ENERGY SAVER

For car air-conditioning

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One of the greatest creature comforts that can be installed in a car for summer motoring is the air-conditioner. The problem is that they use vast amounts of power. This idea shows how power consumption can be reduced to acceptable enough levels to install air-conditioning for next summer.

LIKE MOST refrigeration equipment an air-conditioner depends on the latent heat of a refrigerant. The air is used to heat and vaporize the liquid refrigerant in the evaporator and it's cooled in the process. The heated refrigerant is then compressed, a lot more heat being generated in the process, and then passed on to the condenser where it must be cooled substantially before it can reliquify.

Considering that the interior of the car has large amounts of heat entering it via the bodywork, the windows and the engine compartment, it's obvious that the refrigeration plant has an arduous job — far more so than the average home refrigerator. Human bodies also add substantially to the heating problem in such a confined space.

Consider now the electrical system of the unit in question. The high volume fan in the evaporator requires up to six amps to drive it, and the magnetic clutch on the compressor requires about four amps. The condenser fan needs about ten amps to operate. Hence, when actually operating, the air conditioner load is about twenty amperes.

I discovered these facts after I noticed that the air conditioner cutting in to do a cooling cycle caused the headlights to dim noticeably. The question was: what could I do about it?

On a hot day the condenser needs a large volume of air passing through it. But when on the open road (or, say, above 60 kph) the speed of the car itself forces enough air through the condenser. Under these circumstances the fan is quite unnecessary.

But how to control it? Many electronic means are obvious, but not warranted because of complexity. There is one source of control that will always be available and proportional to need, and that is the wind itself!

With experimentation a wind-controlled flap was designed with a small mercury switch on it that operated the fan relay when the car was stopped or slow moving, but at about 60 kph it reaches the end of its travel (through about 30 degrees), tilting the mercury switch sufficiently to switch off the fan. A spring in tension across the flap's pivot point causes a small snap action to occur on the flap to prevent midway flutter of the switch.

In the interests of reliability and easy maintenance I transferred the heavy current loads from the evaporator thermostat contacts to relays, i.e: the thermostat now operates a relay, which in turn operates the compressor clutch and the condenser fan relay. The condenser fan relay is then under control of the mercury switch on the wind flap.

The relays used were the small 30 ampere capacity plug-in types with interlocking socket bases now commonly used in automotive electrics. They were mounted together in a row on a length of flat strip at the front of the engine compartment with others that I had installed to control headlights, driving spotlight, and horn. Thus if any relay unit is doubtful in operation it can be replaced very quickly, or various sections of the system can be isolated by relay removal to make fault finding easy.

Also to further improve relay contact life, diodes were connected across the highly inductive circuits such as the clutch and fan to prevent destructive arcing at the relay contacts. Whether this is a significant factor for reliability is probably questionable, but

the infallible electrical operation of the system for seven years seems to indicate that these measures were not entirely superfluous.

The unit I made up used four sheet steel pieces. Dimensions are not critical, and ingenuity (and experimentation) are the order of the day!

The flap is made from a piece of 1.4 mm sheet steel cut into a square about 100 mm across. You must leave two tabs at one end for the flap to hinge around, so they will have to be bent up at 90 degrees.

These tabs must have a hole big enough to take a piece of iron wire or brass rod of about ⅛-inch diameter. This is carried by the flap yoke. This is a strip with ends bent up to carry the brass rod, and mounting holes to allow attachment of the unit to the car.

It is a good idea to burr the ends of the rod to prevent it coming out. Another good idea is to put brass washers between the yoke and the flap to make sure the two pieces move freely.

The mercury switch is carried on its own metal strip. The one I constructed was bent into a U shape to enclose the switch and then pop-riveted onto the flap so that the switch was oriented at 90 degrees to the flap. The bulb and its leads are insulated from the metal parts by a bit of veroboard stuck on with Silastic.

I used a fourth piece of metal for a flap limiter, to prevent the flap from travelling too far and wiggling around in the slipstream. Doubtless with a bit of ingenuity in either cutting the metal or in location this could be omitted.

