

ABSTRACT

A tactile cueing apparatus for incorporation in an aircraft flight control system comprising a flight control surface, and a pilot's inceptor for moving the surface via a servo-assisted mechanical linkage connecting the inceptor to the control surface, the apparatus comprising a force sensor for sensing a force applied to the inceptor by the pilot to move the control surface, an electromechanical actuator configured to be installed with the mechanical linkage between the inceptor and means in the system providing said servo-assistance, and control means programmed to cause the actuator

(i) to move so that the linkage moves to a position determined by said force according to a predetermined relationship.

(ii) to apply to the inceptor a resisting force according to a predetermined relationship and which when the linkage has moved to its commanded position is equal and opposite to the force sensed by the force sensor.


(Figure 6)

CLAIMS

1. A tactile cueing apparatus for incorporation in an aircraft control system comprising a controlled element, and an operator's inceptor for moving the controlled element via a mechanical linkage connecting the inceptor to the controlled element, the apparatus comprising an input sensor for sensing a control input to the inceptor by the operator to move the controlled element, a controllable actuator configured to be installed with the mechanical linkage between the inceptor and the controlled element, and control means programmed to cause the actuator
  - (i) to move so as to cause or permit the linkage to move to a position determined by the control input according to a predetermined relationship.
  - (ii) to apply to the inceptor a resisting force determined by the control input according to a predetermined relationship.
2. The apparatus of claim 1 wherein the input sensor senses a force applied to the inceptor by the operator.
3. The apparatus of claim 1 or 2 wherein the predetermined relationship comprises a non-linear relationship between the resisting force and the inceptor position.
4. The apparatus of claim 3, wherein the predetermined relationship comprises at least one range of force values in which a change in the force produces no movement of the mechanical linkage.
5. The apparatus of any preceding claim wherein the control means is programmed to change the predetermined relationship with a change in the aircraft's flight conditions.
6. The apparatus of any preceding claim wherein the actuator is a rotary actuator.

7. The apparatus of any preceding claim comprising a clutch or other disengaging means operable in the event of failure of the apparatus for disengaging the apparatus from the mechanical linkage.
8. The apparatus of claim 7 in which the disengaging means when operative applies a passive resisting force to the inceptor against movement thereof.
9. The apparatus of any preceding claim wherein the said aircraft control system comprises means for providing servo-assistance to the mechanical linkage.
10. The apparatus of any preceding claim wherein the controlled element is a flight control surface.
11. A tactile cueing system comprising a plurality of the apparatuses of any preceding claim each configured to be installed with a said mechanical linkage to a different control element of the aircraft, a said control means of a first said apparatus being arranged to monitor the operation of a said control means of a second said apparatus.
12. The system of claim 11 comprising feedback means for supplying a feedback signal indicative of the linkage position controlled by the second said apparatus to the control means of the first said apparatus and thence to the control means of the second said apparatus.
13. The system of claim 11 and 12 wherein a said actuator is arranged to be controlled in parallel by two said control means.
14. Tactile cueing apparatus, a tactile cueing system substantially as herein described with reference to any of figures 3 to 9 of the accompanying drawings.
15. An aircraft provided with the apparatus of any of claims 1 to 10 or 14 or the system of any of claims 11 to 14.

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BA SYSTEMS  
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Fig.1A.

