 PA and PSU Fan Noise

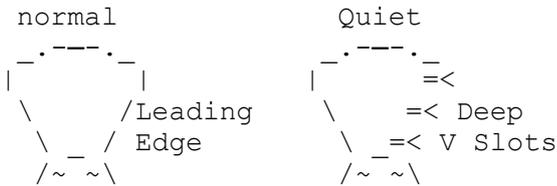By G8MNY   (Updated May 15)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

I have often noticed fan noise from PSUs & powerful RF PAs, this can be quite
distracting on Rx & the fan is normally not necessary in Rx mode.

FAN QUEITENING
Quiet fans are made & usually have feathered slots in the blade leading edges.

```
 normal               Quiet
 _.---._              _.---._
|       |            |      =<
 \     /Leading       \    =< Deep
  \ _ / Edge           \ _=< V Slots
  /~ ~\                /~ ~\
```

There is little loss in efficiency but nearby stationary support bars now
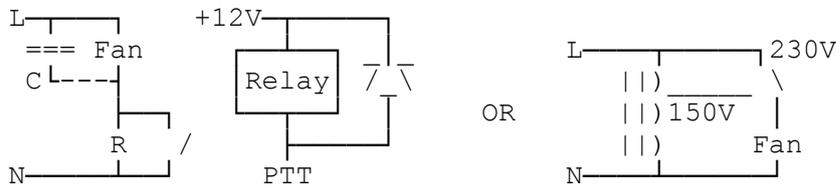produce a softer blurred sound pulse considerably reducing the blade pitch
noise.

FAN SPEED
Permanently reducing the fan seed will reduce the noise & for some over cooled
systems this works well. But for applications where maximum cooling is
occasionally needed a variable speed solution is appropriate.
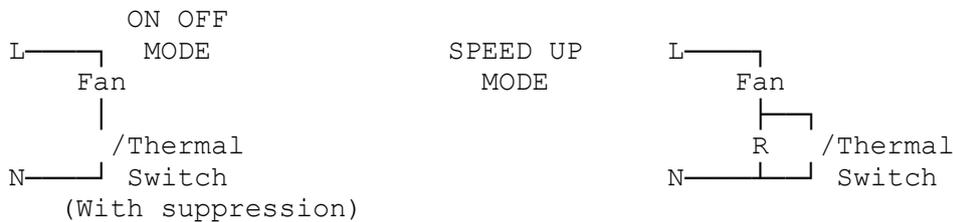

There are several options.
1/ Underrun the fan in Rx mode.
   This needs a series R that shorted out when on Tx. This can be done with a
   relay contact on a mains fan & to keep the R power down the mains fan should
   be Power Factor tuned with a mains C, or use a lower mains voltage,
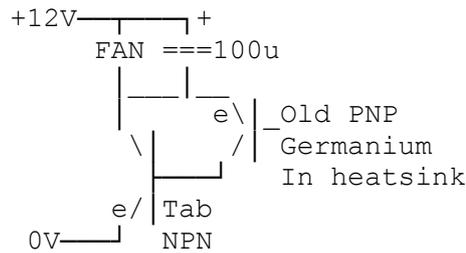
```
    L┐┌───┐      +12V┌───┐                 L───────┐230V
     === Fan        ┌┴┐ ┌┴┐                 ||)____ \
    C └---┐     │Relay│ /_\                 ||)150V  |
         ┌┴┐    └┬─┬─┘          OR          ||) ____ |
    R    /       │ │                        ||)     Fan
 N───┐┌─┘       PTT                      N────┴────┘
```

2/ Temperature sense.
   By adding a thermal switch a DC or mains fan can be kept off or running slow
   most of the time.

```
           ON OFF
  L──┐    MODE            SPEED UP     L──┐
    Fan                     MODE         Fan
     │                                    ├─┐
     │  /Thermal                    R    /Thermal
 N───┘  Switch             N───┘   │  Switch
    (With suppression)
```

3/ Variable controlled DC a fan.
   This offers the quietest fan control.

```
        +12V━━━━┳━━━┓ +
             FAN ===100u
             ┃___┃_
             ┃     e\┃_Old PNP
              \┃   /┃ Germanium
               ┗━┳━┛      In heatsink
             e/┃Tab
        0V━━━━━┛  NPN
```

   If an old germanium PNP it not available it can be a suitable NTC thermistor
   & the NPN can have a hold off R base to emitter to set the operation
   temperature. The cap is needed on DC fans to handle the pulse currents &
   make the motor start better. A permanent quiet run R can be put across the
   NPN if wanted.

Feedback from Osvaldo LW1DSE..
In place of a resistor to drop the voltage for the AC motor fan, I used a 1µF
275VAC, keeping in mind that this cap not resonates with the motor inductance.
I used 1µF, but any other cap will do the job, and increasing its value,
reduces the capacitive reactance ($Xc = 1/ 2Ò * F * C$) and then increases motor
speed. If this cap have infinite value, the motor will run at normal direct
speed. And it doesn't discipates heat!

For DC motors, the solution is simpler. There exists a device called LM35 from
National Semiconductor in TO92 case, the LM35 that is a termal sensor directly
calibrated inside the chip to give an output of 10mV/°C, then, at 30°C it will
give about 300mV. Then, letting this voltage to a comparator like LM311, and
putting the wiper of a potentiometer in the other input as voltage Temperature
reference, and giving some hysteresis using a positive feedback, you can do a
precise termal control, in the form of an on/off circuit. As the power
consumption of a normal fan is in order of tens of mA, the internal LM311
transistor is sufficient to drive this motor directly, the most of them being
brushless, and then the freeweeling diode is unnecesary. Or, you can feed this
voltage to the input of a PWM controller like one of the voltage mode PWM IC's,
and do a PWM analog speed control with low power drain.

See my TECH Buls "Variable Speed Fan for AF PA" & "Variable Speed Thermal Fan"

Why Don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP