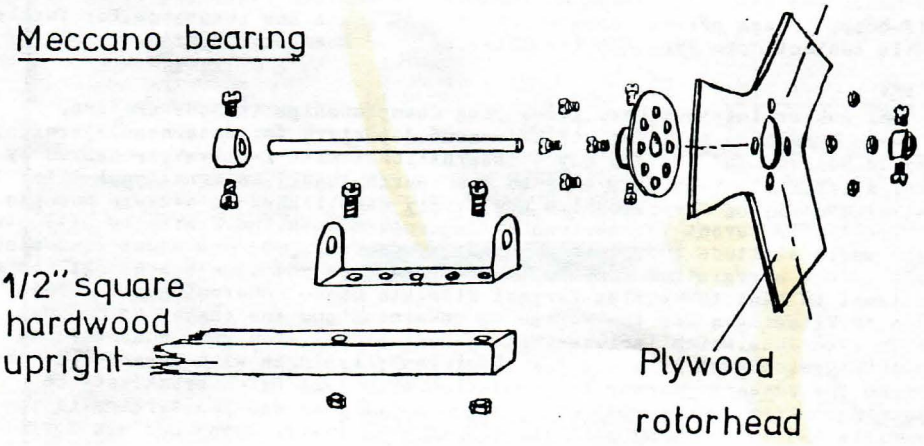
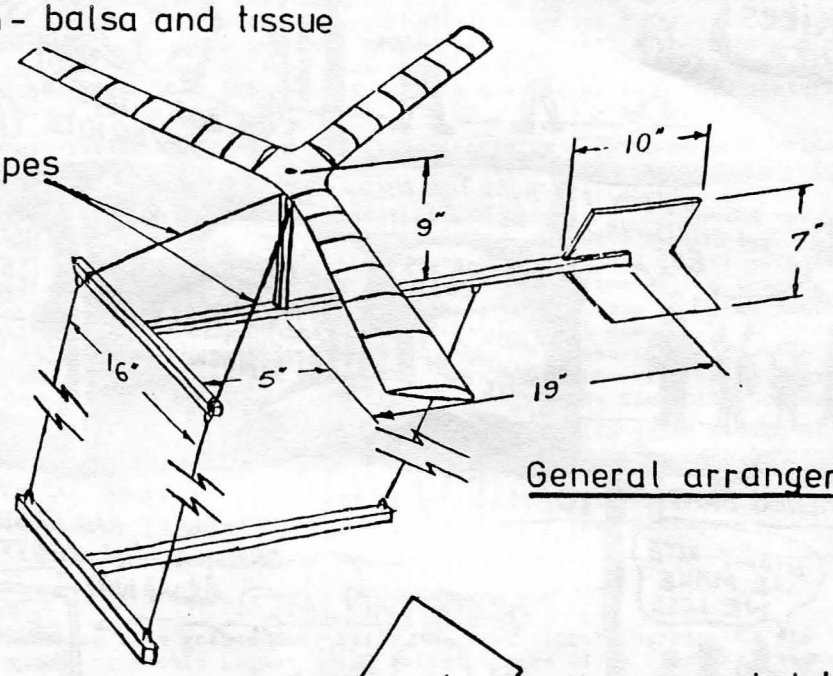
AUTOGYRO KITES by DON ECCLESTON