PRIOR ART

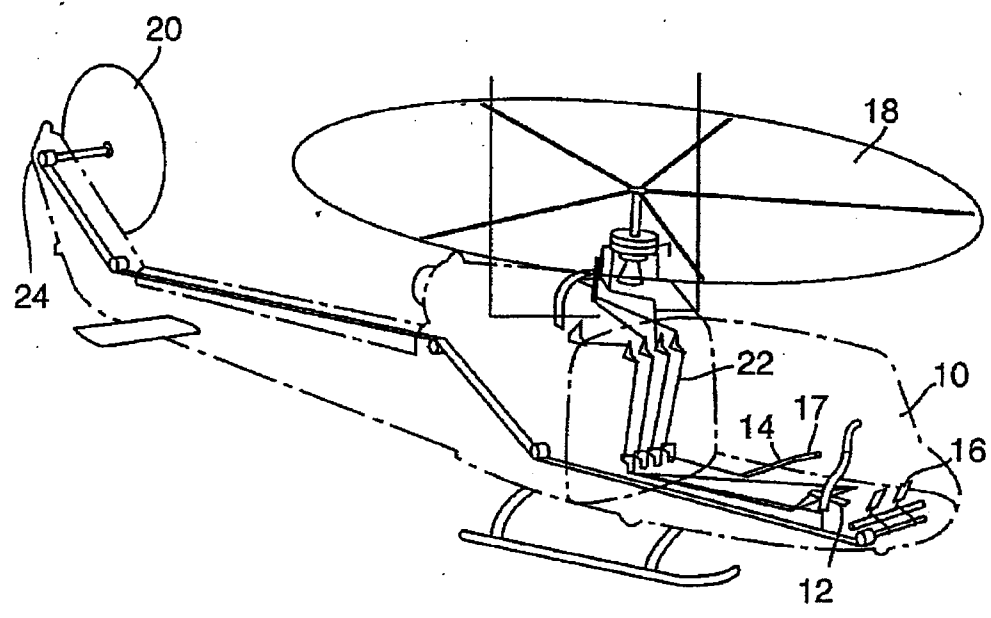
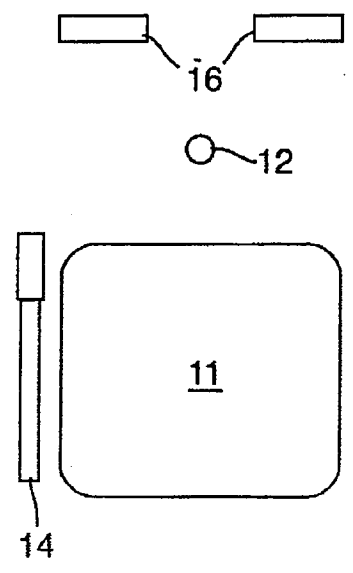


Fig.1B.

PRIOR ART




  
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Fig.2.  
PRIOR ART

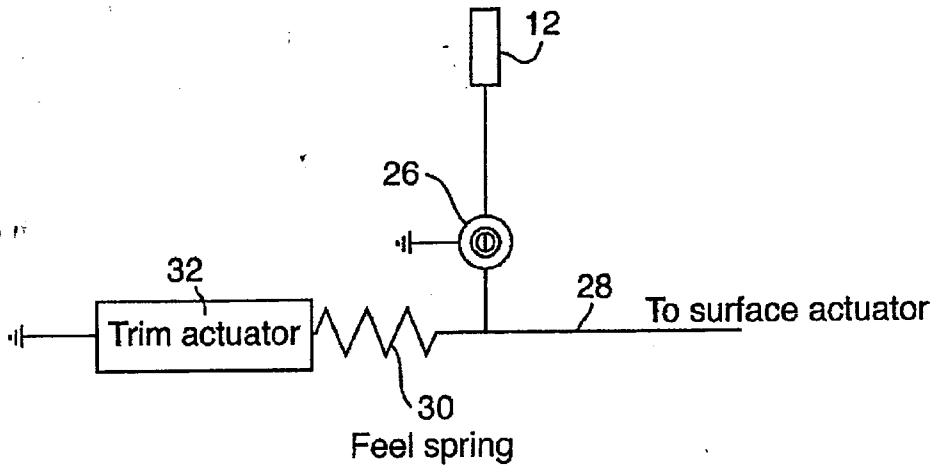
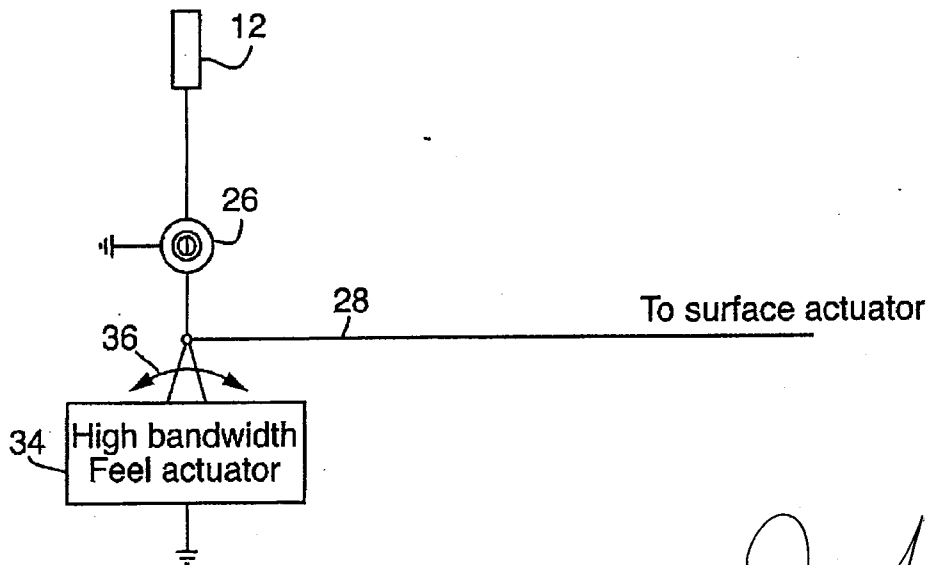


