TECHNICAL ORDER
No. 03-20CA-1

HANDBOOK

OF

OPERATION AND FLIGHT INSTRUCTIONS

FOR THE

CONSTANT SPEED PROPELLER GOVERNORS AND CONTROLS

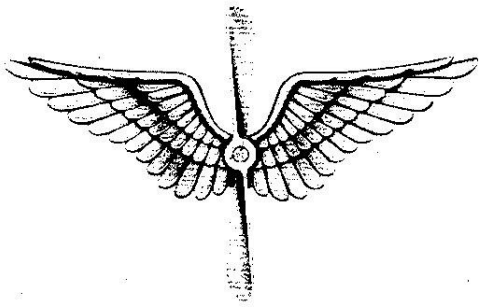
AND

HYDROMATIC PROPELLER GOVERNORS AND CONTROLS

MANUFACTURED BY

HAMILTON STANDARD PROPELLER CO.

EAST HARTFORD, CONN.



PUBLISHED BY AUTHORITY

OF

THE COMMANDING GENERAL, ARMY AIR FORCES

BY

THE AIR SERVICE COMMAND

AIR FORCE SECTION

WRIGHT FIELD

DAYTON, OHIO

AUGUST 20, 1941

Revised 8-20-42

Ross-Gould Co., St. Louis, Mo. - 12/42 - 4000

Index of revision pages issued.

Pages	Latest Revised Date
1	7-25-42
2	7-25-42
4	7-25-42
14A	7-25-42
22A	8-20-42
23	7-25-42
23A	7-25-42
26	7-25-42
27	7-25-42
28	7-25-42

NOTE: The symbol ∅ denotes that portion of a paragraph or page which has been revised. This symbol is not used where the entire page is revised.

INDEX

LIST OF ILLUSTRATIONS

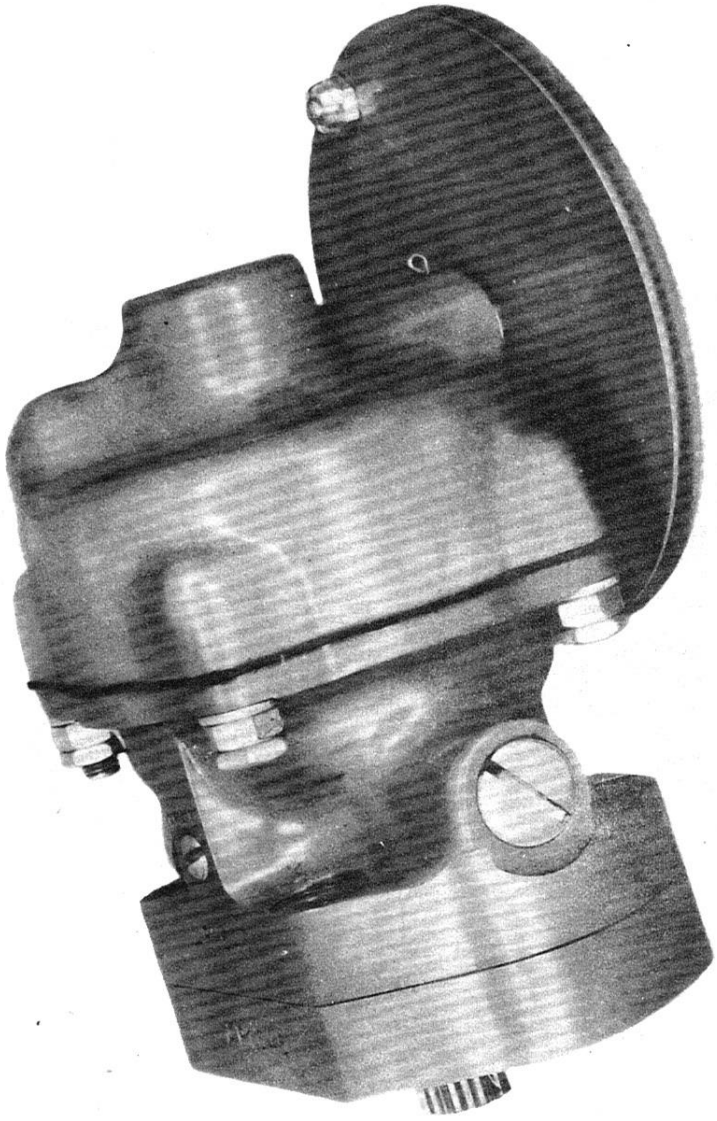


FIG. 1 – MODEL 1A1 CONSTANT SPEED GOVERNOR

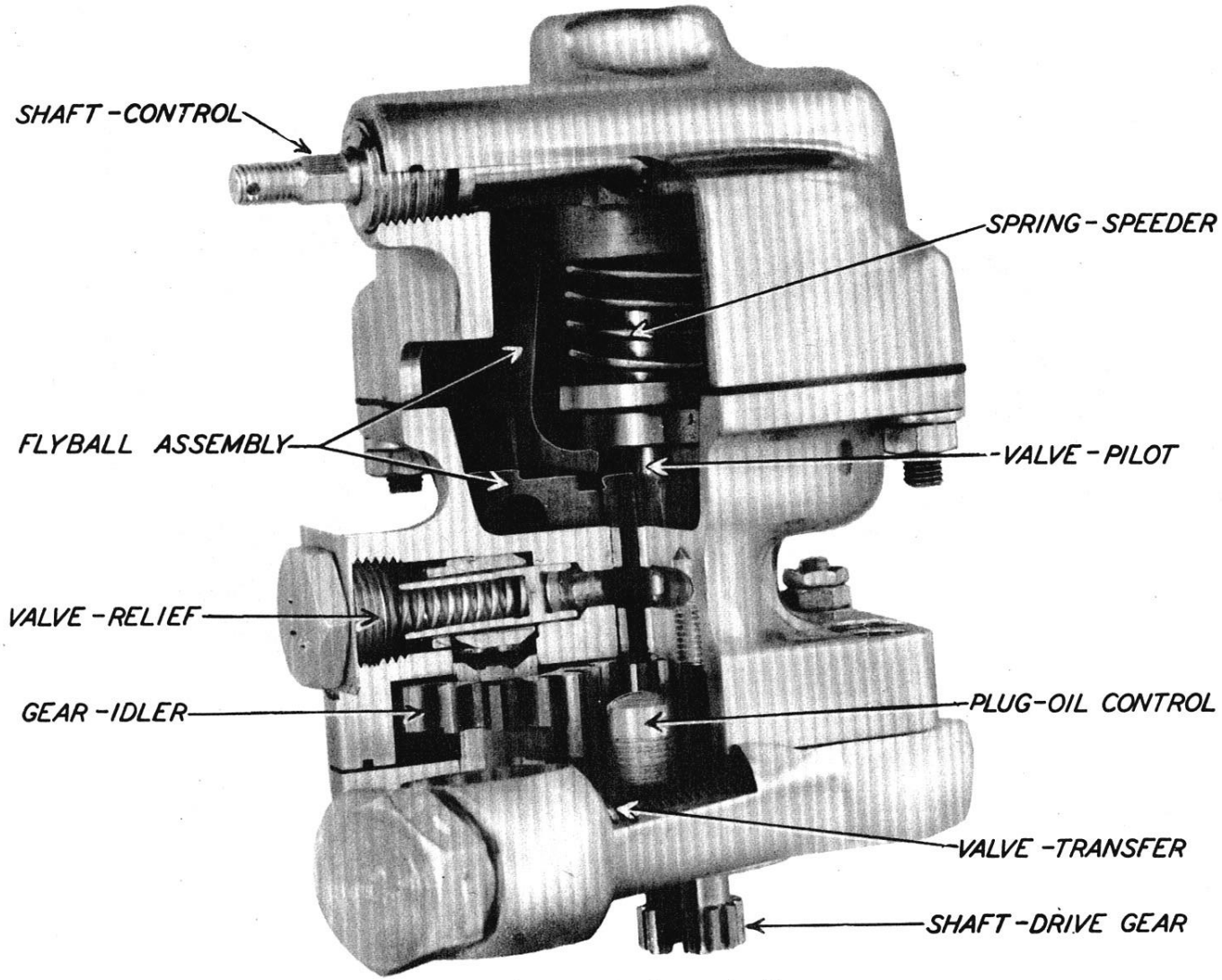


Figure 2- Model 4B6 Hydromatic Governor

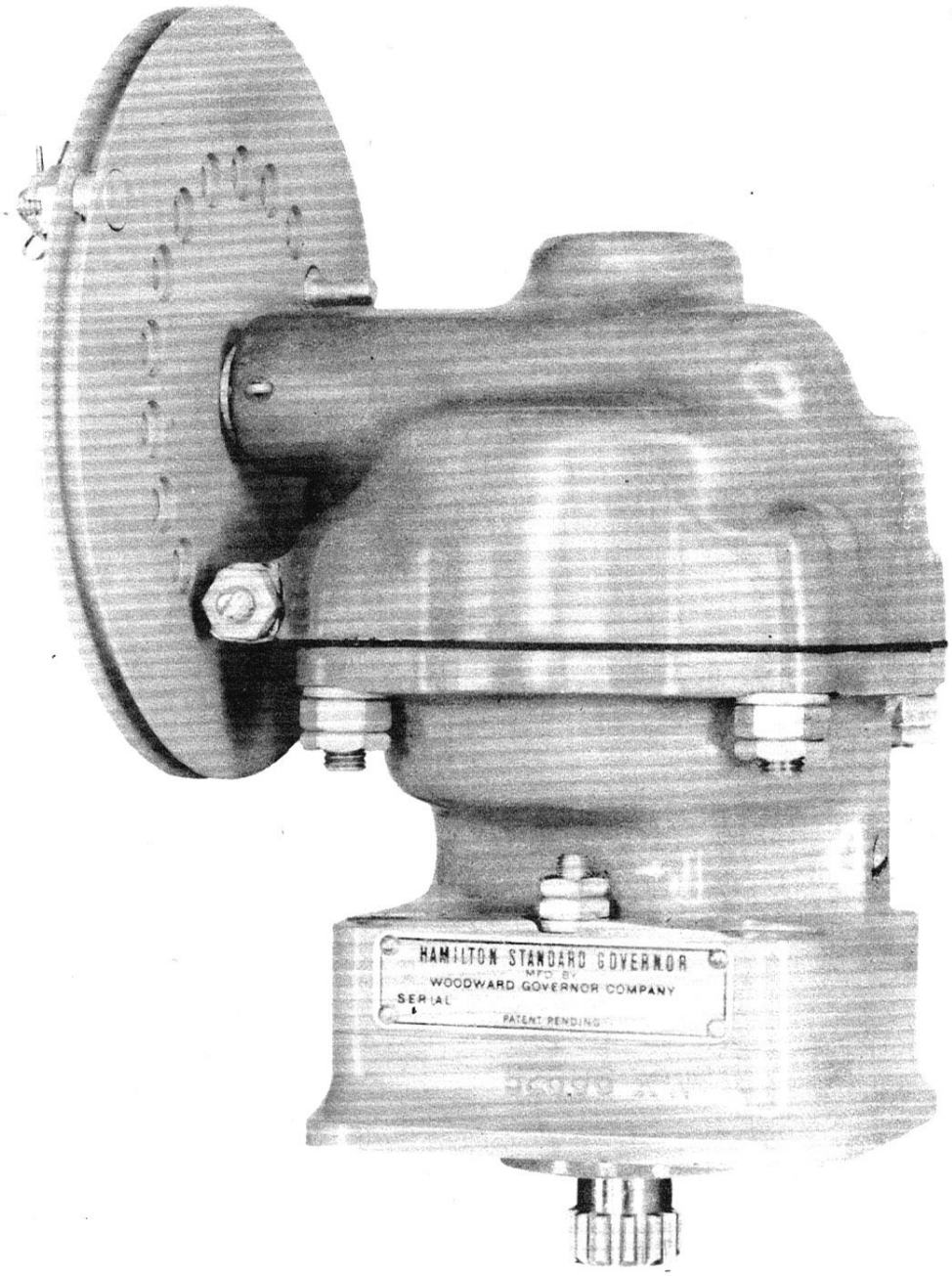


FIG. 3— MODEL 1AI-A5 CONSTANT SPEED GOVERNOR

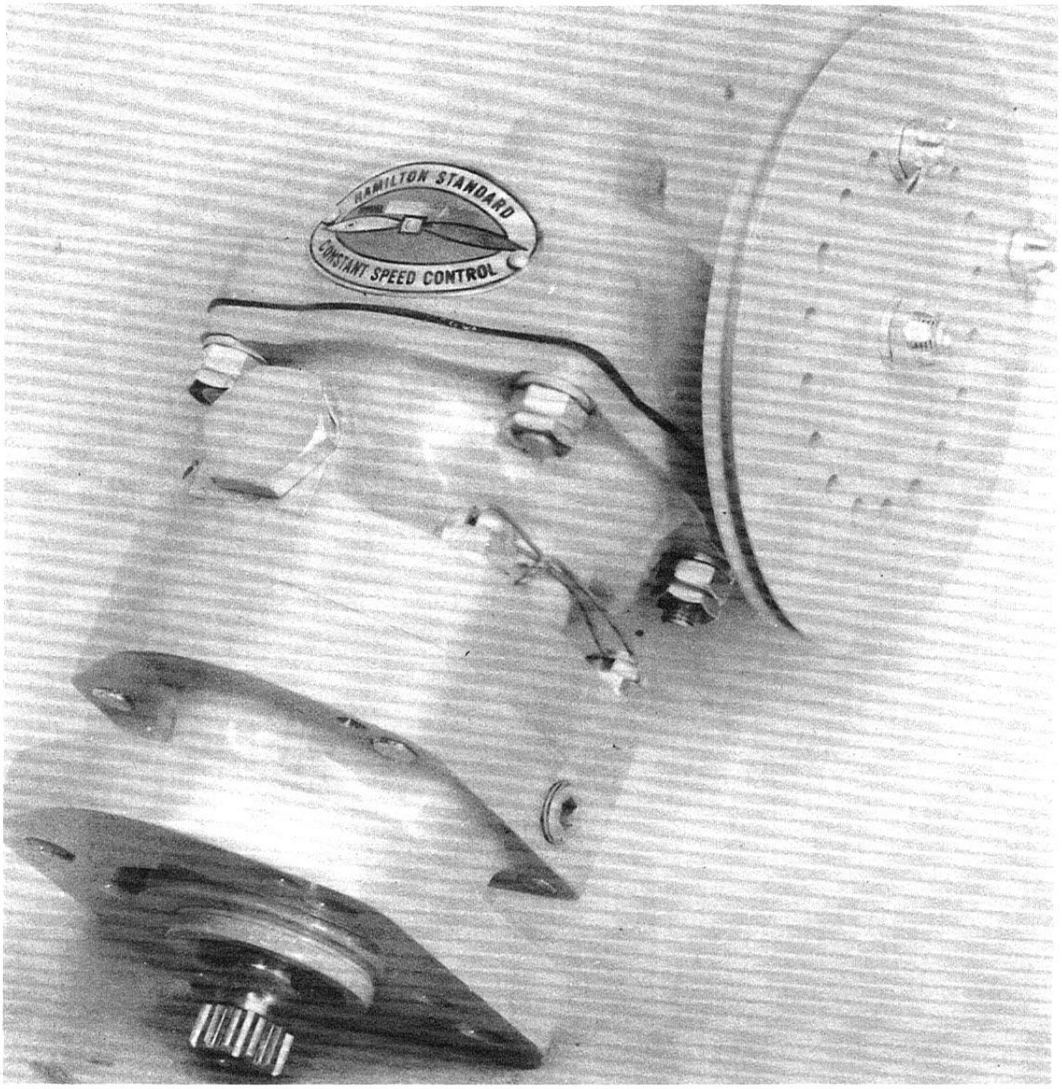


FIG. 4— MODEL 1P12-A CONSTANT SPEED GOVERNOR

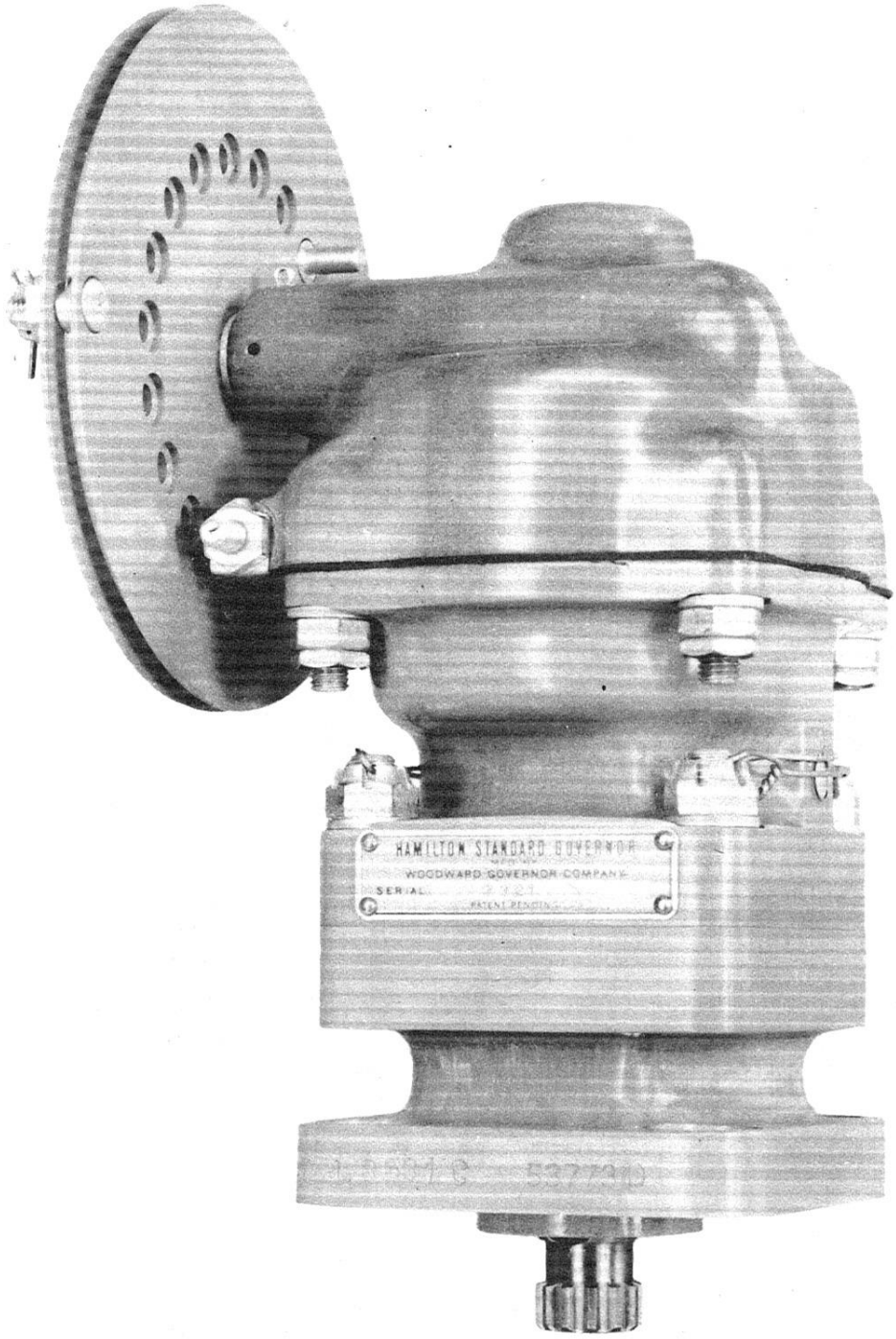


FIG. 5— MODEL 1Q12-A CONSTANT SPEED GOVERNOR

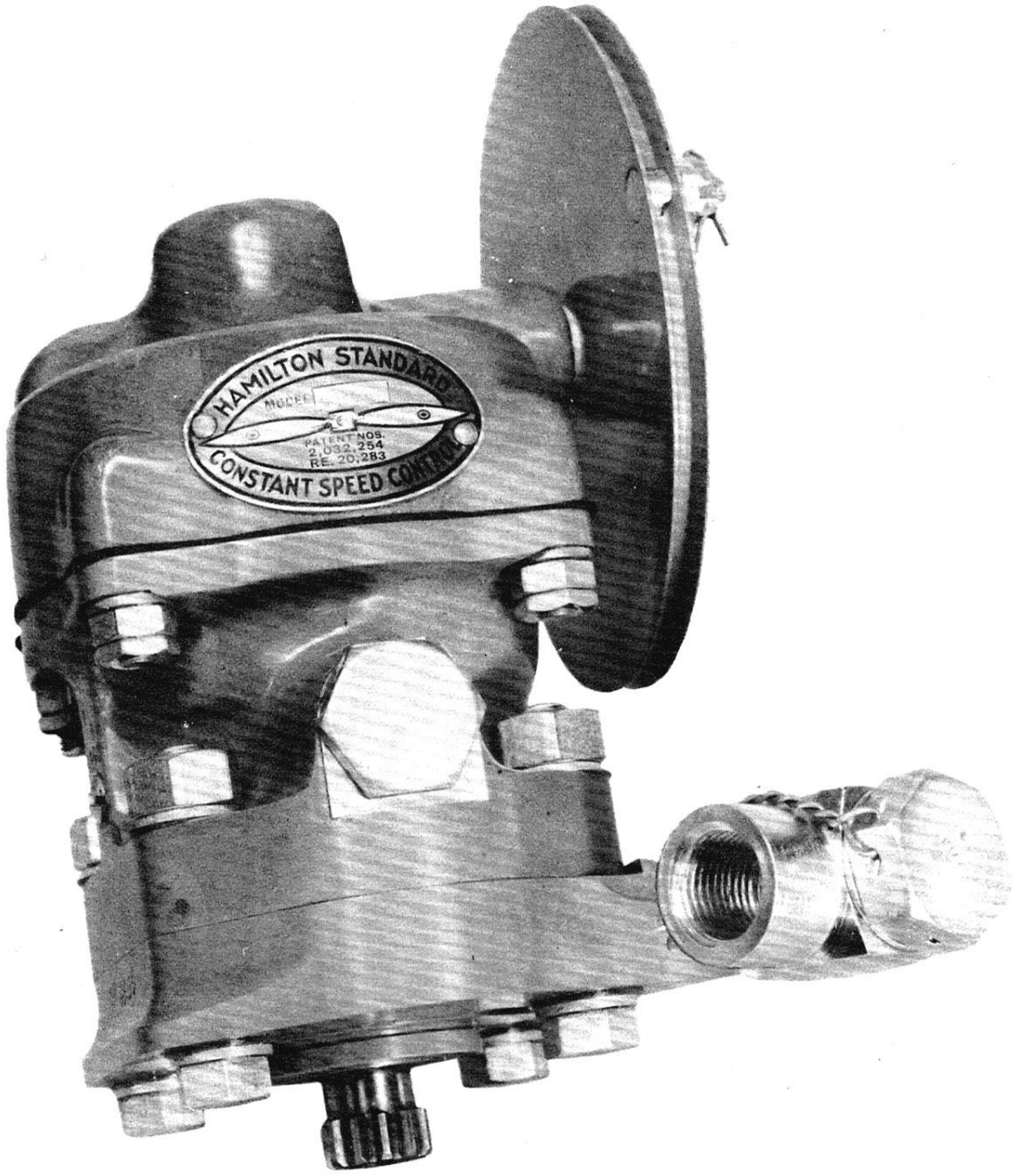


FIG.6— MODEL 4B6 HYDROMATIC GOVERNOR
(SHOWING HIGH PRESSURE SWIVEL FITTING)

