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Adding my Automatic Refrigeration System for Break System of Aircraft

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Abstract:
Explosions in airplane tires were investigated. It was found that main reason had been the excessive heat generated from friction in the brake system due to improper use by the pilots during landing. I designed and added an auxiliary system which operated automatically to cool down the plane tires and consequently reduces the brake temperature.

Keywords: *Noise Removal, CDBMKMF, unsymmetrical median filter, standard median filter*

1) INTRODUCTION

Airlines are considered of great importance to most countries in the world at present for its great and fast services and in the transport service compared with the rest of transportation services. Despite of the interested efforts in this field the researcher believes the need for the installation of the system he designed and installed on the Brazilian airplane Tucano 27. The system is called the self cooling system of the wheels and it lowers temperature of the brakes, which in turn leads to reduce the phenomenon of plane tires burst and reduces the human and material losses.

2) ISOCHORIC

In Thermodynamics (isochoric) is an action or experiment where the volume is constant,
such as the volume of gas
According to the law of Gay-Lussa's or law of ideal gas we apply the equation:

$$\frac{p}{T} = const.$$

And we can deduce from this equation that the relative change in pressure (P) is accompanied
by relative change in temperature (T) of the system when maintaining the volume of the system unchanged.
Thus:

$$\frac{p_2}{p_1} = \frac{T_2}{T_1}$$

Where:
p1: pressure Bar after raising system temperature
p2: the pressure in the system before raising the temperature
T1: the temperature before raising system temperatures
T2: System temperature after raising the temperature
The graph below of volume and pressure. The pressure changes as the temperature changes

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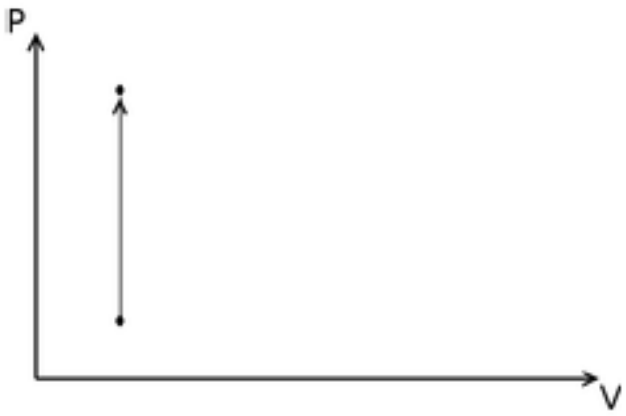
but the volume remains constant .



Relation between volume and pressure

It is observed that the law of Gay-Lussa's is applied to the tires of the aircraft where the size of the tire is fixed and the pressure of the gas inside the tire is proportional to the temperature to the braking assembly. An increase in the temperature of the braking assembly leads to increasing the pressure of the gas inside the tires more than the allowed limit which leads to burst the tires. A pilot is main reason to increase temperature the barking assembly, the pilot might have to use the braking system excessively to reduce the distance needed to stop to prevent the aircraft from exiting from the runway and therefore this can lead to the burst tires.

There are many reasons which make pilot to use the braking system excessively:

- The existence of malfunction in the aircraft.
- Adverse weather conditions.
- The pilot not landing at the beginning of the runway.
- The pilot failing to adhere to the landing speed limit, and other reasons.

As it is known when the burst tires happen , it occur different losses .

Damaging the tire and braking assembly-

- Sometimes, Damaging the tire, braking assembly and the aircraft leg-
- Sometimes, Damaging the tire, braking assembly, the aircraft leg and the wing.
- Sometimes, Damaging the tire, braking assembly, the aircraft leg, the wing and the engine. Sometimes, causing fires which can lead to lose the pilot, aircraft and the load.-
- Sometimes, damage the runway of landing.