Fig.3.



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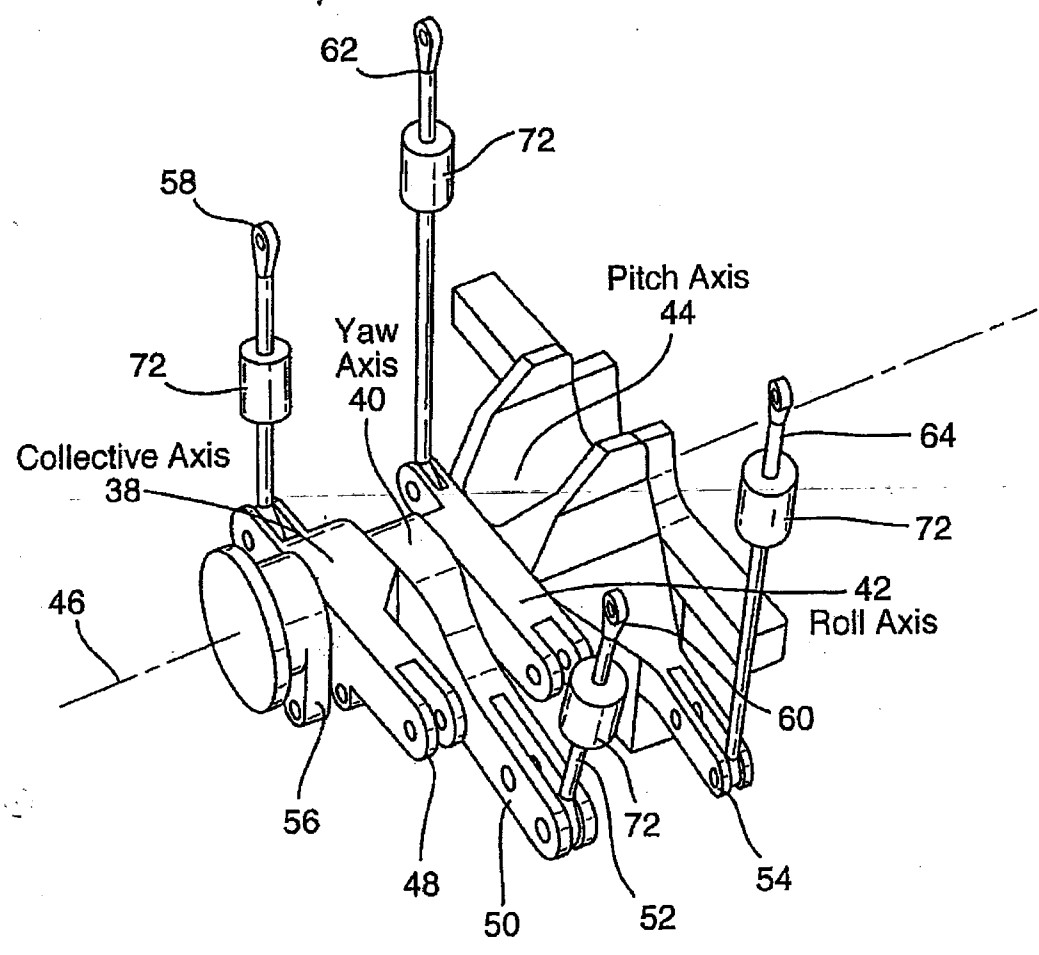
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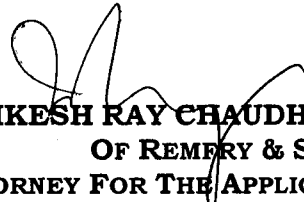
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Fig.4.