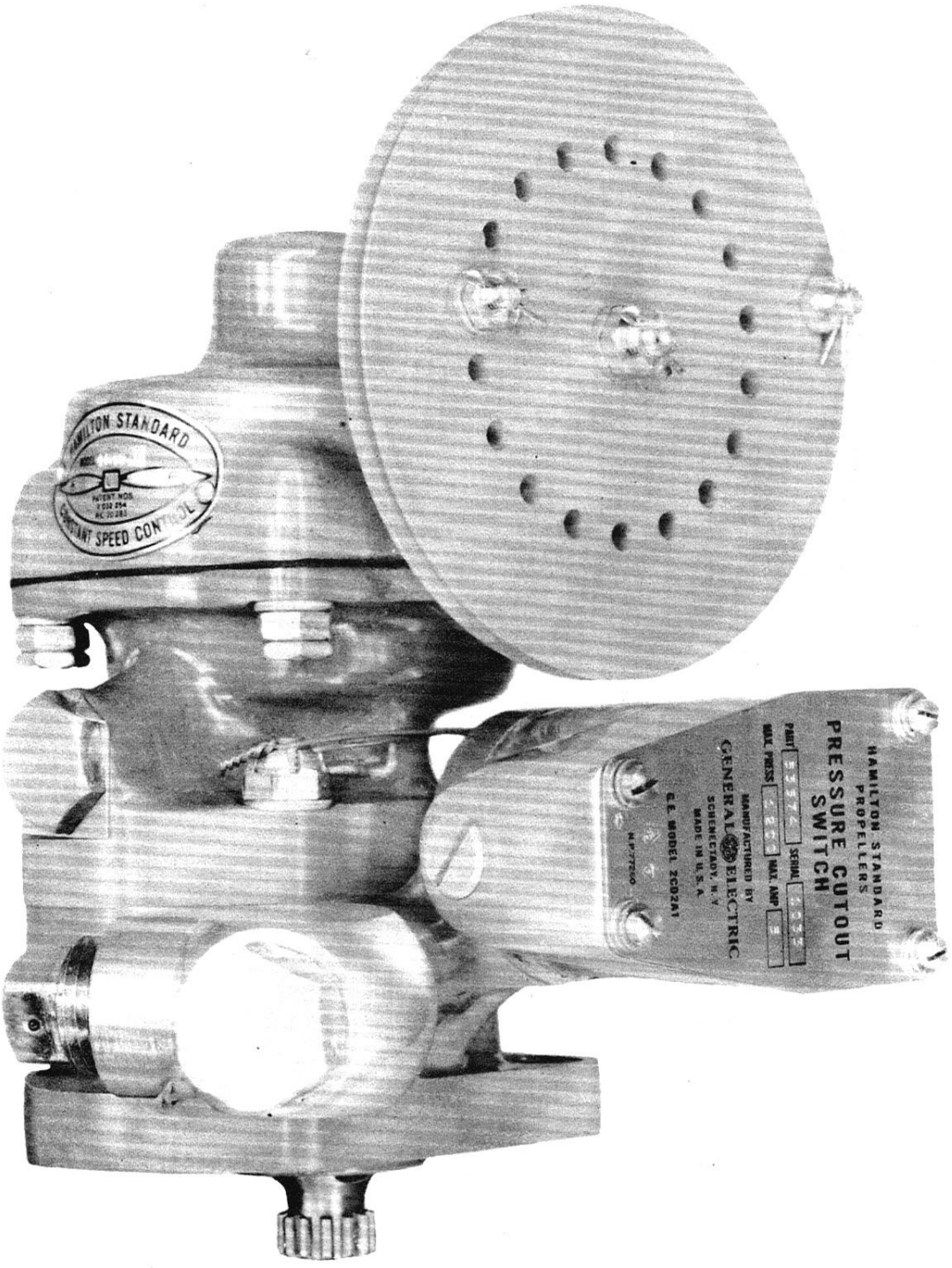


FIG. 7—MODEL 4K11-B HYDROMATIC GOVERNOR

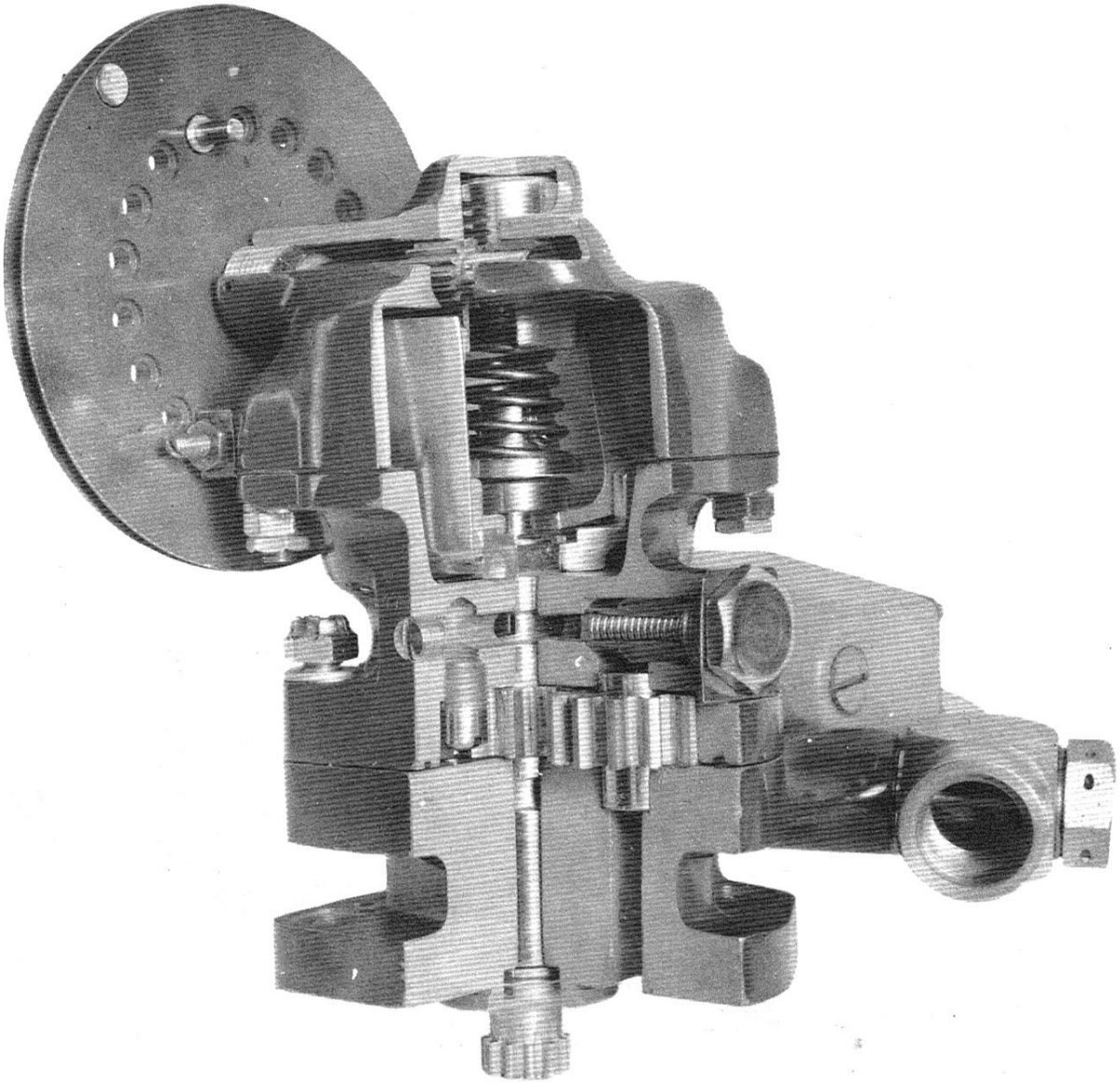


FIG. 8–SECTIONAL VIEW–MODEL 4K11-BOA HYDROMATIC GOVERNOR

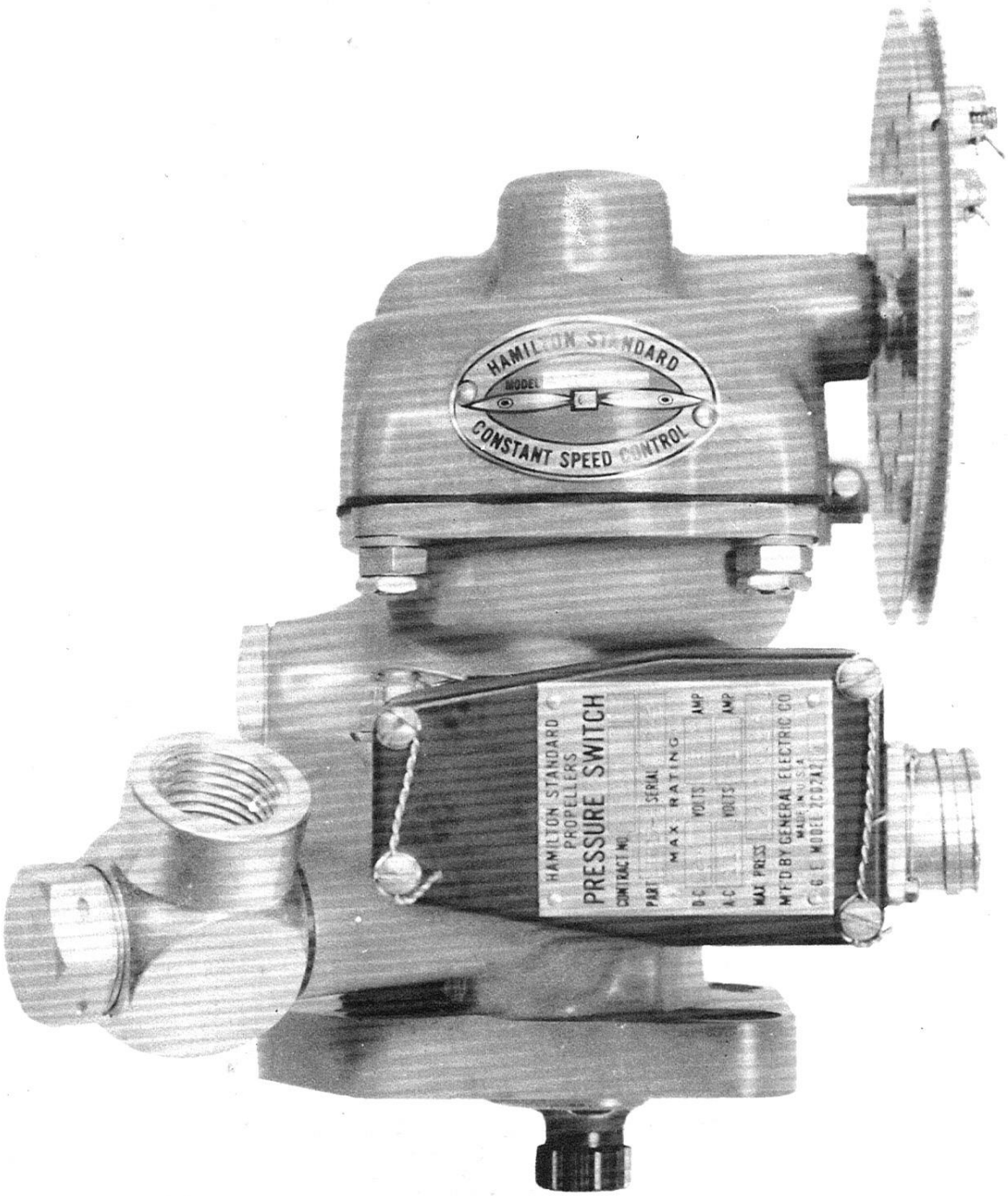


FIG. 9 – MODEL 4KII-BOD HYDROMATIC GOVERNOR

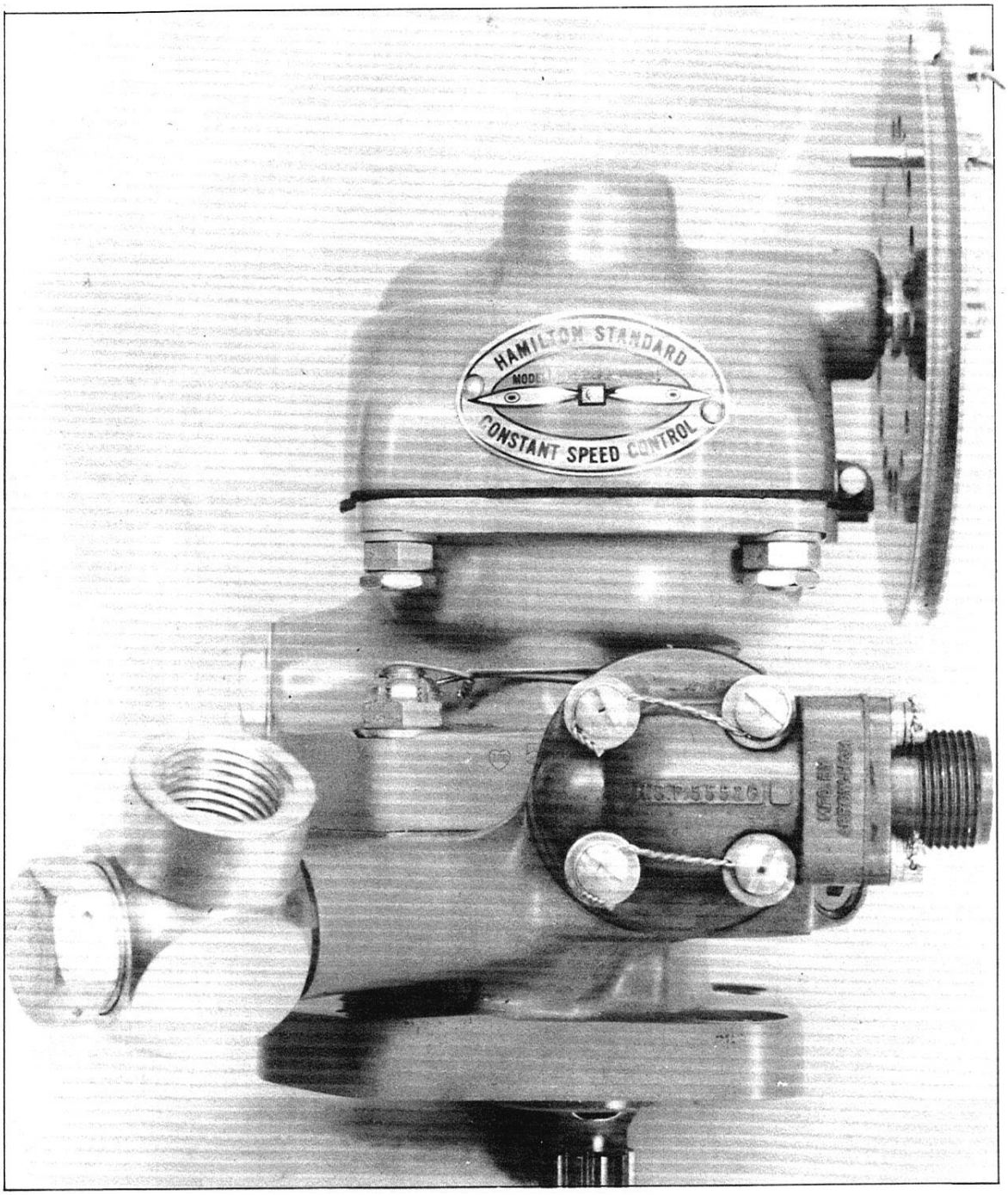


FIG.10— MODEL 4K11-BOJ HYDROMATIC GOVERNOR

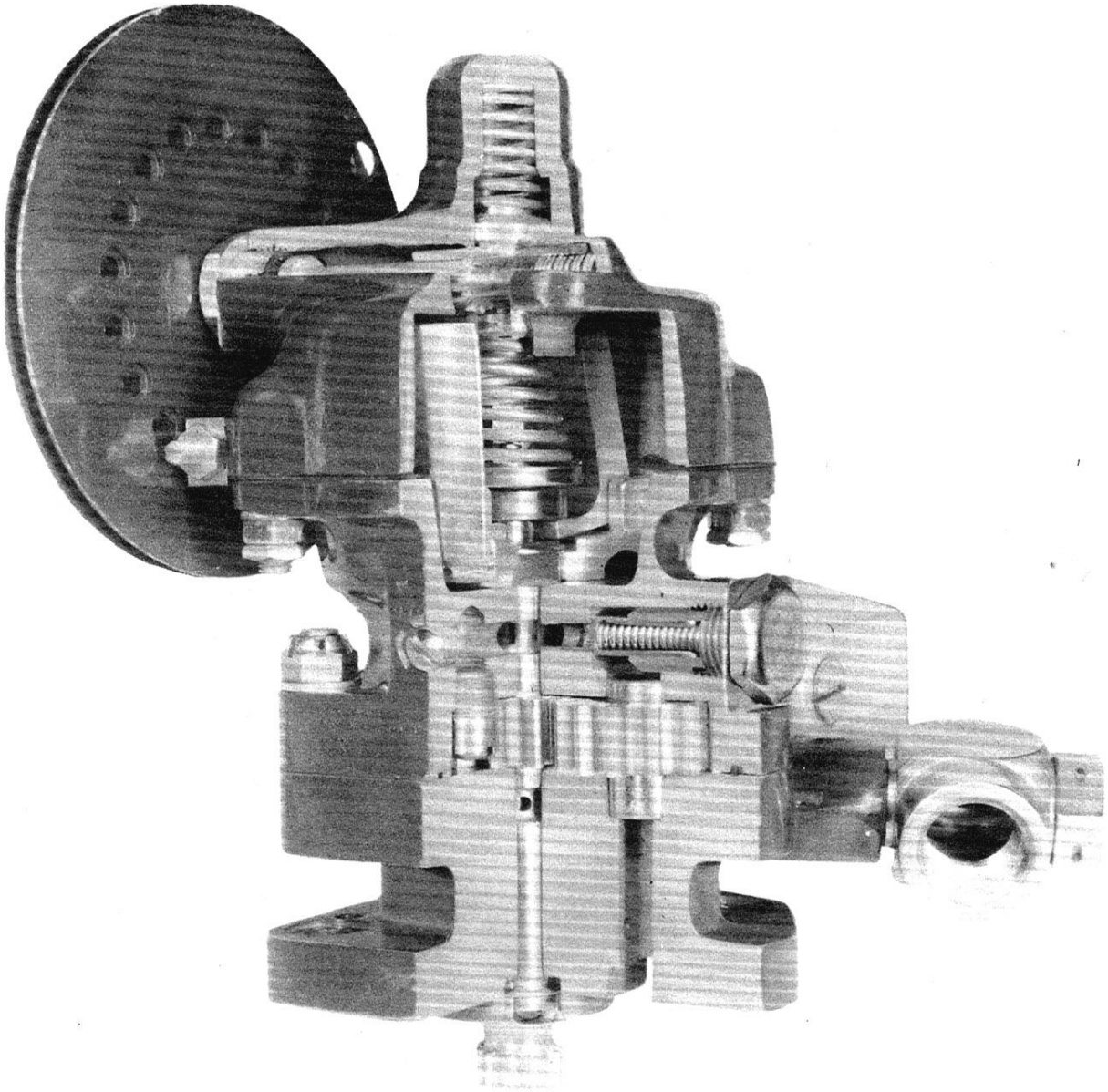


FIG. 11-MODEL 4K11-G0B HYDROMATIC GOVERNOR

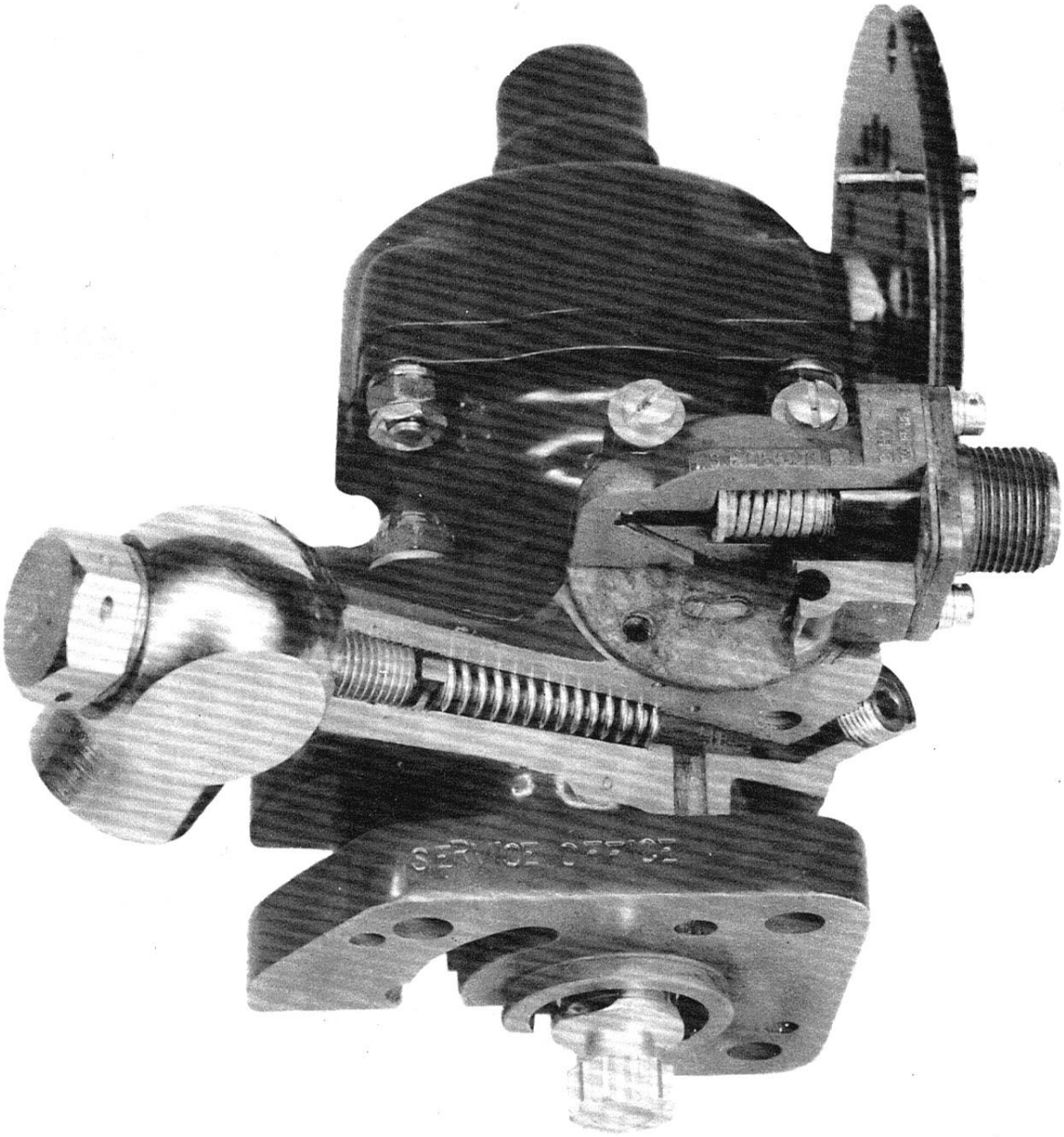


FIG. 12 – MODEL 4KII-GOJ HYDROMATIC GOVERNOR

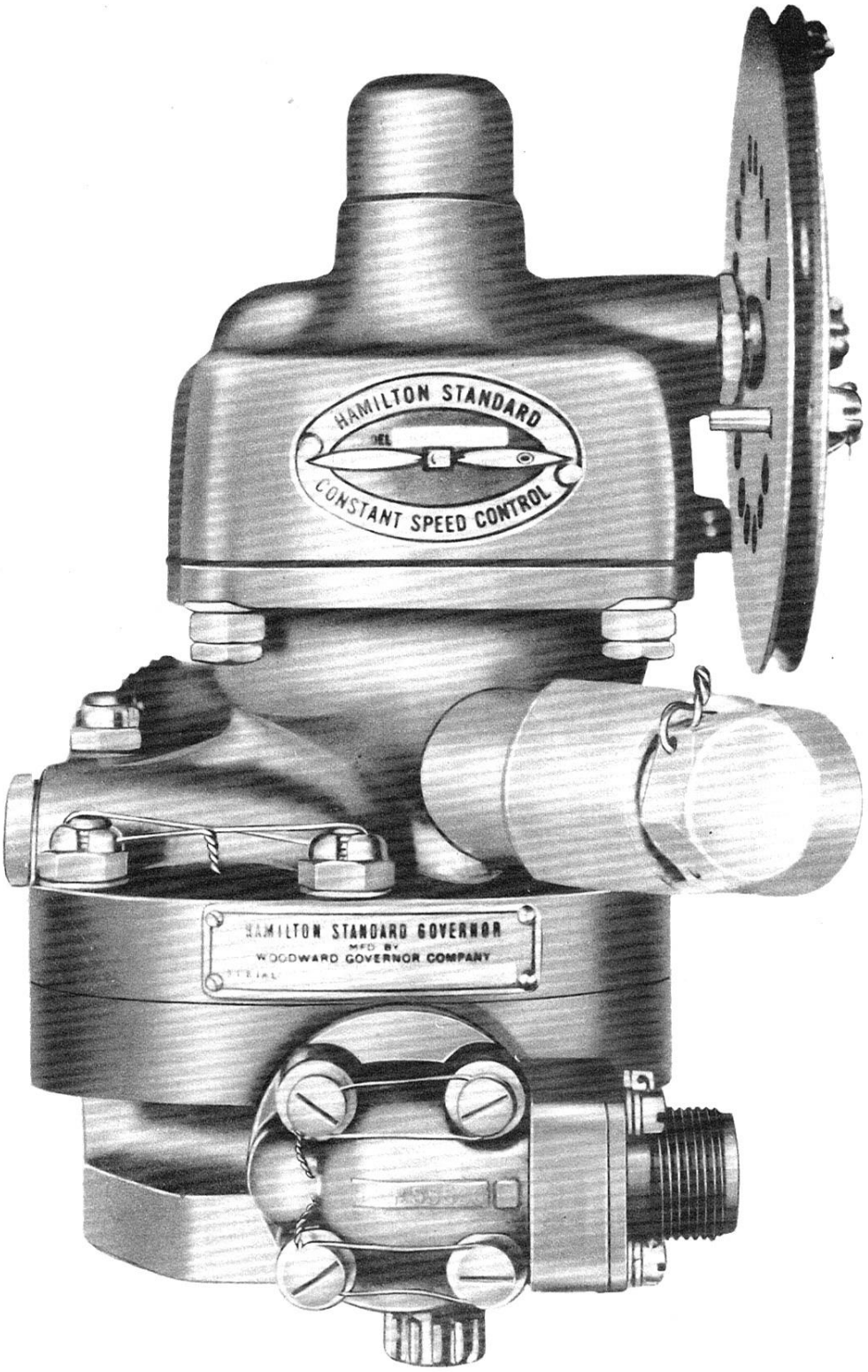


Figure 12A- Model 4G8-G6C Hydromatic Governor

SECTION I

INTRODUCTION

1. This Handbook is issued as the operation and flight instructions for the Hamilton Constant Speed Propeller Governors and Controls and Hamilton Hydromatic Propeller Governors and Controls.

2. Reference has been made in this Handbook to the following Technical Orders which contain applicable data and instructions:

T. O. No.	
03-20CB-1	Operation and Flight Instructions, Controllable Propellers (Hamilton)
03-20CC-1	Operation and Flight Instructions, Hydromatic Controllable Propeller (Hamilton)

SECTION II

GENERAL DESCRIPTION

1. Constant Speed Propeller Governor.(See Figs. 1 to 5 Incl.)

a. The governor is a device which is used in conjunction with the Hamilton Standard Controllable Propeller (See T. O. No. 03-20CB-1) to automatically maintain the engine R.P.M. constant at any speed selected by the pilot. It is a self contained assembly which is normally mounted on a special built pad on the nose of the engine, or in some cases on one of the engine accessory pads. The unit's drive is coupled to the engine by a suitable gear ratio to insure that its operating range coincides with the engine's R.P.M. range. It automatically maintains engine R.P.M. constant by changing the blade angles to meet new conditions of altitude, airplane attitude, and throttle setting. The governor control permits the independent setting of engine power and engine speed. This means that with the specified propeller it will permit the engine to develop any selected power at any selected speed and will maintain that engine power and speed throughout all flight conditions until the pilot readjusts the governor controls for some new operating R.P.M.

b. The only limits to this are those imposed by the governing range of the governor and the mechanical stops in the propeller assembly. Under conditions demanding a lower or higher blade angle than is possible within the limitation of the propeller itself, the governor, although trying to hold the R.P.M. constant, is unable to do so because the blades are prevented from assuming a lower or higher angle by their counterweight stops. Under these conditions, the propeller will act as a fixed pitch propeller and the throttle is used to govern R.P.M. as well as manifold pressure.

c. A small gear booster pump is incorporated in the unit. This pump takes oil from the engine lubricating system and increases its pressure to that required for proper operation of the propeller. The oil pressure is regulated by a relief valve through which all oil not actually required to shift the propeller angle is returned to the inlet side of the pump. Only a small quantity of oil is drawn from the engine system, inasmuch as the propeller demands oil only when going to a lower angle or to replace that lost at the shaft transfer rings. Governing action is obtained by flyball forces working against a speeder spring. The metering of oil to and from the propeller cylinder is dependent on the degree of balance which exists between these forces.

d. Engine oil enters the governor unit through the base and is led to the low pressure side of the booster gear pump. As the oil passes through the pump, its pressure is controlled. From the high pressure side of the pump, the oil is led past the relief

valve and into the hollow drive gear shaft, through ports located in the upper portion of the shaft. Whether this pressure oil is permitted to go through the lower propeller ports of the drive gear shaft and out to the propeller, or whether it will circulate through the relief valve, the hollow idler gear shaft, and return to the inlet side of the booster pump, depends upon the position of the pilot valve with relation to the propeller ports. The position of the pilot valve depends, in turn, upon the relation of the centrifugal force generated by the flyballs to the force exerted by the compression of the speeder spring. Under theoretically stable conditions of flight, these two forces are balanced and the pilot valve covers the propeller ports in the drive shaft. If the throttle setting is changed, or if the altitude or attitude of the airplane is altered, or if the pilot desires a different engine speed and changes the constant speed cockpit control setting, the balanced condition which existed between the forces of the flyball and the speeder spring will be disturbed. Any unbalance in the flyball speeder spring forces will allow one of the two forces to over-ride the other and cause the pilot valve to open the propeller ports in the drive gear shaft, either to the position which allows the high pressure oil in the shaft to flow to the propeller cylinder or to the position which allows the oil in the propeller cylinder to drain into the engine sump.

e. Horsepower varies with R.P.M. and manifold pressure. The R.P.M. is controlled, within the limits previously mentioned, by the governor; the manifold pressure is regulated by the throttle.

2. Hydromatic Propeller Governor. (See Figs. 6 to 12 Incl.)

a. General. - (1) The Hamilton Standard Hydromatic Governor for Quick Feathering Propellers is a development of, and is very similar to, the Constant Speed Governor used with the counterweight type propeller. It is used in conjunction with the Hamilton Standard Hydromatic Controllable Propeller (See T. O. No. 03-20CC-1) to maintain constant the speed of the Hydromatic Propeller by causing a change in blade angle to meet changing conditions of altitude, airplane attitude and throttle setting. This unit is suitable for mounting on the special built-in pad on the nose of the engine.

(2) The unit consists of the same gear type booster pump which boosts the engine oil from engine pressure to higher pressures required to operate the propeller blade angle changing mechanism. A pilot valve controls the flow of oil to and from the propeller, and is actuated by the same spring balanced flyballs used in the governor for the counterweight type propeller. The minimum limit of the governing range of the unit is set by the low R.P.M. adjusting screw in the speed adjustment rack. The relief valve plunger has been modified to permit the force of the relief valve to be supplemented by the force of engine oil pressure, thus the relief valve will operate at a pressure equal to engine oil pressure plus

the spring pressure. A transfer valve has been provided in the base of the unit through which passes the high pressure oil for the feathering and unfeathering operations of the propeller.

(3) The size, weight, and general shape of the Hydromatic Governor is the same as that of the Standard Governor. The method by which the oil enters and passes through the gear pump and is delivered into the hollow portion of the drive gear is the same as that of the Standard Governor.

b. Feathering Controls. - Feathering of the Hydromatic Propeller Blades is accomplished by an auxiliary high pressure system with manual control. The high pressure is admitted to the propeller through an automatic valve located in the base of the governor.

SECTION III

DETAILED DESCRIPTION

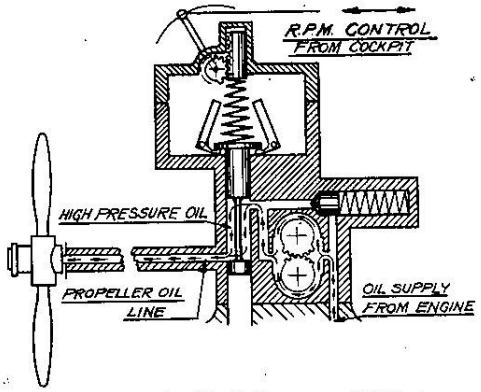
1. Constant Speed Propeller Governor.

a. Figure 13 indicates three states of balance and unbalance for three different operating conditions. The first, "On-speed", is the condition which exists when the factors in flight are constant: i.e., the airplane is flying level at a selected R.P.M. and manifold pressure. There is no tendency for any change in the desired engine R.P.M. The flyballs are turning at a constant speed and exerting a constant force against the balancing compression of the speeder spring. The propeller ports in the drive gear shaft are just closed by the pilot valve. Since no oil is flowing either to or from the propeller cylinder, the angle of the blades is being held fixed. The arrows show that oil is passing through the booster pump and being by-passed through the relief valve to the inlet side of the pump.

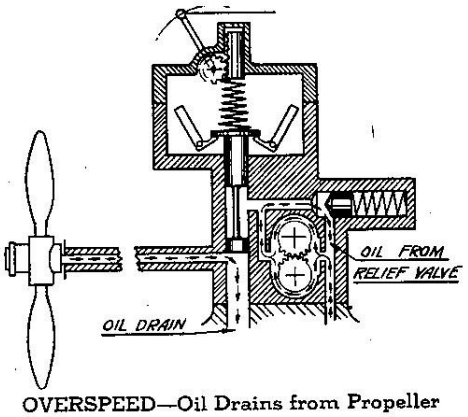
b. The second, "Under-speed", shows what happens when the flyball speeder spring system is thrown into a state of unbalance caused by a small decrease in engine R.P.M. Such a case occurs momentarily when the airplane is pulled up in a steep climb or when the throttle is suddenly moved toward the closed position. Since the flyballs are driven at a definite speed with relation to the engine R.P.M., their rotation will decrease with the decreasing engine R.P.M. This will cause a lessening of their centrifugal force, which will permit the speeder spring to over override the flyballs and force the pilot valve downward. This movement of the pilot valve opens the propeller ports to the high pressure oil. This oil enters the propeller cylinder moving the blades to a lower angle and permitting the engine to regain and hold its R.P.M. at the desired value.

c. The third, "Over-speed", indicates what happens when the engine R.P.M. tend to increase. Such a condition occurs when the airplane is nosed down, or when the throttle setting is increased. With the increase in engine speed there is an increase in the flyball rotational speed and a corresponding increase in centrifugal force. The flyball speeder spring system is thrown out of balance as the force generated by the flyballs overrides the speeder spring load. In moving outward, the flyballs lift the pilot valve and open the propeller ports to the drain position. Oil flows from the propeller cylinder, permitting the blades to assume a higher angle and thus bring the engine R.P.M. back to the desired figure.

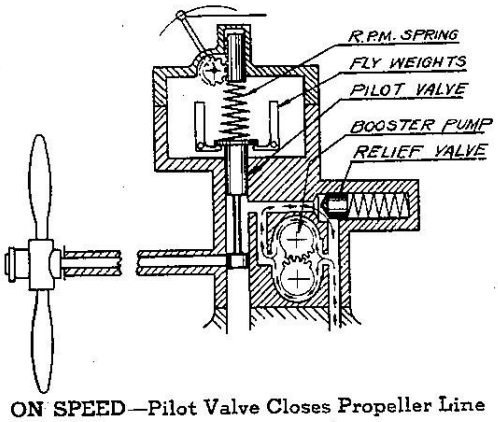
d. Under actual operating conditions, the pilot valve speeder spring system is rarely in the position indicated by the "On-speed". Due to more or less constant changes in altitude, to bumpy air, and to variations in engine H.P. requirements, due to



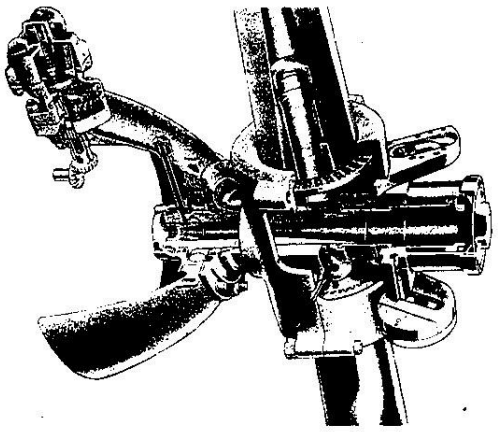
UNDERSPEED—High Pressure Oil Enters Propeller Line To Decrease Pitch



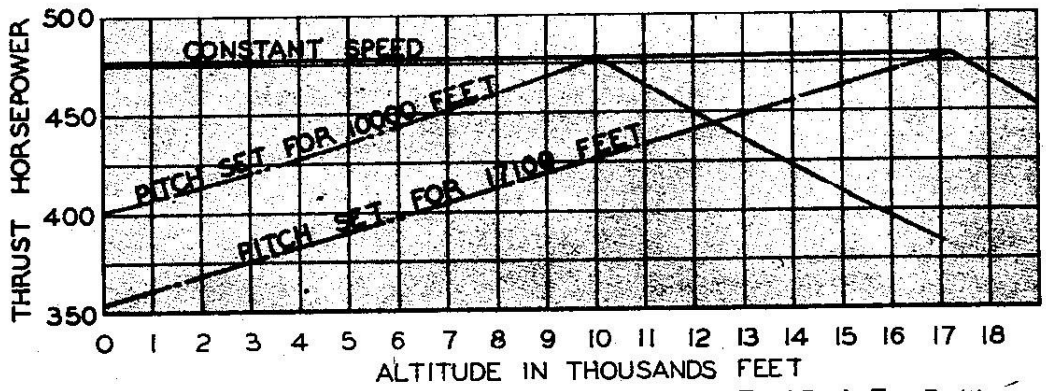
OVERSPEED—Oil Drains from Propeller To Increase Pitch



ON SPEED—Pilot Valve Closes Propeller Line To Maintain Pitch



Cut-away View of Constant Speed Propeller Installation



Typical Comparison of Horsepower Available in Level Flight with Fixed Pitch, Two-Position Controllable, and Constant Speed Propellers.

FIG. 13—SCHEMATIC OPERATION OF CONSTANT SPEED PROPELLER GOVERNOR

maneuvers of the plane, the governor is continually operating to make corrections in propeller blade angles necessary to maintain the engine R.P.M. constant. It is rarely possible to have the balanced condition indicated in the "On-speed", as there is a continual leakage of oil in the engine transfer rings. Since the angle of the propeller blades is regulated by the volume and pressure of oil in the propeller cylinder, it is necessary to supply an additional amount of oil equal to that lost through the transfers in order to hold the blades at a desired angle. To accomplish this, the propeller ports in the governor drive shaft must be "cracked" open. The extent of this opening depends on the amount of transfer ring leakage.

2. Hydromatic Propeller Governor.

a. Figure 14 illustrates the positions and functions of the various parts of the governor during the "On-speed", "Under-speed", "Over-speed", and in and out of feather conditions.

b. The "On-speed" condition as illustrated in "C" exists when the flyball and spring forces are in balance, causing the pilot valve to close the line to the propeller and maintain a given blade angle. Both the pressure and drain ports are closed during this condition. All the oil from the gear pump is being by-passed through the relief valve back to the inlet side of the pump.

c. The "Under-speed" condition as shown in "A" exists when the speed of the flyballs has been reduced, and the spring force overcomes the force of the flyballs. In this condition the spring forces the pilot valve down. The upper land of the valve moves below the metering port in the drive gear and cuts off the high pressure oil, and the lower land moves into the recess in the gear and opens the propeller line to drain. When oil drains from the rear of the Hydromatic propeller piston, the blades assume a lower angle and permit the engine speed to return to the original value, and the flyballs and speeder spring in the control unit return to a balanced state as shown in the "On-speed"condition.

d. In the "Over-speed" condition, as shown in "B" the flyball speed has increased, and their forces have exceeded the force of the speeder spring and the pilot valve is raised. The upper land on the valve then opens the ports through which the high pressure oil flows and the lower land closes the drain. Since oil to the rear of the propeller piston increases the blade angle, the engine speed is thus reduced, and the flyball spring forces return again to a balanced state as shown in the "On-speed" condition.

e. During the feathering and unfeathering operations of the propeller, high pressure oil from an auxiliary source is supplied to the propeller through a transfer valve in the base of the governor. The function of this valve is to cut off oil from the unit to

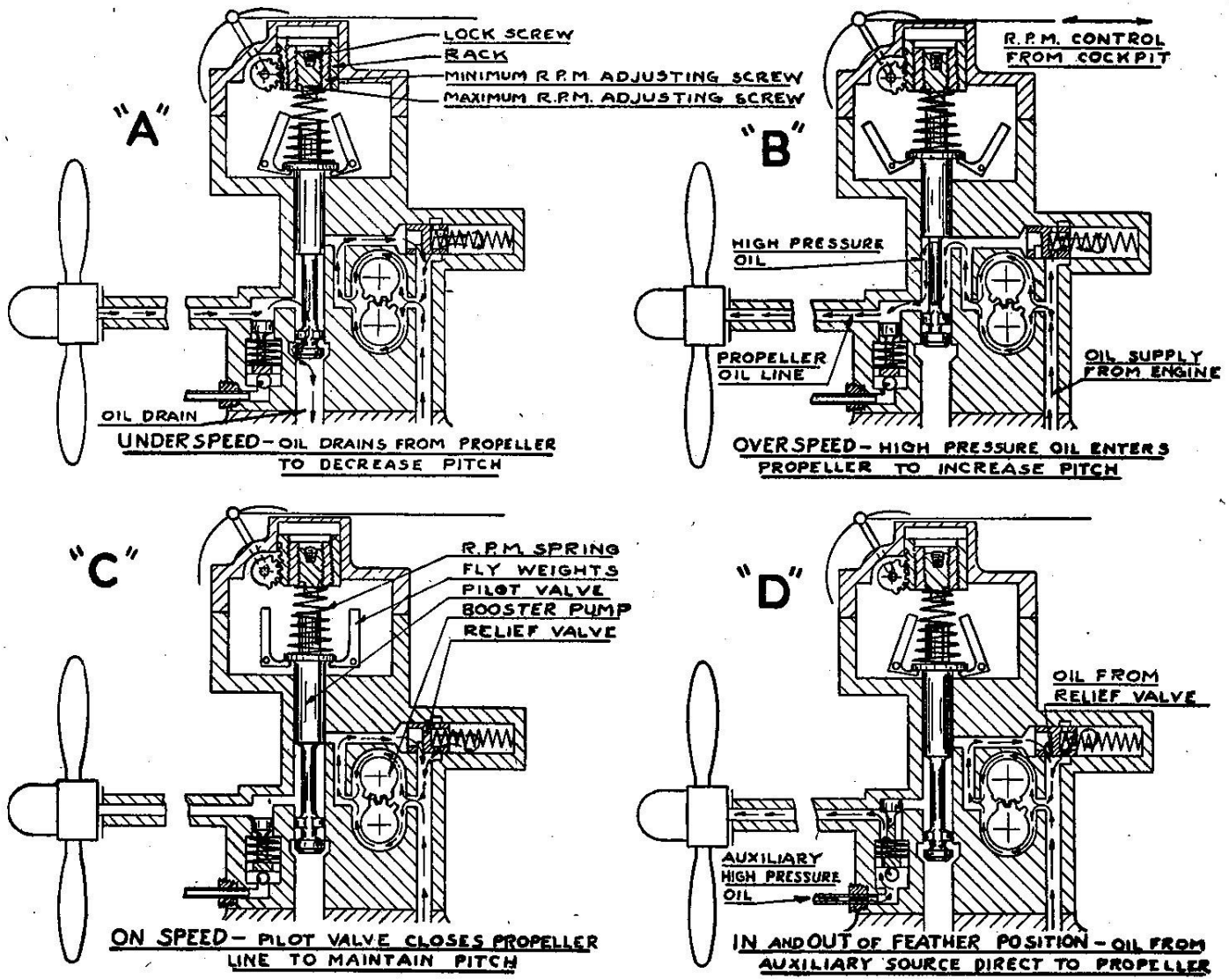


FIG. 14 – SCHEMATIC OPERATION OF HYDROMATIC PROPELLER GOVERNOR

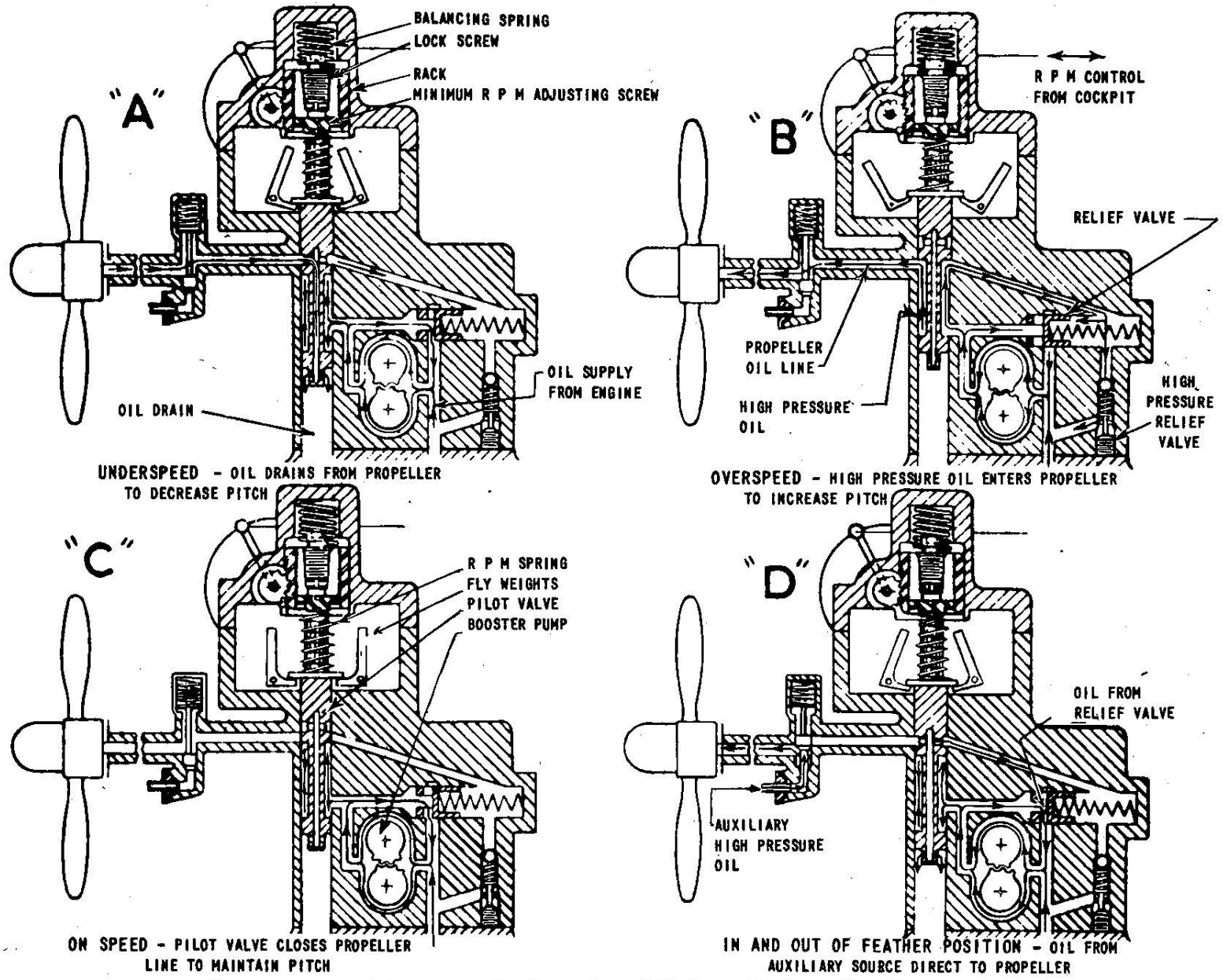


Figure 15 - Schematic Operation of Hydromatic Propeller Governor

the propeller and open the passages through the engine nose to the high pressure feathering oil. The valve assembly consists of a plunger, a return spring, and a ball check. The auxiliary high pressure oil forces the plunger against the spring as shown in "D". When either operation is completed, and the pressure at the source of the auxiliary oil supply is reduced, the spring returns the ball to its seat and reopens the propeller line to governor oil.

3. Double Capacity Hydromatic Type Governor.

a. In order to meet the requirements for a higher rate of pitch change for certain specified propeller installations, a governor of increased output was designed. This governor has a nominal capacity of 16 qts. per minute at 1750 R.P.M. against a back pressure of 150 p.s.i. as compared with the 8 qts. capacity of the "Standard" governor under the same conditions.

b. Although the general operating principles remain unchanged, the body and base assemblies have been redesigned to incorporate the higher capacity booster pump. The head assembly is the same as is used on other Hydromatic governor models and the mounting and drive of the base is so arranged that the governor fits the AN Standard engine drive pad. The high pressure feathering fitting and transfer valve assembly is incorporated in the body rather than in the base and the pressure relief system has been modified.

c. Inasmuch as the design and construction of the "Double Capacity" governor is comparable to constant speed controls in general use, no maintenance or operating difficulties should be experienced by operators familiar with installation and overhaul of other model governors.

4. Pressure Relief System Used in Double Capacity Hydromatic Type Governor.

a. Basic Models Nos. 2G8- 2G10- 2H8- 2H10-
3G8- 3G10- 3H8- 3H10-
4G8- 4G10- 4H8- 4H10-

b. The capacity of the governor pump is nominally 16 qts. per minute and the spring loaded valves are designed to handle this high capacity with no delivery to the propeller at a low power input. It will be noted that the booster pump output is delivered into the chamber surrounding the pilot valve. Figure 15. When the pilot valve is in the "Over-speed" position "B", the output of the pump is delivered to the propeller and also against the relief valve. Oil is also delivered from the pilot valve to the spring side of the relief valve. In this case the pressure on either side of the relief valve is approximately equal and the spring force behind the relief valve, equivalent to about 50 p.s.i., holds the relief valve closed.

c. If, during "Over-speed" correction, the propeller piston should reach the end of its travel as established by the location of the high blade angle stop, the pressure in the propeller line would increase. This increase in pressure would also be effective against the high pressure relief valve and, when sufficient, would cause it to open into the engine pressure line. It will be noted that the passage from the pilot valve to the spring side of the relief valve is small causing a pressure drop of approximately 50 p.s.i. at a flow of approximately 2 1/2 qts. per minute through this passage. This produces a pressure differential across the relief valves sufficient to cause it to open and by-pass the remaining booster pump output into the engine pressure system.

d. When the pilot valve drops so that oil pressure is not being delivered to the propeller line, there is no pressure on the spring side of the relief valve. The valve then by-passes the full pump capacity at a pressure of approximately 50 p.s.i. This calls for very low power input to the governor drive during "Under-speed" operation including feathering and unfeathering, "A" and "D".

e. The "On-speed" power input will be a function of the oil pressure required to maintain constant speed. The average power input will be somewhat less than that required during "Over-speed" operation.

f. The only pressure adjustment on this system is the high pressure relief (dump) valve. The adjusting screw is found in the governor base at the parting line between the base and the engine pad. A pressure gage should be installed in the governor output line and the high pressure relief valve screw so adjusted that the maximum differential between governor and engine pressure is 330 to 350 p.s.i.

g. The fit between the threads of the adjusting screw and those in the base is intended to prevent change in adjustment. Any leakage past the threads of this screw is stopped by the gasket between the base and the engine pad.

SECTION IV

OPERATION INSTRUCTIONS

1. Constant Speed Propeller Governor.

a. Ground Run-Up. - (1) After the first thirty seconds of operation with the propeller in the full low R.P.M. position, the propeller governor cockpit control will be set in the increase R.P.M. position. With the engine R.P.M. lower than those for which the cockpit control is set to govern, the speeder spring will override the flyballs and hold the propeller ports open to the booster pump high pressure oil. The propeller will be in full high R.P.M. position and the engine R.P.M. will vary with the engine horsepower output until the engine R.P.M. for which the cockpit control has been set is reached. Magnetos may be checked under this condition by watching the tachometer for drop in R.P.M. while the magneto switch is turned.

(2) Before take-off, the operation of the governor and the propeller should be checked. This may be done by moving the cockpit control from the increase R.P.M. position to the decrease R.P.M. position and watching the propeller cylinder move back toward the hub, or by noting the drop in R.P.M.

b. Take-off and Climb. - (1) The propeller governor cockpit control is moved to the increase R.P.M. position. As the airplane increases from zero speed, at the start of the take-off, toward flying speed, and as the manifold pressure is increased, the engine R.P.M. will increase until it reaches the amount for which the high R.P.M. limit stop has been set. From this point on the R.P.M. will be held constant by the governing action of the unit. This means that full power is available during take-off and climb without the danger of excessive engine speed.

(2) Soon after take-off, it is generally desirable to reduce both the manifold pressure and the R.P.M. Since the manifold pressure for take-off is very near the maximum allowed by the engine manufacturer, and since it would increase if the R.P.M. were decreased, the logical sequence is to reduce the manifold pressure first and then the R.P.M. All movements of the throttle and governor cockpit control should be done slowly.

c. Cruising. - Once the R.P.M. has been brought to the desired tachometer reading, it will be held constant by the governor. Since changes in the plane's attitude and altitude, as well as changes in the engine's manifold pressure, can be made without altering the R.P.M., it is recommended that if any changes in the cruising R.P.M. or manifold pressure are desired that the R.P.M. be first set to the new value and then the manifold pressure be brought to its setting. This is especially true of multi-engine installations. Once the propellers have been brought into synchronism, the manifold pressures may be altered without causing any change in

R.P.M. or necessitating re-synchronizing.

d. Single Engine Performance. - If, for any reason, it is necessary to cut out an engine, the control for the propeller on the idle engine should be placed in full low R.P.M. position. In this position, the propeller is in positive high pitch and has less drag. This is important because the single engine performance of some of our modern planes is based on the assumption that the idle propeller is in this position.

e. Oil Line Failure. - On some installations, external oil lines are run from the governor to the propeller oil supply connection. If a failure of the high pressure line should occur, the oil leak may be checked by placing the cockpit control in the full low R.P.M. position. In this position, the pilot valve in the unit is mechanically held above the propeller ports of the drive gear shaft. The only oil which can flow through the ports, under this condition, is the small amount which will leak past the pilot valve.

f. Mixture Control. - Since the governor holds the engine R.P.M. constant regardless of engine power output, the mixture can no longer be adjusted by watching the tachometer, except when the propeller control has been placed in the full low R.P.M. position and the propeller blades are fixed against their high angle stop.

2. Hydromatic Propeller Governor.

a. Ground Run-Up. - (1) This is done with the governor cockpit control in the take-off position. With the engine R.P.M. lower than that for which the governor is set to govern, the speeder spring will override the flyballs and close the ports to booster pump pressure and open the propeller line to drain.

(2) The propeller will be in full low angle position and the engine R.P.M. will vary with the engine horsepower output until the engine R.P.M. for which the cockpit control has been set is reached. Magnetos may be checked under this condition by watching the tachometer for drops in R.P.M. as the magneto switch is turned.

(3) Before take-off, the operation of the governor should be checked. This may be done by moving the cockpit control from the take-off toward the low R.P.M. position and noting the drop in R.P.M.

b. Take-off and Climb. - (1) The governor cockpit control is moved forward to the take-off position. As the airplane increases from zero speed, at the start of the take-off, toward flying speed, and as the manifold pressure is increased, the engine R.P.M. will increase until it reaches the R.P.M. for which the governor has been set. From this point on the R.P.M. will be held constant by the governing action of the unit. This means that full power is available during take-off and climb without excessive engine speed.

(2) Soon after take-off, it is generally desirable to reduce both the manifold pressure and the R.P.M. Since the manifold pressure for take-off is very near the maximum allowed by the engine manufacturer, and since it would increase cylinder pressures if the R.P.M. were decreased, the logical sequence is to reduce the manifold pressure first and then the R.P.M. All movement of the throttle and governor cockpit control should be made slowly.

c. Cruising. - Once the R.P.M. has been adjusted to the desired tachometer reading, it will be held constant by the governor. Changes in the plane's attitude and altitude, as well as changes in the engine's manifold pressure, can be made without altering the R.P.M. If any changes in the cruising R.P.M. or manifold pressure are designed the R.P,M. will be first set and then the manifold pressure changed.

d. Single Engine Performance. - If, for any reason, it is necessary to cut out an engine in flight, the propeller on the idle engine should be feathered. In this position the propeller is stopped and has minimum drag. This is important because single engine performance of some modern planes is based on the assumption that the idle propeller is in this position.

e. Oil Line Failure. - In case of failure of high pressure oil line (feathering line) or an oil leak between the governor and the propeller, the cockpit control should be placed in the maximum speed position. The engine must be throttled until the speed is at some point below the maximum or take-off engine speed. Under these conditions the oil to the propeller is cut off by the pilot valve in the governor and the blades go to full low angle position.

f. Mixture Control. - Since the governor holds the engine R.P.M. constant regardless of engine power output, the mixture can no longer be adjusted by watching the tachometer when the governor has been placed in minimum R.P.M. position. It is impossible to put the blades in full high angle position when the mixture is to be checked. It is recommended that governor be used in conjunction with some automatic means of regulating the fuel air ratio, such as an automatic carburetor, or a fuel-air ratio analyzer.