For the reasons mentioned above I designed the auto refrigerating system which operate automatically with the braking system and prevent the temperature of the braking assembly from increasing no matter the cause

Below are the components of my system, its working principle and advantages

3) MY COMPONENTS OF AUTOMATIC REFRIGERATION SYSTEM FOR BREAK SYSTEMOF AIRCRAFT

1)) The container

Capacity of the container is five liters containing a mixture of (1) liter acetone and (4) liters of distilled water (in order to increase the speed of evaporation and avoid leaving residue on the braking compound),The container has an upper aperture used to fill it and a side one to connect it with the compound. The container has a glass ruler which enables us to determine the level of liquid in it ,From experience amount of fluid is sufficient for (3-4) trips. As shown figure (1).

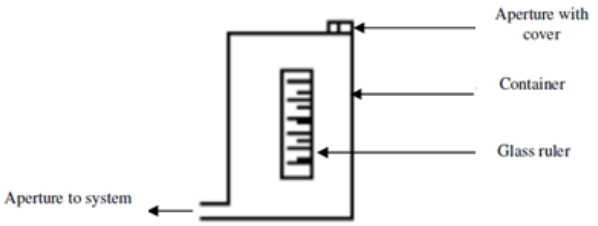


figure 1

2)) Electric pump

Electric pump consists of two parts

- Mechanical part and consists of a core equipped with a number of feathers

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- Electrical par to rotate the feathers. It operates to take fluid from the container and push it with pressure to the system as in figure (2)
- The pump is connected to an electric circuit with a switch and green light whose purpose is to examine the system during control check before takeoff by ground engineer and log the examination in the record of the plane) (the plane log is used to record all engineering maintenance performed on the plane such as check, repair, parts replacement and periodic inspection).
- Pump is connected to the braking paddle such that when applied by the pilot it operates automatically by pushing the coolant fluid to the system.

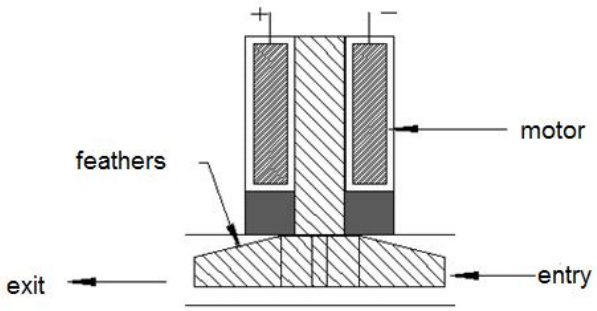

figure 2

3)) Electric solenoid valve

Consists of two parts

- mechanical part consists of a valve and a spring. The spring works push the valve forward to shut down the system when not in use
- Electric part:

* When an electrical signal arrives a mechanism works to pull the valve back out in order to open the way for the coolant to pass to the system.

* This part of is also connected with the braking system paddle, so that when pressed by the pilot the valve opens allowing passage of coolant to the system, as in Figure (3).

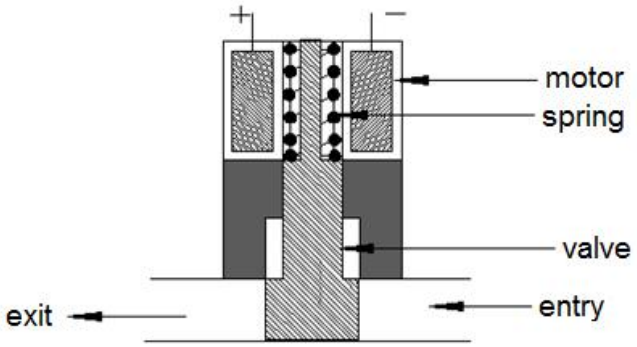

figure 3

4)) Jet nozzles

The squirt coolant liquid coming from the cooling system on the braking system to cool it and reduce temperature, as in Figure (4)

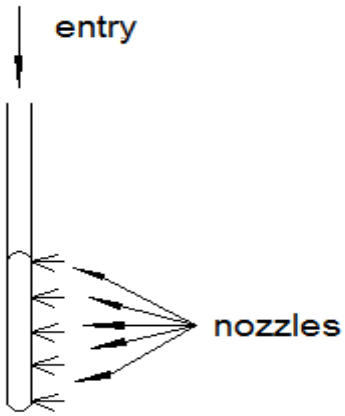

figure 4

5)) Electric circuit components

There are two electric circuits for cooling system as shown in figure (5)

A- Manual circuit:

To test the system by ground engineer for the system validity and record it in the Maintenance book.