It was while watching the facinating T.V. programme about Commander Ken Wallis and his autogyros that the "bug" bit.An autogyro kite?Well why not?I hadn't seen one but it must be possible.
Ken Wallis' two bladed rotor,which could rock horizontally,seemed the obvious place to start.Balsa wood,tissue paper,Meccano,and string all came together to form the mk.1 autogyro.The most difficult aspect was building in a means of varying the angle of attack of the blades,(this later proved unnecessary). An angle of -10 degrees was selected as a possible compromise between the angle required to cause the rotor to "windmill" and the best angle for generating lift.
Static tests showed the rotor to be working well,but needing a moderate to fresh wind in order to generate any noticeable lift.
In the first test flights the machine had to be towed rapidly into a strong breeze in order to fly at all.The results were;
a) short flights (both in time and distance) due to lack of 'runway'.
b) the machine invariably ended up tipping over to the right.
c) the pilot ended up "base-over-apex".
The following conclusions were drawn;
a) there was a definite need for more information on rotating wing machines.
b) the lift to weight ratio was inadequate.
c) there appeared to be an element of instability in the design.
Information on rotary wing aircraft was very difficult to find but eventually a really useful book was obtained (The Helicopter - History,Piloting and How it Flies - by J.Fay).This soon revealed several important aspects e.g. the rot would rotate without needing negative angle of attack;blades could be hinged individually to allow for the difference in lift between the advancing and retreating blades,hinging also allows the blades to take up a natural "coning angle"(the helicopter's equivalent of dihedral);"Delta Hinges" could be used to give a variable angle of attack which changes with rotational velocity.
These aspects and others were incorperated into mk.2 machine which was fitted with a three-bladed rotor and a three-string control system.
Initial tests have proved successful in fresh/strong winds.Observations of these tests indicate that;
a) the L/W ratio needs to be improved further.
b) a simpler control system may be adequate when the L/W ratio is correct as the tipping to one side appears to happen only when effective windspeed is falling off.

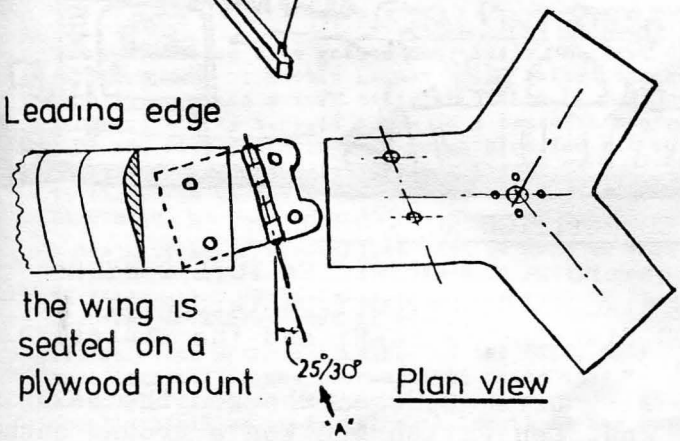
As mk.2 is not considered entirely satisfactory,this article may be a little premature.
With regard to the future,my own feelings are that the mk.2 has performed sufficiently well to justify further development with modern materials and technology in order to get a lift to weight ratio that will allow the machine to fly in less strong winds.The following diagrams show that the basic configuration needs quite a bit of "plastic surgery" before its appearance can be considered acceptable.



3 blades - each 36" x 3" x 3/8" deep (at 40% chord)
Main frame - 1/2" hardwood
Tail fin - balsa and tissue



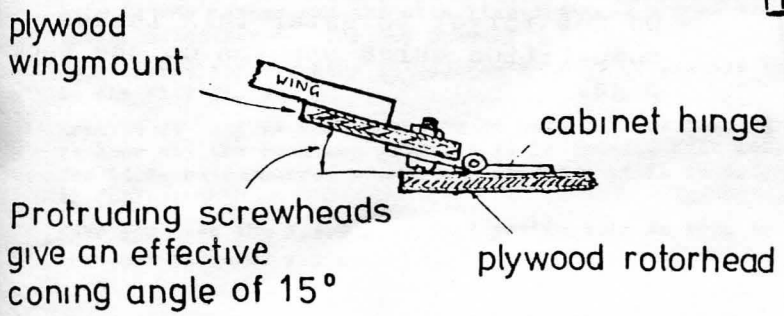
General arrangement



Plan view

It is essential that the relationship between the angle of the hinge and the leading edge is as shown

The Delta Hinge



View in direction of arrow A