneto Rheological Fluids- Their viscosity increase when magnetic field is applied.
- Ino Printing Fluid- They become solid for the time electricity passes through them.
- Many more such materials exist which can change properties of the fluids in response to external stimuli like temperature, pressure, etc.



# WORKING



The STF is stored in a container at a vulnerable position (for impact) in an automobile (say front).

Static Method- It absorbs the impact only due to its inherent properties. The fluid remains stationary throughout the process.


Dynamic Method- It can be used with inputs from sensors to detect possible collisions and give the approximate impact force and their location to direct the fluid to that area.

Also, magneto rheological fluids and other materials stated above can also be used to increase their effectiveness and range of use.





# WORKING (PART 2)




Also the fluid can be stored at some other place to improve handling and performance by lowering center of gravity, or to increase space.

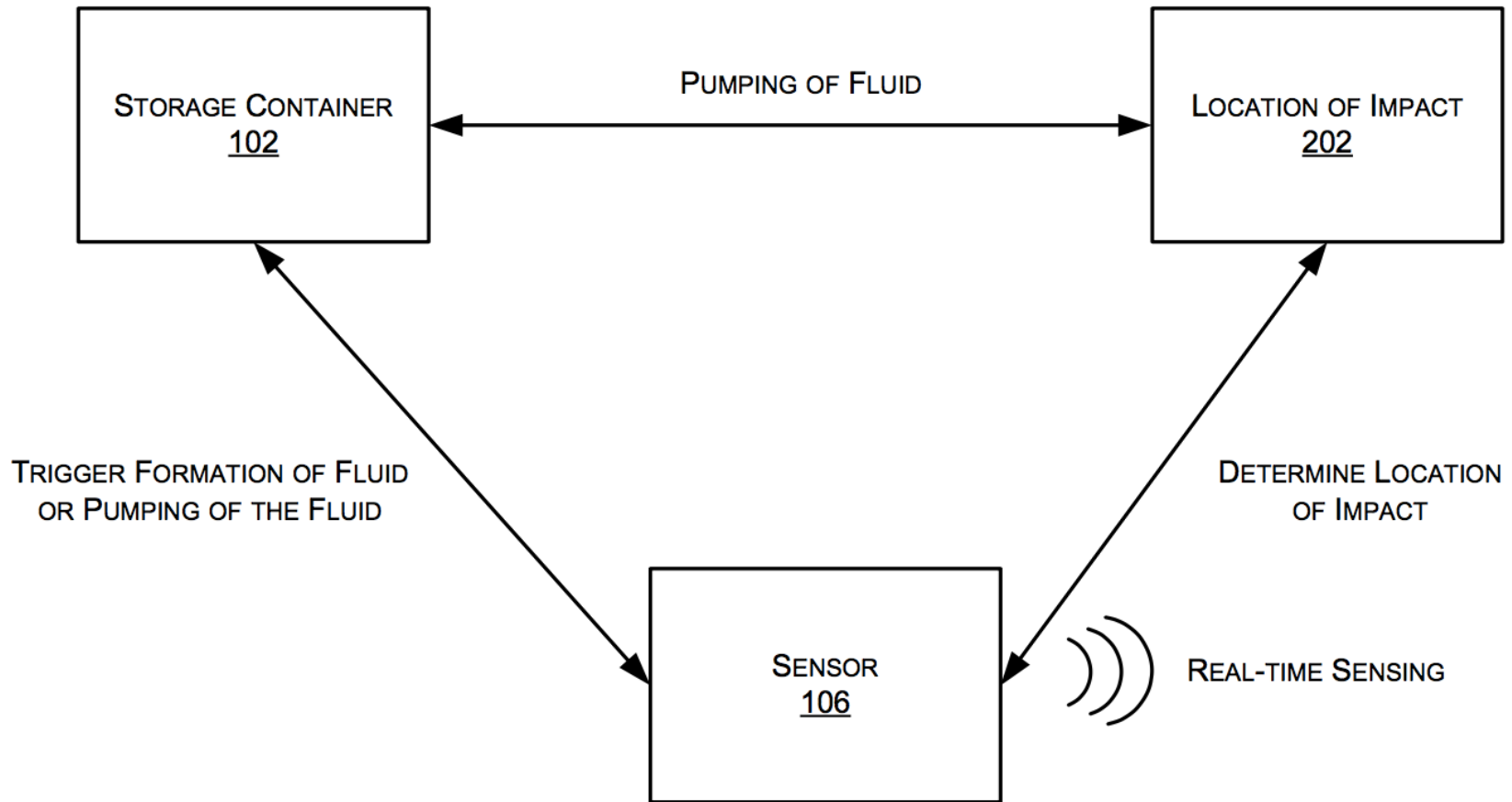
The fluid is then pumped using above stated dynamic method.

Other way is to pump solvent in a container containing solute so that it becomes easy to transport and maintain.

Fluid could also be stored between engine and passenger compartments for protection from debris, caving in dashboard and to absorb NVH.