B- Automatic circuit

When pilot press pedals of the aircraft its send two single one of it connected to electric motor to turn on and second single to electric solenoid valve to open the way for coolant.

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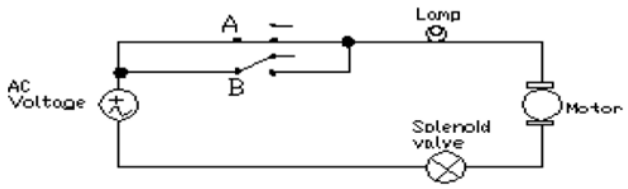

figure 5

6)) The working principle of system

When the aircraft landing on the ground and use system braking by the pilot sends Two electric signals ,first to run electric pump which in turn withdraw fluid from container and second electric soled valve to open the way for the coolant and go to spray the barking system assembly by jet nozzles as shown in figure (6).

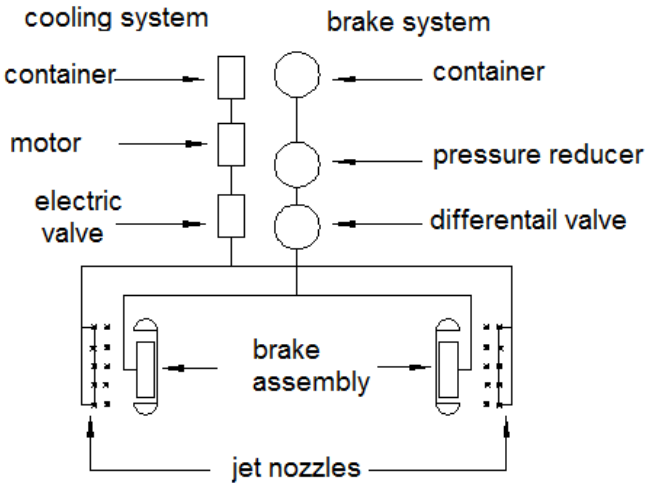

figure 6

7)) Testing and conclusions

I selected two aircrafts type Tucano 27 which it caused frequent accidents (Tucano 27 is aircraft Brazilian-made dual seat used for many purposes and the main purpose is to train students in the colleges of the Air Force and rehabilitation Aviation). i installed my cooling system on one of the aircraft and made sure that both aircrafts fly in same time in day and night and under the same weather conditions and during six months of follow-up , the test concluded that there are a difference between aircraft equipped with cooling system and non equipped ,as shown in the following table.

N	Tucano aircraft equipped with auto refrigerating system	Tucano aircraft non-equipped auto refrigerating system
1	Reduce in temperature of barking system assembly	rise in temperature braking system assembly
2	Increase the efficiency of friction for braking system	Reduce the efficiency of friction for braking system
3	Short distance of the runway	Increase distance of the runway
4	Reduce tire burst	Increase tire burst
5	Reduce changing the tires	Increase changing the tires
6	Reduce changing gland and bearing	Increase changing gland and bearing

8)) IMPLEMENTATION

After the dramatic success of the experiment, it was implemented in (80) eighty aircrafts successfully.

4) RECOMMENDATIONS

1- Recommendation to install self-cooling system on plane wheels and other types of aircraft and examine its impact on braking system.

2- Recommendation to examine planes by modern methods such as

- Examination by wave's magnetic particle inspection branch circuit breaker.
- Examination by radiography.
- Examination by X-ray

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