  
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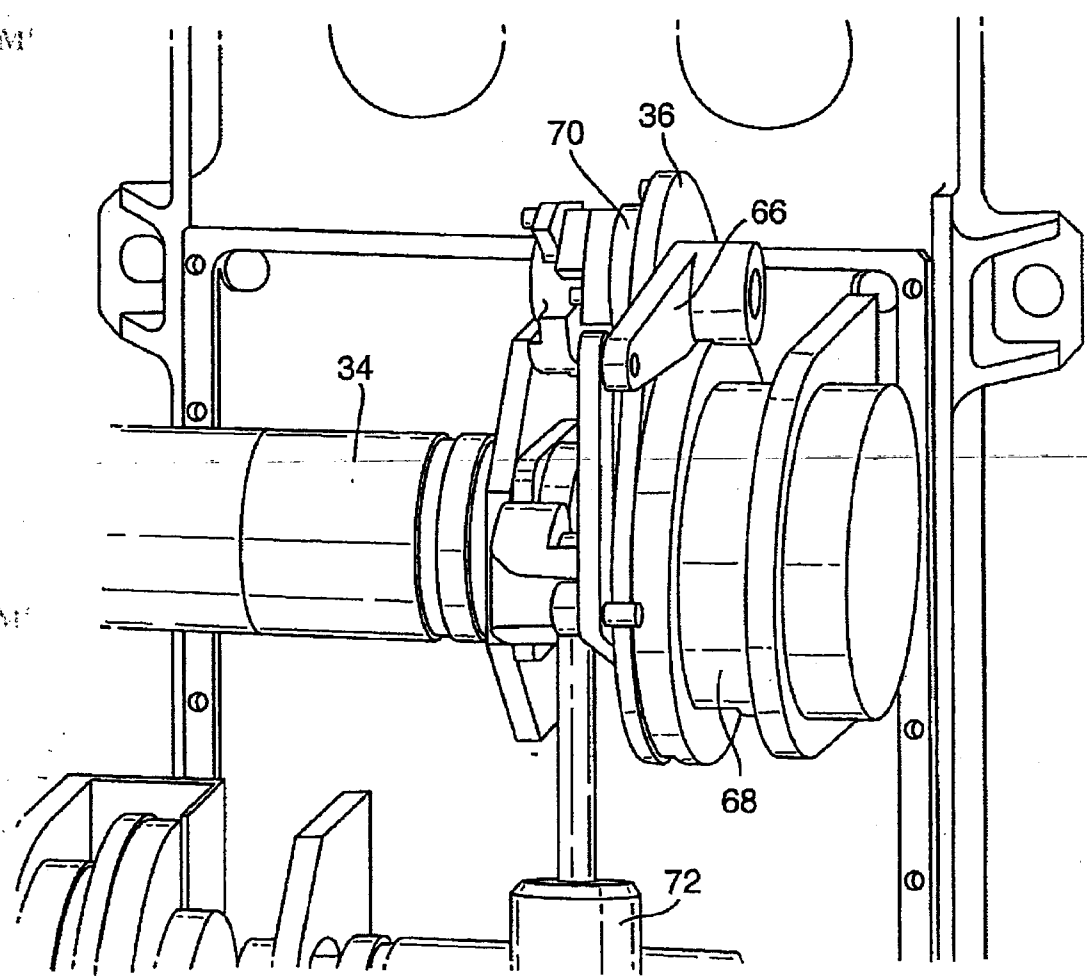
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Fig.5.