3. Possible Causes of Poor Synchronization.

One of the major causes of synchronization complaints appears, as a result of experience in numerous cases, to be power variations between engines. Although most of the accumulated data are not clear in this regard, in numerous instances, poor synchronization has been traced definitely to either faulty carburetion or faulty ignition. When synchronization troubles are encountered, careful checks should be made of the spark plugs, ignition harnesses, and magnetos, and in addition, the induction system should be checked for possible poor distribution or other causes or power fluctuations. Each should be checked separately if it is desired to determine the cause. In

addition to the factors mentioned above, the following are possible causes of poor synchronization.

a. Air in the Propeller System. - In some instances, faulty propeller operation has been traced to the presence of air in the propeller oil system. Air, being compressible, causes a delay in the start and a reduction in the rate of pitch change. Such a condition would be enccuntered only immediately after installation of the propeller and before a number of pitch changing cycles had occurred. Care should therefore be taken to expel the air trapped during installation by moving the governor control to the full high and the full low R.P.M. positions, several times during the run-up, with sufficient throttle to make the piston in the propeller travel the major portion of the constant speeding stroke, displacing oil on both sides of the piston, and thereby eliminating the majority of the trapped air.

b. Variation in Transfer Leakage. - Faulty propeller operation and poor synchronization can result from poor sealing at the oil transfer bearing of the propeller shaft. Variations in leakage may arise from oil temperature differences between engines, or dimensional clearance differences of the oil transfer bearings. In cases marked synchronization troubles occur, a check should be made to determine the leakage rates of two engines, it is important of course that the tests be run under the same conditions of oil viscosity, temperatures, pressure and R.P.M. The difference in the rate of leakage past the transfer rings in any two engines should not exceed approximately 75 pounds per hour. For the best propeller operations, the maximum rate of leakage in any engine should not exceed 150 pounds per hour using SAE #50 at (71.1°C.) (160°F.) at 150 p.s.i. pressure with the propeller shaft turning at 1000 R.P.M.

c. Control Linkage.

(1) Difficulty in obtaining synchronization may be caused by malfunctioning of the control linkage in any one of the following respects:

(a) Original maladjustment.

(b) Excessive backlash.

(c) Short control lever making fine adjustments of speed impossible.

(d) Excessive deflection of structure supporting controls when adjusted to control or flight loads.

(2) Consideration of these factors is often helpful in correcting unsatisfactory operation.

d. Rough Air. - It is believed wothwhile to note that apparent lack of synchronization can result from a change in flight conditions. If, for instance, the airplane has been flying in smooth air and encounters, an air disturbance over rough terrain, the Constant Speed Controls will obviously be working to a greater extent in an effort to maintain constant R.P.M. The increased demand will undoubtedly be evidenced by slight "out of synchronization" from time to time. This is probably one of the reasons for the variation in reports referred to in the second paragraph.

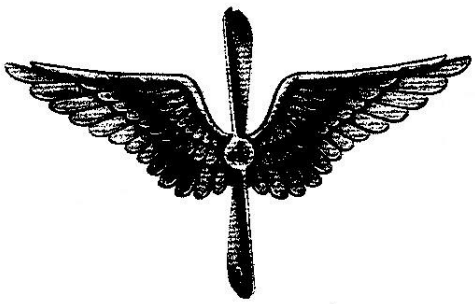
e. Other Possible Causes. - (1) A governor relief valve stuck in the unloading position will cause a drop in the pressure available to operate the propeller, thereby causing sluggish pitch changing action. To eliminate this possibility, the relief valve plunger should be checked to see that it slides freely in its bushings, and seats properly in the body of the governor.

(2) A sticky pilot valve or fly ball will affect the sensitivity of the Constant Speed Control and cause a delay in the correction of an off-speed condition. This possibility can be eliminated by a check of the pilot valve to see that it slides and rotates within the drive gear and that it is free from carbon deposited by the oil system, and a check of the governor fly balls to insure that they move freely about their pivot point.

(3) If the inherent friction of one propeller differs very greatly from that of the other, the rates of pitch change will vary to some degree. This will result in an "out of synchronization" condition. This is not a very great possibility because the inherent friction of the propeller is relatively small in comparison with the propeller operating forces. The suggested check for such a condition is an examination of the propeller for signs of excessive wear, and to insure that the blade torques are adjusted within the proper limits.

HANDBOOK
OF
SERVICE AND OVERHAUL INSTRUCTIONS
WITH
PARTS CATALOG
FOR THE
CONSTANT SPEED PROPELLER GOVERNORS AND CONTROLS
AND
HYDROMATIC CONSTANT SPEED PROPELLER GOVERNORS AND CONTROLS
MANUFACTURED BY
HAMILTON STANDARD PROPELLER CO.
EAST HARTFORD, CONN.

NOTE: Reference to periodic inspections specified in Section IV, will be entered where applicable, on A.A.F. Forms 41-A.



PUBLISHED BY AUTHORITY

OF

THE COMMANDING GENERAL, ARMY AIR FORCES

BY

THE AIR SERVICE COMMAND

AIR FORCE SECTION

WRIGHT FIELD

DAYTON, OHIO

SEPTEMBER 20, 1941

FOTO-LITH, INC.
11-28-42-12000

Revised 8-30-42

Index of revision pages issued

Pages	Latest Revised Dates
27	8-30-42
28	8-30-42
28A	8-30-42
29	8-30-42
30	8-30-42
31	8-30-42
32	8-30-42
32A	8-30-42
33	8-30-42
34	8-30-42
35	8-30-42
36	8-30-42
36A	8-30-42
37	8-30-42
83	8-30-42

NOTE: The symbol ø denotes that portion of a paragraph or page which has been revised. This symbol has not been used where the entire page is revised.

INDEX

INDEX

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

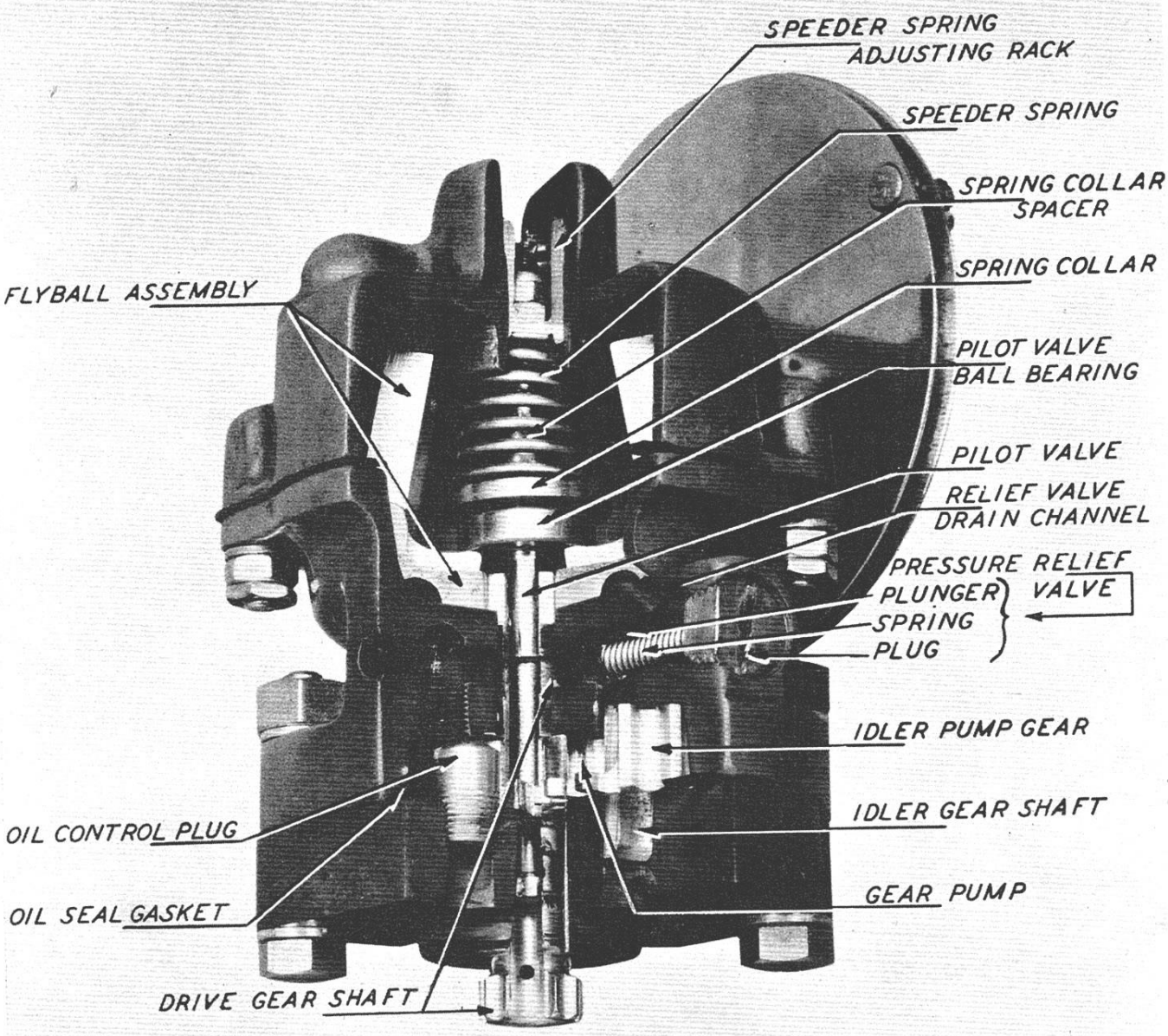


FIG. 1 - CUTAWAY VIEW - MODEL 1A1 GOVERNOR

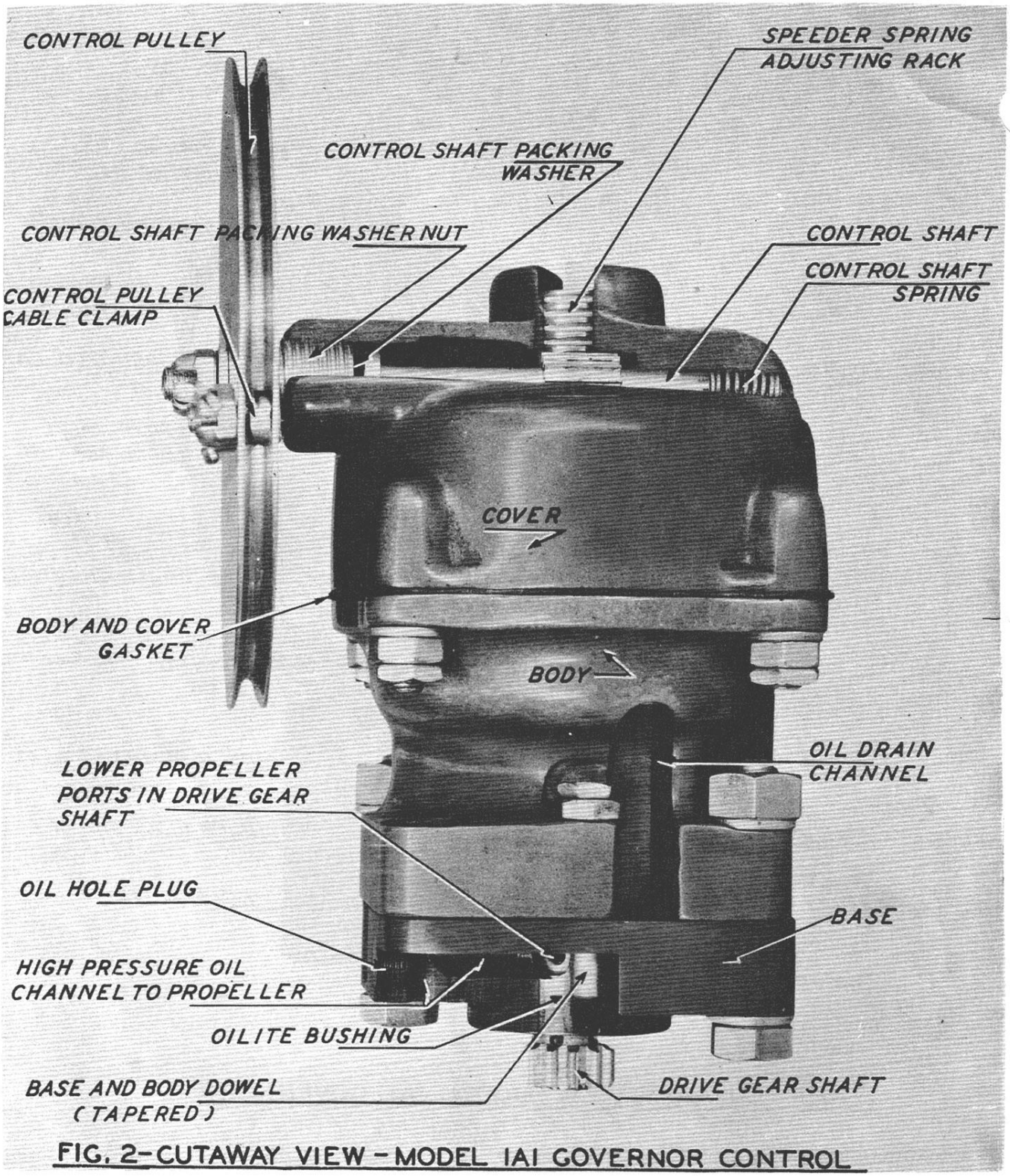


FIG. 2-CUTAWAY VIEW - MODEL IAI GOVERNOR CONTROL

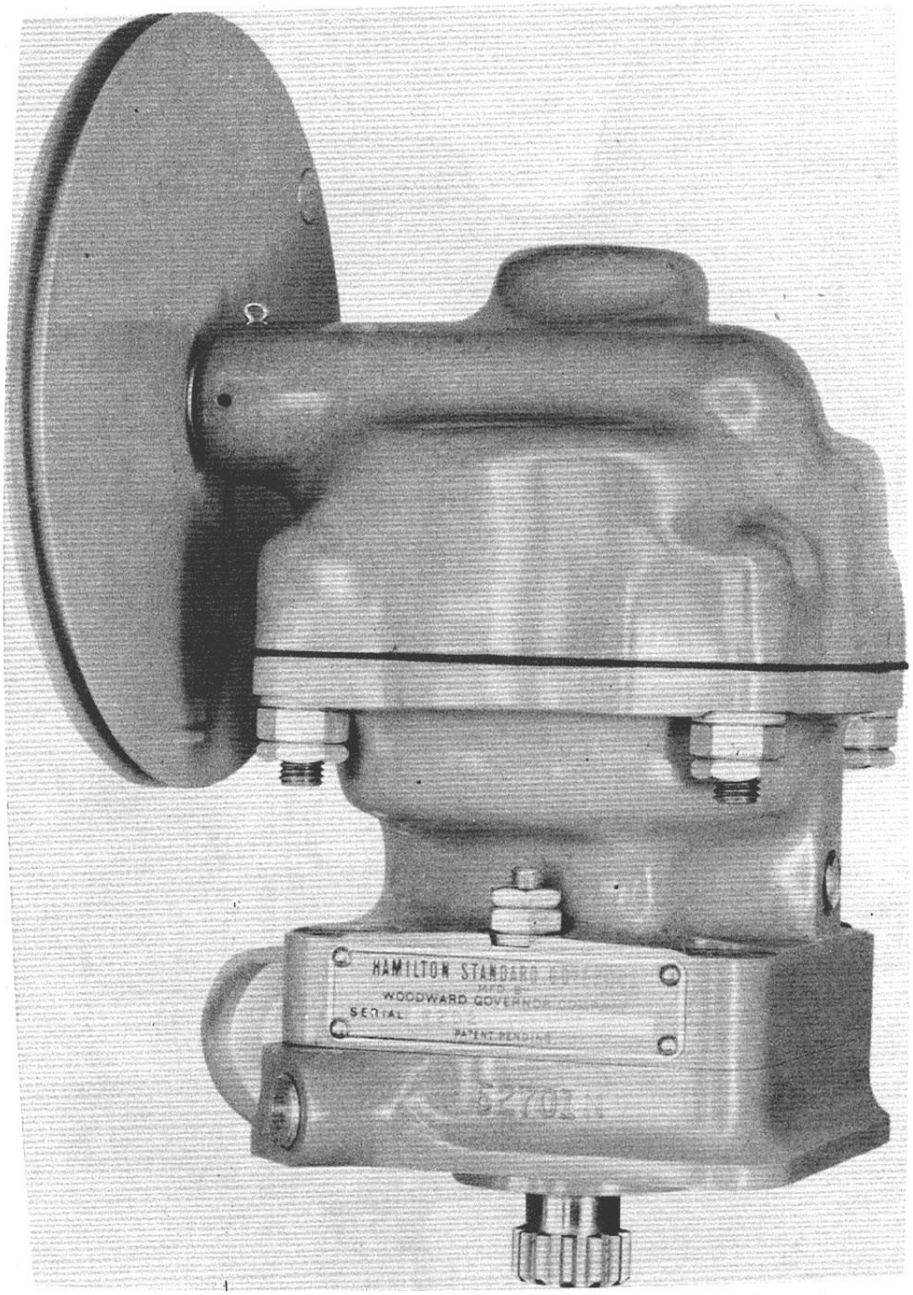


FIG. 3—GOVERNOR ASSEMBLY (RIGHT)
MODEL 4B6-C-4

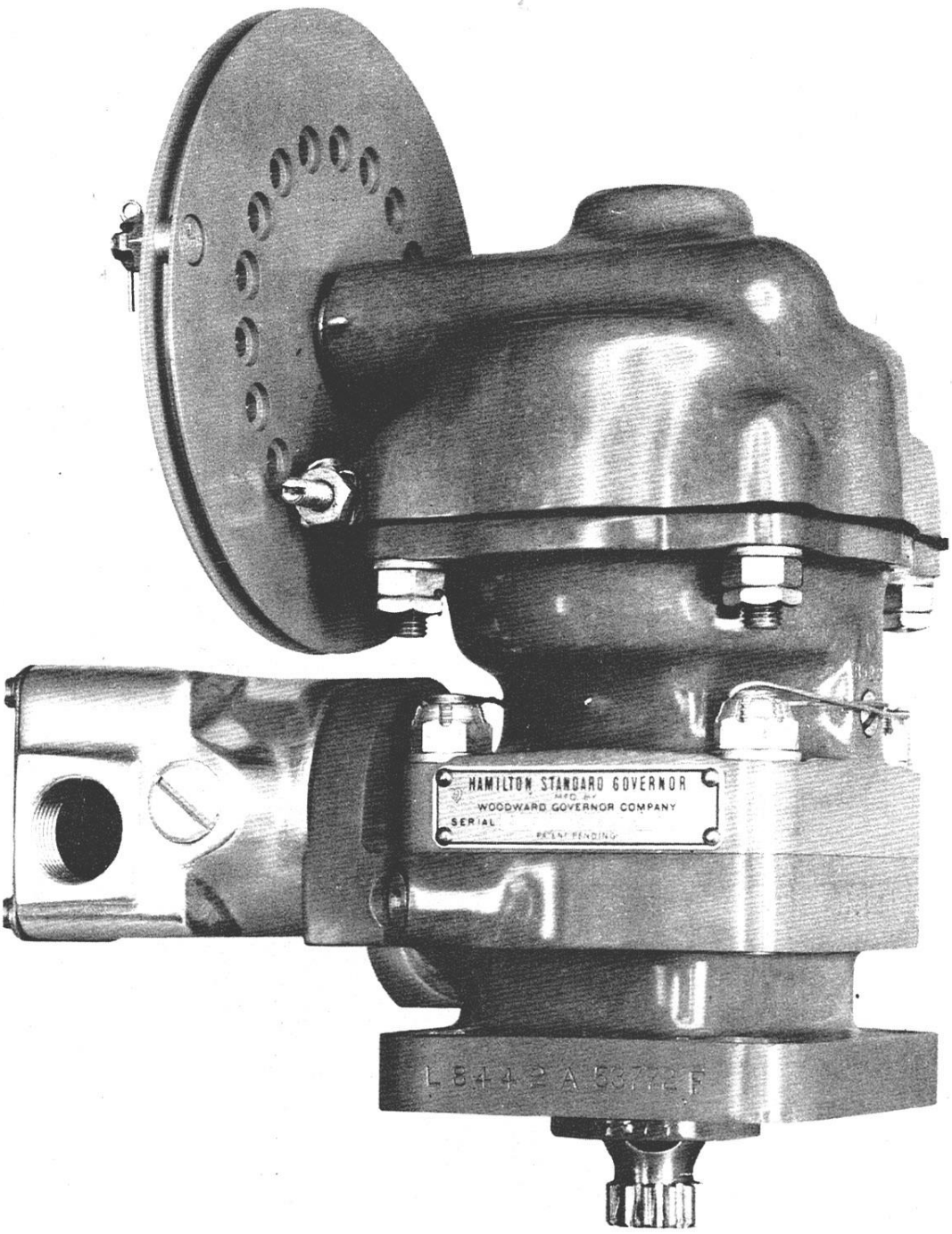


FIG. 4—GOVERNOR ASSEMBLY (LEFT)
MODEL 4K11-D

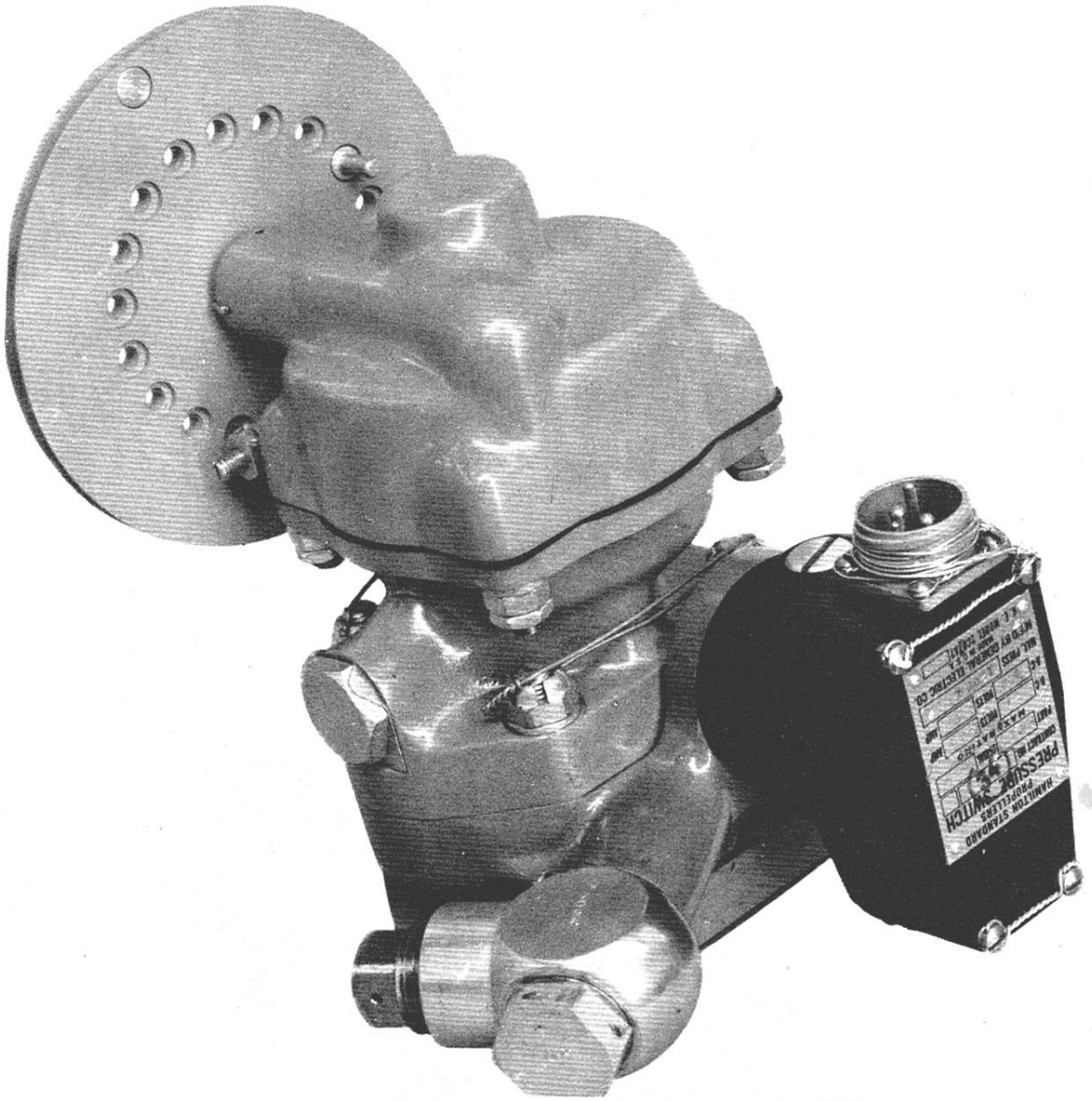


FIG. 5—GOVERNOR ASSEMBLY WITH PRESSURE SWITCH CONTROL—MODEL NO. 4K11-BOB

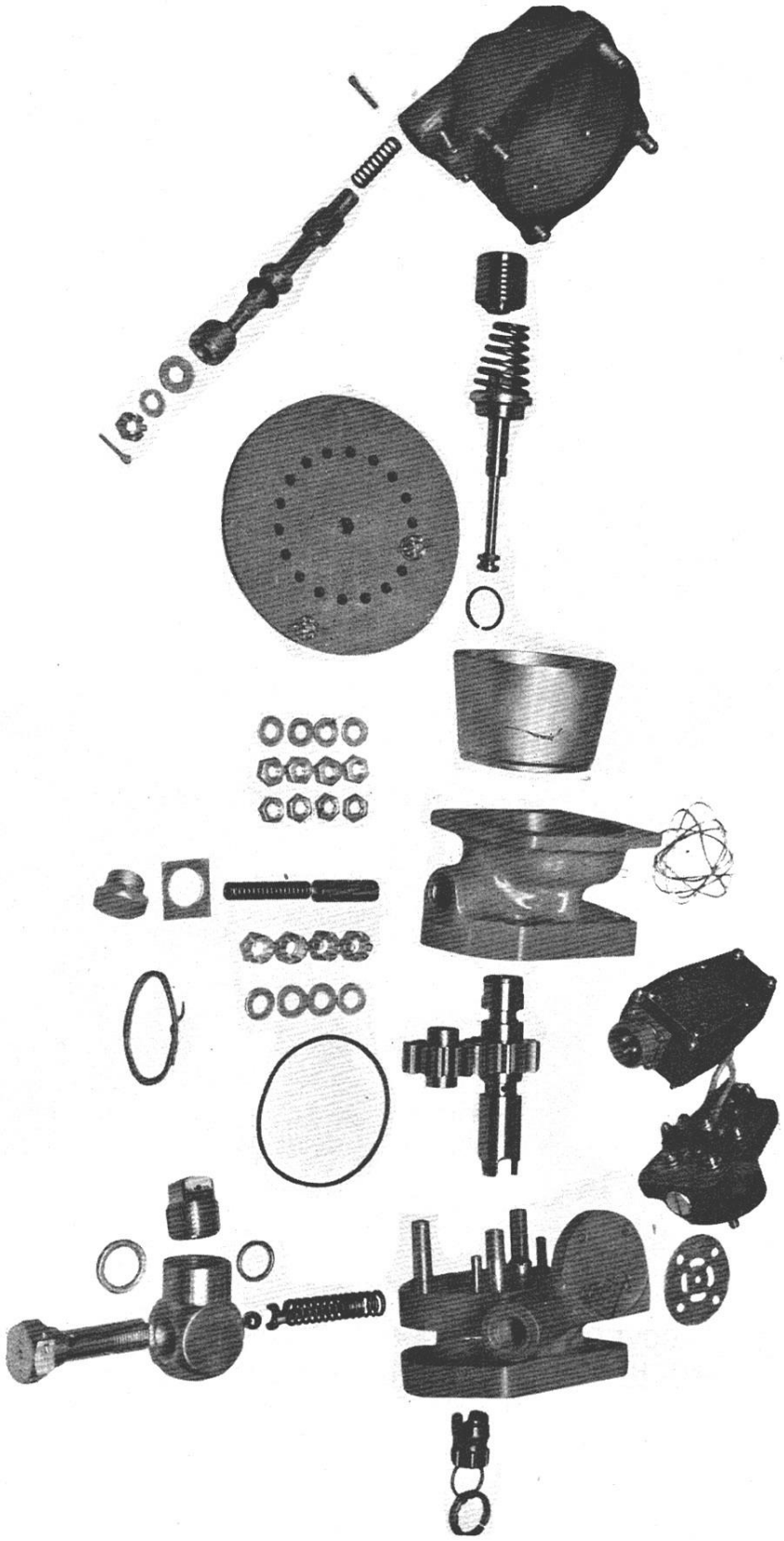


FIG. 6—EXPLODED VIEW—GOVERNOR 4KII-SERIES

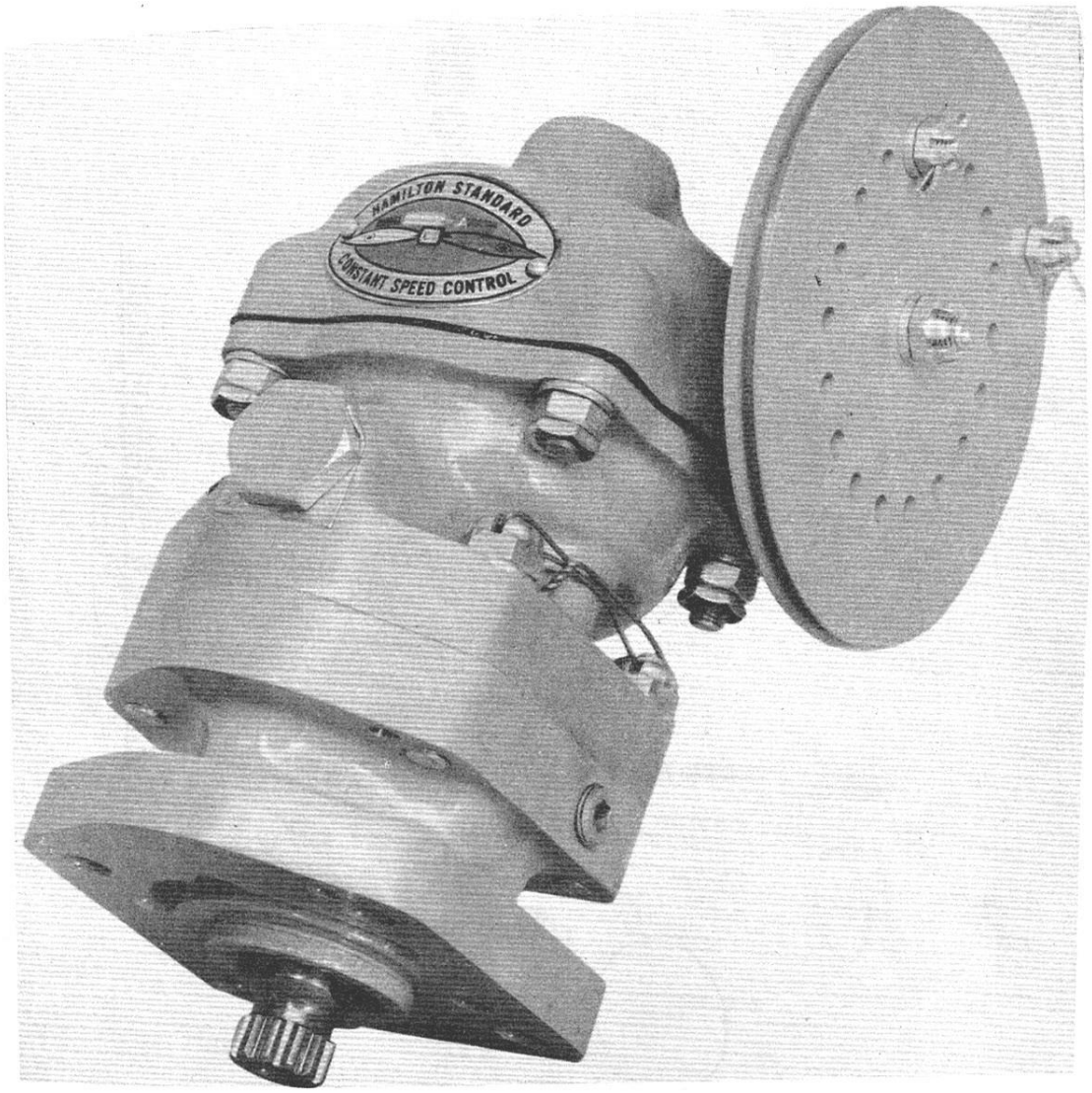


FIG. 7—GOVERNOR ASSEMBLY
MODEL I P12-A

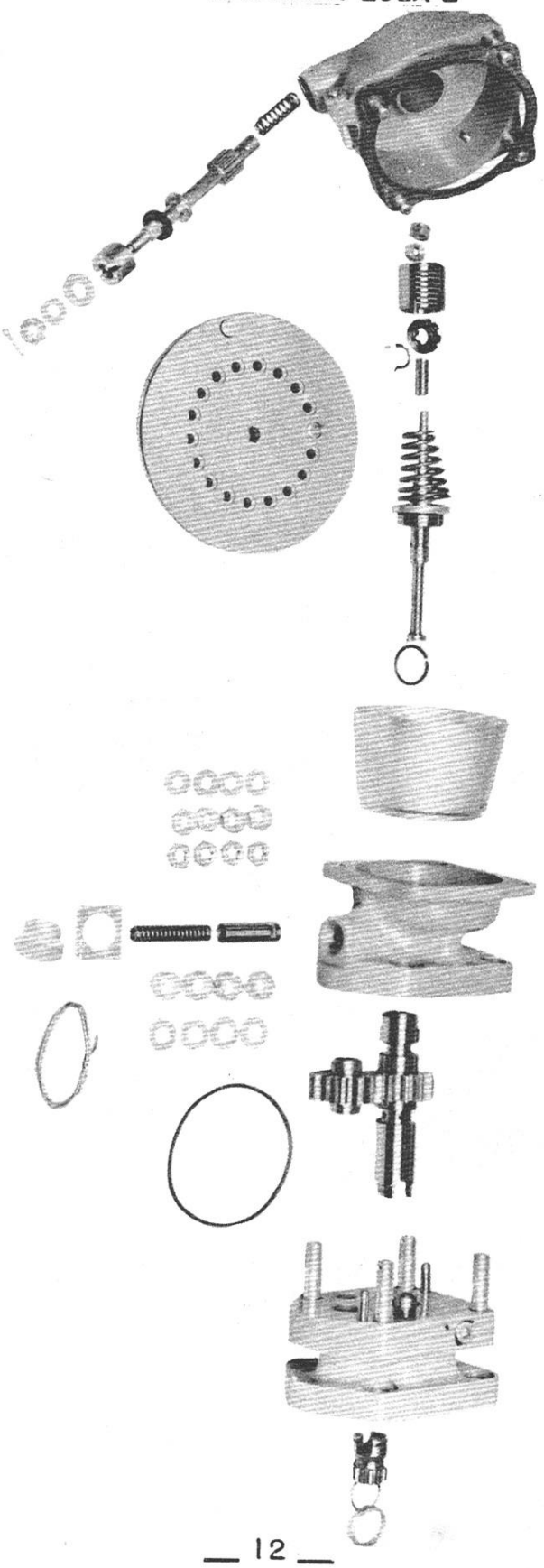


FIG. 8—EXPLODED VIEW—GOVERNOR MODEL NO.1 P12-A

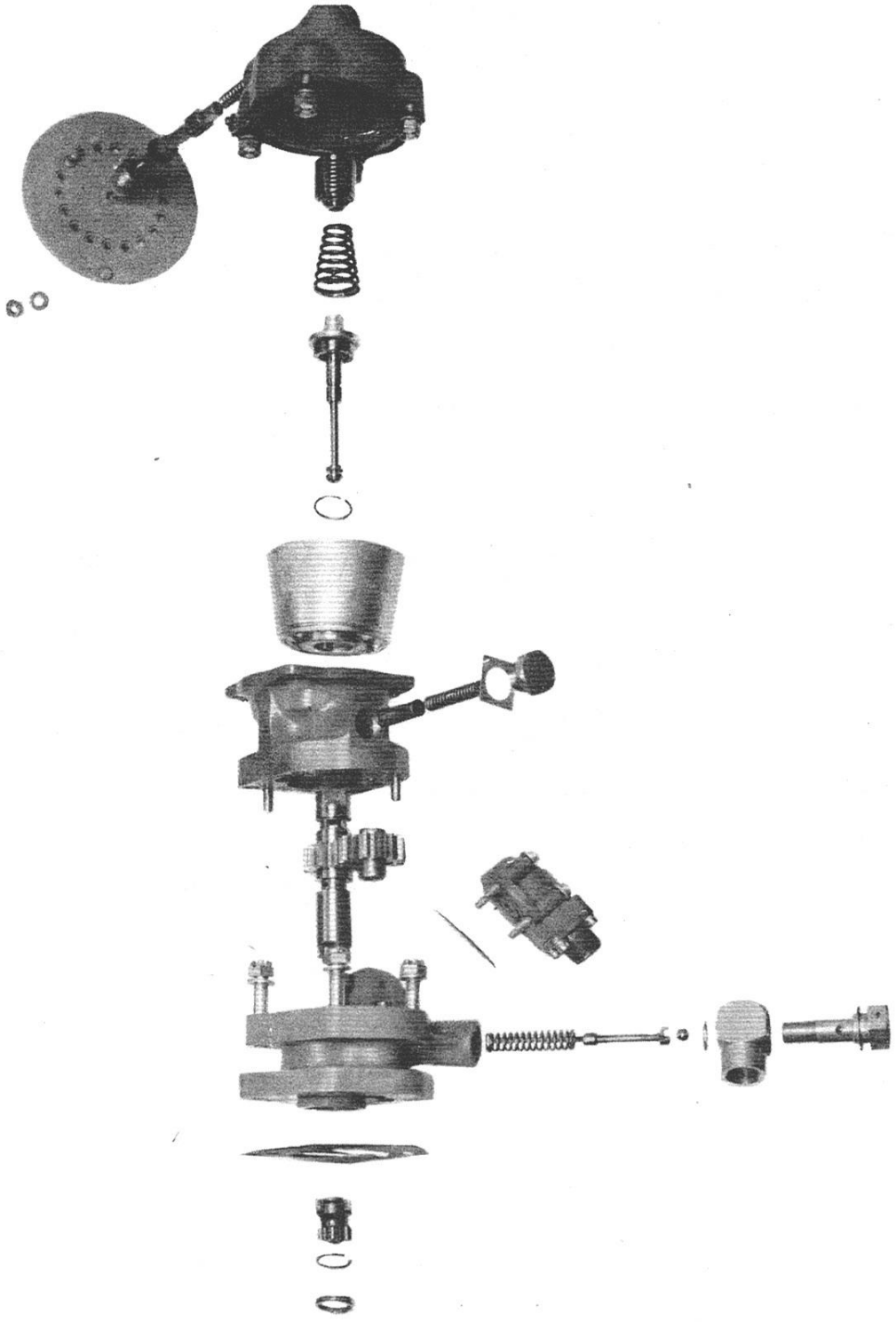


FIG. 9 —EXPLODED VIEW——MODEL 4KII-BOJ HYDRO-MATIC GOVERNOR

SECTION I

INTRODUCTION

1. The governor is a device which is used in conjunction with the Hamilton Standard Controllable Propellers (see T. O. No. 03-20CB-1 and 03-20CC-1) to automatically maintain the engine R.P.M. constant at any speed selected by the pilot.

2. This Handbook is to be read by all personnel who are required to maintain and overhaul constant speed propeller governors and hydromatic constant speed governors. For the operation of this equipment, see T. O. No. 03-20CA-1.

3. Reference has been made in this Handbook to the following Technical Orders which contain applicable data and instructions:

T. O. No.	
03-20CB-1	Operation & Flight Instructions - Hamilton Two Position and Constant Speed Controllable Propellers.
03-20CA-1	Operation & Flight Instructions for Constant Speed Propeller Governors.
03-20CC-1	Operation & Flight Instructions for Hamilton Hydromatic Controllable Propellers.
03-5-15	Push Button Control Switch.
03-20CA-6	Pressure Cut-out Switches.

SECTION II

DESCRIPTION

1. Constant Speed Propeller Governor.

a. Case. - The case consists of three parts: i.e., Base, Body and Cover. They are machined accurately from aluminum forgings and special aluminum castings. Before assembly, they are anodized to prevent corrosion.

b. Booster Gear Pump. - (1) This consists of the Drive Gear Shaft, the Idler Gear, and the Idler Gear Shaft.

(2) The Drive Gear Shaft is made from molybdenum steel. It is through this shaft that the gear pump and the flyball assembly are driven. One end of the shaft has twelve splines which are designed to fit the engine drive coupling. Above and below the spur gear portion of the shaft are bearing surfaces and located at each of these are oil ports. The upper ports permit the high pressure oil from the booster pump to enter the drive gear shaft. The lower ports are open to the propeller oil line. The bearing surfaces and the inner walls of the shaft are held to close tolerance limits.

(3) The Idler Gear is made from molybdenum steel. The Idler Gear is supported by the Idler Gear Shaft. This shaft is hollow and is made from cast iron. Cast iron is used to provide a satisfactory bearing surface for the idler gear. The pump gear wear is evenly distributed by using thirteen teeth on the drive gear and fourteen teeth on the idler gear.

c. Relief Valve Assembly. - This assembly consists of a Bushing, Plunger, Spring, and Plug. The Bushing is made from hardened carbon steel and is a press fit in the body. It acts as a guide for the Plunger. The tolerance limit between the bushing and the plunger, which is made from hardened carbon steel, is held to very close limits. The O.D. of the outer end of the bushing is reduced and the end slotted. This permits any oil which may work past the plunger to have access to the relief valve drain channel. The Spring is inspected for flatness and must, when the tapered Plug is screwed tightly into the body, relieve at 180-200 pounds. This relief pressure requires adjustment only at overhaul periods.

d. Pilot Valve - Speeder Spring Assembly. - (1) The Pilot Valve is made from a carbon steel which is case hardened. Its upper and lower bearing surfaces are held to tolerance limits of .0002". The upper end of the pilot valve is threaded to fit the

spring collar. Between the threaded portion and the upper bearing surface is located the Pilot Valve Ball Bearing. This ball bearing is a press fit on the pilot valve. The pilot valve is designed to equalize the pressure forces of the oil and permit a balanced valve.

(2) The Spring Collar is made from a carbon steel which is not hardened. It is threaded at the lower end to fit the pilot valve stem and is threaded at the upper end for the pilot valve nut and lock nut. The flange at the base of the spring collar supports the base of the speeder spring.

(3) The Spring Collar Spacer fits over the spring collar spindle. It bottoms against the shoulder on the spring collar and serves to determine accurately the initial compressed length of the speeder spring. There are two lengths of spacers. The combination of one of these spacers and one of the two types of speeder springs gives the governing range of the "A", "C" or "E" units.

(4) The combination of the 50665 Speeder Spring and the 51884 Spacer gives the operating characteristics of the "A" control.

(5) The combination of the SK1651-1 Speeder Spring and the 52146 Spacer gives the operating characteristics of the "C" control.

(6) The combination of the 50665 Speeder Spring and the 52146 Spacer gives the operating characteristics of the "E" control.

(7) The Speeder Spring is of the conical helical type. It is accurately tested for deflection at specified loads to insure satisfactory operation over the governing range of the unit. Its characteristics are definitely determined from theoretical governor design, and establish the correct balance between flyball and spring forces at each R.P.M. in the speed range.

(8) The Speeder Spring Adjusting Rack is made from a hardened carbon steel. The flange in its base is carefully regulated as to thickness and location. The top of the speeder spring rests against the bottom of this flange. The hole in the flange is bevelled and polished to obviate any tendency of the rack to hang or bind as it slides up and down over the spring collar spacer. Parallel teeth on the face of the rack mesh with the gear portion of the control shaft and permit the control shaft to move the rack up and down, thus decreasing or increasing the compression of the speeder spring.

(9) The Pilot Valve Nut screws down on the threaded upper portion of the spring collar spindle and bottoms against

the spring collar spacer. This nut forces the rack down on the speeder spring, giving the spring its initial compression. The fiber-lined Self Locking Nut prevents the pilot valve nut from becoming loose and chattering on the spring collar threads.

e. Control Shaft Assembly. - This consists of a Spring, a Control Shaft, a Leather Washer, and a Nut. The spring is located between the cover space and the inner end of the control shaft. The flanged shoulder of the shaft is continually pressed against the leather washer, preventing oil leakage. Toward the inner end of the control shaft, which is made of nickel chromium, is a fourteen tooth gear. These teeth are designed to mesh with the teeth on the face of the rack. The outer end of the control shaft is hex shaped. This permits the installation of the control pulley or lever. The control shaft retaining nut fits into the cover and is safetied with a cotter key.

f. Flyball Assembly. - This consists of a Flyball Head, a Flyball Head Cup, two Flyballs, and two Flyball Head Hinge Pins. The flyball head is designed to fit on the upper end of the drive gear shaft. On the upper face of the flyball head are hinge bracket type flyballs attached by suitable hinge pins. A flyball head cup is spun on the flyball head and secured by two spot welds. The cup causes the oil, which may accumulate in the head around the flyballs to rotate at the same speed as the flyballs. This eliminates excessive side loads and prevents any turbulance of the oil from interfering with the action of the flyballs. The flyball assembly is cadmium plated to prevent corrosion and is held in place by a wire snap ring which fits in a groove at the top of the drive gear shaft.

g. Gaskets. - (1) All governors require a gasket between the cover and body section and another between the body and base sections.

(2) The Body-Cover Gasket is of the conventional type.

(3) The Oil Seal Gasket, between the body and base, is a rubber composition ring. This fits in the groove which is milled in the upper face surface of the base. This type of gasket is used because it is necessary to hold the pump housing end clearances to tolerances which preclude the use of a standard type of gasket. The ring gasket permits a surface to surface fit of the base and body and, at the same time, furnishes a seal which is oil tight.

(4) On all models, except Models A2 and A4, standard type gasket is used between the base and engine mounting pad.

(5) On models A2 and A4, a standard type Bearing Thrust Cover Gasket is used between the base and Thrust Cover of the vertical drive shaft.

h. External High R.P.M. Stops. - (1) A stop for the high limit of the governing range of the unit is provided on the control pulley. It consists of a pin that can be located in any one of the 18 holes in the pulley. The motion of the pulley is stopped when the pin comes to rest against the adjustable screw which is threaded through a boss cast integral with the cover of the unit.

(2) This design is comparatively new and is not incorporated in many units in the field at the time of publication of this manual.

i. Constant Speed Control Heads. - (1) Type No. 1 and No. 4 control heads are superseded in production by the No. 1A and 4A (see Fig. 10) to provide an adjustable stop for maximum R.P.M. The rack and control shaft have also been modified to insure proper mating of gears and pulley for assembly purposes. The new rack assembly also permits adjustment of the speeder spring load.

(2) For No. 1A heads, assembly 53298, rack, part 51686, is superseded by part 53346. Add adjusting screw 53389 and adjusting screw snap ring 53388.

(3) For 4A head, assembly 53347, rack 52551 is superseded by part 53346. Add rack assembly 53348, refer to Fig. 11 and paragraph j. below.

(4) Spring collar spacer 51864 is superseded by part 53392 to compensate for difference in thickness of the neck of the rack and adjusting screw of the new rack assembly.

(5) This change is not considered necessary for Type No. 1 and No. 4 governors now in use.

j. Constant Speed Control - Rack Assembly. - (1) Rack assembly 53348 has been superseded in production by assembly 54022, (see Fig. 12), to provide more positive locking of the minimum R.P.M. adjusting screw. Minimum R.P.M. adjusting screw, part 32550 is superseded by part 54021. Taper lock screw, part 51321, is superseded by part 54103. Maximum R.P.M. adjusting screw, part 52549 is no longer used.

(2) Maximum R.P.M. adjustings will be made entirely by means of external pulley stops on head assembly.

2. Hydromatic Constant Speed Propeller Governor. (See Fig. 2).

NOTE: Description of the Hydromatic Constant Speed Propeller is the same as Constant Speed Propeller Governor described in this section, paragraphs 1., a., b., c., d., e., f., g., h., and i. Further description as follows:

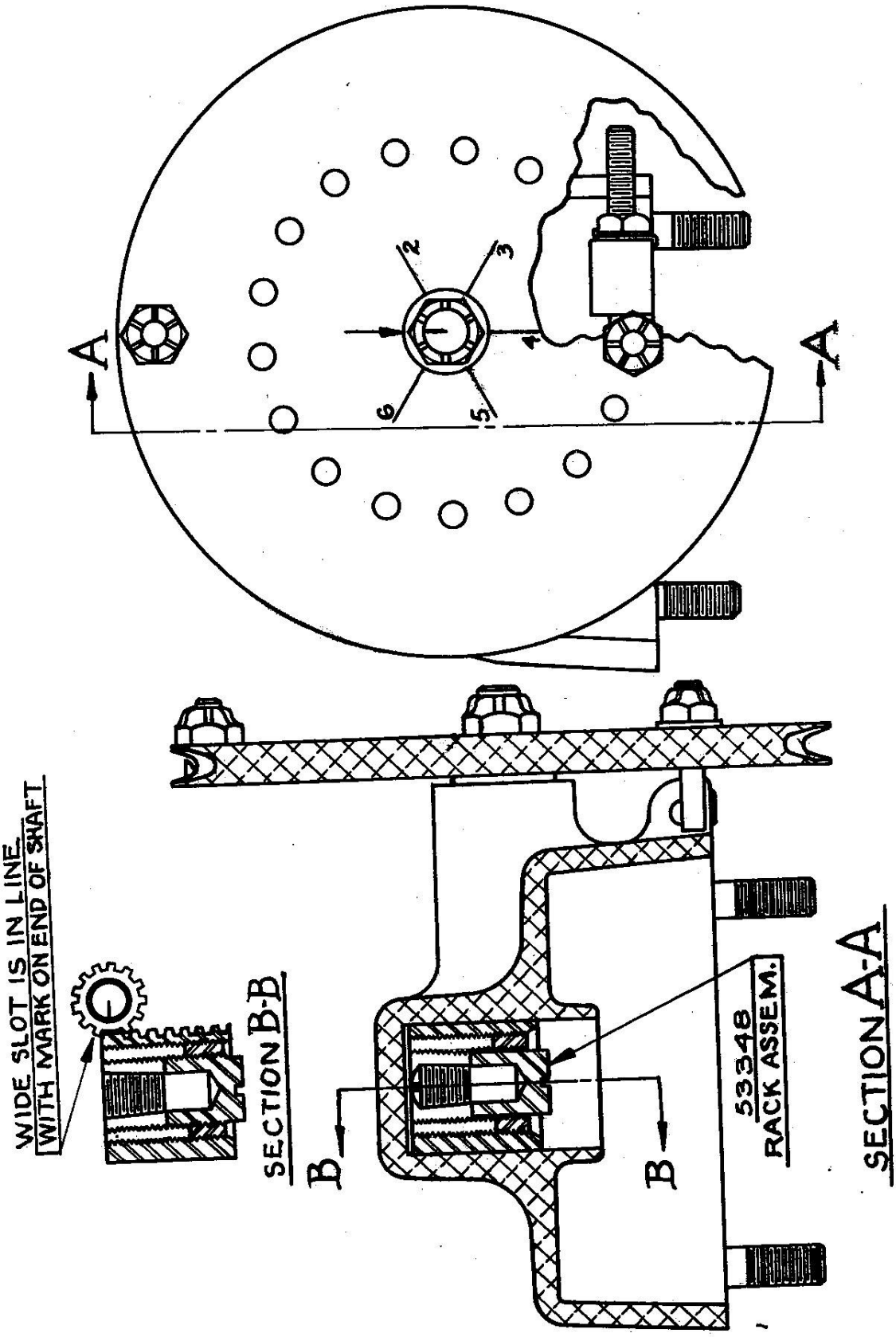


FIG. 10—CONSTANT SPEED CONTROL HEAD

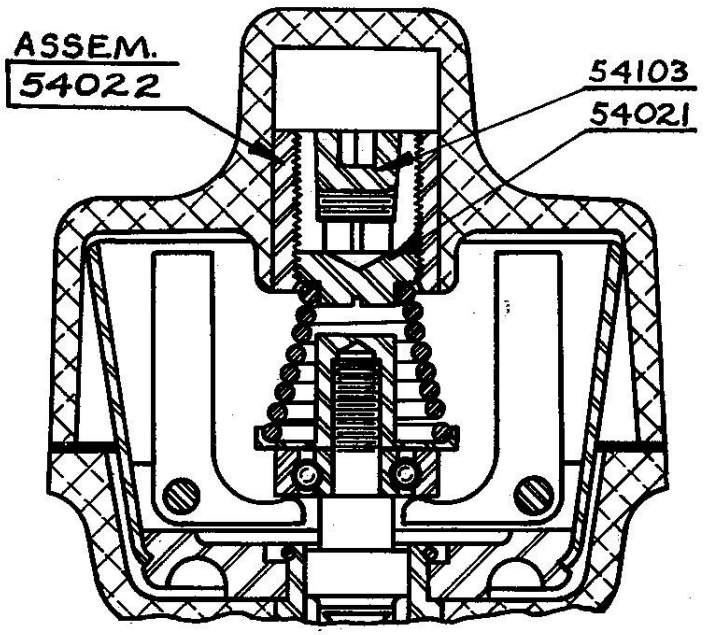


FIG.-12-CONSTANT SPEED CONTROL RACK ASSEMBLY (NEW MODEL)

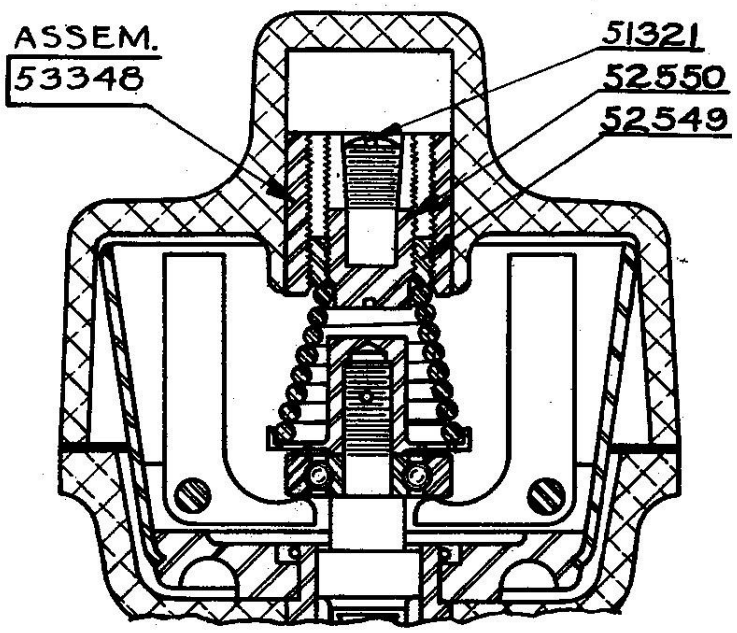


FIG.-11-CONSTANT SPEED CONTROL RACK ASSEMBLY - (OLD MODEL)

a. Rack Assembly. (See Fig. 13). - The speeder guide which contains the locking screw is threaded into the low R.P.M. adjustment and the low R.P.M. adjustment in turn is threaded into the speed adjusting rack. After the relative positions of the three pieces have been adjusted to give the desired minimum R.P.M., the whole assembly is locked by tightening the small wedging screw in the upper end of the spring guide.

b. High Pressure Transfer Valve. (See Fig. 14). - The transfer valve for the feathering and unfeathering operations located in the governor base consists of a plunger, spring, and a ball check. The plunger in its bore is held to a close fit so that it slides freely but will permit the minimum amount of oil to pass. The swivel type elbow connection can be turned to any position in 360° to facilitate the attachment of the high pressure line from the auxiliary pressure source.

c. Double Capacity Hydromatic Type Governor. - (1) In order to meet the requirements for a higher rate of pitch change for certain specified propeller installations, a governor of increased output was designed. This governor has a nominal capacity of 16 qts. per minute at 1750 R.P.M. against a back pressure of 150 P.S.I. as compared with the 8 qts. capacity of the "Standard" governor under the same conditions.

(2) Although the general operating principles remain unchanged, the body and base assemblies have been redesigned to incorporate the higher capacity booster pump. The head assembly is the same as is used on other Hydromatic governor models and the mounting and drive of the base is so arranged that the governor fits the AN Standard engine drive pad. The high pressure feathering fitting and transfer valve assembly is incorporated in the body rather than in the base and the pressure relief system has been modified as explained in paragraph d. below.

(3) Inasmuch as the design and construction of the "Double Capacity" governor is comparable to constant speed controls in general use, no maintenance or operating difficulties should be experienced by operators familiar with installation and overhaul of other model governors.

d. Pressure Relief System Used in Double Capacity Hydromatic Type Governor. - (1) This reference is intended to provide a general outline of the pressure relief system as used in double capacity Hydromatic type governors.

(2) Basic Models Nos. 2G8- 2G10- 2H8- 2H10-
3G8- 3G10- 3H8- 3H10-
4G8- 4G10- 4H8- 4H10-

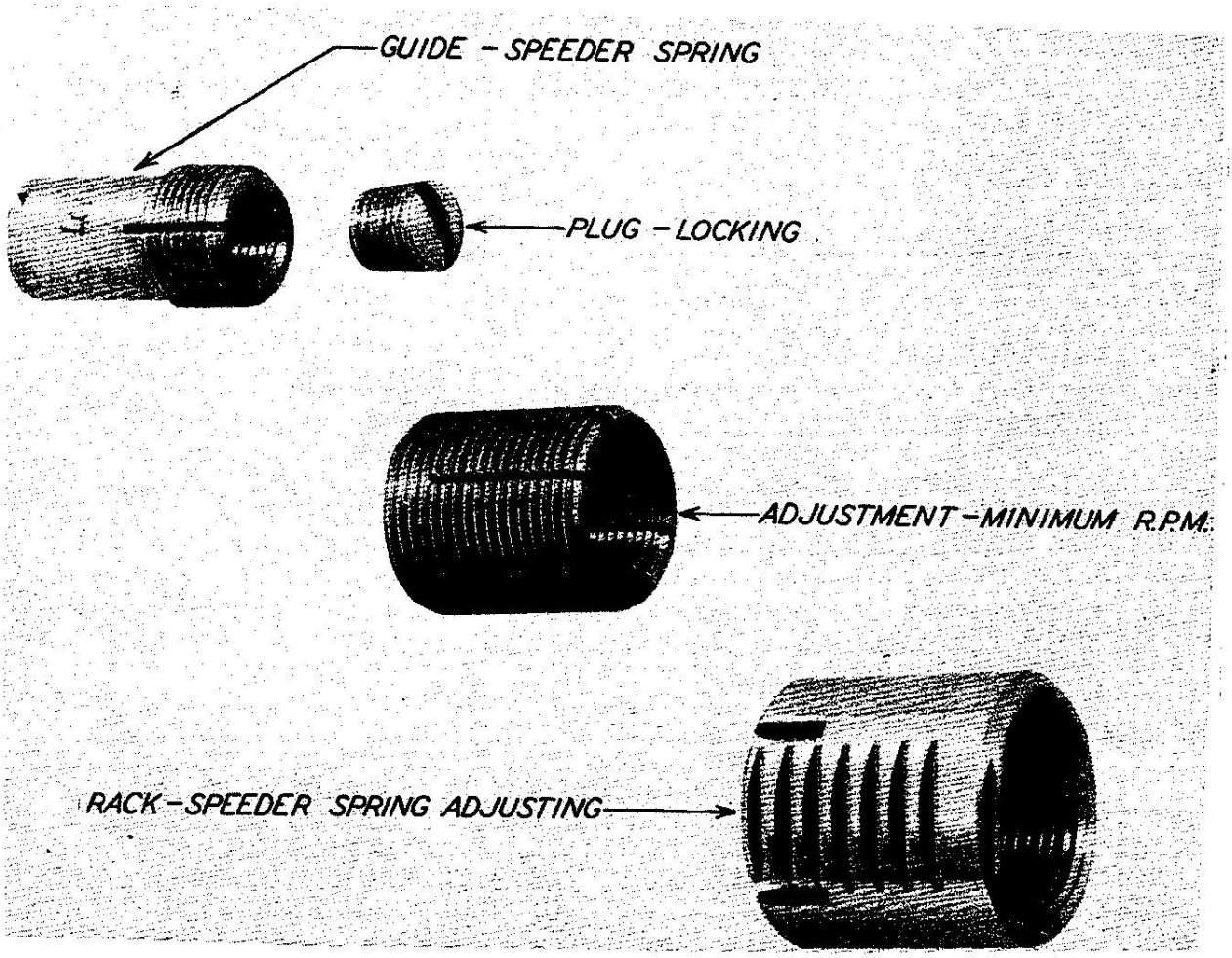


FIG. 13 — RACK ASSEMBLY SPEEDER SPRING ADJUSTING

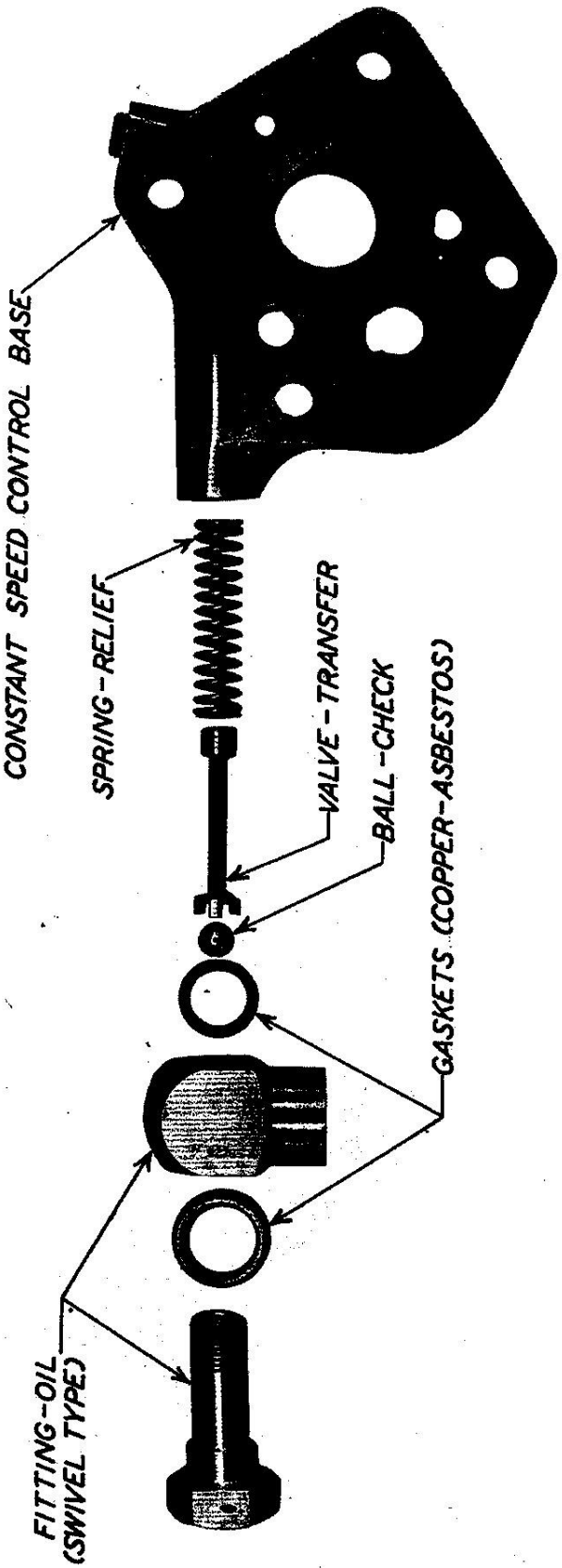


FIG. 14 — VIEW SHOWING CONSTANT SPEED CONTROL TRANSFER VALVE (EXTENDED)

(3) The capacity of the governor pump is nominally 16 qts. per minute and the spring loaded valves are designed to handle this high capacity with no delivery to the propeller at a low power input. It will be noted, by referring to the schematic layout (Fig. 15) that the booster pump output is delivered into the chamber surrounding the pilot valve. When the pilot valve is in the "overspeed" position "B", the output of the pump is delivered to the propeller and also against the relief valve. Oil is also delivered from the pilot valve to the spring side of the relief valve. In this case the pressure on either side of the relief valve is approximately equal and the spring force behind the relief valve, equivalent to about 50 P.S.I., holds the relief valve closed.

(4) If, during overspeed correction, the propeller piston should reach the end of its travel as established by the location of the high blade angle stop, the pressure in the propeller line would increase. This increase in pressure would also be effective against the high pressure relief valve and, when sufficient would cause it to open into the engine pressure line. It will be noted that the passage from the pilot valve to the spring side of the relief valve is small causing a pressure drop of approximately 50 P.S.I. at a flow of approximately 2 1/2 qts. per minute through this passage. This produces a pressure differential across the relief valve sufficient to cause it to open and by-pass the remaining booster pump output into the engine pressure system.

(5) When the pilot valve drops so that oil pressure is not being delivered to the propeller line, there is no pressure on the spring side of the relief valve. The valve then by-passes the full pump capacity at a pressure of approximately 50 P.S.I. This calls for very low power input to the governor drive during "underspeed" operation including feather and unfeathering, "A" and "D".

(6) The "onspeed" power input will be a function of the oil pressure required to maintain constant speed. The average power input will be somewhat less than that required during "overspeed" operation.

(7) The only pressure adjustment on this system is the high pressure relief (dump) valve. The adjusting screw is found in the governor base at the parting line between the base and the engine pad. A pressure gauge should be installed in the governor output line and the high pressure relief valve screw so adjusted that the maximum differential between governor and engine pressure is 330 to 350 P.S.I.

(8) The fit between the threads of the adjusting screw and those in the base is intended to prevent change in adjustment. Any leakage past the threads of this screw is stopped by the gasket between the base and the engine pad. It may be advisable to use a semi-setting compound, Sealing, Aircraft Instruments A.C. Spec. 2-87 to lock the adjusting screw.

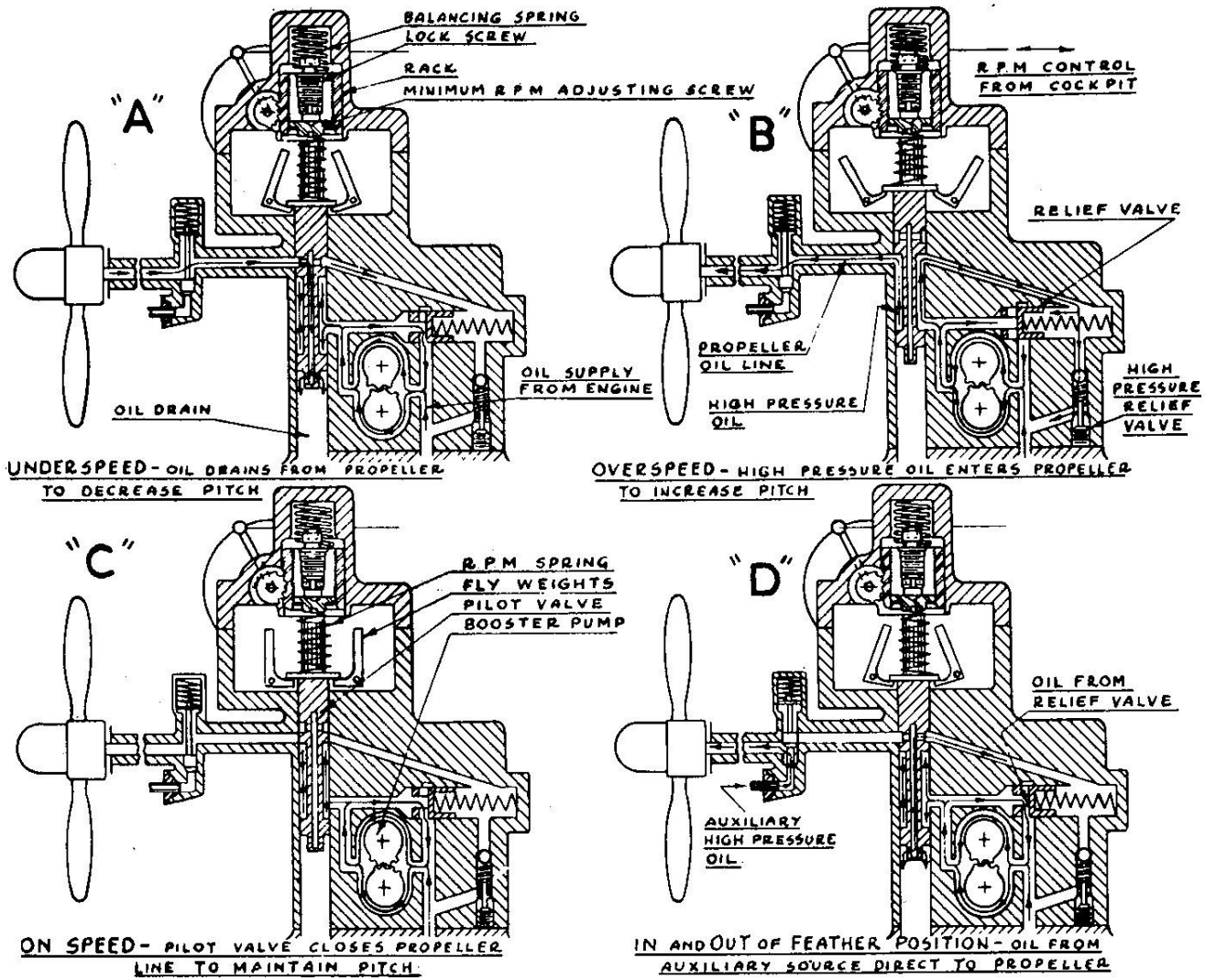


FIG. 15—SCHEMATIC VIEWS OF PRESSURE RELIEF SYSTEM

3. Governor Settings.

Unless otherwise specified all Hamilton Standard governors are set for a range of 1100 to 2700 engine R.P.M. This will in some cases on older installations require a change in cockpit control range. For the full range 1100 to 2700 governor R.P.M. with the Hydromatic propeller control, a pulley travel of approximately 118 degrees is required. For the range from positive high pitch to 2700 R.P.M. for constant speed propellers, a pulley travel of approximately 170 degrees is required.

4. Model Designations.

a. The governor is identified as to model by two numerals and a letter, i.e., 1A1.

(1) The first numeral refers to the head design:

Mechanical head
Electrical head

(2) The letter refers to the body section:

"A" The speeder spring (No. 50665), - spacer (No. 51884) combination in this unit permits operating range of 1730 to 2735 R.P.M.

"C" The speeder spring (No. SK-1651-1), - spacer (No. 52146) combination in this unit permits operating range of 1200 to 2722 R.P.M.

"E" The speeder spring (No. 50665), - spacer (No. 52146) combination in this unit permits an operating range of 1480 to 2735 R.P.M.

b. Detailed explanation of model designations of constant speed controls shown below:

MODEL — 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL — 1st pos. Head	2nd pos. Body	3rd pos. Base	HEAD ASSEMBLY Description
1						Assembly #51885. Mechanical head used with the counterweight type propeller. Uses the 4" control pulley without the external high RPM stops.
1			A			Assembly #53298. Mechanical head same as Type 1 except pulley and cover designed to provide a high RPM stop.
1			B			Assembly #54939. Mechanical head same as Type 1 except uses 1 1/4" pulley and rack assembly #53390.
1			C			Assembly #54120. Mechanical head same as Type 1A except uses 3" pulley.
1			F			Assembly # 58013. Same as 1 except incorporates improved type control shaft packing nut.
1			G			Assembly #58014. Same as 1A except incorporates improved type control shaft packing nut.
1			H			Assembly #58015. Same as 1B except incorporates improved type control shaft packing nut.
1			J			Assembly #58016. Same as 1C except incorporates improved type control shaft packing nut.
2						Assembly #52422. Electric head for 12 volt D.C. operation.
3						Assembly #52423. Electric head for 24 volt D.C. operation.
3			A			Assembly #58709. Electric head for 24 volt D.C. operation. Supersedes #3 head.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	—	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	HEAD ASSEMBLY Description
4			—				Assembly #52546. Mechanical head used with the Hydromatic propeller. 4" control pulley. Does not incorporate RPM pulley stops. Rack assembly consists of minimum RPM adjustment and speeder spring guide.
4			—	A			Assembly #53347. Same as Type 4 except cover and pulley designed to provide high RPM pulley stops.
4			—	B			Assembly #54118. Same as Type 4A except speeder spring guide eliminated.
4			—	C			Assembly # 54260. Same as Type 4B head except omits high RPM stops on pulley.
4			—	D			Assembly #54251. Same as 4B except uses 3" pulley.
4			—	E			Assembly #55181. Mechanical head with threaded-on extension cap for housing the speeder spring balancing spring behind the speed adjusting rack. Otherwise same as Type 4A head.
4			—	F			Assembly #55150. Same as 4E except extended cap is part of the cover casting. Also incorporates improved type control shaft packing nut.
4			—	G			Assembly #55856. Same as 4F except steel liner in rack bore.
4			—	H			Not in production
4			—	J			Not in production
5			—				Not assigned
6			—				Assembly #53462. Synchronizer Head Assembly for use with propeller synchronizing installation.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	—	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	HEAD ASSEMBLY Description
6			—	A			Assembly #54588. Approved design Synchronizer Head. Supersedes Type 6 Head Assembly.
7			—				Not in production.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BODY ASSEMBLY Description
	A		—			Assembly #51888. Used with counter-weight type propeller. Governing range 1730-2735 RPM.
	A		—	5		Assembly #53394. Spacer changed for use with the 1A head assembly. Otherwise same as A.
	A		—	6		Assembly #54096. Same as A5 except drilled for Type 12 base.
	B		—			Assembly #51871. Used with Hydro-matic propeller. Uses speeder spring #50665.
	B		—	1		Assembly #52547. Pilot valve with .010" neg. lap. (None used in service.)
	B		—	2		Assembly #52637. Same as B except relief valve operates at 180-200 p.s.i. plus engine pressure.
	B		—	3		Assembly #52558. Same as B2 except relief valve operates at 280-300 p.s.i. plus engine pressure.
	B		—	4		Assembly #53558. Same as B2 except spring collar #52552 replaced by collar #53468 to permit minimum regulating limit of unit of 900 RPM.
	B		—	5		Assembly #53542. Same as B4 except relief valve operates at 280-300 p.s.i. plus engine pressure.
	B		—	6		Assembly #55253. Same as B4 except adapted for use with the modidied #4 base for Hydromatic propeller operation.
	C		—			Assembly #51891. } Same as A and A5 except governing range 1200-2735 RPM.
	C		—	5		Assembly #53395. }
	C		—	6		Assembly #54096. Same as C5 except #53392 spacer is used.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BODY ASSEMBLY Description
	D	—				Assembly #51960. Same as B, B3,
	D	—		3		Assembly #52706. and B5 except uses
	D	—		5		Assembly #53559. speeder spring SK-1651.
	E	—				Assembly #52150. Same as A and A5 except governing range 1500-2735
	E	—		5		Assembly #53425. RPM.
	F	—				Not assigned.
	G	—				Assembly #53972. Double capacity pump. Relief valve operates 50 p.s.i. plus pressure in propeller line.
	G	—		1		Assembly #54834. Same as Type G except incorporates Pilot Valve and Drive Gear Shaft suitable for propeller with fast-acting cam. Supersedes Type G Body Assembly.
	G	—		2		Assembly #57154. Adapted for use in propeller accumulator system. High pressure, double capacity pump. Incorporates bronze bushings in gear shaft bores. Not in production.
	G	—		3		Assembly #57866. Same as G1 except for non-feathering installation. Incorporates positive high pitch feature by using #53392 spacer and #53681 spring collar. High pressure valve removed.
	G	—		4		Assembly #58410. Same as G2 except uses a 3/8" female N.P.T. swivel elbow. Supersedes type G2 body assembly. Good only for clockwise rotation.
	G	—		5		Assembly #58420. Same as G4 except uses 3/4-16 NF 3 thd. straight male union #58431. Good only for clockwise rotation.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	—	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BODY ASSEMBLY Description
	G		—		6		Assembly #58667. Same as G1 except location of oil hole changed for use with base with high pressure strainer.
	G		—		7		Assembly #58668. Same as G3 except location ol oil hole changed for use with base with high pressure strainer
	G		—		8		(Assy. No. not assigned.) Same as G5 except has provision for positive high pitch operation.
	G		—		9		(Assy. No. not assigned.) Same as H6 except #50665 speeder spring is used.
	G		—		10		Assembly #59107. Same as G4 except 360° mounting of head.
	G		—		11		Assembly #59108. Same as H3 except #50665 speeder spring.
	H		—				Obsolete.
	H		—		1		Assembly #54348. Same as Type G1 except SK-1651-1 speeder spring is used. Supersedes Type H Body Assembly.
	H		—		2		Assembly #55446. Same as H, except for non-feathering installation. High pressure valve removed.
	H		—		3		Assembly #59010. Same as H1 except reworked for 360° mounting of head.
	H		—		4		Assembly #58695. Same as H3 except external 1-14 thd. on high pressure boss. Location of oil hole changed for use with base with high pressure strainer.
	H		—		5		Assembly #58669. Same as H1 except location of oil hole changed for use with base with high pressure strainer

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BODY ASSEMBLY Description
	H	—		6		Assembly #58670. Same as H2 except location of oil hole changed for use with base with high pressure strainer.
	I	—				Not assigned.
	J	—				Not assigned.
	K	—				Assembly #53924. Suitable for use with Type 11, 12, or 13 bases. Incorporates extended drive gear #53940. Combines the modifications of the B2 and B4 bodies.
	K	—		1		Assembly #53925. Same as K except relief valve operates at 280-300 p.s.i. plus engine pressure. Combines the modifications of the B3 and B5 bodies.
	L	—				Assembly #53976. Same as K except speeder spring SK-1651 is used. Incorporates detail modifications of D and D4 body assemblies.
	L	—		1		Assembly #53977. Same as K1 except speeder spring SK-1651 is used. Incorporates detail modifications of D3 and D5 body assemblies.
	M	—				Assembly #54017. Suitable for use with Type 12 base. Incorporates extended drive gear #53940. Governing range. 1730-2735 RPM. Incorporates detail modifications of A and A5 bodies.
	N	—				Not assigned.
	O	—				Not assigned.
	P	—				Assembly #54018. Same as M except governing range is 1200-2735 RPM. Incorporates modifications of C and C5 body assemblies.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BODY ASSEMBLY Description
	Q					Assembly #54019. Same as M except governing range is 1500-2735 RPM. Incorporates modifications of E and E5 body assemblies.
	Q			1		Assembly #54949. Same as Type Q except has #52146 spacer for use with #1 Head Assembly.
	R					Not in production.
	S					Assembly #54465. Double capacity pump. Used with constant speed propeller on direct drive Cyclone.
	S			1		Assembly #54574. Same as Type S except #53392 spacer is used. Supersedes Type S Body Assembly.
	S			2		Assembly #56850. Same as S except relief valve operates at 280-300 p.s.is.
	S			3		Assembly #56851. Same as S1 except relief valve operates at 280-300 p.s.i.
	S			4		Assembly #57685. Same as S1 except speeder spring #50665 is used.
	T					Assembly #54375. Same as Type S body except adapted for Hydromatic non-feathering operation. Not in production.
	U					Not in production.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BASE ASSEMBLY Description
		1				Assembly #52713. Used with Type A, C, and E Body Assemblies. Used with counterweight type propeller suitable for standard governor pad on engine nose section. Assembly #50832 suitable for use on Wright J6 engine rear section.
		2				Assembly #50830. 35° angular drive suitable for gun synchronizer or or auxiliary drive. Used with Type A, C, and E body Assemblies.
		3				Assembly #50842. Used on Wright Sperry drive. Used with A, C, and E Body Assemblies.
		3			A	Assembly #54265. Pressure connections not tapped.
		4				Assembly #50840. Vertical drive. Suitable for gun synchronizer or auxiliary drive. Used with A, C, and E Body Assemblies.
		5				Not assigned.
		6				Assembly #52703. Used with B or D Body Assemblies suitable for standard governor pad on engine nose section. Incorporates transfer valve for feathering and unfeathering operations.
		6			A	Assembly #53572. Same as Type 6 except incorporates pad for #53539 pressure cutout. (Note: None used in service. Two sent to Army on consignment.)
		6			B	Assembly #54048.
		6			C	Assembly #57449. Same as 6 except 1/4" thicker. Adapted for use on Rolls-Royce Merlin Engines.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BASE ASSEMBLY Description
		7				Not assigned.
		8				Assembly #53973. Used with Type G or H Body Assemblies. Incorporates separate flange for mounting. Suitable for standard pad or engine nose section. Suitable for use with studs fixed or removable which extend 15/16" above the engine pad. Incorporates differential type pressure cutout switch #53574.
		8			A	Assembly #55016. Same as Type 8 except pressure cutout switch #55017 is used.
		8			B	Assembly #55221. Same as Type 8 except pressure cutout switch #54946 is used.
		8			C	Assembly #56216. Same as 8 except #55526 pressure cutout switch is used.
		8			D	Assembly #58674. Same as 8C except has 8 cut-out switch positions, oil groove, and high pressure strainer.
		9				Not assigned.
		10				Assembly #54349. Same as Type 8 except without pressure cutout switch. Used with non-feathering installations.
		10			A	Assembly #54494. Same as Type 10 except has no pressure cutout switch boss and dump valve.
		10			B	Assembly #57350. Same as 10A except incorporates bronze bushings in gear shaft bores and vent hole for relief valve. Used on accumulator installations.

MODEL — 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL — 1st pos. Head	2nd pos. Body	3rd pos. Base	BASE ASSEMBLY Description
		10			C	Assembly #58411. Same as 10B except suited only for clockwise rotation. Supersedes the No. 10B base assembly.
		10			D	Assembly #58675. Same as #10 except oil groove, and high pressure strainer incorporated.
		10			E	Assembly #58676. Same as 10A except high pressure strainer used.
		11				Assembly #53969. Used with Type K and L body assemblies. Incorporates differential pressure cutout #53574, and separate mounting flange suitable for standard pad on engine nose section with studs extending 15/16" above the pad surface. Uses swivel-type fitting with 1/2" female pipe thread.
		11			A	Assembly #54243. Same as Type 11 except uses swivel fitting with 3/8" female pipe thread.
		11			B	Assembly #54959. Same as Type 11 except pressure cutout switch #54946 is used.
		11			C	Assembly #57425. Same as 11 except for location of feathering line boss. Not in production.
		11			D	Assembly #55111. Same as Type 11 except pressure cutout switch #55017-4 is used.
		11			E	Assembly #55372. Same as 11D except #55017-5 switch is used.
		11			F	Assembly #55682. Same as 11D except 7/16" hex on high pressure swivel clamp bolt.
		11			G	Assembly #55773. Same as 11A except #55017-5 switch used.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BASE ASSEMBLY Description
		11 —			H	Assembly #55901. Same as 11A except #55017-1 switch used.
		11 —			J	Assembly #56215. Same as 11 except #55526 pressure cutout switch is used.
		11 —			K	Assembly #57218. Same as 11A except pressure cutout switch #55017-1 is used.
		11 —			L	Assembly #58331. Same as 11E except pressure cutout switch #57633 is used.
		11 —			M	Assembly #58332. Same as 11G except pressure cutout switch #57633 is used
		11 —			N	Assembly #58443. Same as 11J except strainer assembly #58449 is used.
		11 —			P	Assembly #58444. Same as 11L except strainer assembly #58449 is used.
		11			Q	Assembly #58445. Same as 11M except strainer assembly #58449 is used.
		12 —				Assembly #53967. Used with Type M, P, and Q Body Assemblies. Provides separate flange for mounting used with studs extending 15/16" above the governor pad. Suitable for use on standard pad on engine nose.
		12 —			A	Assembly #55609. Same as 12 except 1/8" of stock removed from mounting flange on one side for ignition harness clearance on Pratt & Whitney SB4G engines.
		13 —				Assembly #53948. Same as Type 11 without pressure cutout.

MODEL 1st pos. Head	2nd pos. Body	3rd pos. Base	DETAIL 1st pos. Head	2nd pos. Body	3rd pos. Base	BASE ASSEMBLY Description
		13			A	Assembly #54244. Same as 11A without pressure cutout.
		13			B	Assembly #53495. Same as Type 13A except has 7/16" hex on high pressur swivel clamp bolt.
		13			C	Assembly #58446. Same as 13 except strainer assembly #58449 is used.
		13			D	Assembly #58447. Same as 13A except strainer assembly #58449 is used.
		14				Not assigned.
		15				Assembly #55239. Same as Type 4 except has transfer valve and pressure cutout switch #53574 for Hydromatic propeller operation. Superseded.
		15			A	Assembly #55240. Same as Type 15 except #55017 pressure cutout switch is used. Superseded.
		15			B	Assembly #55179. Same as Type 15 except without pressure cutout switch. Superseded.
		15			C	Assembly #56901. Same as 15 except pressure cutout switch #55526 is used.
		16				Not assigned.
		17				Assembly #55361. Same as 3 except for Hydromatic propeller operation. Switch #55017. Not in production.
		17			A	Assembly #55362. Same as 17 except no switch used. Not in production.
		18				Not in production.

ADAPTERS

Assembly #55370. Transfer valve and cutout switch adapter for use with 4B4 and 4B2 controls. Switch #55017-4 is used.

Assembly #55567. Same as # 55370 except switch #55017-5 is used.

Assembly #56119. Same as #55370 except switch #55526 is used.

Assembly #58333. Same as #55370 except switch #57633 is used.

5. Improved Constant Speed Control Base.

a. To comply with a change in the Army standard specification which will call for constant speed control mounting studs fixed in the engine pad and extending 15/16 inch above the surface of the pad, the constant speed control base has been redesigned to provide a mounting flange 1/2 inch thick. The thickness on previous models was 1 7/32 inches and required the longer studs in the pad.

b. This new base is attached to the governor body by studs fixed in the base extending through the body instead of making use of the studs in the engine nose pad for this purpose. This eliminates the possibility of any misalignment in the drive gear bearings which may result from improper handling of the assembly during installation or removal.

c. The new base, Type 12, replaces Type 1. Type 11 and 13 bases replace Type 6. The new base increases the overall height of the constant speed control approximately 1 1/4 inches.

SECTION III

REMOVAL AND INSTALLATION

1. Constant Speed Propeller Governor.

a. Removal of the Unit from the Engine. - (1) Disconnect the cockpit control from the unit. In case a pulley is installed on the governor the pulley will be removed from the shaft noting the index marking on pulley and shaft and before removal to insure reinstallation in the same position.

(2) On units having external piping, disconnect the pipe connections.

(3) Remove the four mounting stud nuts.

(4) Remove the governor.

NOTE: On some installations the fit is so close that it is impossible to raise the unit high enough to clear the mounting studs. In these cases, the usual procedure is to remove the cap section of the unit's case. This is done by removing the four nuts and palnuts which fasten the cap section to the body section. The cap section may now be lifted from the unit. As the cap section is lifted, the control shaft should be turned counterclockwise looking at the face of the pulley. The purpose of this is to disengage the speeder spring adjusting rack and the control shaft. If the cap section is removed with the pilot valve-spring collar assembly, it cannot be raised high enough to pull the pilot valve out of the drive gear shaft and still keep these two parts in alignment. This alignment should be kept in order to prevent side loads which might bend the spring collar spindle.

(5) If it is necessary to temporarily remove a unit between propeller overhaul periods, the control should be moved to full decrease R.P.M. position, the pulley or lever and shaft should be marked and removed from control shaft. This will permit re-installation in exactly the same position and will facilitate the adjustment of the control system.

b. Installation. - (1) The installation of the governor and cockpit controls will be in accordance with the installation drawings, covering the particular airplane, except that the following precautions will be taken.

(a) Each governor assembly should be checked to insure their proper functioning before installing on an engine. Also check to insure that the proper type gasket is installed between the governor and the mounting pad.

(b) To install a governor remove the cover from the surface on which the governor is to be mounted. Then set the governor in position, checking the fit of the governor circular lining boss. In some cases it will be found that this boss is slightly larger than the opening on the engine into which it fits. If this condition exists, further investigation will be made to determine which part is to be reworked.

(c) The governor securing nuts should then be screwed on the mounting studs and run down finger tight. Remove the governor head and check the backlash and freedom of movement while tightening the governor securing nuts. It is essential to tighten these nuts down evenly. The securing nuts should not be drawn down excessively tight as this may cause the displacement of the gasket material in the vicinity of the mounting studs and result in warping the governor base. In some cases it has been noted that the governors are susceptible to binding after having the nuts tightened. This condition can normally be relieved by slacking off slightly one or more nuts. The nut or nuts causing the difficulty can be determined by trial.

(d) Another precaution which is advisable is that during the tightening of the securing nuts the propeller shaft should be rotated to at least three positions, checking the governor for backlash and freedom of movement at each point.

(e) It is a good practice to check the governors for freedom of movement before installing as a few cases have been reported where cold temperatures and improper fit of bearings have caused the governors to bind. Therefore, any binding or drag in the governor should be thoroughly investigated before attempting to install it on an engine.

(f) Should binding or drag be experienced with two or more governors, it is advisable to check the engine drive parts. Engines equipped with the governor drive in the nose sections can be checked by removing the nose section and installing a governor on it. If the governor binds, the vertical drive gear in the nose section can be checked for freedom by rotating it back and forth to determine the backlash. The alignment of the governor drive spline in the vertical drive gear can be determined by working the vertical drive gear up and down. Both these checks should be made at several different points by removing the governor and turning the vertical drive shaft to a new position and then reinstalling the governor.

(g) The primary precaution is to make sure the governor turns freely when assembled to its drive on the engine.

(2) When installing model A-2 governors, care will be taken to insure that the cotter pins for the drive gear nut is not bent over the end of the vertical drive shaft. This is necessary to prevent interference due to the small clearance between the end of the drive shaft and the mounting base.

(3) The revised procedure of installation for elevated base type governor and in compliance with AN Specification 9507, the studs in the engine governor pads will no longer have lock wire holes. Washers, part AN-960-516, nuts, part AN-360-5, and palnuts, part AN-356-524, are required. Pass the governor base flange down over the mounting studs until washers, part AN-960-516, can be inserted in place and one or two threads on the studs are exposed. Start all nuts, part AN-360-5, and tighten equally until the governor base has been drawn down sufficiently to expose one or two threads on the studs above each nut. Start palnuts, part AN-356-524. Tighten nuts, part AN-360-5, equally until the governor base is drawn securely against the face of the pad. Tighten the palnuts.

(4) Governor drive coupling support, part 55398, has been designed to eliminate the possibility of disengagement of the governor drive coupling in the event of improper installation or failure of the snap ring, part 53942. On Pratt & Whitney engines, the governor coupling may drop down due to either of the above causes until it rests on the spline ends of the engine driving member. This will result in partial disengagement of the coupling and governor shaft driving lugs to an undesirable extent which may result in failure of the lugs. Support, part 55398, fits over the splined end of coupling, part 53939, and acts as a spacer between the end of the engine driving member and the shoulder on the coupling. At the first opportunity these supports should be installed on all governors incorporating the coupling, part 53939, change G, now in use on Pratt & Whitney engines. These supports are not to be used in lieu of snap ring, part 53942, but are intended as additional insurance against coupling disengagement.

c. Constant Speed Control Installation Data. - (1) Considerable variation in the relative positions of various components of the constant speed control is required to accommodate individual features of power plant installation on various airplanes. In the recent development of the integral high RPM pulley stop, provision was made to fabricate and mark the pulley assembly so that it can be removed for maintenance inspection and reassembled without the necessity of readjusting the stops. This feature also permits assembly of new constant speed control and adjustment of the stops at the factory so that the unit can be delivered ready for installation.

(2) In order that advantage may be taken of this factory assembly procedure, it is desirable that adequate information be given for assembly of governors to meet the requirements.

(3) The several possible positions of each component of the constant speed control are identified by numbers as indicated in Fig. 15. For possible installation of constant speed control, an

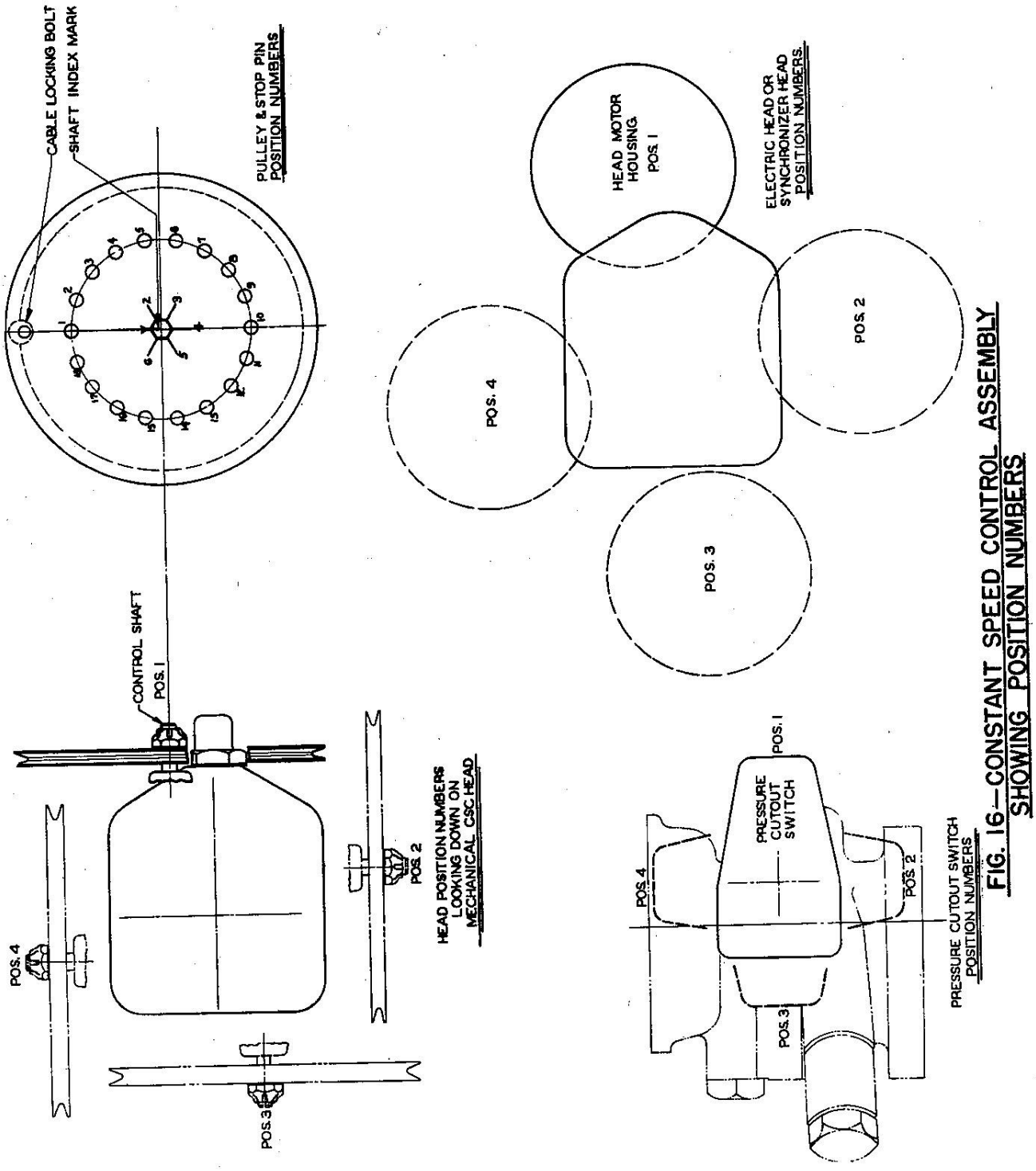


FIG. 16—CONSTANT SPEED CONTROL ASSEMBLY SHOWING POSITION NUMBERS

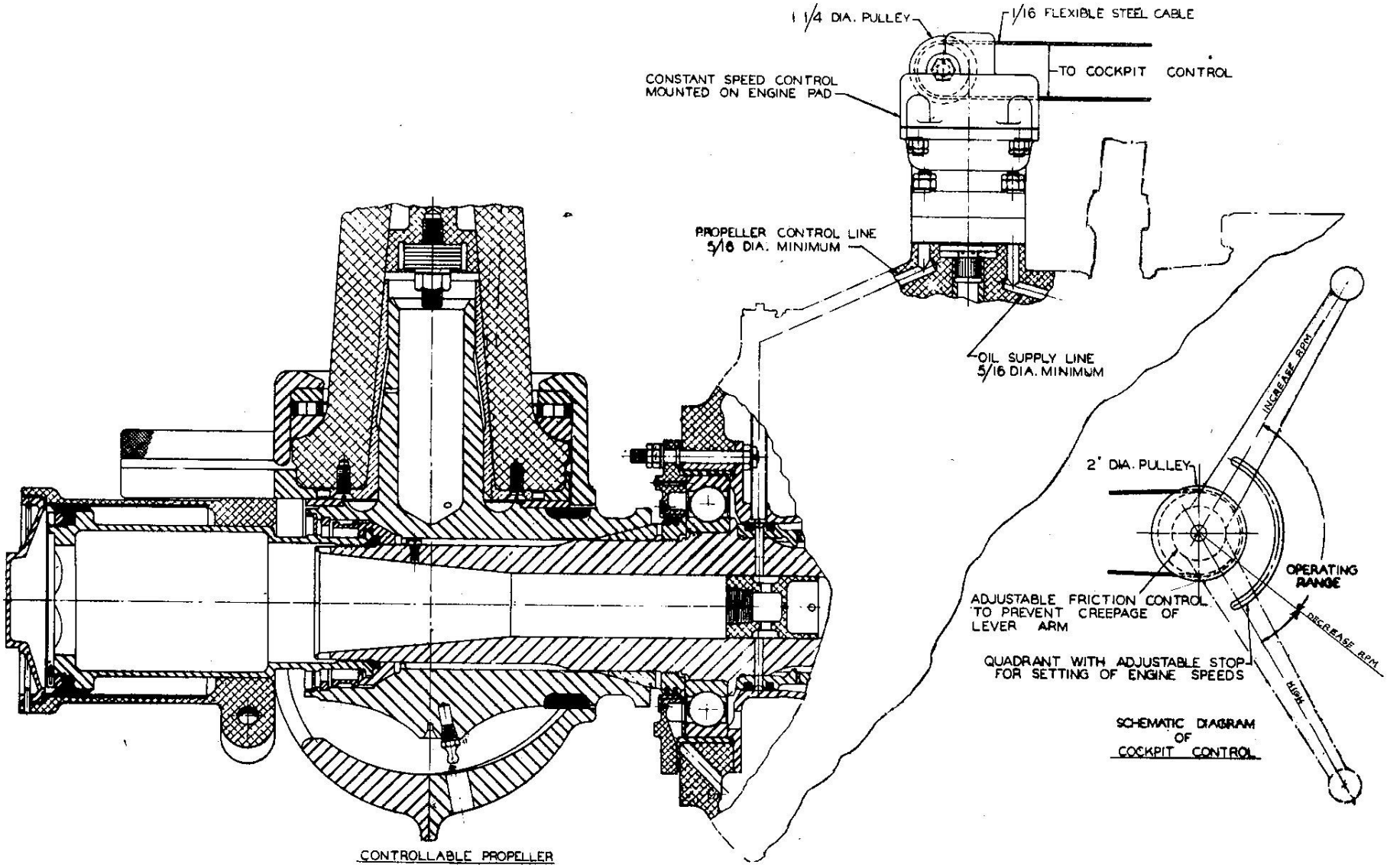


FIG. 17—TYPICAL INSTALLATION OF GOVERNOR WITH NO.1 BASE MOUNTED ON ENGINE NOSE PAD (FOR REFERENCE ONLY)

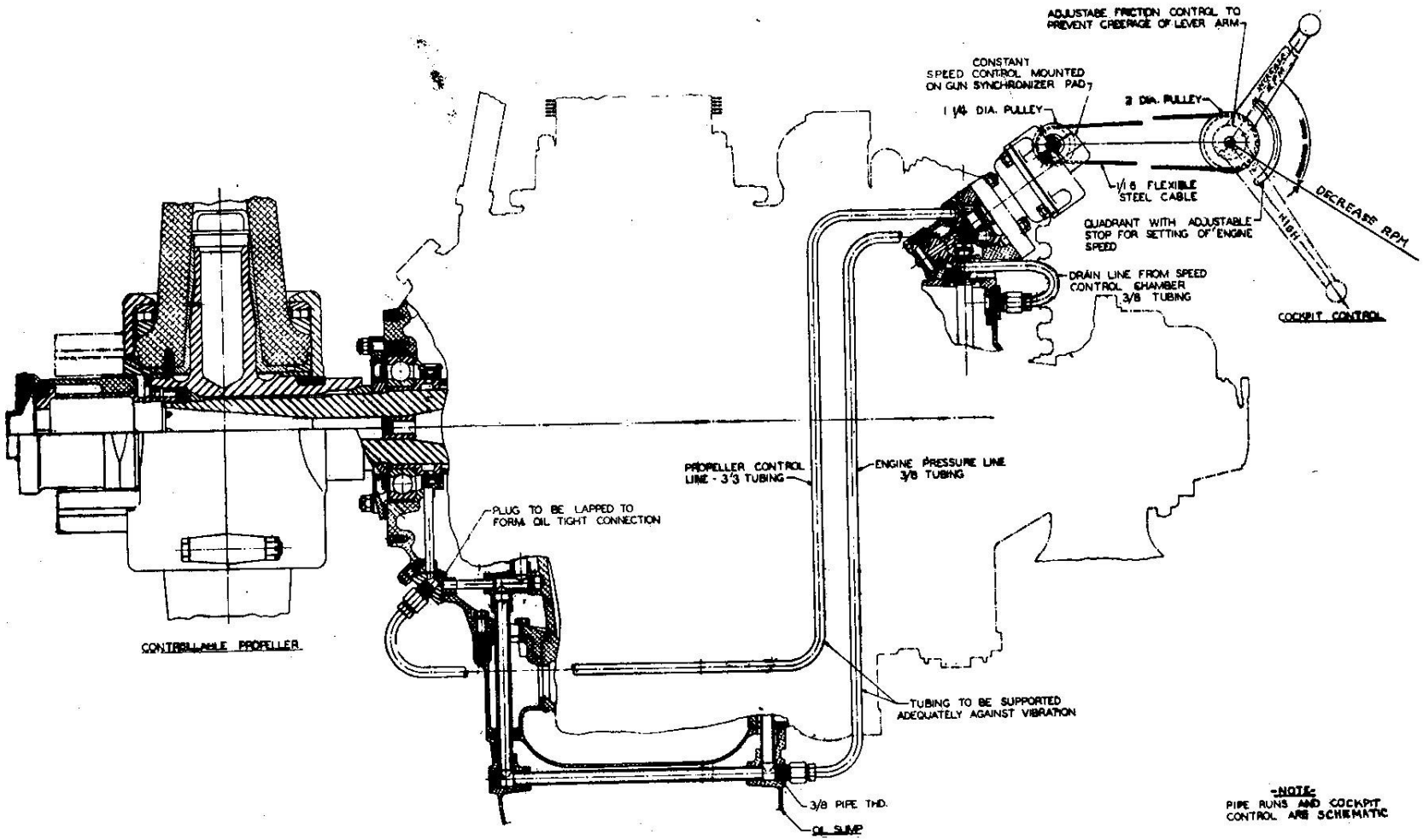


FIG. 18—TYPICAL INSTALLATION OF GOVERNOR WITH NO. 2 BASE MOUNTED ON GUN DRIVE (FOR REFERENCE ONLY)

example of installation is as follows:

Governor Model 4K11-B
Head Position #4
Pressure Cut-Out Position #3
Pulley Position #1
Stop Pin Position #11
For Use With:
Propeller Model 23E50-47
For Installation On:
Engine (Make and Model No.)
Take-Off Rating (Horsepower and Engine RPM)
Airplane (Make and Model)

(4) This procedure permits installation of constant speed controls having Type 12, 11 and 13 bases without the necessity of disassembly by the customer. Where complete information is not given, constant speed controls will be assembled on the basis of information from file records.

(5) It is still recommended that the head assembly be removed when installing controls having Type 1 and 6 bases to permit check to insure that no binding of the drive shaft or gears occurs as the assembly is secured to the pad.

d. Adjustments. - (1) The angular range required at the constant speed unit to give rated R.P.M. at one end and positive high angle at the other is only a part of the unit's total angular range. Before flying, it is important that the control system between the governor and the cockpit be adjusted to set the unit for rated R.P.M.

(2) In case governor adjustment has not been accomplished on a suitable test stand and it is necessary to adjust or readjust for take-off R.P.M., the following procedure will be adhered to: For trial setting, place the cockpit lever in extreme rear position. Turn the pulley or lever attached to the governor control shaft in a clockwise direction until the rack bottoms in the cap. Connect control cable or rod extending from the cockpit control lever to the pulley or lever attached to the governor shaft. Loosen the increase R.P.M. stop and shift away from the governor. Start engine and operate on ground until desired take-off R.P.M. is obtained, moving the governor lever in cockpit forward. Stop engine, exercising care to insure that the setting of the governor lever in the cockpit is not disturbed. Adjust increase R.P.M. stop toward governor until it bottoms against pulley stop or lever. Make flight test to insure that the governor is adjusted properly. If during flight the rated R.P.M. cannot be obtained or if excessive R.P.M. is encountered readjustment of the controls is necessary. To increase the R.P.M. the governor stop will be loosened and shifted away from the governor pulley or lever. Make another trial flight adjusting cockpit

adjusting cockpit control lever until rated R.P.M. is obtained, marking the quadrant at this position. After landing and stopping engine, adjust cockpit control lever to marking on the quadrant and reset governor stop. To decrease the R.P.M., adjust cockpit control during trial flight marking the quadrant and after landing and stopping engine adjust the cockpit control to the marking and the governor stop until it firmly bottoms against the governor control lever or pulley.

e. Installation and Adjustment of Electrically Controlled Governor. - (1) For outline dimensions of constant speed unit refer to Figure 19.

(2) For outline dimensions of control switch refer to Figure 20.

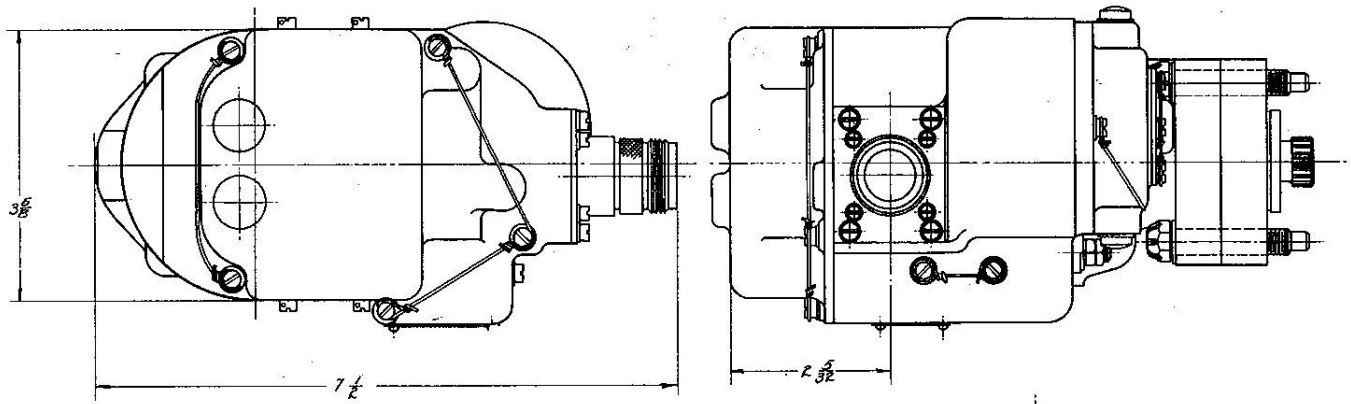
(3) For wiring diagram refer to drawing covering the particular airplane and propeller installation.

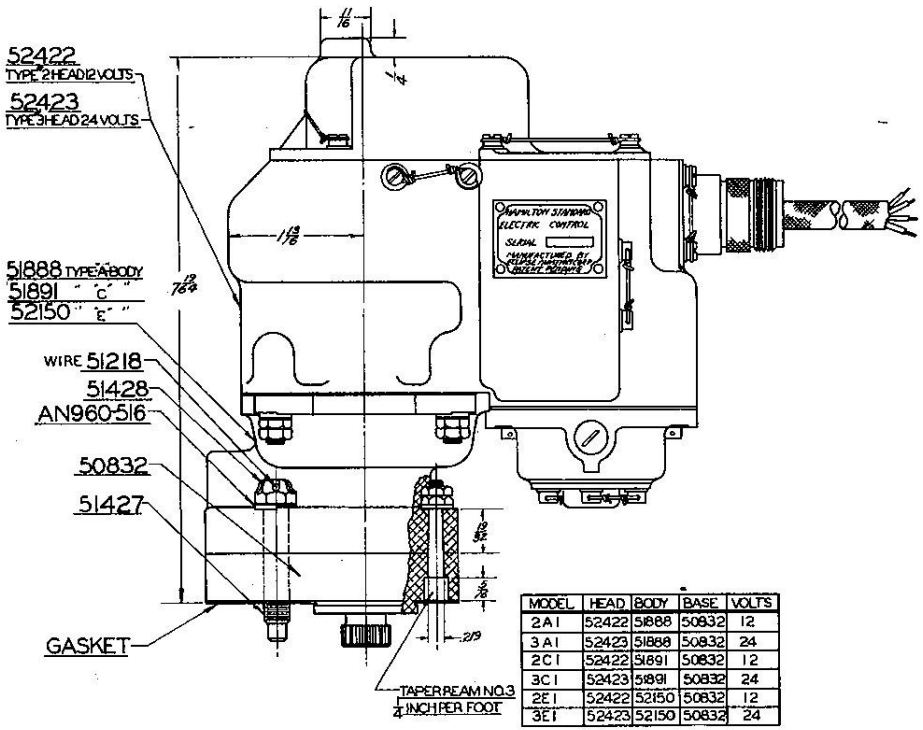
(4) For details of R.P.M. limit switch in constant speed unit refer to Figure 21.

(5) The electric constant speed unit mounts on the standard pad on the nose of the engine in exactly the same manner as the mechanically controlled constant speed unit. The unit is controlled from the cockpit electrically, the connection being electric wiring instead of the push-rods and cables used in mechanical installations.

(6) Before putting the control into operation, it is important to be sure that the limit switch in the constant speed unit, which is for the purpose of regulating the maximum (take-off) R.P.M., is correctly adjusted. Usually the units are adjusted for the maximum R.P.M. of the particular engine on which they are intended to be used. However, in cases where units are installed on other engines having different take-off R.P.M. ratings or different ratios for driving the constant speed units, it may be necessary to readjust them accordingly. To determine whether or not the take-off R.P.M. adjustment is correct, set the unit to maximum R.P.M. by holding the control switch in the Increase position until the miniature lamp lights. Then run up the engine on the ground by opening the throttle to the allowable take-off manifold pressure. This should give full take-off R.P.M. If the R.P.M. is in excess of this amount, shift the governor toward decrease R.P.M. by "jogging" the control switch until the tachometer indicates take-off R.P.M. (with throttle opened to take-off manifold pressure). Then shut the engine down without disturbing the constant speed control setting.

(7) Remove the cap on the governor control head (this is secured in place by machine screws). Figure 21 indicates the parts where the adjustment is made. There is a rough adjusting screw





MODEL	HEAD	BODY	BASE	VOLTS
2A1	52422	51888	50832	12
3A1	52423	51888	50832	24
2C1	52422	51891	50832	12
3C1	52423	51891	50832	24
2E1	52422	52150	50832	12
3E1	52423	52150	50832	24

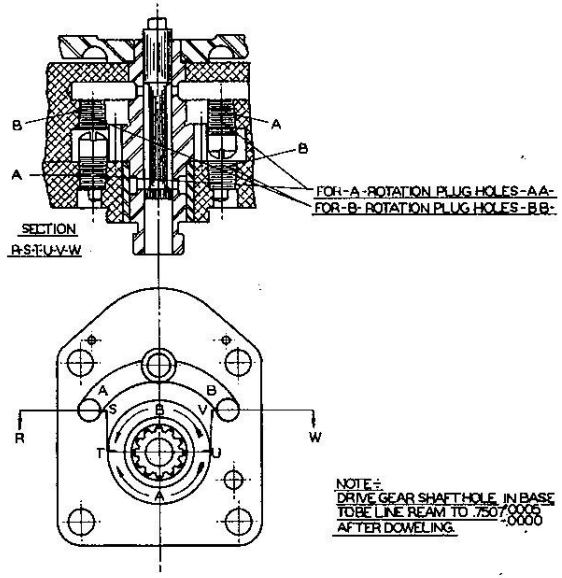


FIG. 19— CONTROL ASSEMBLY—ELECTRIC TYPE

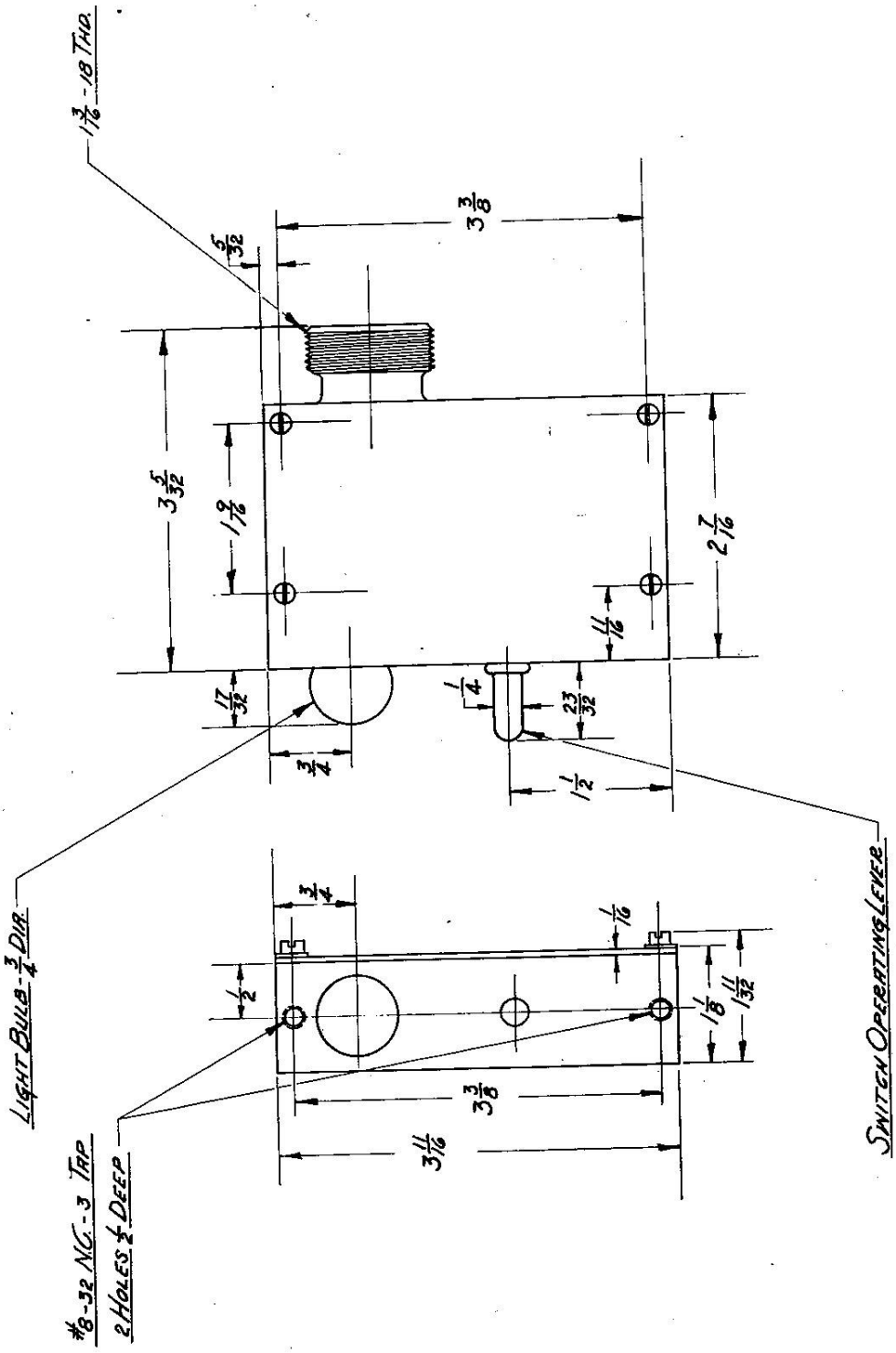


FIG. 20—OPERATING SWITCH ELECTRIC TYPE GOVERNOR

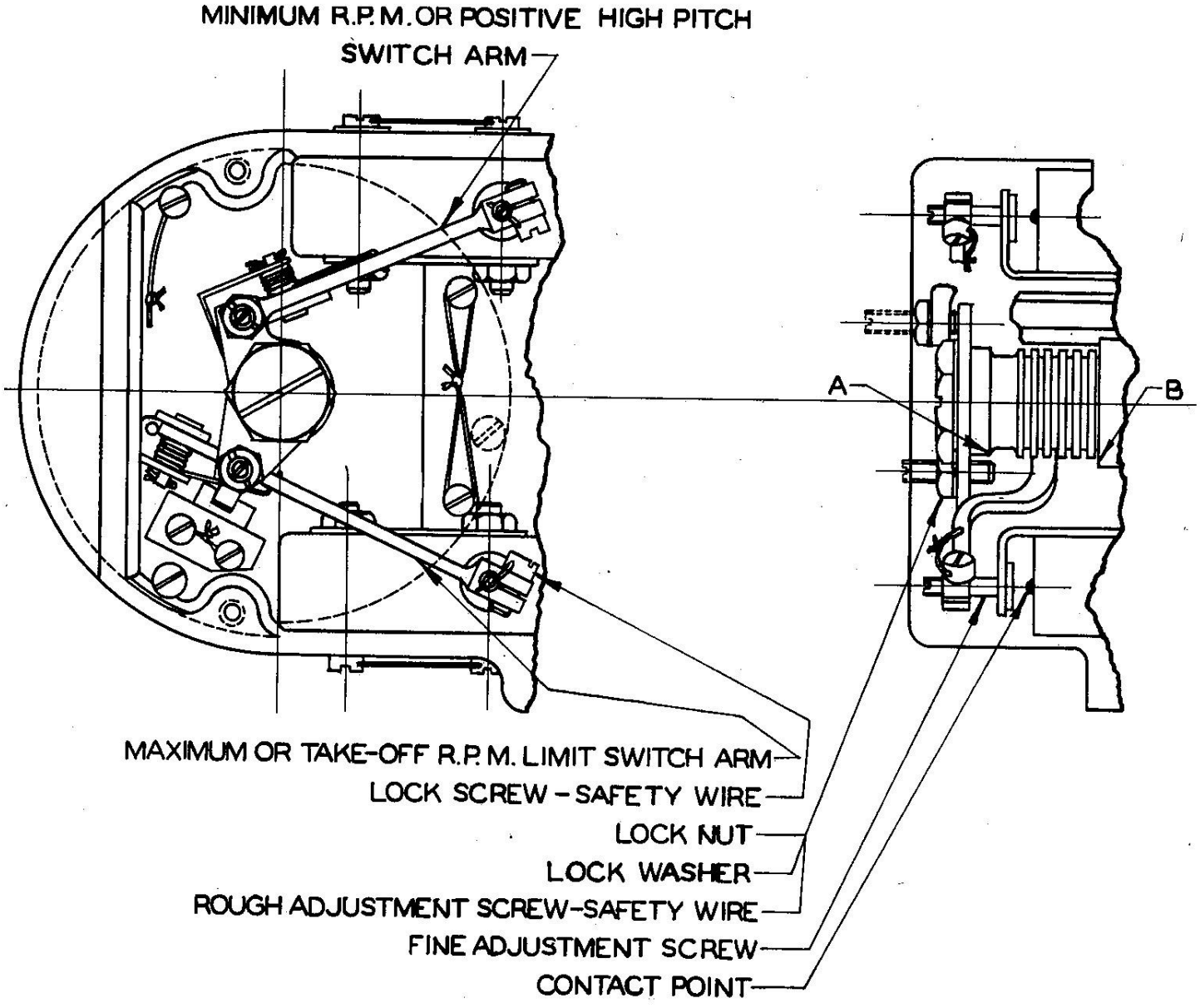


FIG. 21 — OPERATING RANGE ADJUSTMENTS ELECTRIC TYPE CONTROL

and a fine adjusting screw as indicated. Remove the safety wire from the rough adjusting screw and loosen the locking nut. Turn this adjusting screw clockwise (looking down on the unit) until the switch arm closes lightly on the contact point. Tighten the lock nut and safety-wire the adjusting screw. Then replace the cover and secure it with the screws and safety wire.

(8) However, if the R.P.M. is less than take-off R.P.M. it may be either that the R.P.M. adjustment in the constant speed unit is set too slow, or that the low pitch limit of the propeller itself is too high. To determine which is the reason, shift the constant speed unit to a little slower setting by "jogging" the control switch momentarily toward decrease R.P.M. with the throttle still opened to take-off manifold pressure. If the R.P.M. falls correspondingly when this is done, it is reasonably certain that the constant speed control is holding the R.P.M. down below take-off R.P.M. and that it is necessary to readjust the R.P.M. limit switch in the unit. (Under these conditions, refer to paragraph (9) below for procedure.) However, if the R.P.M. is not immediately affected by "jogging" the switch toward decrease R.P.M. while the engine is running up with the throttle opened to the allowable take-off manifold pressure, it is an indication that the high R.P.M. limit stop of the propeller is too high. (Under these conditions, see paragraph (11).)

(9) Remove the cap attached to the governor control head. Remove the safety wire from the rough adjusting screw and loosen the lock nut (see Fig. 21). Turn the adjusting screw counterclockwise, bearing in mind that one full turn increases the R.P.M. approximately 100 R.P.M. The number of turns should be enough to give the difference between the actual R.P.M. at which the engine turned and the desired take-off R.P.M. preferably with a little to spare. Then tighten the lock nut, safety-wire the adjusting screw, replace the cover and secure it with the screws. Adjust the control to its maximum R.P.M. position by holding the control switch in the increase R.P.M. position until the minature lamp lights. Run up the engine again on the ground; it should now run at take-off R.P.M. or slightly greater with the throttle opened to take-off manifold pressure. Under these conditions, "jog" the control switch toward decrease R.P.M. until the tachometer reading indicates that the governor is controlling at take-off R.P.M. Shut down the engine without disturbing this governor setting and if the difference between the indicated and desired R.P.M. is greater than 50 R.P.M. readjust the rough adjusting screw in the governor by turning it clockwise until the switch arm closes lightly on the contact point. Tighten the lock nut, safety-wire the adjusting screw, replace cover and secure with screws and safety wire.

(10) The fine adjusting screw (see Fig. 21) should be used to make R.P.M. changes below 50 R.P.M. and, therefore, should be set in its mid-position while initial adjustments are being made with the rough adjusting screw. To make final adjustments with the fine adjusting screw, loosen the lock nut and turn the screw

clockwise for decrease R.P.M., or counterclockwise for increase R.P.M., one turn corresponding to approximately 10 R.P.M. in either direction. The adjustment is made in similar manner to that described above for the rough adjusting screw and when done should be secured with its lock nut and safetied as described.

CAUTION: In making the maximum R.P.M. adjustment, it is necessary that the switch arm be depressed before flanges A and B meet. (See Fig. 21.) To check this, hold the control switch toward increase R.P.M. until the miniature lamp lights. Under these conditions, the flanges should be separated by a minimum of 0.010" clearance.

(11) In case the R.P.M. is limited because of the high R.P.M. limit stop the propeller is set too high as mentioned above and it is necessary to readjust the propeller itself. In general, the high R.P.M. limit should be such that the engine will turn at its rated take-off R.P.M. when the throttle is opened to the allowable take-off manifold pressure while the plane is standing still on the ground at sea level density. After having adjusted the propeller to the correct low pitch limit, it is necessary to repeat the ground run-up tests as described above in order to set the maximum R.P.M. limit of the governor.

2. Hydromatic Constant Speed Propeller Governor.

NOTE: Removal and Installation same as for Constant Speed Propeller Governor as noted in this Section, Paragraph 1, a., b., additional data as follows:

a. Installation Adjustments. - (1) Angular Range: The angular range required at the governor to give take-off R.P.M. at one end and minimum governing R.P.M. at the other is only a part of the unit's total angular range. Before flying, it is important that the control system between the governor and the cockpit be adjusted for take-off R.P.M. when the cockpit lever is 1/8" from its full forward position, and for minimum R.P.M. when the cockpit lever is in its rearward position.

(2) Trial Setting: For the trial setting, place the cockpit lever approximately 1/8" from the forward end of its full travel. Turn the pulley or lever attached to the governor control shaft in a clockwise direction until the rack bottoms in the cover. Rotate the control shaft counterclockwise the necessary number of degrees to give desired take-off R.P.M., in accordance with the applicable diagram Fig. 22. With the control shaft held in this position, connect the linkage between the cockpit control lever and the governor. This setting will give approximately the take-off R.P.M. and permit sufficient movement of the cockpit control lever to obtain minimum R.P.M.

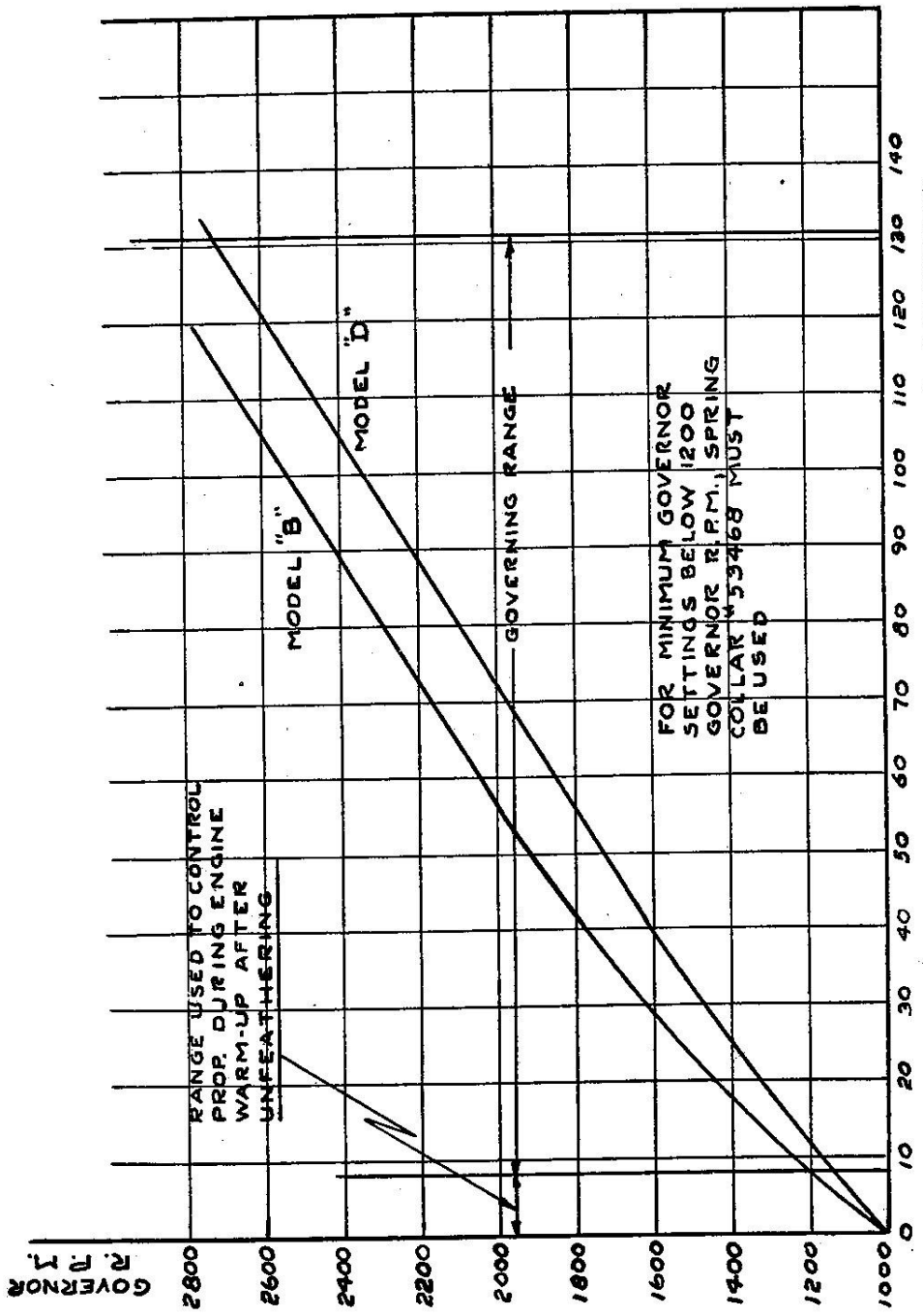


FIG. 22—PULLEY ROTATION-VS-GOVERNING R.P.M. FOR HYDROMATIC GOVERNOR.

NOTE: The designer of the control system must allow sufficient angular motion at the governor to permit obtaining both take-off R.P.M. and minimum R.P.M. of the engine. The R.P.M. given on the accompanying Fig. 22 is that of the governor. The R.P.M. of the governor is determined by the engine drive ratio.

b. Checking Adjustments. - (1) The following are suggested methods of checking and adjusting the trial installation setting. In each case, the purpose is to have the cockpit lever 1/8" from its full forward position when the governor is set for take-off R.P.M. It should be clearly borne in mind that with the governor governing, the pilot can only regulate engine R.P.M. and not blade angles.

(2) Where the low angle stops in the propeller have been set to give a low enough blade angle to permit the engine to turn its take-off R.P.M., or slightly more, at rated manifold pressure on the blocks, the following procedure applies:

(a) If, with the cockpit control full forward, more than take-off R.P.M. is obtained at run-up, the propeller is in full low angle position and the governor is set to govern at higher than take-off R.P.M. To correctly adjust the linkage system between the cockpit lever and the governor, pull the cockpit lever slowly back until the tachometer indicates a drop in R.P.M. At this point, the governor is set to govern at the indicated R.P.M. Move the cockpit lever forward slightly so the tachometer reads take-off R.P.M., and shut down the engine. Without disturbing the cockpit lever, regulate the adjustable stop at the governor to limit the rotation of the control shaft to this exact angular position. Readjust the linkage system so that the cockpit lever is within 1/8" of its full forward position when the governor pulley or lever is held against the adjustable stop. Minor adjustments may be necessary after flight tests.

(b) If, with the cockpit control full forward, the take-off R.P.M. is not obtained at run-up, it is because the governor is governing at an R.P.M. lower than take-off. The blades are not in full low angle, but are being governed to some higher angle by the governor. (Loss of engine power may give a similar indication and should be considered.) Take-off R.P.M. will be obtained when the governor is adjusted to higher R.P.M. To accomplish this, stop the engine and readjust the linkage system with the governor pulley or lever rotated more in a counterclockwise direction. When take-off R.P.M. is obtained at rated manifold pressure, proceed as outlined under b., (1), (a).

(c) Where the low blade angle settings in the propeller will not permit take-off R.P.M. at rated manifold pressure while the plane is against the blocks, it is necessary to make the control system adjustment after a flight. This is accomplished by regulating the cockpit lever, in flight, until the tachometer read-

ing corresponds with the engine's take-off R.P.M. When this reading is obtained, mark the position of the cockpit lever. Upon landing, return the lever to the marked position and adjust the stop at the control unit to restrict the control shaft from rotating beyond this point. The linkage system should then be readjusted with the cockpit lever approximately 1/8" from its full forward position and the governor pulley or lever against the adjustable stop.

(d) If, on the test flight, take-off R.P.M. cannot be obtained with the cockpit control full forward, it is because the governor is governing at an R.P.M. lower than take-off. It will then be necessary to land and readjust the linkage system with the pulley or lever at the governor rotated sufficiently farther in a counterclockwise position to permit take-off R.P.M. In general, the low angle limit should be such that with the propeller in full low angle the engine will turn at its take-off R.P.M. when the throttle is opened to the allowable take-off manifold pressure while the plane is on the blocks (sea-level density). The propeller will always be in full low angle position when the governor is set to govern at a faster R.P.M. than that at which the engine is running.

c. Low Angle Limit. - The propeller low angle limit must not be adjusted so low that it will be impossible to maintain level flight in case the propeller is forced to full low angle. Flight tests should be made to insure that the low angle required to give take-off R.P.M. while standing still will permit the airplane to maintain level flight without exceeding the maximum R.P.M. rating of the engine. As a rule, the low angle which gives take-off R.P.M. with allowable manifold pressure while the plane is at rest will permit level flight at reduced power. If level flight cannot be maintained, the low angle adjustment must be increased.

d. High R.P.M. Stop. - The high R.P.M. stop is incorporated in the control pulley and cover of the model 4A to 4G governor heads. The stop consists of a pin which can be located in any one of the 18 holes in the control pulley. The pulley travel is limited when the pin rests against the adjustable screw which is threaded into the boss cast integral with the cover. A jam nut and lock wire hold the screw in the desired position after the adjustment is made. In some installations it will be necessary to relocate the pulley on the "hex" of the control shaft to locate the cable clamp in a favorable position in relation to the control cable. If so, it will be necessary to move the stop pin the required number of holes in the pulley according to the new position of the pulley on the "hex".

e. Calculation of the Angular Movement Required at the Governor to Provide Correct Governing. - (1) The curves shown in Fig. 22 indicate the governing R.P.M. corresponding to the angular position of the control shaft of the model "B" and "D" governors. Their governing characteristics are:

	B	D
High Governing R.P.M. (Governor R.P.M.)	2735	2722
Low Governing R.P.M. (Governor R.P.M.)	1200	1100
Pulley Movement for Governing Range	108°	123°

(2) The total angular travel required for any installation is only that necessary to give minimum R.P.M. at one end and take-off R.P.M. at the other. In calculating the required angular travel of the governor shaft, it is essential to consider the drive ratio between the engine and the governor. In most of the nose installations, the ratio is either greater or less than crankshaft speed.

(3) With the control system correctly designated so that the total travel in the cockpit gives the total angular movement required at the governor to obtain minimum R.P.M. on one end and take-off on the other, it is only necessary to adjust the installation so that when the cockpit lever is in its extreme forward position, the governor is set for take-off R.P.M. The adjustment will then, of course, also be correct for minimum R.P.M. when the lever is in its extreme rearward position.

f. Installation and Adjustment of Electrically Controlled Governor. - (1) The electrically controlled governor is mounted on the standard pad on the nose of the engine in exactly the same manner as the mechanically controlled governor. The unit is controlled from the cockpit electrically, by suitable switches, instead of the push-rods and cables used in mechanical installations.

(2) For details see technical orders 03-5-15 and 03-20CA-6.

SECTION IV

INSPECTION AND SERVICE MAINTENANCE

1. Inspection.

Column 28 - Propellers and Accessories.

Daily. - Inspect for external oil leaks around governor base and head.

50-Hour. - Inspect control system and governor for security of mounting. Check for proper safetying of exposed nuts, clevis pins, etc.

Inspect governor assembly for free movement of drive.

2. Maintenance.

a. Since the governor is a self-contained unit continually working in oil, it is subjected to little wear. In cases where external piping is required, special attention should be given to the high pressure oil line to insure that it is securely mounted and not subjected to excessive vibration which might cause failure.

b. Whenever the propeller is removed for overhaul the governor assembly will accompany the propeller. See Section V, paragraph 1.

SECTION V

DISASSEMBLY, INSPECTION, REPAIR & ASSEMBLY - DEPOT

1. Constant Speed Propeller Governor.

a. General. - Overhaul of governor assemblies will be performed at the time of propeller overhaul. This work may be performed by service activities having facilities and properly trained personnel.

b. Disassembly. - (1) Remove the four nuts and palnuts which hold the cover and body sections together.

(2) Lift off the cover section. Care should be taken not to bend the spring collar spindle. Pull the pilot valve straight out of the drive gear shaft.

NOTE: Carbon formed in the drive gear shaft, above the operating range of the pilot valve, may cause the pilot valve to stick in the drive gear shaft. A little solvent will free the pilot valve and allow it to be pulled from the drive gear shaft.

(3) Remove the pilot valve from the cover section by turning the control shaft in the increase R.P.M. direction.

(4) Remove the snap ring which holds the flyball assembly on the drive gear shaft and lift off the flyball assembly.

(5) Remove the four nuts and palnuts which hold the base and body sections together.

NOTE: On all units, except those having Model 1 bases, the base and body sections are held in alignment by four studs. This means of alignment could not be used with the Model 1 base because of the engine mounting studs. Instead, two dowel pins and a tapered pin are used to locate the base accurately on the body. This tapered pin also serves to hold the base and body sections together when the unit is not mounted on the engine. Before removing Model 1 bases, be sure to remove the taper pin. This pin is located on the side of the unit opposite the relief valve. A suitable clamp should be used to remove the taper pin.

(6) Remove the base from the body. On No. 1 bases, this is most easily done by tapping on the upper end of the drive gear shaft. Be sure, however, that the tapered pin has been removed before doing this.

(7) Lift the drive gear shaft and idler gear from the body section. The idler gear shaft is a press fit in the base section. It need not be removed unless it is worn.

(8) Unscrew the relief valve plug and remove the spring and the plunger.

(9) Disassemble the pilot valve-spring collar speeder spring assembly.

(a) Remove the self-locking fiber nut and pilot valve nut from the spring collar spindle.

(b) Lift off the rack, speeder spring and speeder spring spacer.

(c) Remove the cotter and unscrew the pilot valve from the spring collar. Care must be taken not to leave any vise marks or scratches on the pilot valve bearing surfaces and not to bend the pilot valve-spring collar assembly.

(d) Remove the pilot valve ball bearing. This is a press fit on the pilot valve and may be tapped off.

NOTE: It is seldom necessary to disassemble the pilot valve from the spring collar. This should only be done when the pilot valve ball bearing is to be replaced. In case the spring collar spindle is bent or its threads worn, the complete pilot valve-spring collar assembly must be replaced. This is required because the cotter hole in the pilot valve is drilled after the valve has been fitted to its spring collar.

(10) Remove the control shaft assembly:

(a) Remove the cotter key and unscrew the control shaft packing washer nut.

(b) Pull out the control shaft, packing washer and spring.

c. Inspection - Depot. - After disassembly of any or all parts a careful inspection is made and any damage or wear is properly recorded. All ferrous parts will be inspected by the magnaflux system.

d. Repair. - Special attention will be given the following parts:

(1) Pilot Valve Bearing: The pilot valve ball bearing should be cleaned and carefully examined to insure good condition. This part should be replaced if found worn.

(2) Spring Collar: The threads on the upper end of the spring collar should be examined to be sure that they have not been worn by the pilot valve nut. If worn, the pilot valve spring collar assembly should be replaced.

(3) Spring Collar Spacer & Oil Pressure Relief Valve Plunger: The spring collar spacer and the oil pressure relief valve plunger should be inspected for indications of grooving. If these units show signs of being grooved, they should be polished down with fine emery and crocus cloth.

(4) Idler Gear Shaft: The idler gear shaft should be inspected for side wear. If it shows indications of being worn by the idler pump gear, the shaft should be replaced.

(5) Control Shaft: The teeth of the control shaft should be inspected for wear. This shaft is plated and the wearing off of the plating should not be confused with actual wearing of the teeth. This shaft should be replaced if the teeth are badly worn.

e. Modification. - If not previously accomplished, the following modifications will be made during overhaul.

(1) Remove straight pin securing the bushing and redrill hole with a No. 50 drill (.070") to a depth of 1/4 inch and tap No. 2-56 thread N.C. (Cl-3) to 7/32 inch full thread depth. Countersink hole 82° x 11/64 inch diameter and install screw, Part No. AN505-2-3, staking it carefully at the screwdriver slot.

(2) On earlier design governor replace base and body taper dowel Part No. 50656 with flat head screw Part No. 53401 to eliminate damage due to the taper dowel being pulled through the base as a result of excessive tightening. This change can be accomplished by firmly clamping the body and base together, thence drilling and reaming a straight hole to .2187" + .0003" - .0002" and countersinking the base for the screw head.

(3) To eliminate fatigue failures all couplings Part No. 53939 prior to change "G" installed in 4K11 service governor and coupling Part No. 53628 prior to change "H" installed in 2G8 service governor will be replaced with new couplings manufactured to drawing 53939 change "G" and 53628 change "H". The change letters referred to are either stamped or etched on the particular parts.

(4) To eliminate the tendency of the relief valve spring Part No. 51737 to take a permanent set this part has been modified as shown on drawing 51737 change "D". This change consists of an increase in the wire diameter from .045" to .051" and reduce the

overall free length from 1 15/16" to 1 1/2". All springs of the smaller diameter wire and longer length will be replaced with the later type springs.

(5) Governor drive gear shafts Part No. 53895 prior to change "D" installed in governor models 4G8 and 4G10 and shaft Part No. 53940 prior to change "C" installed in governor models 4K11, 1M12, 1P12 and 1Q12 will be modified as shown in Figures 23 and 24 respectively.

f. Assembly. - (1) General - Direction of Drive Rotation: The governor is so designed that it can be adapted to operate for clockwise or counterclockwise direction of rotation. Located on both the high pressure and the low pressure side of the booster pump are two plug holes; one in the base for the engine inlet oil, and one in the body for high pressure booster pump oil. The four holes are stamped A and B in the base, and B and A in the body. Two Oil Control Plugs are screwed into the A-A holes if the direction of rotation of the drive when viewing the engine pad is counterclockwise and into the B-B holes if the drive rotation is clockwise. These plugs control the flow of oil through the booster pump so that inlet oil at engine pressure always enters on the low pressure side and outlet oil on the high pressure side.

(2) Control Shaft: (See Figures 25 & 26) to assemble the control shaft in the cover:

(a) Put the leather packing washer over the outer end of the shaft and slide it up against the shoulder flange.

(b) Place the spring in the hole which locates the inner end of the control shaft in the cover.

(c) Insert the control shaft.

(d) Thread on the control shaft packing nut.

(e) Install the safety pin so that the head end of the pin is adjacent to the control shaft and the legs spread back against the governor cover surface as shown on Drawing 40A8289.

(3) Method of Assembling and Setting Governing Limits of Type 1-A, 4-A, 4-B and 4-C Governor Heads: (a) The accompanying curve sheets Nos. 27, 28 and 29 apply to the model "C", "E", "A", "M", "P" and "Q" governors respectively.

(b) The type 1-A cover incorporates the control shaft with one tooth omitted, the rack with one tooth space filled in, and a threaded ring containing a snap ring which replaces the

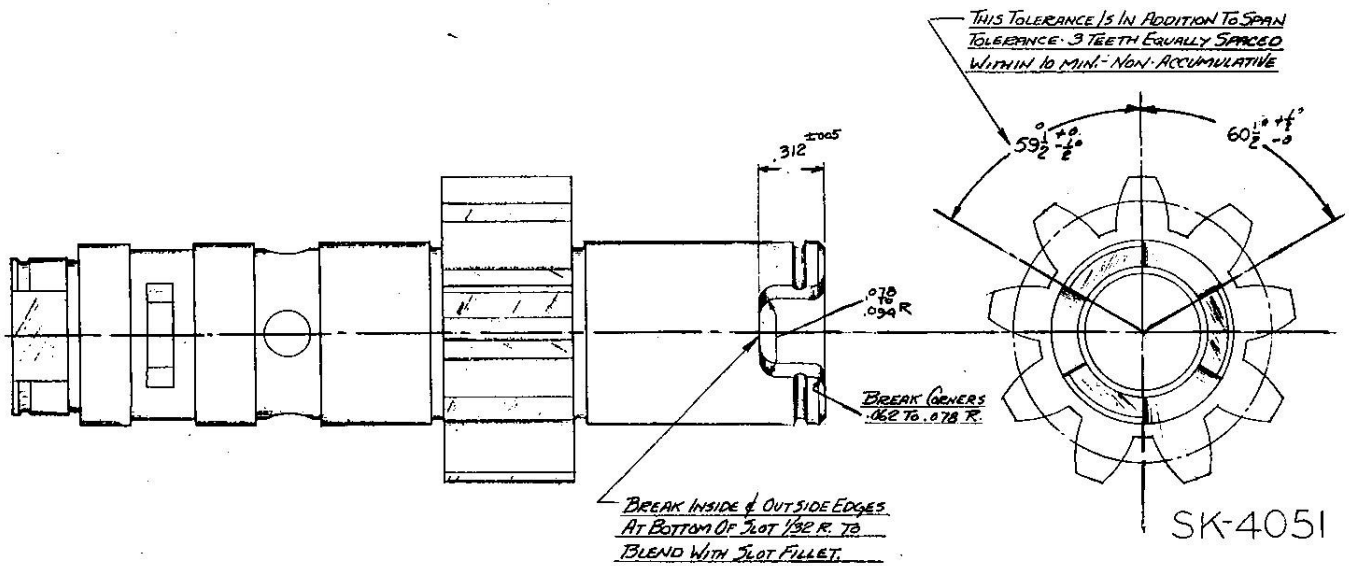


FIG. 23—GOVERNOR DRIVE SHAFT
PART NO. 53940

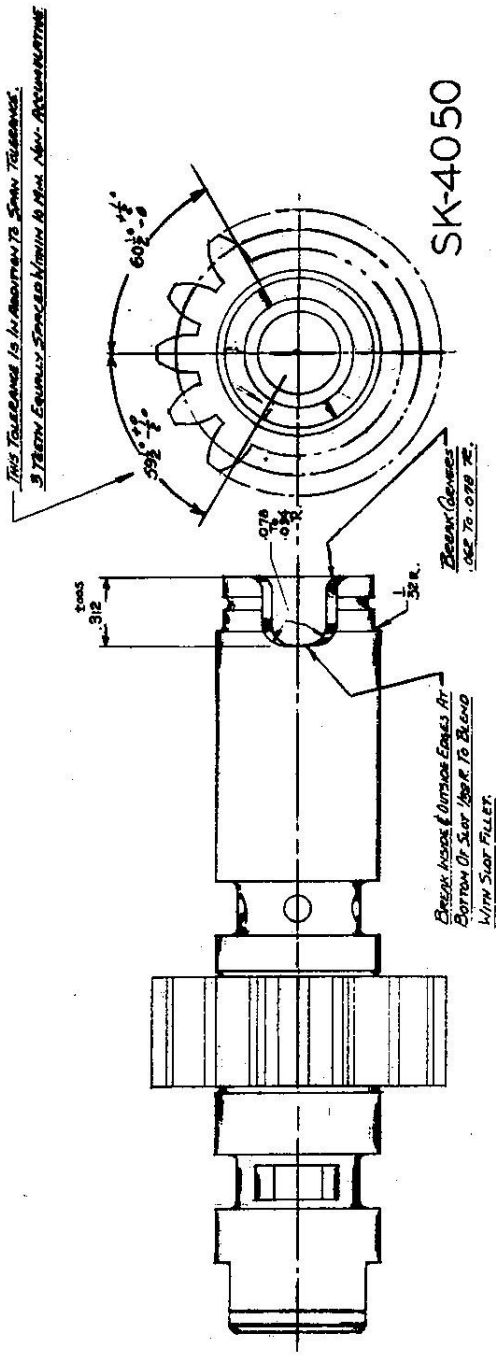


FIG. 24—GOVERNOR DRIVE SHAFT PART NO. 53895

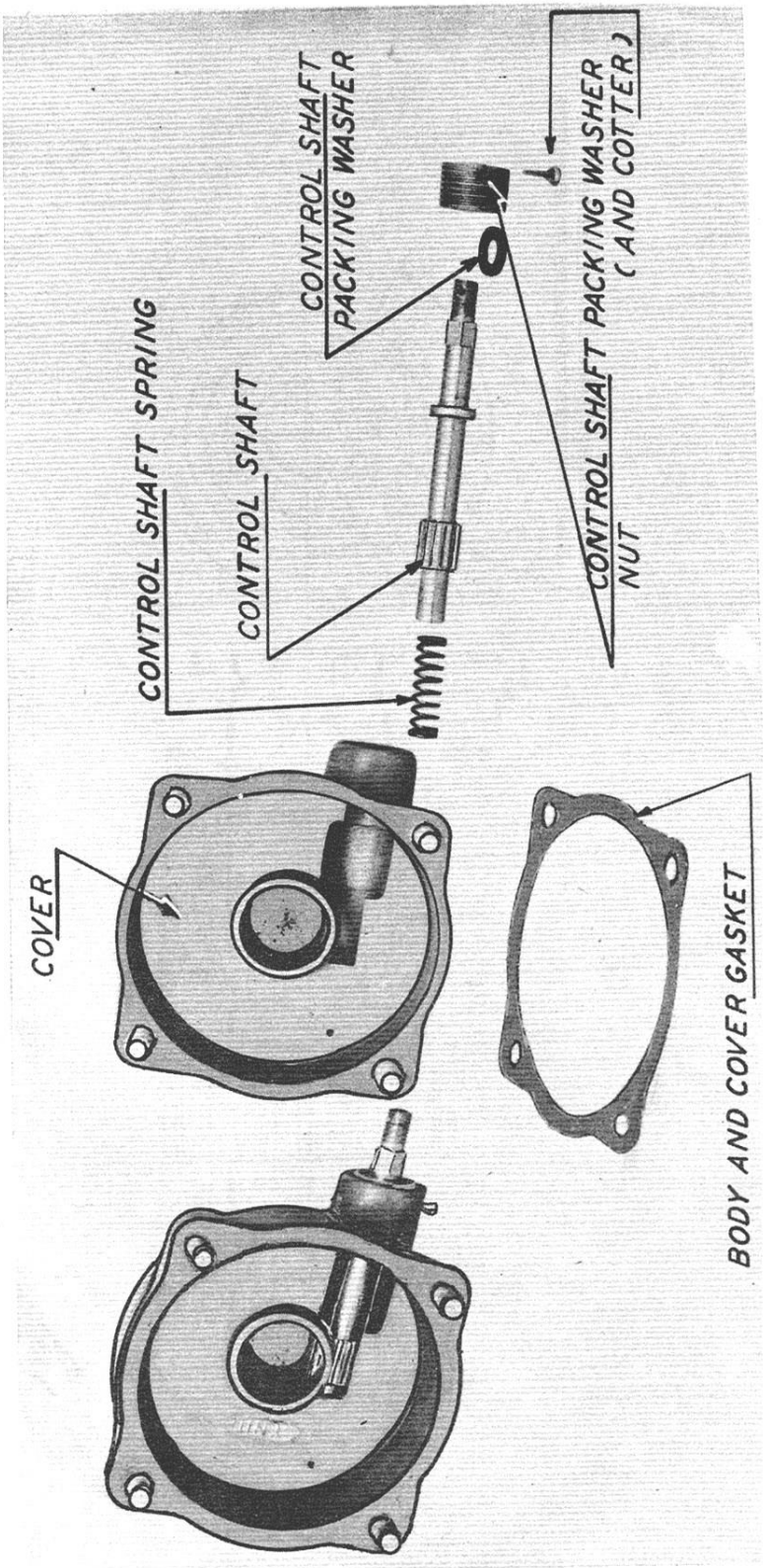


FIG. 25—COVER ASSEMBLY

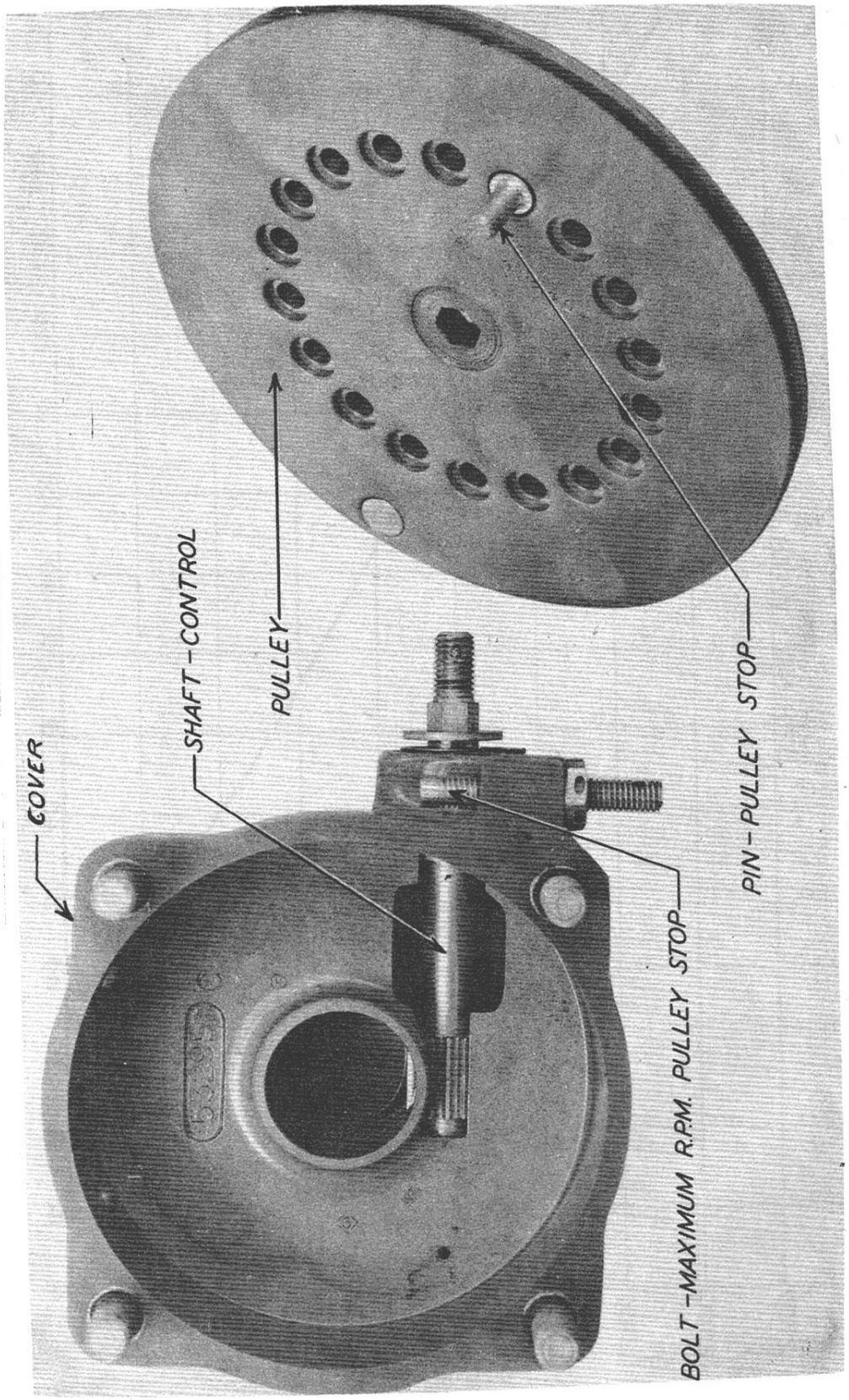


FIG. 26—COVER ASSEMBLY WITH PULLEY STOP PIN

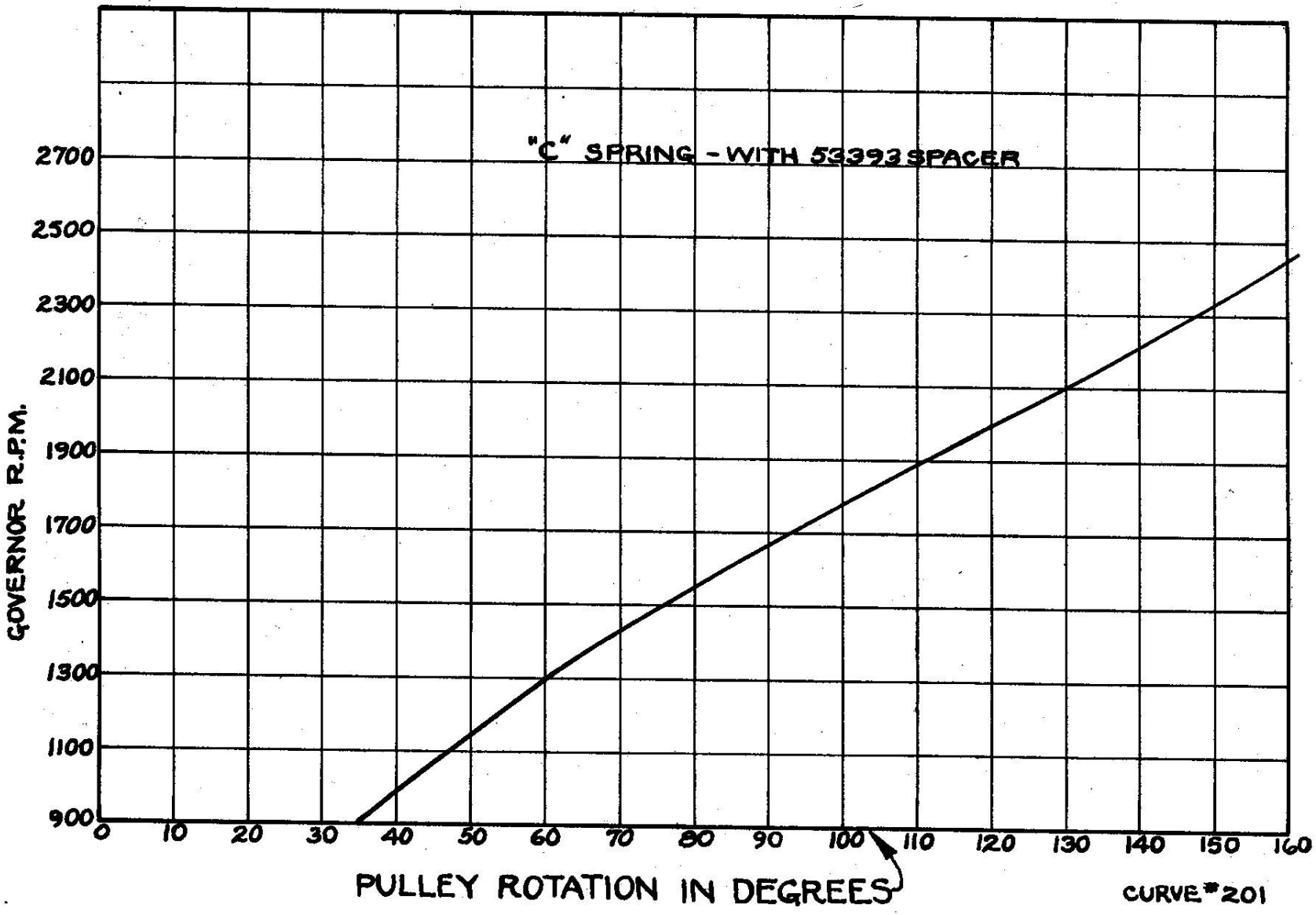


FIG. 27—PULLEY ROTATION-VS-GOVERNOR R.P.M. ("C" SPRING)

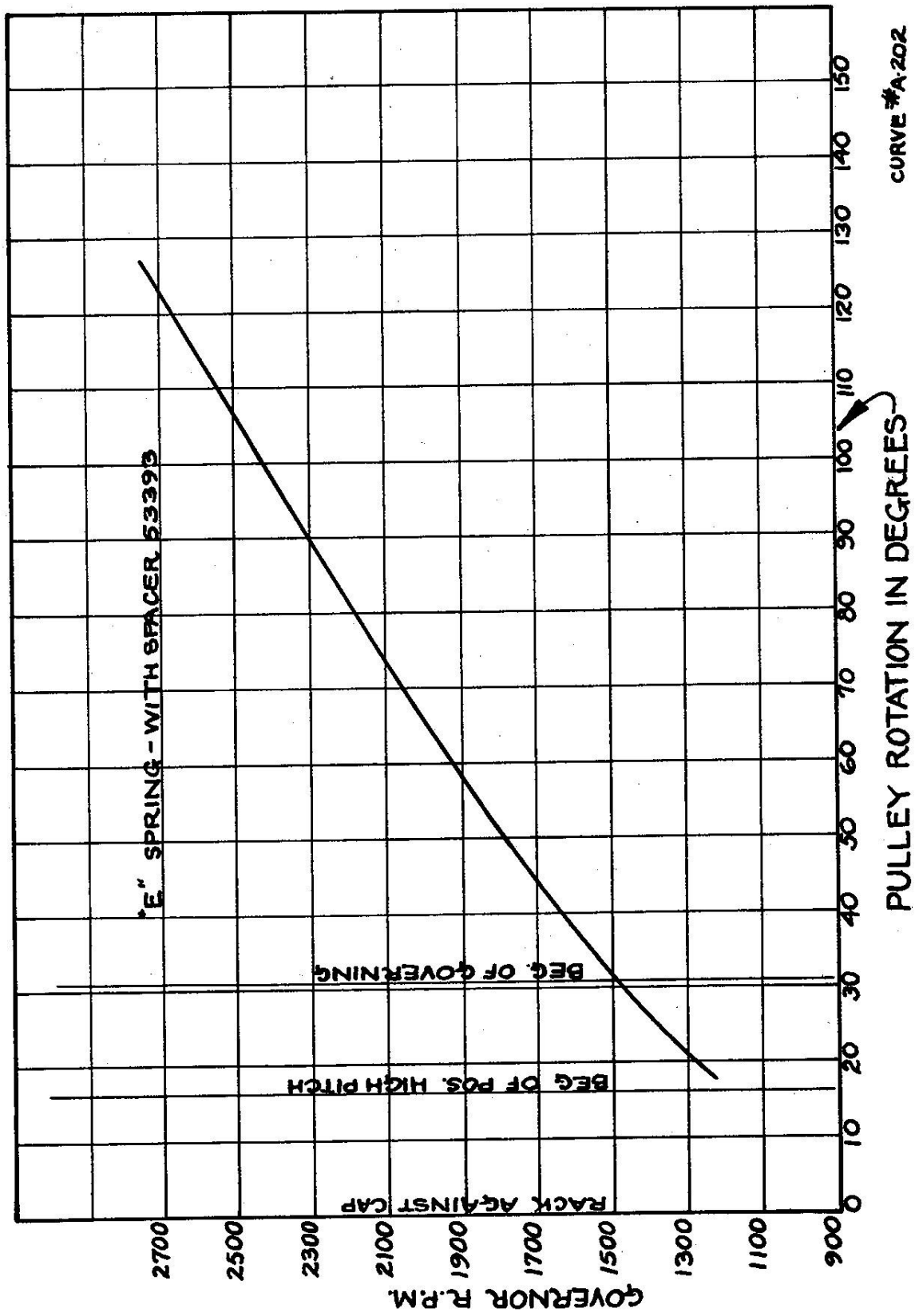


FIG. 2 8 — PULLEY ROTATION —VS— GOVERNOR R. P. M. ("E" SPRING)

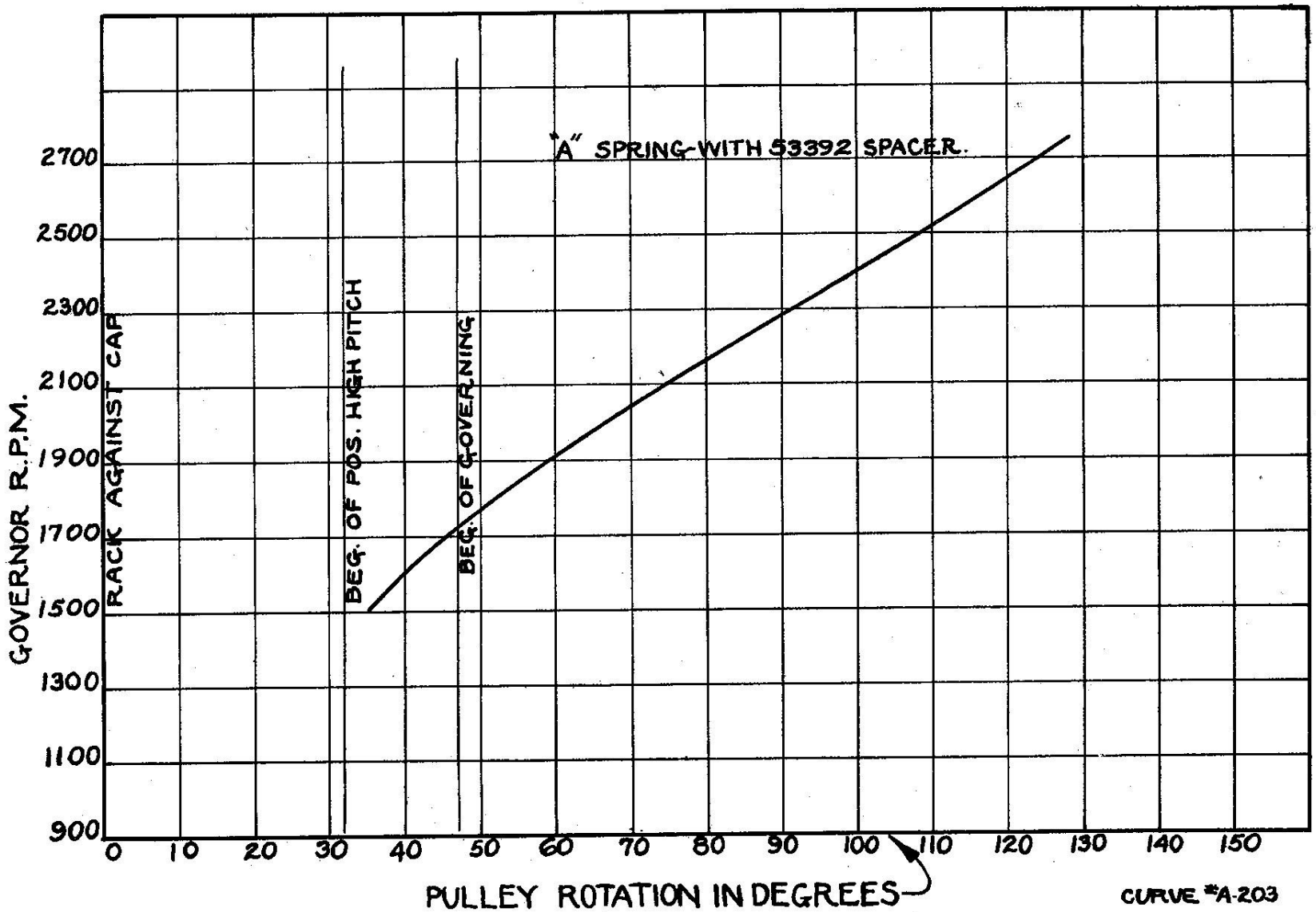


FIG. 29—PULLEY ROTATION-VS-GOVERNOR R.P.M. ("A" SPRING)

fixed web in rack #51666. In the pulley are 18 holes into any one of which the stop pin may be inserted. The points of the hex on the outside of the pulley are marked with an arrow and the numerals 2, 3, 4, 5 and 6. The outer end of the control shaft is marked with a line across one half of its diameter in line with one point of its hex.

(c) In assembling, the large space on the control shaft should be mated with the filled-in tooth space in the rack. The pulley should be mounted on the control shaft so that the arrow and the mark on the control shaft line up.

(d) The unit assembled as described above is ready to be set for maximum RPM.

(e) To determine the pulley rotation for the various governor speeds, reference is made to the applicable curve (26, 27 or 28). The pin is located in the nearest hole that will give the required degree angular travel of the pulley. The pulley travel is measured from the point at which the rack bottoms in its bore in the cover to the point at which the pin stops against the outside adjustable screw.

(f) In setting the maximum governor speed, the angular travel to get the required speed is set first. With the pulley travel set, the ring in the rack is adjusted up or down to get the desired governing RPM. If after the pulley travel has been set the governor speed is too low, the ring should be turned down toward the spring collar. One turn should equal approximately 200 RPM.

(g) The rack and control shaft, and the shaft and pulley of the 4-A cover are assembled in the same manner as outlined for the type 1-A cover.

(h) No definite angular travel is required for maximum RPM. The stop pin and adjustable screw in the cover should be adjusted so that the pulley is stopped against the head of the screws at the specified maximum RPM. The minimum limit is set in the usual manner.

(i) It is important that the positive low pitch adjustment in the rack is set so that no interference with the pilot valve occurs when the speeder spring is fully compressed.

(4) Pilot Valve - Spring Collar - Speeder Spring Assembly: (See Figures 30 & 31) to assemble the pilot valve, spring collar and speeder assembly, proceed as follows:

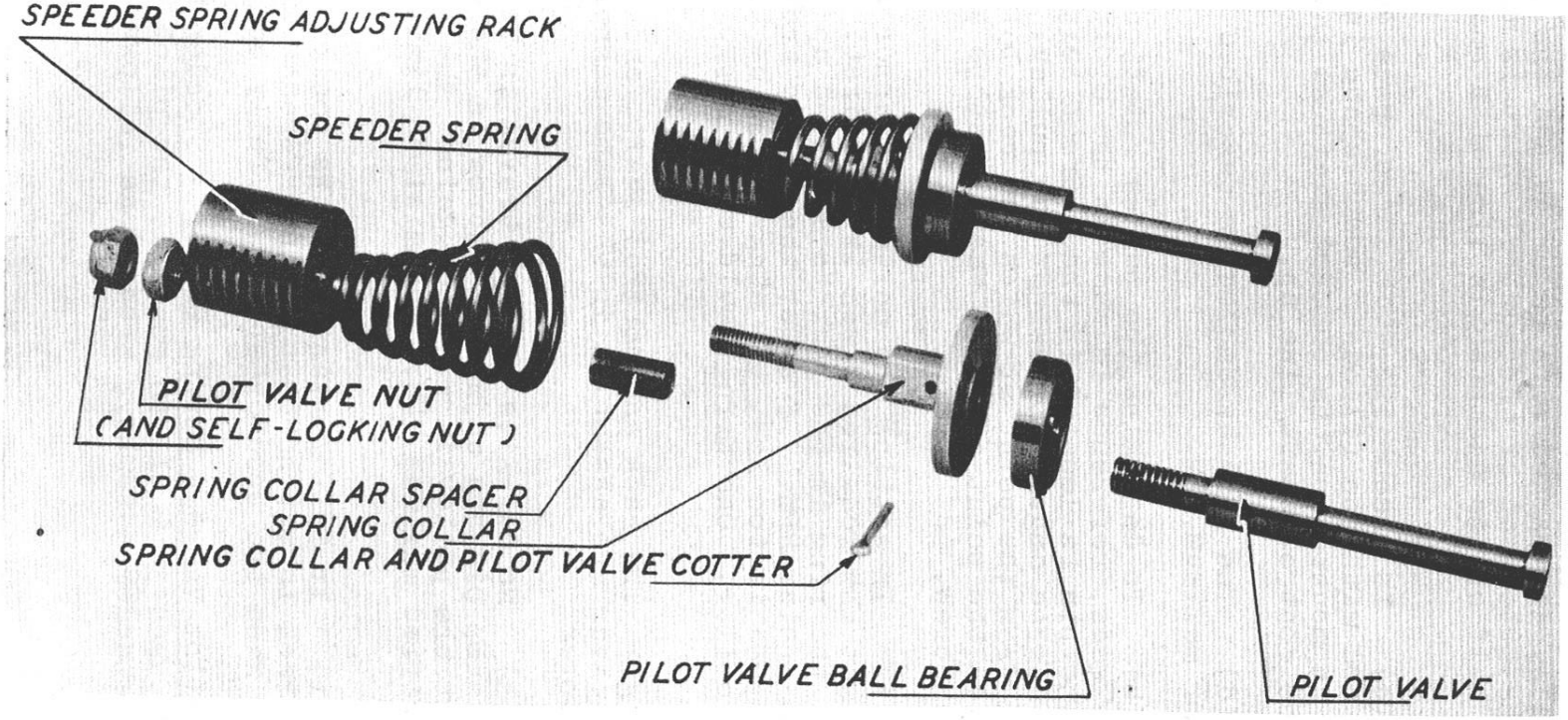


FIG. 30—PILOT VALVE DETAILS

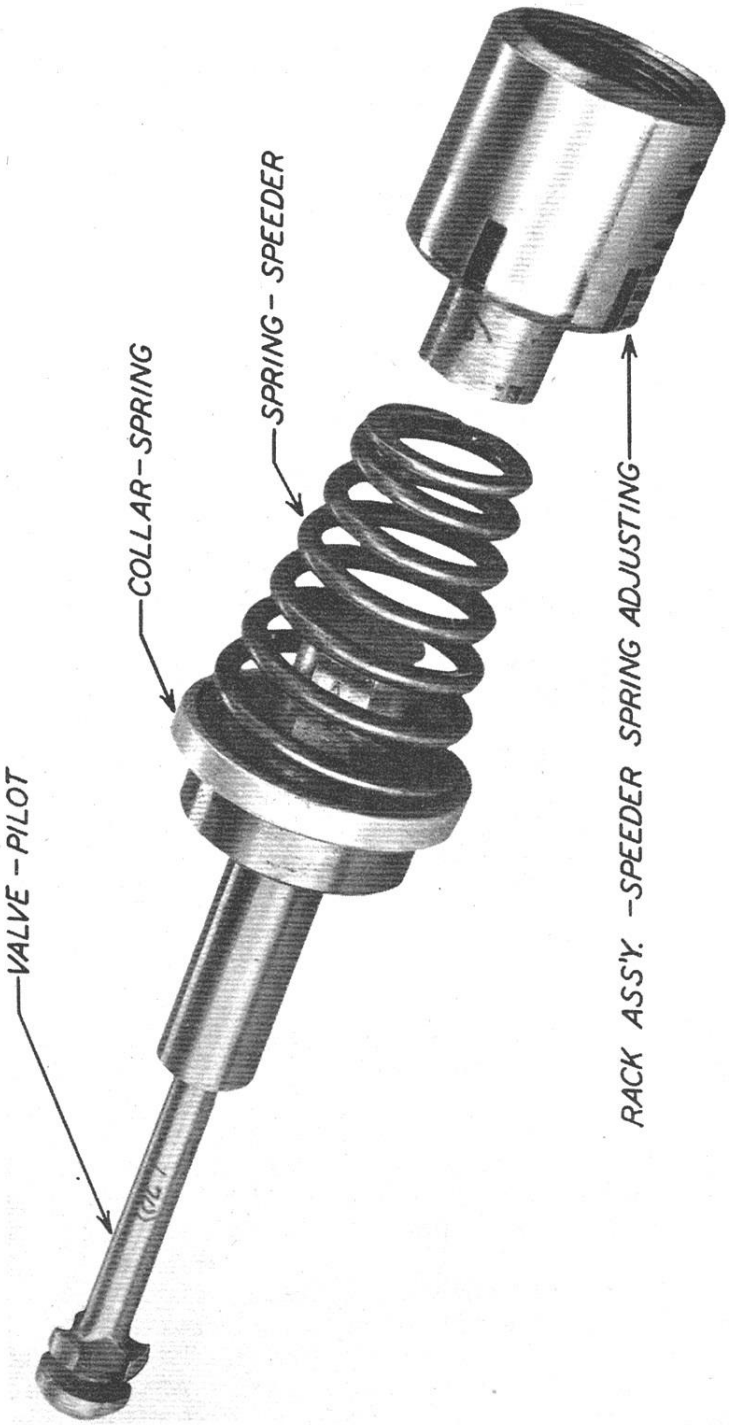


FIG. 31 — PILOT VALVE ASSEMBLY

(a) Press the pilot valve ball bearing down over the upper end of the pilot valve until it bottoms on the upper bearing surface of the valve.

(b) Thread the pilot valve in the spring collar and safety with a steel cotter key. The cotter holes should line up when the valve has been turned tightly into the spring collar.

(c) Slide the spring collar spacer over the spring collar spindle.

(d) Place the speeder spring over the spring collar spindle so that its large base is seated on the flange of the spring collar.

(e) Place the speeder spring rack so that the top of the speeder spring bottoms on the flange in the base of the rack.

(f) Tighten the pilot valve nut down on the spring collar spacer until it bottoms on the spring collar spacer.

(g) Safety by turning the self-locking nut down tight against the pilot valve nut.

(5) Drive Gear Shaft: (See Fig.32.) Place the drive gear shaft in the body section.

(6) Idler Gear: (See Fig.32.) Mesh the idler gear with the drive gear.

(7) Oil Seal Gasket: Install a new oil seal gasket in the groove which is cut in the bottom of the body section.

(8) Base: (See Fig.33 &34.) (a) Place the base on the body section.

(b) Check to see that the unit is plugged (A.A. or B.B.) for proper pump rotation.

(c) Install and tighten the four nuts which hold the base and body section together. As the nuts are tightened rotate the drive gear shaft to be sure it is free and that the bearing surfaces in the base and body sections are in alignment.

NOTE: With Model 1 base alignment is secured by means of the two dowel pins located on either side of the nose section of the base and by the tapered pin. This pin also serves to hold the base and body sections together. After placing the base on the body section, install the tapered pin and the tapered pin nut.

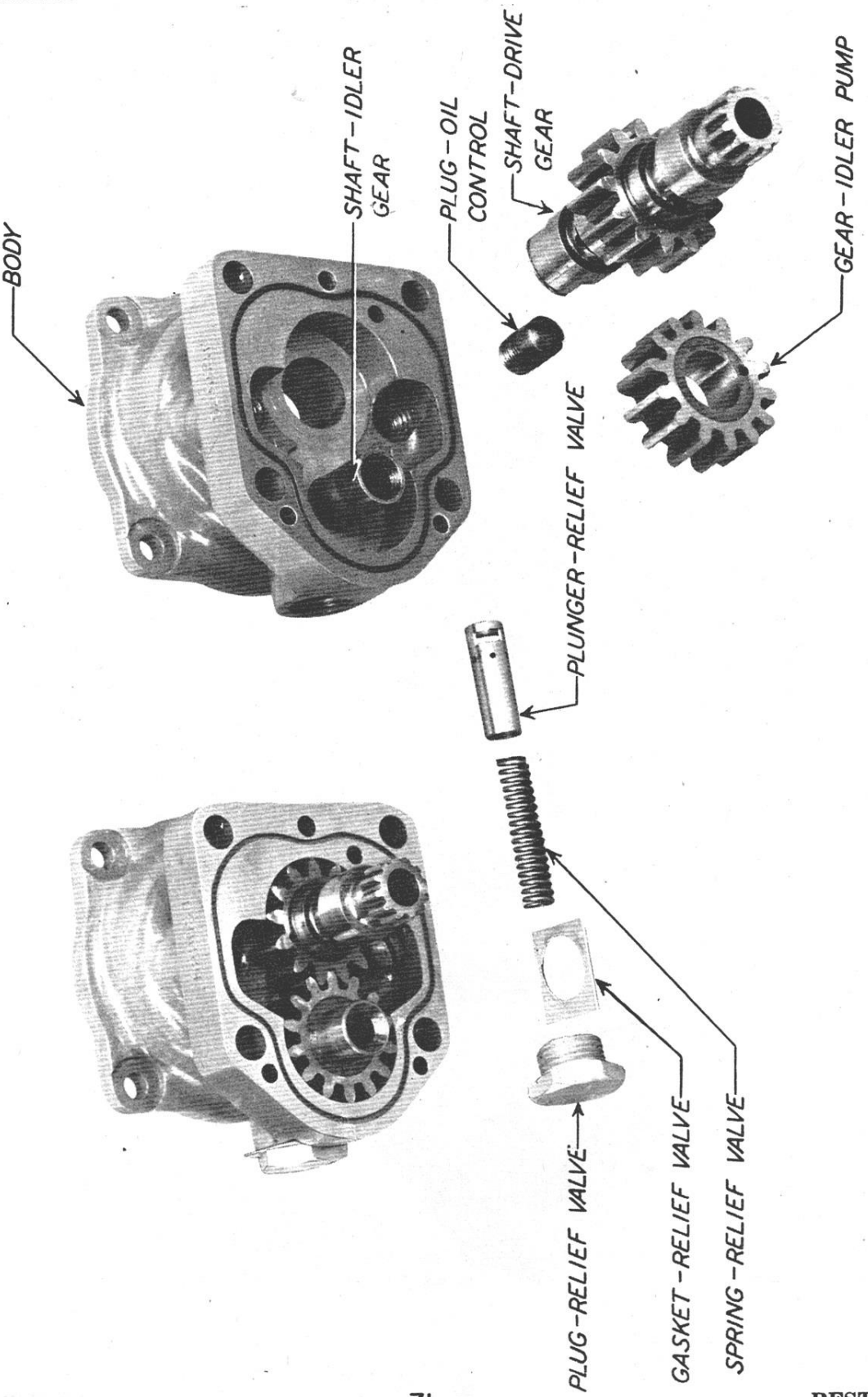


FIG. 32—BODY & DRIVE GEAR ASSEMBLY

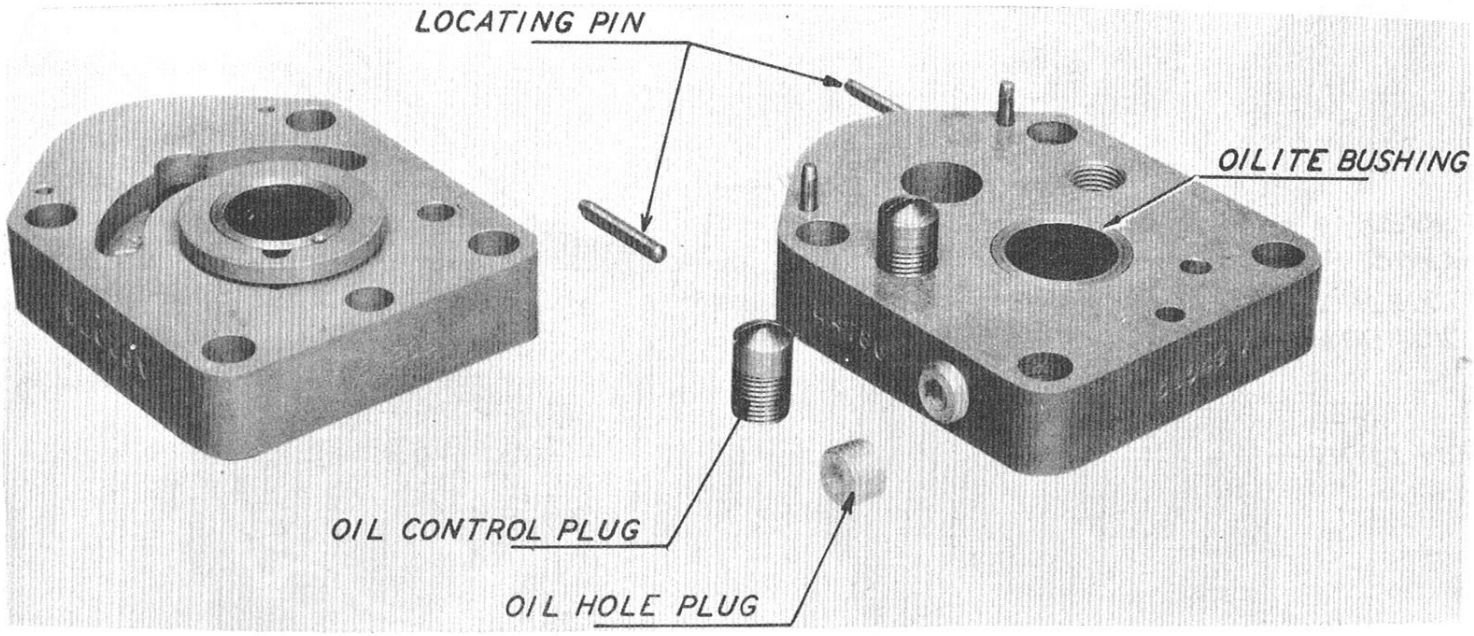


FIG. 33—MODEL IAI BASE ASSEMBLY

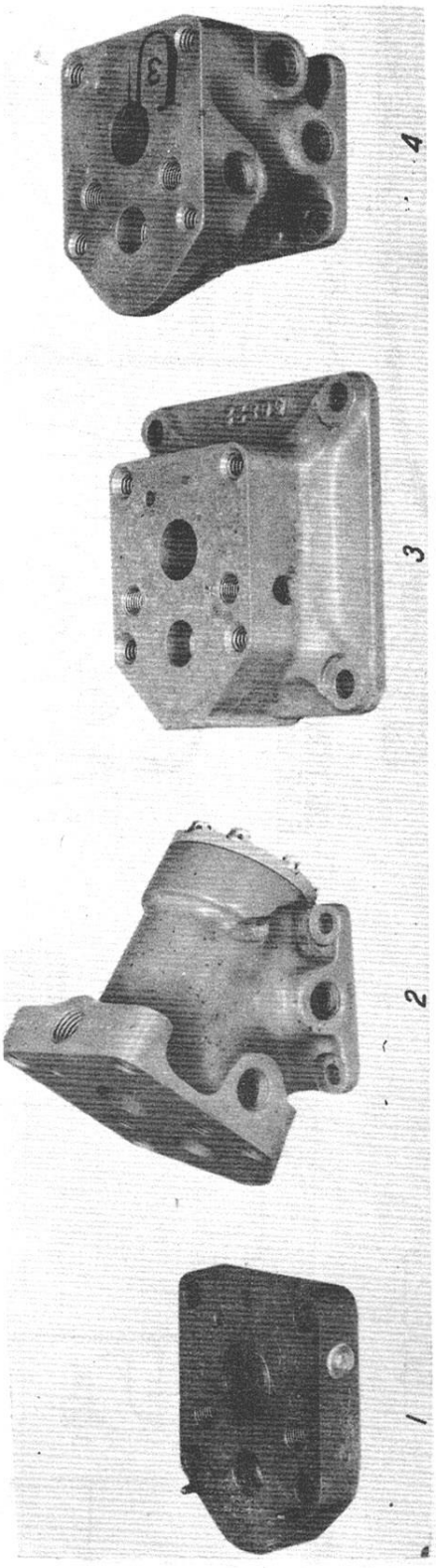


FIG. 34—MOUNTING BASES MODELS IA1, IA2, IA3 & IA4

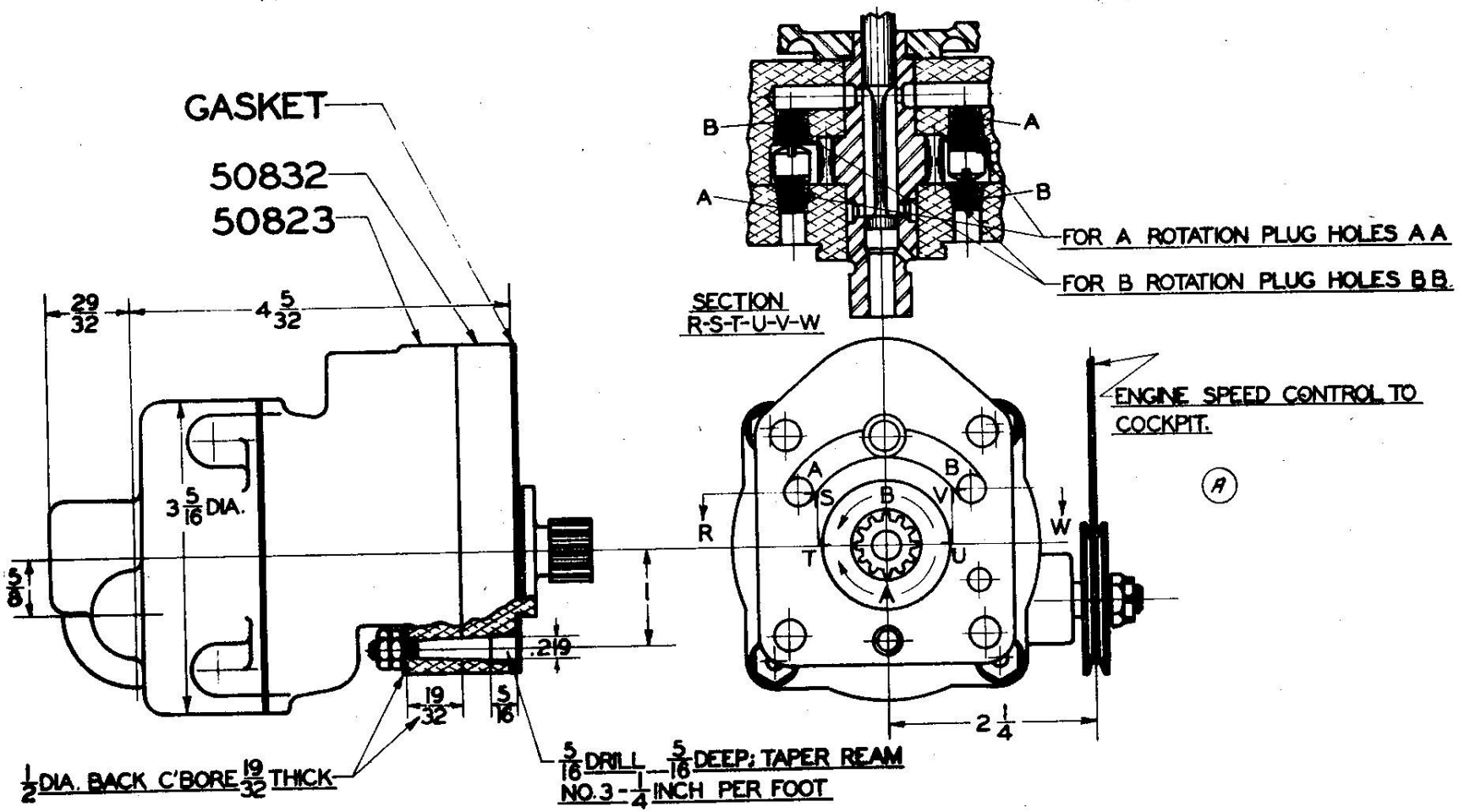


FIG. 35—GOVERNOR WITH NO. I BASE FOR ENGINE NOSE MOUNTING

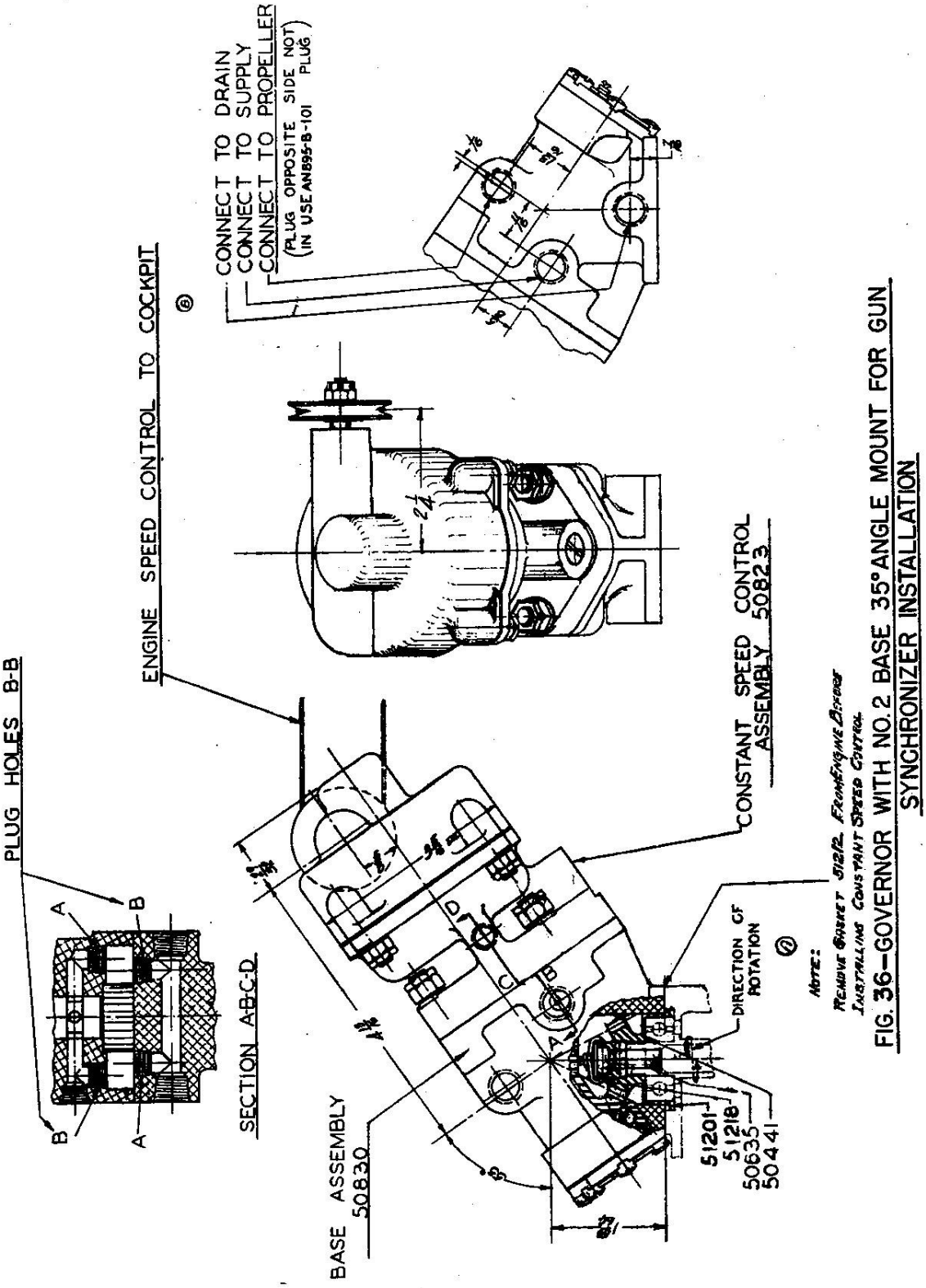


FIG. 36—GOVERNOR WITH NO. 2 BASE 35° ANGLE MOUNT FOR GUN SYNCHRONIZER INSTALLATION

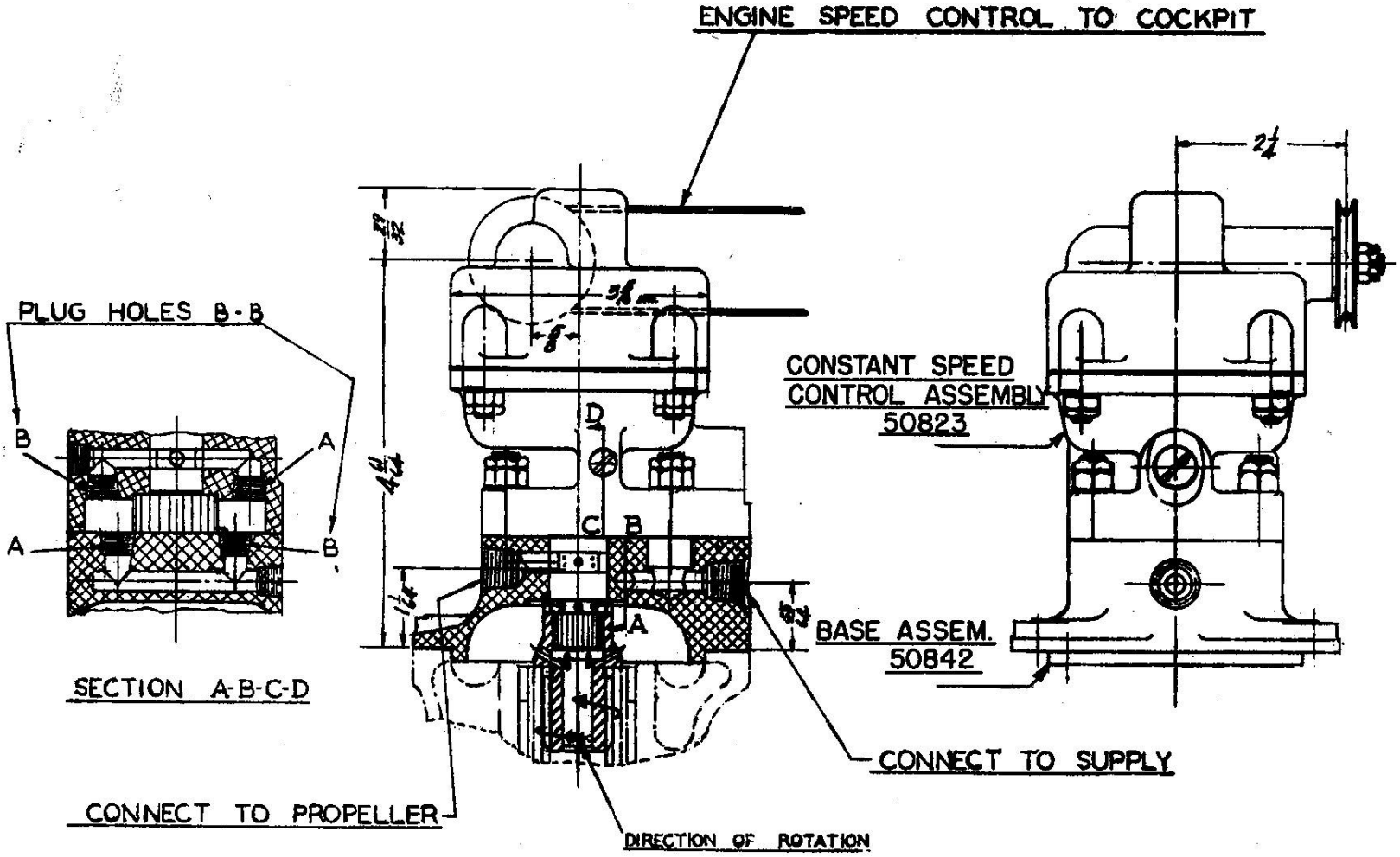


FIG. 37—GOVERNOR WITH NO. 3 BASE FOR REAR ACCESSORY MOUNTING

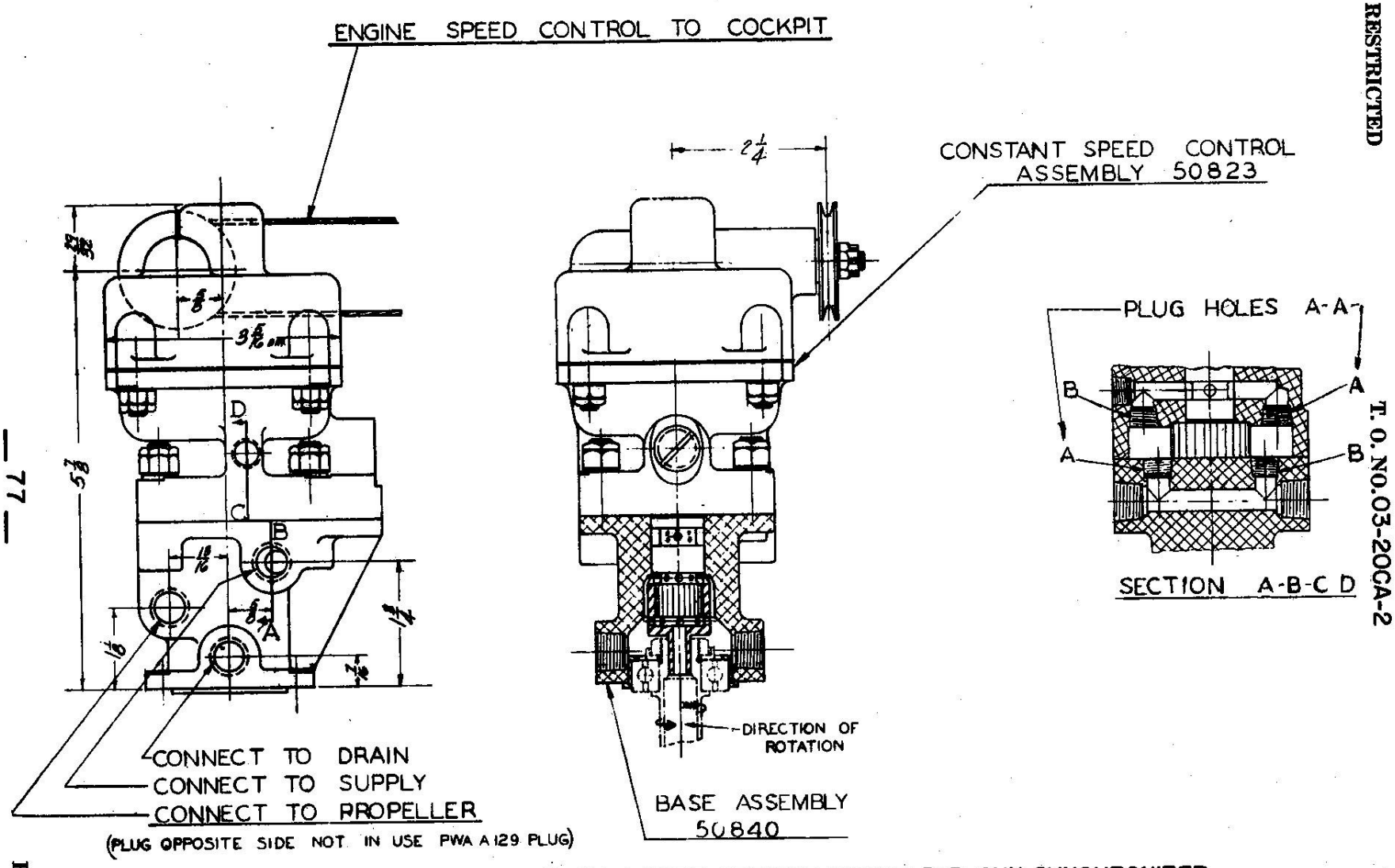


FIG. 38—GOVERNOR WITH NO.4 BASE UPRIGHT MOUNT FOR GUN SYNCHRONIZER INSTALLATION

(9) Relief Valve: (See Fig. 32) (a) Service experience has shown the desirability of providing a Relief Valve Assembly which can be readily removed and whose parts may be interchanged without affecting the specified results in Relief Valve pressure. In order to accomplish this, a Relief Valve Plug has been designed which can be removed easily and which always gives the original compression length to the Relief Valve Spring, when tightened into the Body.

(b) The new Plug differs from the former Plug in that it has straight threads instead of tapered, and has a hex head in place of a screw head. The straight threads and the hex head simplify the removal of the Plug. The straight threads permit the Plug to be turned into the Body until its shoulder bottoms a special gasket against the face of the Body which is machined flat. By holding the Plug, the Gasket, and the face of the Body to close tolerances, the original compression length of the Relief Valve Spring is held constant. This means that Relief Valve parts may be interchanged without causing the pressure to vary above or below the specified limits.

(c) A special gasket (Part #52205) is used between the head of the Plug and the Body. This gasket acts as an oil seal. By turning two of its corners down over two faces on the Plug's hex head, the gasket also serves to safety the Plug.

(d) The former design Body cannot be reworked to take the new Relief Valve Plug because the outer end of the pipe thread hole is already larger than the diameter of the straight thread on the new Plug. Consequently, this change involves a new design Body and Plug together with a new Gasket, as follows:

Body---------- Part #50647 has been superseded by Part #52203
Plug---------- Part #50664 has been superseded by Part #52204
Gasket---------- Part #52205 has been added to the assembly
Spring---------- has not been changed
Plunger---------- has not been changed

(e) The new design of Body (Part #52203) is interchangeable with the superseded Body (Part #50647). The new design of Relief Valve Plug (Part #52204) and Gasket (Part #52205) can only be used with the new design of Body (Part #52203). Consequently, to incorporate this change in existing Controls, it is necessary to replace Body (Part #50647) with Body (Part #52203), replace Plug (Part #50664) with Plug (Part #52204), and add Gasket (Part #52205).

(f) To assemble the relief valve in the body, place the plunger and the spring in the relief valve opening.

(g) Turn the plug securely into the body.

(10) Flyball Assembly: (See Fig.39.) Place the flyball assembly on the upper end of the drive shaft and lock it by means of the snap ring. Engage the teeth of the rack with those of the control shaft.

(11) Cover Section: (See Fig.25.) Place the cover section on the body. In doing this, care should be taken to maintain alignment between the drive gear shaft and the pilot valve-spring collar assembly, as this assembly slides into the drive gear shaft. Secure the cover section to the body by means of the four nuts. Securely safety all exposed nuts and clevis pins.

NOTE: Model 2 bases (35° angular mount) incorporate a special intermediate Unit Drive Gear. This gear has a female spline at the upper end, which fits the splined lower end of the drive gear shaft, and a 12 tooth angular gear near the lower end, which meshes with the coupling to the engine drive. A ball bearing supports the lower end of this shaft. The Unit Drive Gear Assembly is removable by unsafetying and unscrewing the seven Bearing Thrust Cover Screws which secure the Bearing Thrust Cover to the base.

2. Hydromatic Constant Speed Propeller Governor.

a. General. - Overhaul of governor assemblies will be performed at the time of propeller overhaul.

b. Disassembly. - (1) Remove the four nuts and palnuts which hold the cover and body sections together.

(2) Lift off the cover section. Carbon formed in the drive gear shaft, above the operating range of the pilot valve, may cause the pilot valve to stick. A little solvent will free the pilot valve and allow it to be removed.

(3) Remove the rack from the cover section by turning the control shaft in a counter-clockwise direction.

(4) Remove the pilot valve from the drive gear shaft.

(5) Remove the snap ring which holds the flyball assembly on the drive gear shaft and lift off the flyball assembly.