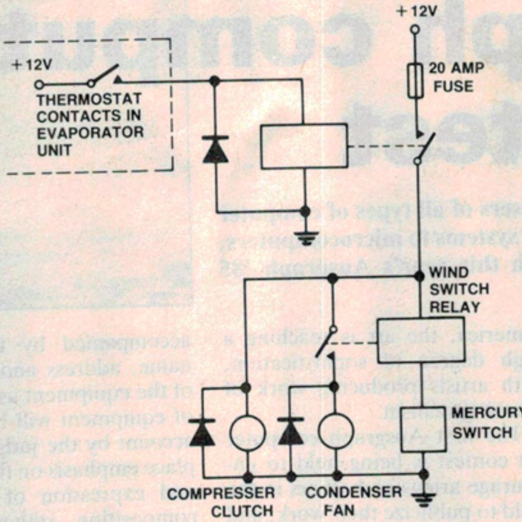
A small spring placed between the flap and one of the non-moving parts, and running across the axis of the hinge, provides the system with some hysteresis, by attemping to hold the flap open or closed a little longer than the air pressure would allow.

The wind switch should be mounted high in front of the radiator behind the grille so that the flap hinge is about level with the top of the grille opening. Thus it is in direct path of the wind coming through the radiator grille but not entirely open to the weather.

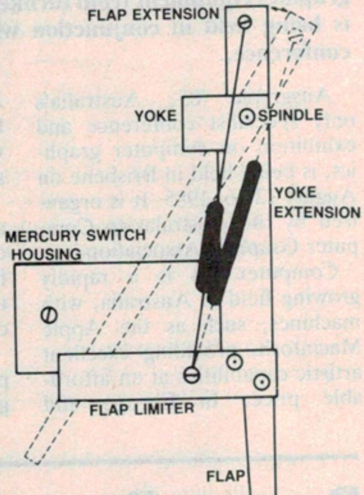
To be sure that it does work, wire a meter or a lamp from the wind switch into the car so that its operation can be observed. If all is well the switch will operate at about 50 kph and a slight hysteresis will be noticed, ie it will switch at plus or minus a few kph depending on whether accelerating or decelerating. If the hysteresis is more than, say, 5 kph, the chances are that the spring tension on the flap is a bit much and a small adjustment is required.

When you are satisfied that the switch is working OK, it can be wired in as per the diagram, and from then on, you may be sure of efficient operation from your air-conditioner for summer driving!

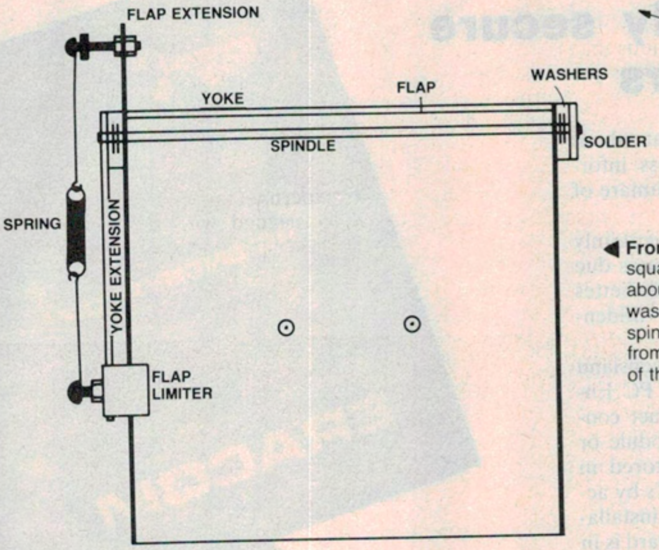
Happy motoring! ●



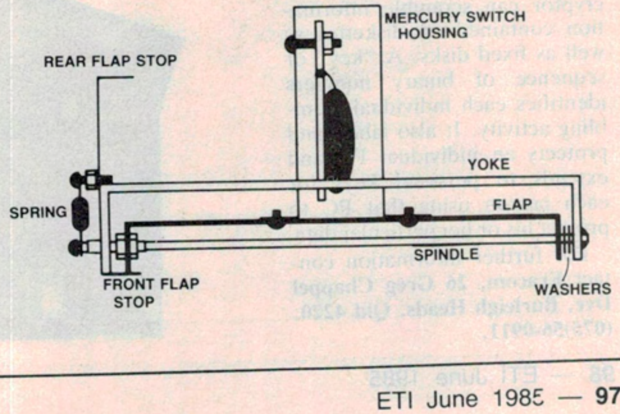
◀ **Wiring it in.** This shows the circuit for connecting the energy saver switch and relay in the air conditioner circuitry. Note the addition of diodes across the various components (see text).



Side view. Showing the flap limiter bracket and mercury switch housing in particular. The tilt of the flap, and consequent spring extension, is shown, too. ▶



◀ **Front view.** The flap is a square piece of sheet steel about 100 mm a side. Note the washers slipped over the spindle, separating the flap from the yoke. The attachment of the spring is clearly visible.



Top view. Showing the two flap stops on the flap limiter bracket and details of the mercury switch housing. ▶