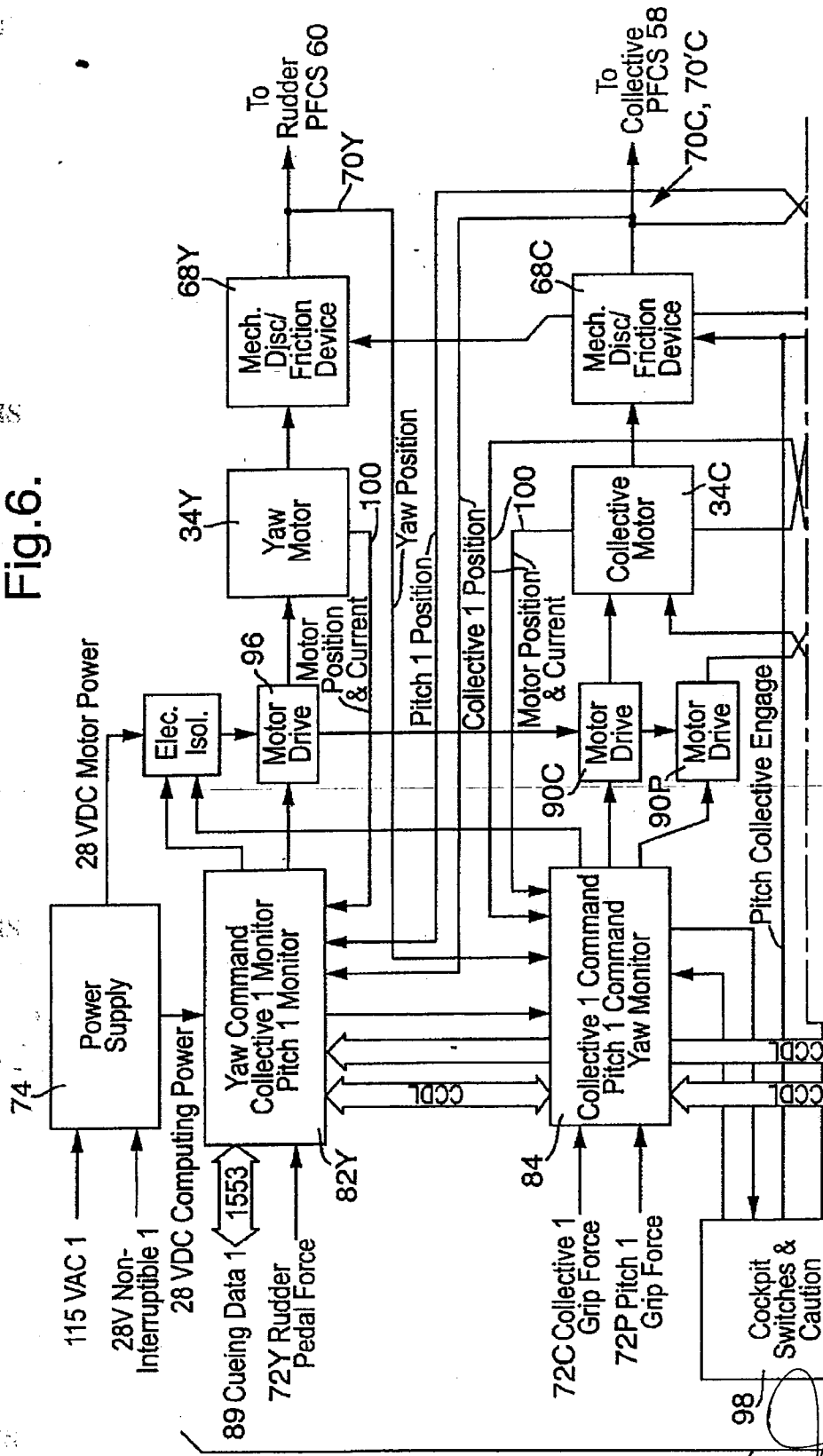


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