# FLOW CHART

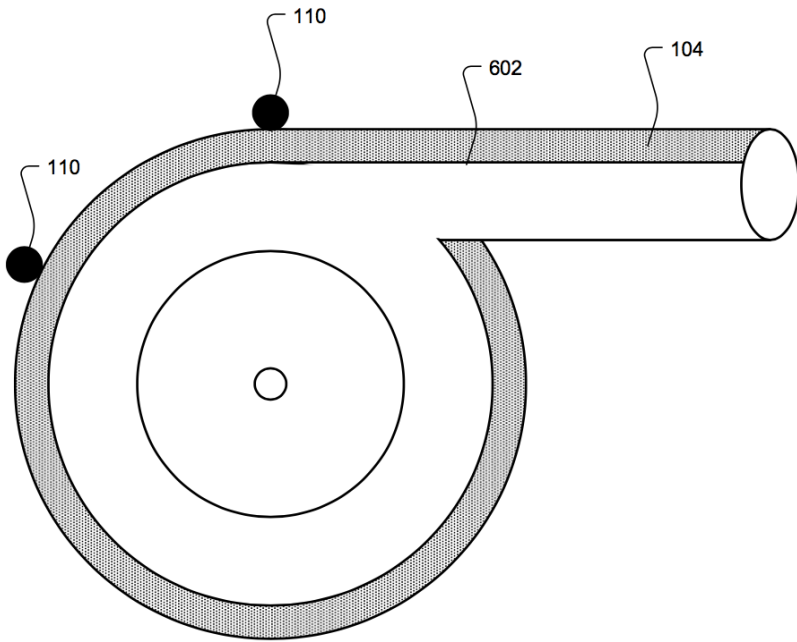


# TURBOCHARGER PROBLEMS

- The turbochargers used in cars today are mostly fixed ratio. i.e. the spooling takes place between specific range of RPM, thus severely limiting the performance of the vehicle.
- Variable geometry turbochargers like twin scroll attempt to solve the above problem by creating multiple pathways of different diameters.
- Inlet depending on current RPM. But the above methods are complex, therefore hard to maintain, expensive and need a lot of space.



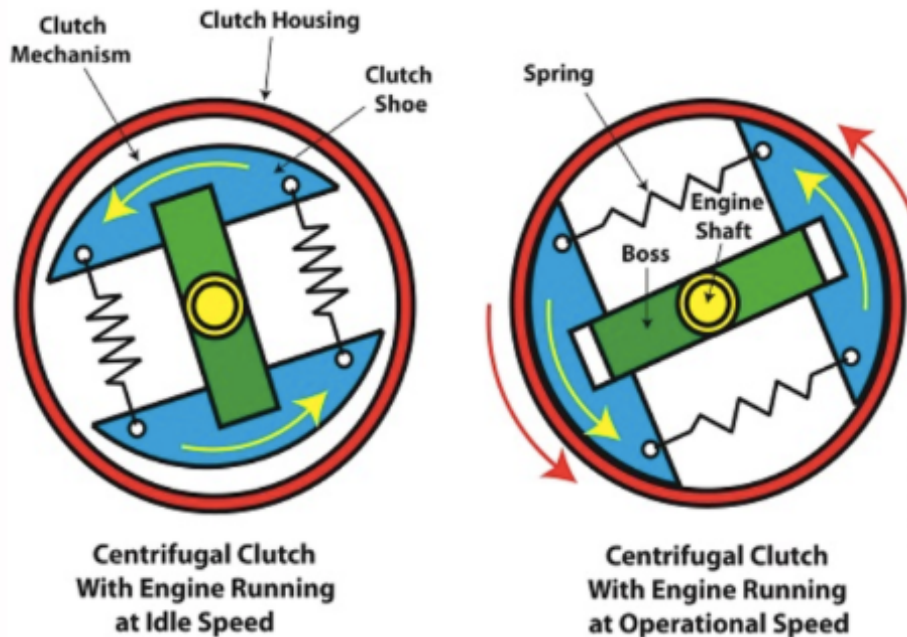
# TURBOCHARGER



- In the figure, the fluid layer is shown by grey color.
- The thickness can be controlled by various means- for example magnetostriction.
- The diameter of the tube can be controlled by ECU with inputs from RPM and velocity sensors.
- Thus the existing complicated systems become one single pipe.



# CENTRIFUGAL CLUTCH



- In the current design of the centrifugal clutch, the weights are replaced by the fluid and springs by electromagnets.
  - In the centrifugal clutch, electromagnets are provided to pull the STF in (i.e. disengage) when needed.
  - The general working is also improved, also resulting in more compact size.
- 
- This gives it the unique feature of applying neutral gear irrespective of speed.
  - This results in more fuel efficiency and finer control, especially when paired with autonomous or semi-autonomous features.



# MORE METHODS

- This technology can be further used in many other application with some minor modifications.
- In automobiles, they can be used in suspension, steering, mufflers, flywheel, centrifugal clutch, etc. as explained in the patent application.
- When the fluid can be pumped to various containers located in a vehicle at various positions, we can drastically change the vehicle dynamics.
- Also, it can be used to stabilize oil rigs or similar structures, thus making them lighter and more portable.
- Additionally, this can be used in stationary structures to protect them from earthquakes.



# APPLICATIONS

- Automobiles
- Armored vehicles
- Ships
- Submarines



# CONCLUSION

- This system increases the overall weight of the vehicle, but its advantages far outweigh its negative effects on performance.
- In future, as more advanced materials are invented, the system can be modified accordingly and made better.
- As these materials stated are being heavily researched around the globe, its price is sure to decrease, especially when made in large quantities.





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**THANK YOU**