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THE McDONNELL AIRCRAFT CORPORATION

Presents

PROPOSED MODIFICATIONS.

TO THE XF-85 AIRPLANE

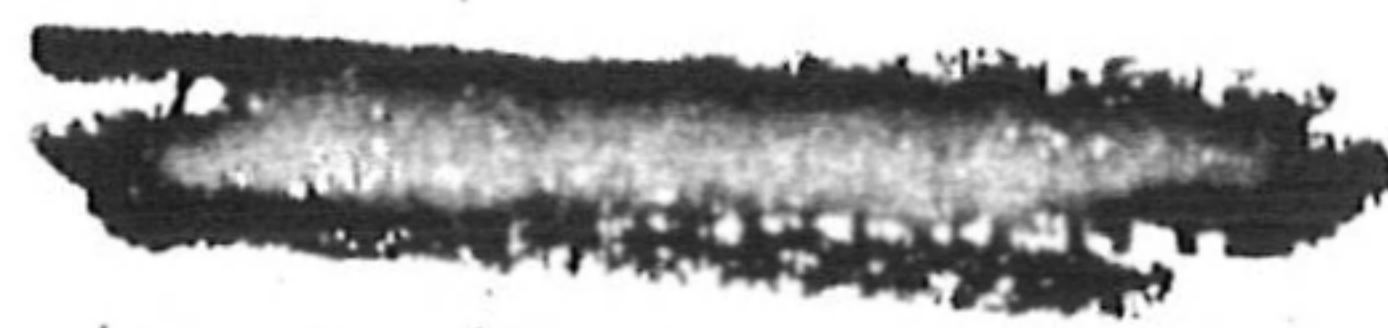
AND TRAPEZE MECHANISM

CONFIDENTIAL REPORT

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Resume of Advantages to be Gained by
Modification of Hook and Trapeze Mechanisms

1. Although the XF-85 airplane in its present configuration has completed five (5) flights to date including three (3) successful 'hook-ons', the manufacturer believes that a redesign of the hook mechanism in the XF-85 and the trapeze mechanism in the B-29 will provide a very satisfactory combination usable by average fighter pilots. It is further believed that accomplishment of these modifications and flight testing of same will prove a major step in the development of satisfactory techniques for flight refueling, rearming and remaning of fighter type aircraft. This program will also provide invaluable design information if airborne interceptor type aircraft are procured.

2. The present design of the trapeze and hook mechanisms was based largely on the only past experience available, namely the dirigible based fighters of some years ago. These basic design concepts were:

- a. The entire trapeze must be a rigid structure providing shock absorption in a two dimensional plane.
- b. The point of attachment (i.e. the center of the hook on the fighter) must be essentially above the center of gravity of the fighter so that the fighter can literally 'hang' on the hook.

3. Flight tests of the XF-85 have indicated that these concepts do not constitute the most desirable approach. Instead, the following concepts appear much more desirable and the result in many attending advantages:

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- a. The attaching bar on the trapeze should be initially unrestrained to allow the pilot a substantial overrun after attachment both fore and aft and laterally. This will tremendously reduce the precise coordination of speed and position now required of the fighter pilot.
 - b. The hook for initial attachment should be well forward of the center of gravity so that the fighter will be towed by the bomber rather than 'hang' below. After initial hook-on and prior to engagement of rigid attaching mechanisms, a more stable situation is created by towing the fighter rather than hanging it from a point above its center of gravity.
 - c. The change in location of the hook greatly reduces the pilot's psychological hazard since the hook over the c.g. places it very close to the pilot's head, whereas the towing hook is well forward.
4. As a result these changes in design concepts the following advantages automatically accrue:
- a. Simplified and Lighter Weight Trapeze
The new design concepts make it possible to simplify the design and reduce the number of parts in the trapeze mechanism to less than half the present number with the attending decrease in weight. This in turn results in:
 - (1) Greatly improved maintenance of the trapeze.
 - (2) Ready removal or jettisoning of the trapeze from three (3) supporting points.

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- (3) Reduced trapeze actuation loads and time.
- (4) Improved performance of the parent airplane.

b. Reduced Turbulence in the Hook-On Zone

The present trapeze extends approximately 10 feet below the B-29. Because of the structural bulk of the present design, it is not very practical to substantially increase this distance. However, flight tests by the Air Materiel Command and McDonnell Aircraft have shown that the turbulent region extends approximately fourteen (14) feet below the airplane. To essentially avoid this region, attachment should be made about twenty (20) feet below the parent aircraft. The extension to 20 feet is feasible with the modified and simplified trapeze and is so indicated on the accompanying drawings.

c. Adaptable for Use with Other Jet Fighter Aircraft

With the modified trapeze and the hook location latitude allowed by the new design concepts, it becomes entirely feasible to modify other fighters so that flight refueling, rearming and remaning is possible. If flight refueling only is required, the trapeze could be modified to allow single point pressure refueling without the necessity for additional modifications to the fighter to allow engagement of rigid attaching mechanisms.

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Launching and Retrieving Procedure
for Revised Hook and Trapeze Mechanisms.

A. Launching

1. Trapeze is unlatched and lowered from stowed position to stabilized position.
2. Fighter pilot starts jet engine and checks controls.
3. Fighter pilot presses push button to "Release" position energizing an actuation sequence in which both aft and forward hooks are disengaged and jet fighter is airborne.
4. Jet fighter retracts hooks and parent aircraft retracts trapeze to stowed position.

B. Retrieving

1. Fighter signals parent aircraft and trapeze is extended to "Retrieve" position.
2. As fighter approaches, pilot presses push button switch energizing actuators on both forward and aft hooks to "hook-on" position.
3. Fighter engages retrieving bar with forward hook which automatically latches into place and centers itself between the centering latches.
4. Fighter pilot cuts power and retrieving cylinder (unrestrained around supporting axis) swings freely until drag forces dampen out inertia.
5. Fighter is towed as telescoping retrieving cylinder hydraulically retracts. Simultaneous with this operation a centering device centers and latches retrieving cylinder in place.

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6. With retrieving bar fully retracted, torsionally stabilized and latched in place, fighter retracts front hook to "stowed" position pulling airplane into stabilizing collar and causing aft hook to contact with stabilizing bar. As this is accomplished electrical circuit is automatically completed to aft hook actuator which closes hook to "engaged" position.
7. With fighter thus stabilized, trapeze is retracted into stowed position and latched in place.

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