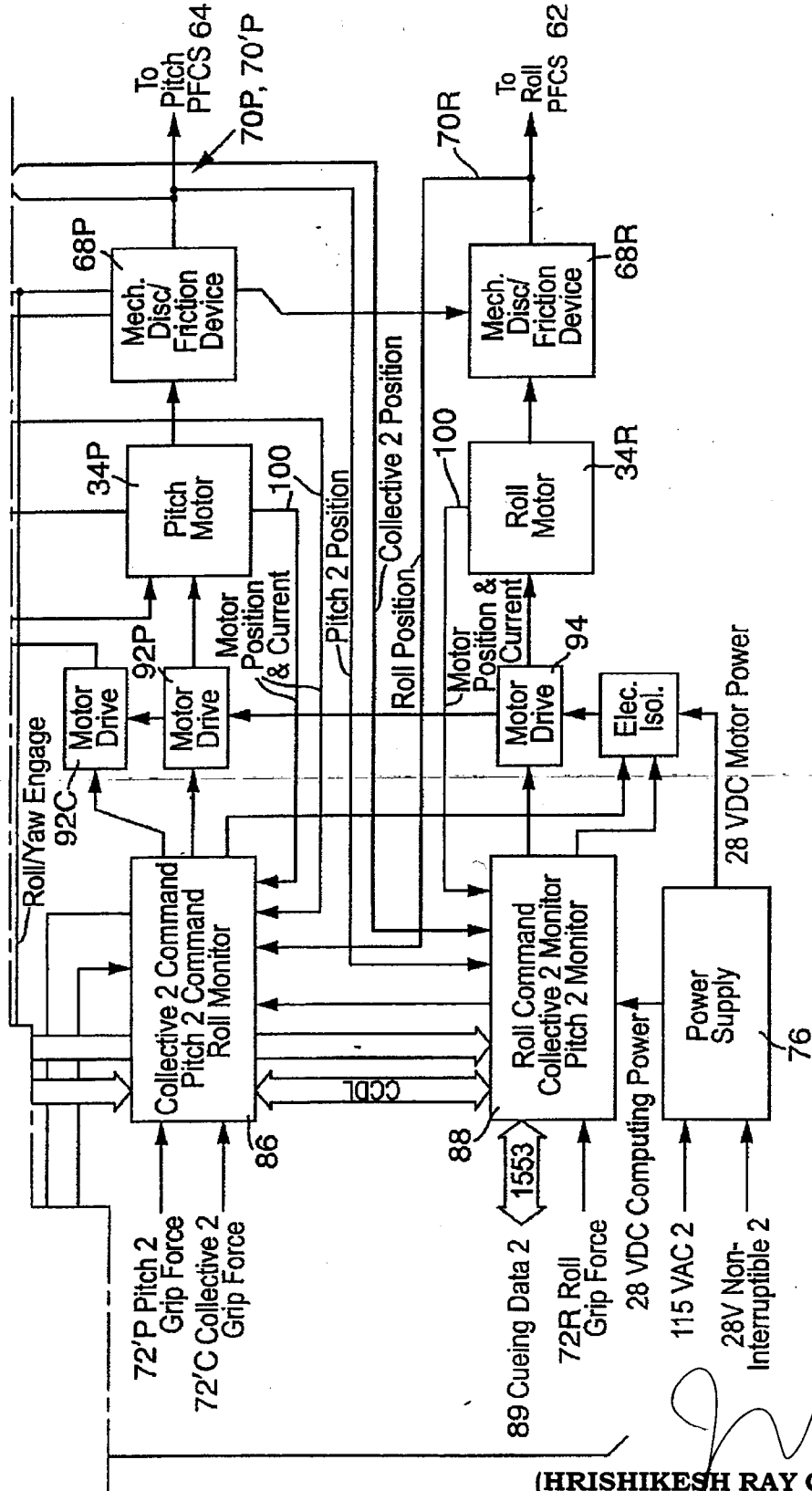
Fig.6.



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Fig.6. (Cont)



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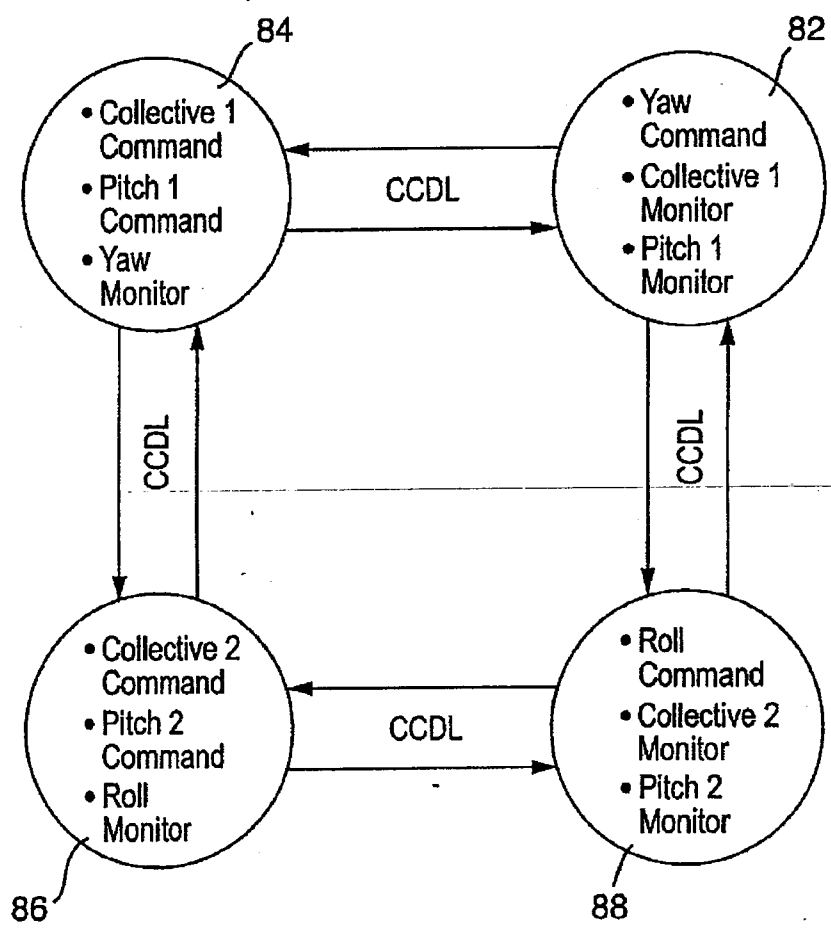
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Fig.7.



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Fig.8.

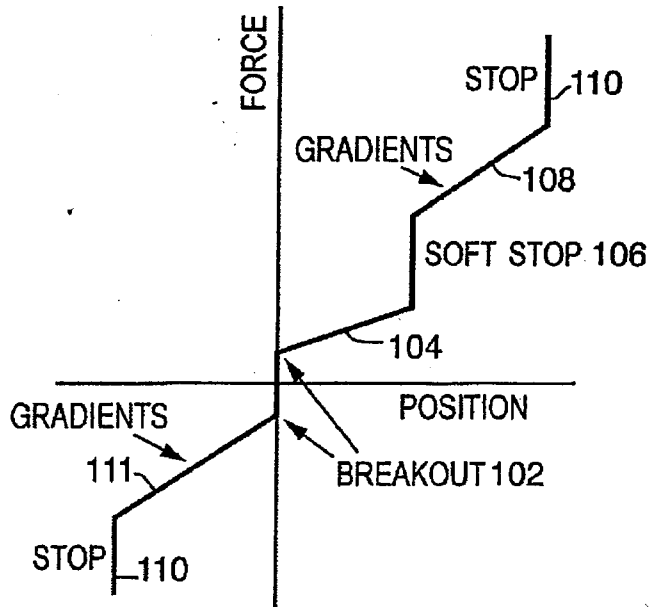
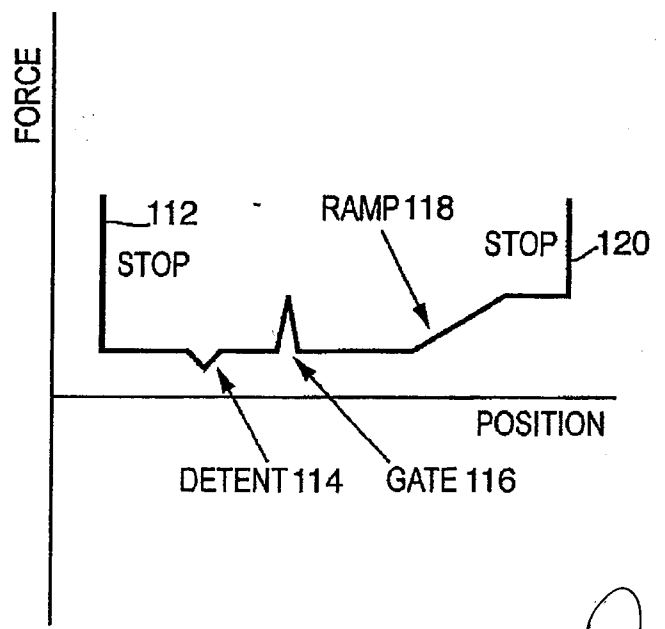


Fig.9.



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