(6) On all units having bases for mounting on the standard nose pad, two dowel pins and a tapered pin are used to locate the base accurately on the body. This tapered pin also serves to hold the base and body sections together when the unit is not mounted on the engine. This pin is located on the side of the unit

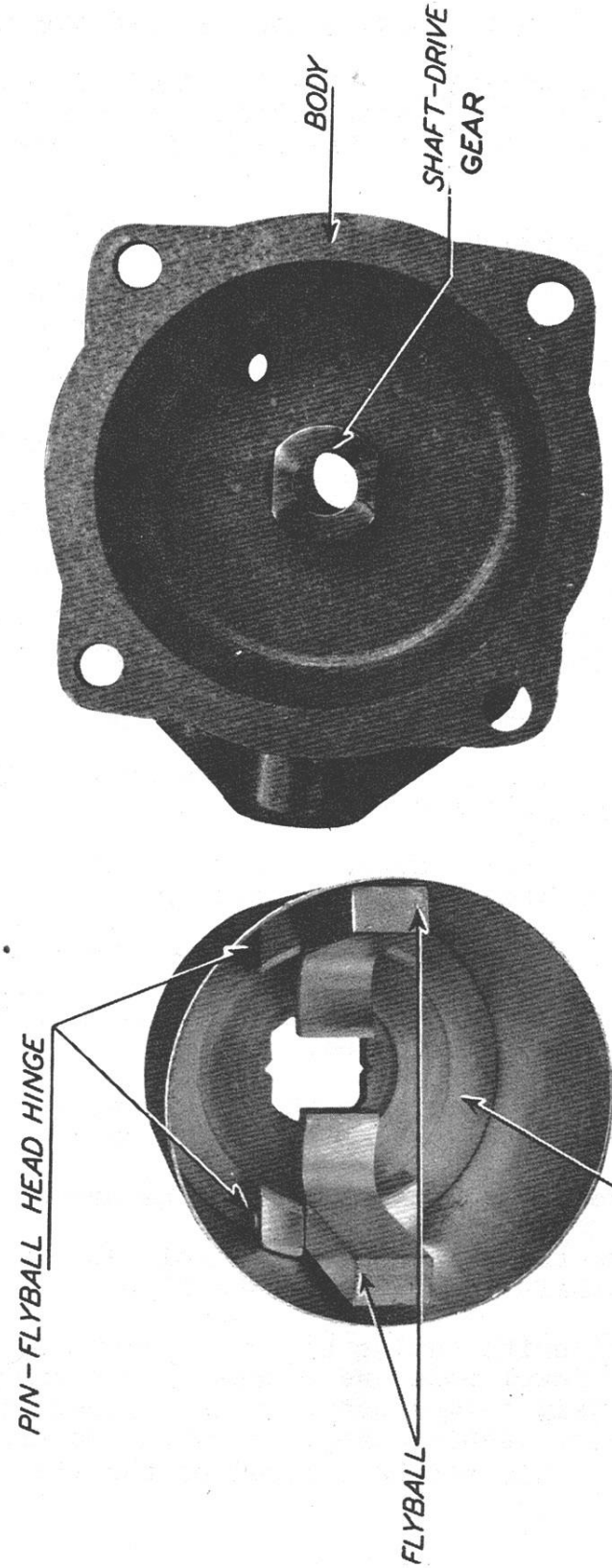


FIG. 39— FLYBALL HEAD ASSEMBLY

opposite the relief valve. It shall be made certain that this pin is removed before removing the base from the body. A suitable clamp shall be used for removal of the taper pin.

(7) Remove the base from the body. This is most easily done by tapping on the upper end of the drive gear shaft. Be sure, however, that the tapered pin has been removed before doing this.

(8) Lift the drive gear shaft and idler gear from the body section. The idler gear shaft is a press fit in the base section. It need not be removed unless it is worn.

(9) Unscrew the relief valve plug and remove the spring and the plunger.

(10) Disassemble the pilot valve, spring collar and speeder ring assembly.

(a) Remove the cotter and unscrew the pilot valve from the spring collar. Care must be taken not to leave any marks or scratches on the pilot valve bearing surfaces.

(b) Remove the pilot valve ball bearing. This is a press fit on the pilot valve and may be tapped off.

(c) It is seldom necessary to disassemble the pilot valve from the spring collar. This should only be done when the pilot valve ball bearing is to be replaced.

(11) Remove the control shaft assembly from the cover section.

(a) Remove the cotter key and unscrew the control shaft packing washer nut.

(b) Pull out the control shaft, packing washer and spring.

(12) Remove bolt through high pressure elbow in base.

(13) Remove ball check, spring and plunger.

c. Inspection - Depot. - After disassembly of any or all parts careful inspection will be made and any damage or wear properly recorded. All specified ferrous parts will be inspected by the magnaflux system.

d. Repair. - Special attention will be given the following parts:

(1) The pilot valve ball bearing will be cleaned and carefully examined to insure good condition. This part shall be replaced if found worn.

(2) The oil pressure relief valve plunger shall be inspected for indications of scoring. If it shows signs of being scored it shall be polished with fine emery and crocus cloth.

(3) The idler gear shaft shall be inspected for side wear. If it shows indications of being worn, the shaft shall be replaced.

(4) The teeth of the control shaft shall be inspected for wear. This shaft is plated and the wearing off of the plating should not be confused with actual wearing of the teeth. This shaft shall be replaced if the teeth are badly worn. (Use of cable type control to the governor will reduce wear if due to vibration.)

(5) The test stand run-up of the unit will check the wear on the gear pump, the fit of the pilot valve in the drive gear shaft, and the oil pressure relief valve assembly.

(6) Worn parts shall be replaced. Oversize parts are not available.

e. Assembly. - (1) General - Direction of Drive Rotation: The governor is so designed that it can be adapted to operate for clockwise or counterclockwise direction of rotation. Located on both the high pressure and low pressure side of the booster pump are two plug holes; one in the base for the engine inlet oil, and one in the body for high pressure booster pump oil. The four holes are stamped A and B in the base, and B and A in the body. Two Oil Control Plugs are screwed into the A-A holes if the direction of rotation of the drive when viewing the engine pad is counterclockwise and into the B-B holes if the drive rotation is clockwise. These plugs control the flow of oil through the booster pump so that inlet oil at engine pressure always enters on the low pressure side and outlet oil on the high pressure side.

(2) Control Shaft: (See Fig.25.) Refer to paragraph f. (2), page 32. To assemble the control shaft in the cover:

(a) Put the leather packing washer over the outer end of the shaft and slide it up against the shoulder flange.

(b) Place the spring in the hole which locates the inner end of the control shaft in the cover.

(c) Insert the control shaft.

(d) Thread on the control shaft packing nut.

(e) Safety the nut with a cotter key.

(3) Pilot Valve - Spring Collar - Speeder Spring Assembly: (See Fig. 30.) To assemble the pilot valve, spring collar and speeder spring assembly, proceed as follows:

(a) Press the pilot valve ball bearing in place on the pilot valve stem.

(b) Fit the spring collar on the pilot valve and safety with a steel cotter key.

(c) Place the speeder spring in the spring collar so that its large base is seated on the flange of the spring collar.

(4) Body: (See Fig. 32.) (a) Place the drive gear shaft in the body section.

(b) Mesh the idler gear with the drive gear.

(c) Install a new oil seal gasket in the groove which is cut in the bottom of the body section.

(d) Replace the plunger, spring and ball check at the transfer valve. Replace the elbow and bolt for the high pressure connection. After tightening, this bolt will be safetied with .040" stainless steel wire, part number 51218.

(e) Check to see that the unit is plugged (A.A. or B.B.) for proper pump rotation.

(5) Base: (a) Place the base on the body section.

(b) With Model 6 Base, alignment is secured by means of the two dowel pins located on either side of the nose section of the base and by the tapered pin. This pin also serves to hold the base and body sections together. After placing the base on the body section, install the tapered pin and the tapered pin nut.

(6) Relief Valve: (Fig.32.) Refer to paragraph 1., f., (9). Assemble the relief valve in the body.

(a) Place the plunger and the spring in the relief valve opening.

(b) Tighten the plug securely and safety with the locking washer.

(7) Flyball Assembly: (See Fig.39.) (a) Place the flyball assembly on the upper end of the drive shaft and lock it by means of the snap ring.

(b) Place the speeder spring assembly in the drive gear shaft.

(8) Cover Section: (See Fig.25& Fig. 26) (a) Place the rack in its bore in the cover with the spring guide down.

(b) Place cover section on the body. In doing this, care will be taken to place the speeder spring guide carefully in the small end of the spring

(c) Secure the cover section to the body. Pal-nuts should be installed.

3. Testing.

a. Within a very short time a special testing devise will be available for all depots. This test unit will be universal for all types of governors and controls. Information with test data will be forwarded as soon as procurement is made.

b. In Governor Test Specifications for use with Test Rig M-85 having types A, B, C, D, E, K, L, M, P and Q bodies, the pump capacity shall not be less than 8 quarts per minute when operating at 1750 RPM, at a back pressure of 150 PSI. In governor models having types G, H, and S bodies, the pump capacity shall not be less than 16 quarts per minute when operating as specified above.

c. The relief valve in governor models having types A, C, E, M, P, Q and S bodies shall be set to maintain a pump pressure from 180 to 200 PSI at 1750 RPM. In bodies, types B, D, K and L, when using relief valve spring, No. 51737, the relief valve shall be set to maintain a pump pressure from 180 to 200 pounds per square inch, and when spring No. 53529 is used, from 280 to 300 pounds per square inch. In bodies, types G and H, the relief valve shall be set to maintain a pump pressure of from 330 to 350 pounds per square inch.

d. There shall be no external leakage when the pump chamber and oil passages are subjected to a pressure of 400 pounds per square inch.

e. In the 8-quart per minute capacity controls when operating at 1750 RPM at a pressure between 180 and 200 pounds per square inch, the rate of internal leakage shall not exceed 15 quarts per hour for new controls, or 25 quarts for overhauled controls. In the 16-quart capacity controls when operating as specified above, the

rate of internal leakage shall not exceed 20 quarts per hour for new controls, or 30 quarts for overhauled controls.

f. All the above tests shall be run using SAE No. 10 oil at approximately room temperature.

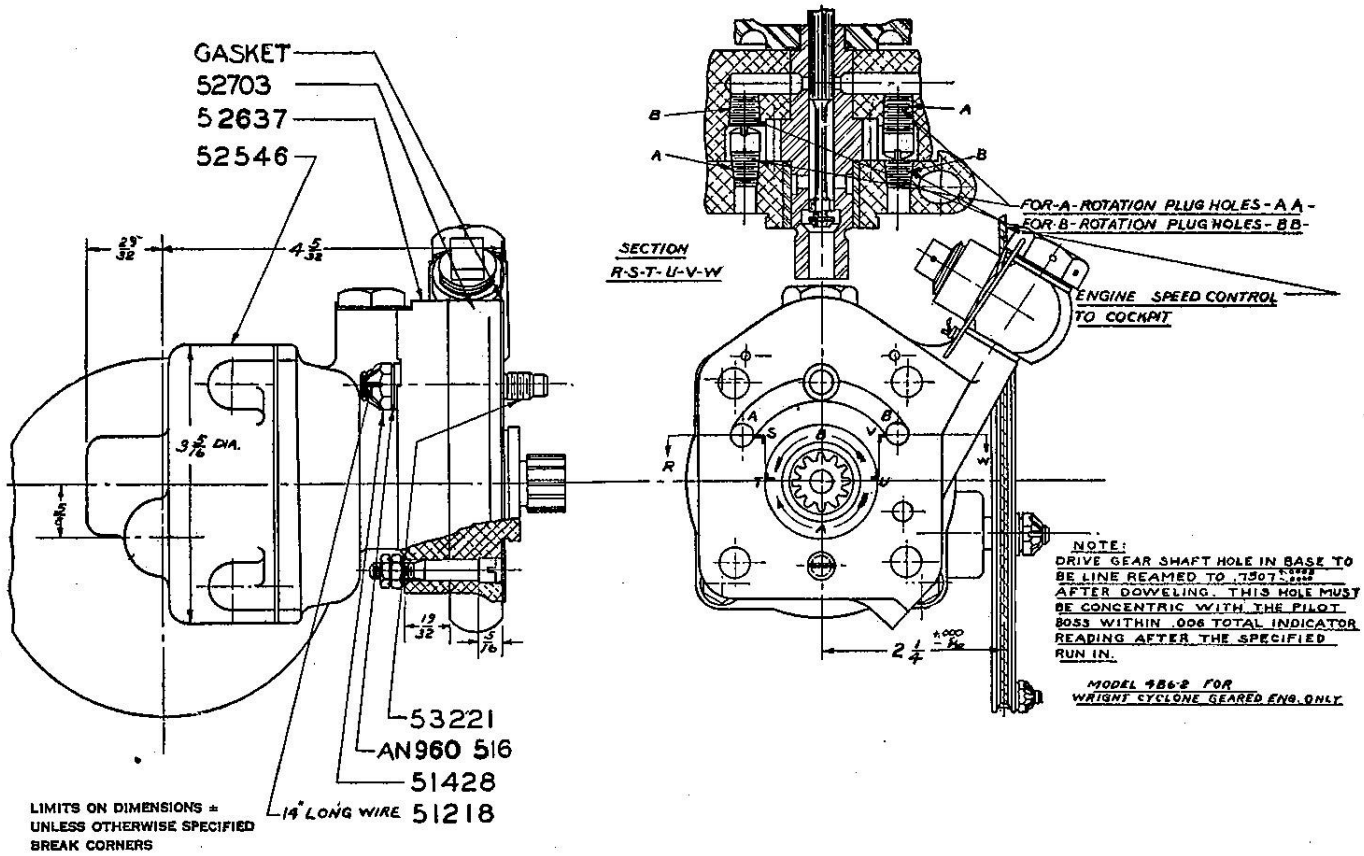


FIG. 40 — BASE ASSEMBLY — TYPE 6

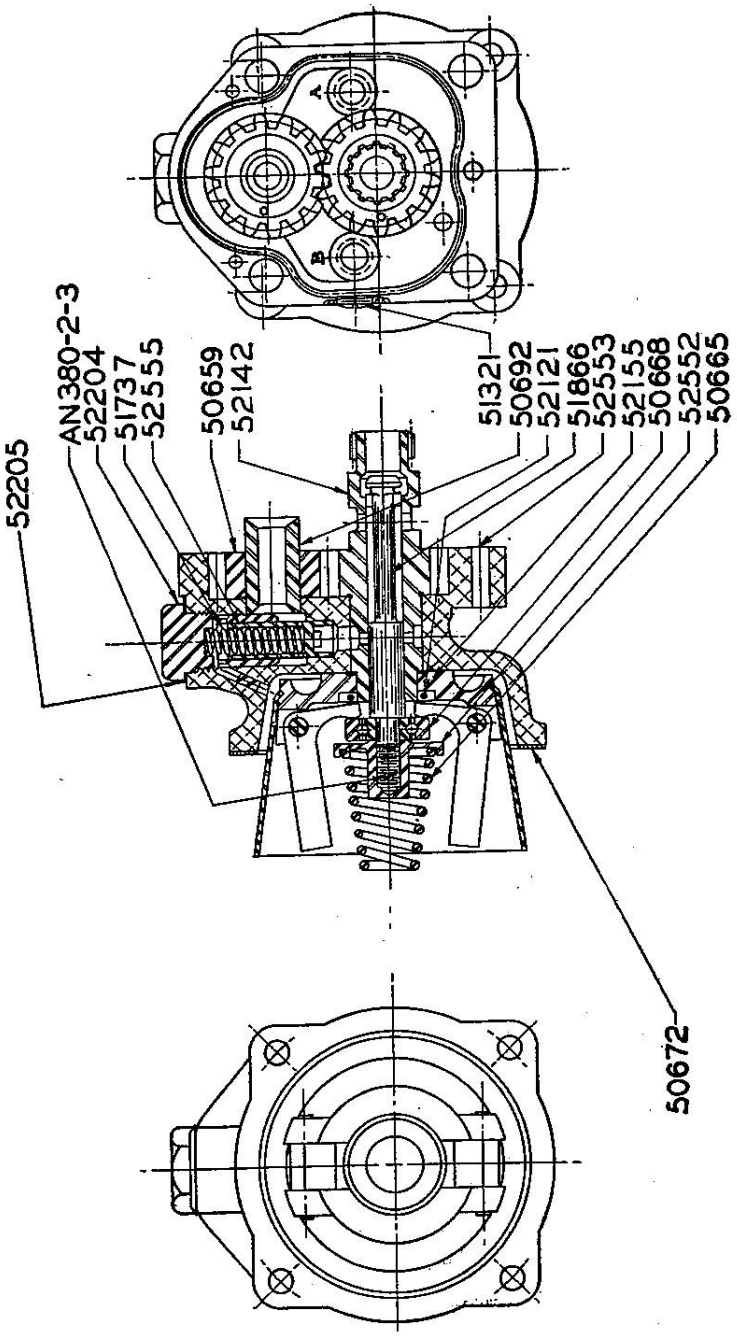


FIG. 41 — BODY ASSEMBLY — TYPE B2

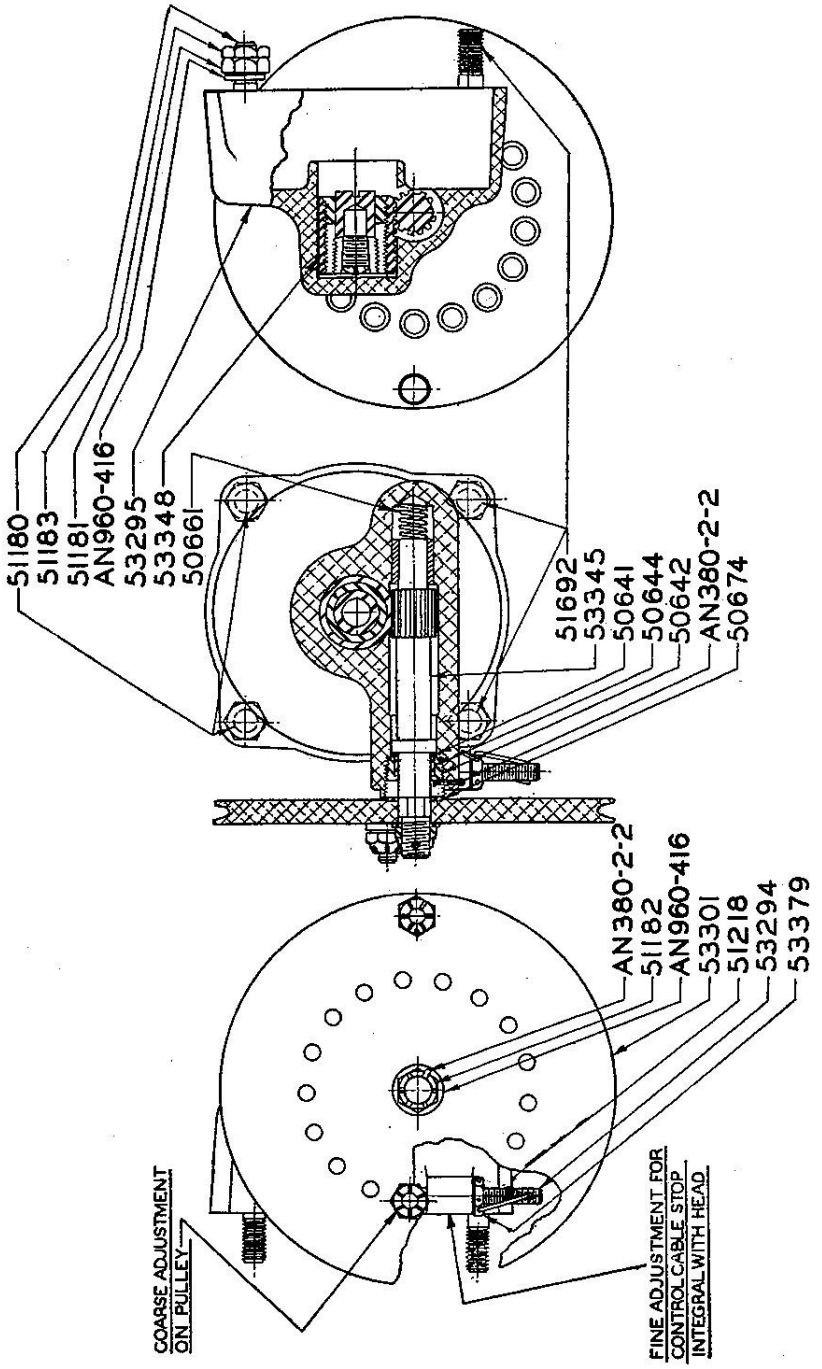


FIG. 42 — HEAD ASSEMBLY — TYPE 4A

PARTS CATALOG

FOR THE

CONSTANT SPEED PROPELLER GOVERNORS & CONTROLS

AND

HYDROMATIC CONSTANT SPEED PROPELLER GOVERNORS & CONTROLS

MANUFACTURED BY

HAMILTON STANDARD PROPELLER COMPANY

EAST HARTFORD, CONN.

SEPTEMBER 15, 1941

Mat. Div. A. C. 176-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	51H20	51H50	52510	52779	52801	53345	50631	53358	52081	52151	52805	52806	52648	51223	52784	53620	51651	53695	53877	1K11-B	1K11-B1	3111-00D	51932	1K11-B00	1K11-B1	3111-00D	1K11-B0B	1K11-B0D	1H6-B1A	1P12-A	REMARKS (STATE SUPERSEDURES AND WHEN AFFECTIVE)
			PRODUCTS ABOVE ARE USED ON:																			1A1	1A1	1A1	1A1	1A1-45	1A2	1A2-45	1G1	1B1	1B1	1B2	2B8	1A6-2	1A6-4	1A6-5										
AN310-3		Nut - Control Pulley Cable Clamp	1	1	1	1	1	2	1	2	1	1	1	1	1			1	1	1	1	1	2	2		2	2	2	2	2				
AN310-4		Nut - Control Shaft Pulley Retaining	1	1	1	1	1	1	1	1	1	1	1	1	1							1	1	1		1	1	1	1	1				
AN310-5		Nut - Stud	4	4	4	4	4	4		4			4			4	4	4	4	8	4	4	4	4	8	4	4	6	4				
AN315-3R		Nut - Pulley Stop Bolt	2	2	2	2	1	3	5	6	2	2	2	2	5			1	1	1		1	1	1		1	1	1	1	2				
AN315-4R		Nut - Cover Stud	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
AN315-5R		Nut - Stud	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4	4				
AN356-428		Palnut - Cover Stud							4	4					4																		
AN356-524		Palnut - Stud	1	1	1	1	1	1			1	1	1	1				1	1	1													
AN356-1032		Palnut - Dowel	1	1	1	1	1	1	1	1	1	1	1	1	1															1			
AN365-1032		Nut - Pilot Valve	3	3	3	3	3	4	3	4	3	3	3	3	3			3	3	3	3	4	4	4		4	4	4	4	4				
AN380-2-2		Pin - Cotter	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
AN380-2-3		Cotter - Spring Collar and Pilot Valve														1	1	1															
AN895-B72		Plug - 3/8" Standard Pipe														1			1	1	1	1	1	1	1	1	1	1					
AN895-B73		Plug - 1/2" Standard Pipe						3	3					3																			
AN895-B101		Plug - 1/4" Pipe														1	1	1	1	1	1	1	1	1	1	1	1	1	1				
AN900-10		Gasket - Elbow Clamp Bolt	1	1	1	1	1	2		1	1	1	1	1				1	1	1		1	1	1		1	1	1	1	1				
AN960-10		Washer - Dowel	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5					
AN960-416		Washer	4	4	4	4	4	4	4	4	4			4	4	10	4	4	4	8	8	8	4	8	4	4	6	4					
AN960-516		Washer - Stud																				1					1						
SK1651		Spring - Speeder									1																	1					
SK1651-1		Spring - Speeder						1																									
50409		Plug - Engine Valve						1	1																								
50441		Gear - Drive						1	1					1																			
50558		Cover - Bearing Thrust						1	1					1																			
50559		Gasket - Bearing Thrust Cover														1	1	1	1	1	1	1	1	1	1	1							
50588		Plug - Body												1																			
50612		Plug - Engine Valve								1																							
50613		Plug - Engine Valve							1	1																							
50635		Sleeve - Drive Gear																															Superseded by 53265
50641		Washer - Control Shaft Packing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	1					
50642		Nut - Control Shaft Packing Washer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50643		Bushing - Oil Pressure Relief Valve	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	1					
50644		Bushing - Control Shaft	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	1					
50646		Clamp - Control Pulley Cable	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1														Superseded by 53295
50648		Cover - Assembly	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1														Superseded by 53295-1
50648-1		Cover	1	1	1						1	1																					Superseded by 53345
50649		Base																															
50651		Shaft - Control	1	1	1	1	1	1	1	1	1	1	1	1	1																		Superseded by 53401
50654		Valve - Pilot																														1	
50656		Dowel - Base and Control	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					
50658		Plug - Oil Control	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50659		Gear - Idler Pump	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50661		Spring - Control Shaft	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50665		Spring - Speeder	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50667		Cup - Flyball Head	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50668		Ball Bearing - Pilot Valve	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					
50669		Flyball	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					
50671		Pin - Flyball Head Hinge	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
50672		Gasket - Body and Cover	1	1	1						1	1																					
50673		Gasket - Engine Mount	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1	1	1	1	1				
50674		Washer - Control Shaft (Inner)	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1		1			
50692		Shaft - Idler Gear							7	7					1																		
50693		Screw - Bearing Thrust Cover																															

CHECKER

ISSUED

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

ABOVE PARTS ARE USED ON

PART NUMBER	SIZE	PART NAME	1A1 / 51429	1A1 / 51496	1A1 / 52510	1A1 / 52779	1A1 / 52801	1A1-A5 / 53354	1A2 / 50834	1A2-A5 / 53358	1C1 / 52081	1E1 / 52151	1E1 / 52805	1E1 / 52806	1E2 / 52698	2GB / 51228	4B6-2 / 52784	4B6-4 / 53629	4B6-5 / 53633	4K11 / 53995	4K11-B / 53871	4K11-B / 4K11-B	4K11-B1 / 4K11-B1	3L11-00D / 3L11-00D	4K11-B0B / 51983	4K11-B0D / 4K11-B0D	4K11-B1B / 4K11-B1B	4H8-B1A / 4H8-B1A	1P12-A / 1P12-A	REMARKS STATE SUPERCEDURES AND WHEN AFFECTIVE.
50794		Gear - Unit Drive							1	1					1															
50830		Type 2 Base Assembly							1	1					1															
50832		Type 1 Base Assembly	1	1	1						1	1																		
51176		Nut - Stud																												Superseded by AN315-5R
51179		Palnut - Dowel																												Superseded by AN356-1032
51180		Stud - Cover	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2		2	2	2	2	2	
51181		Nut - Cover Stud																												Superseded by AN315-4R
51182		Nut - Control Shaft Pulley Retaining																												Superseded by AN310-4
51183		Palnut - Cover Stud																												Superseded by AN356-428
51186		Nut - Control Pulley Cable Clamp																												Superseded by AN310-3
51192		Stud - Base and Unit							4	4					4															
51195		Palnut - Stud																												Superseded by AN356-524
51198		Bearing Thrust							1	1					1															
51201		Liner							1	1					1															
51211		Nut - Dowel																												Superseded by AN315-3R
51218		Wire - Lock	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		14"	12"	3"	19"	19"	19"	36"	36"	36"	36"	22"	36"	22"	22"	32"	10"	
51219		Gear - Drive													1															
51243		Pulley - Control	1		1	1	1		1		1	1	1	1	1		1	*	1	1										Superseded by 53242
51321		Plug - Body Taper Screw	1	1	1	1	1	1	1	1	1	1	1	1	1		2	2	2	2	1	1	1	1	1	1	1		1	
51427		Stud																												Superseded by 53221
51428		Nut - Stud																												Superseded by AN310-5
51471		Gasket - Oil Seal	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1		1	
51475		Type 6 Base Assembly																												
51476		Base																												
51477		Valve															1	1	1	1	1	1	1	1	1		1			
51479		Gasket - Valve Plug														1	1	1	1	1	1	1	1	1	1	1	1	1		
51480		Spring - Valve																												Superseded by 53387
51481		Ball - Valve															1	1	1	1	1	1	1	1	1	1	1			
51482		Pulley - Control		1																										
51574		Pin - 1/8" Diam. x 15/16" long																												
51686		Rack - Speeder Spring Adjusting	1	1	1	1	1		1		1	1	1	1	1															Superseded by 53166
51692		Stud - Cover	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2		2	2	2	2	2	Superseded by 53346
51710		Plunger - Oil Pressure Relief Valve	1	1	1	1	1	1	1	1	1	1	1	1	1														1	
51737		Spring - Oil Pressure Relief Valve	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1		1	1	1		1	1	1			1	
51738		Nut - Stud							2	2					2															Superseded by 53529
51742		Base							1	1					1															
51866		Valve - Pilot															1	1	1											
51884		Spacer - Spring Collar	1	1	1	1	1		1																					Superseded by 53947
51885		Type 1 Head Assembly 4" Pulley	1		1	1	1		1		1	1	1	1	1															Superseded by 53392
51888		Type A Body Assembly	1	1	1	1	1		1																					Superseded by 53298
51891		Type C Body Assembly									1																			Superseded by 53394
51963		Type 1 Head Assembly 3" Pulley		1																										Superseded by 53395
52109		Pin - 1/16" Diam. x 1/4" long																												Superseded by 54361
52110		Bushing	1	1	1	1	1	1			1	1	1	1			1	1	1											
52115		Plug - Oil Hole	1	1	1	1	1	1			1	1	1	1			1	1	1	1	1	1	1	1	1	1	1		1	
52121		Ring - Snap	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
52141		Shaft - Drive Gear	1	1	1	1	1	1	1	1	1	1	1	1	1															
52142		Shaft - Drive Gear															1	1	1											Superseded by 53940
52143		Head - Flyball	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
52146		Spacer - Spring Collar									1	1	1	1	1															Superseded by 53393
52150		Type E Body Assembly										1	1	1	1															Superseded by 53425
52155		Flyball Assembly	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
52203		Body	1	1	1	1	1	1	1	1	1	1	1	1	1															Superseded by 53971 In M.P.Q. Governors
52203-1		Body	1	1	1	1	1	1	1	1	1	1	1	1	1															Superseded by 53971-1 " " " " "

CHECKER ISSUED

RESTRICTED

T.O.NO.03-20CA-2

RESTRICTED

Mat. Div. A. C. 176-Wright Field 12-8-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	51429	51496	52570	52479	52800	52854	52854A	52856	52081	52151	52805	52806	52598	52228	52781	52629	52633	53095	53571	1K11-E	1K11-EL	3K11-5	4K11-20D	4K11-30D	4K11-40D	4K11-50D	4K11-60D	1K6-B1A	1P12-A	REMARKS (STATE SUPERCEDURES AND WHEN AFFECTIVE)
			1A1	1A1	1A1	1A1	1A1	1A1	1A1-A5	1A2	1A2-A5	1C1	1C1	1E1	1E1	1E2	2B3	1K6-2	1K6-1	1K6-5	1K11	1K11-E	1K11-EL	3K11-5	4K11-20D	4K11-30D	4K11-40D	4K11-50D	4K11-60D	1K6-B1A	1P12-A	
			PARTS ARE USED ON:																													
52204		Plug - Oil Pressure Relief Valve	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
52205		Gasket - Relief Valve Plug	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
52255		Operating Switch													1																	
52422		Type 2 Head Assembly													1																	
52423		Type 3 Head Assembly																			1											
52471		Stud		4												1	1	1	1													Superseded by 53221
52546		Type 4 Head Assembly														1	1	1	1													Superseded by 53347
52549		Screw - Maximum RPM Adjusting														1	1	1	1													Superseded by 54021
52550		Screw - Minimum RPM Adjusting														1	1	1	1													Superseded by 53346
52551		Rack - Speeder Spring Adjusting														1																Superseded by 53468
52552		Collar - Spring														1	1	1														Reworked from 52203 Body - Sups. by 53785
52553		Body (50588 Plug Inserted)														1	1	1														Superseded by 53785-1
52553-1		Body														1	1		1	1	1		1	1	1							Reworked 51710 - Superseded by 53531
52555		Plunger - Oil Pressure Relief Valve			1	1	1					1	1																			
52606		Base														1																Superseded by 53558
52637		Type B2 Body Assembly														1	1	1														Superseded by 53396
52701		Base (Flange Type)			1	1	1					1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
52702		Gasket - Engine Mount														1	1	1														Superseded by 53572
52703		Type 6 Base Assembly (Flange Type)			1	1	1					1	1																			
52713		Type 1 Base Assembly (Flange Type)														1	1	1														Superseded by 54105
52765		Elbow - High Pressure Valve														1	1	1														
52766		Bolt - Elbow Clamp						1	1					1																		
52879		Screen						1	1					1																		
52880		Liner - Assembly						1	1					1																		
53128		Bushing - Control Shaft (Inboard)	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1	1					1		
53166		Pin - 3/16" Diam. x 15/16" long	2	2	2	2	2	2			2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
53203		Plug - Connection																														
53221		Stud	4	4		4	4	4		4			4			4	4	4				1	1	1		1		1	1			
53242		Pulley						1	1													1	1	1		1	1		1	1		
53243		Screw - Low Pulley Stop						1	1													1	1	1		1	1		1	1		
53265		Washer - Control Shaft Packing	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
53294		Bolt - Pulley Stop						1	1													1	1	1		1	1		1	1		
53295		Cover						1	1													1	1	1		1	1		1	1		
53295-1		Cover						1	1																					1		
53298		Type 1A Head Assembly 4" Pulley						1	1													1	1	1		1			1	1		
53301		Pulley - Adjusting Stop Assembly	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1	1					1		
53345		Shaft - Control						1	1													1	1	1		1	1		1	1		
53346		Rack - Speeder Spring Adjusting																														Superseded by 54118
53347		Type 4A Head Assembly 4" Pulley																														Superseded by 54022
53348		Rack - Speeder Spring Adjusting - Assy.																														Superseded by AN315-3R
53379		Nut - Pulley Stop Bolt														1	1	1	1	1	1	1	1	1	1	1	1					
53387		Spring - Valve						1	1																					1		
53388		Ring - Adjusting Screw Snap						1	1																					1		
53389		Screw - Speeder Rack Adjusting						1	1																					1		
53390		Rack - Speeder Spring Adjusting - Assy.						1	1																							
53392		Spacer - Spring Collar																												1		
53393		Spacer - Spring Collar																														
53394		Type A5 Body Assembly						1	1																							
53401		Screw - Base and Body	1	1	1	1	1	1		1	1	1	1			1	1	1														
53425		Type B5 Body Assembly													1		1	1	1	1	1	1	1	1	1	1	1	1	1			
53468		Collar - Spring																1			1					1						
53529		Spring - Oil Pressure Relief Valve																1			1					1						
53530		Plug - Oil Pressure Relief Valve																														

CHECKER

ISSUED

Mat. Div. A. C. 175-Wright Field 15-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	51129	51409	52510	52779	52801	53334	50834	53358	52081	51152	52805	52608	51228	52784	53620	51623	51695	53871	1K1-B	1K1-B1	3K14-00D	51683	1K1-B2	1K1-B0D	1K1-B1E	1H6-31A	1P12-A	REMARKS STATE SUPERCEDURES AND WHEN AFFECTIVE.
			1K1	1K1	1K1	1K1	1K1	1K1-45	1K2	1K2-45	1K1	1K1	1K2	26B	1H6-2	1H6-4	1H6-5	1K1	1K1-B	1K1-B	3K14-00D	1K1-B0B	1K1-B0D	1K1-B1E	1H6-31A	1P12-A					
			Middle Parts are used on																											
	53531		Plunger - Oil Pressure Relief Valve														1			1				1							
	53542		Type B5 Body Assembly														1													Superseded by 53925
	53558		Type B4 Body Assembly													1														Superseded by 53924
	53574		Switch - Pressure Cutout											1				1	1	1	1									
	53628		Coupling - Drive Gear Shaft											1													1			
	53681		Collar - Spring	1	1	1	1	1	1	1	1	1	1	1	1													1		
	53721		Base											1													1			
	53770		Lock Plate					1		1									1	1	1		1	1			1	1		
	53772		Base															1	1	1	1	1	1	1	1					
	53773		Base																									1		
	53785		Body															1	1	1	1	1	1	1					Superseded by 52553	
	53785-1		Body															1	1	1	1	1	1	1						
	53894		Body											1													1			
	53895		Shaft - Drive Gear											1															Superseded by 54695	
	53896		Gear - Idler											1													1			
	53897		Valve - Pilot Assy.											1															Superseded by 54841	
	53898		Valve											1															Superseded by 54696	
	53899		Plug - Pilot Valve											1													1			
	53900		Pin - Pilot Valve Plug											1													1			
	53901		Plunger - High Pressure Valve											1													1			
	53902		Spring - High Pressure Valve (Outer)											1													1			
	53903		Spring - High Pressure Valve (Inner)											1													1			
	53904		Gasket - High Pressure Valve Plug											1													1			
	53905		Plug - High Pressure Valve											1													1			
	53906		Plunger - Relief Valve											1													1			
	53907		Spring - Relief Valve											1													1			
	53908		Plug - Relief Valve											1													1			
	53909		Ball - Dump Valve											1													1			
	53910		Spring - Pressure Dump Valve											1													1			
	53911		Plug - Dump Valve											1													1			
	53912		Plug - Oil Control											2													2			
	53913		Wire - Shear Coupling Lock											1													1			
	53914		Stud - Body and Base											5				4	4	4	4	4	4	4	4	5	4			
	53915		Gasket - Base											1													1			
	53917		Gasket - Pressure Switch Boss											1				1	1	1	1	1	1	1	1	1				
	53924		Type K Body Assembly															1	1	1			1	1						
	53925		Type K1 Body Assembly																		1					1				
	53933		Stud - Control Mounting											4				4	4	4	4		4							
	53939		Ring - Snap - Shear Coupling															1	1	1	1	1	1	1	1		1			
	53940		Shaft - Drive Gear															1	1	1	1	1	1	1	1		1			
	53941		Ring - Oil Seal											1												1				
	53942		Coupling - Shear Drive Gear Shaft															1	1	1	1	1	1	1	1		1			
	53947		Valve - Pilot															1	1	1	1	1	1	1	1					
	53967		Base Assembly - Type 12																								1			
	53969		Base Assembly - Type 11															1	1	1										
	53971		Body																								1		Superseded by 52203 Exc. M P & Q Governors	
	53971-1		Body																								1		Superseded by 52203-1 " " " "	
	53972		Type G Body Assembly											1															Superseded by 54834	
	53973		Type 8 Base Assembly											1																
	53976		Type L Body Assembly																		1									
	53981		Stud - Body and Base											1													1			
	54018		Type P Body Assembly																								1			
	54021		Screw - Minimum RPM Adjusting																1	1	1		1	1			1			

CHECKER ISSUED

Mat. Div. A. C. 176-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

MODELS PARTS ARE USED ON

PART NUMBER	SIZE	PART NAME	1A1 51429	1A1 51496	1A1 52510	1A1 52779	1A1 52801	1A1-A5 53354	1A2 50834	1A2-A5 53358	1C1 52081	1E1 52151	1E1 52805	1E1 52806	1E2 52698	2G8 54228	4B6-2 52784	4B6-4 53629	4B6-5 53633	4K11 53995	4K11-B 53871	4K11-B 4K11-B	4K11-B1 4K11-B1	3L11-OOD 3L11-OOD	4K11-BOB 54983	4K11-BOD 4K11-BOD	4K11-B1B 4K11-B1B	4B8-B1A 4B8-B1A	1P12-A 1P12-A	REMARKS STATE SUPERCEDURES AND WHEN AFFECTIVE.
																					1	1	1		1	1		1		
54022		Rack - Assembly - High and Low Pitch Stop																			1	1	1		1	1		1		
54103		Lock - Taper														1				1	1	1	1	1	1	1	1	1		
54104		Bolt - Swivel Clamp														1				1	1	1	1		1	1	1	1		
54105		Elbow - High Pressure Valve																							1					
54109		Pulley																							1					
54113		Pulley - Adjusting Stop Assembly																			1	1	1			1	1	1		
54118		Type 4B Head Assembly 4" Pulley																							1					
54251		Type 4B Head Assembly 3" Pulley																										1		
54348		Type H1 Body Assembly																												
54361		Pin - 1/16" Diam. x 7/8" long	1	1	1	1	1	1		1	1	1	1				1	1	1									1		
54695		Shaft - Drive Gear																										1		
54696		Valve																										1		
54841		Valve - Pilot - Assembly																							1		1			
54946		Switch - Pressure Cutout																							1		1			
54959		Type 11B Base Assembly																										1		
55016		Base Assembly																						1		1		1		
55017-4		Switch - Pressure Cutout																						1		1				
55111		Type 11D Base Assembly																												

CHECKER

ISSUED

Mat. Div. A. C. 176-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	CATCH	LOCK-CAT	MODELS PARTS ARE USED ON	REMARKS STATE SUPERSEDURES AND WHEN AFFECTIVE
AN310-3		Nut - Control Pulley Cable Clamp	1			
AN310-4		Nut - Control Shaft Pulley Retaining	1			
AN310-5		Nut - Stud	4			
AN315-3R		Nut - Pulley Stop Bolt	1			
AN315-4R		Nut - Cover Stud	4			
AN315-5R		Nut - Stud				
AN356-428		Palnut - Cover Stud	1			
AN356-524		Palnut - Stud				
AN356-1032		Palnut - Dowel	1			
AN365-1032		Nut - Pilot Valve				
AN380-2-2		Pin - Cotter	3			
AN380-2-3		Cotter - Spring Collar and Pilot Valve	1			
AN895-B72		Plug - 3/8" Standard Pipe	1			
AN895-B73		Plug - 1/2" Standard Pipe				
AN895-B101		Plug - 1/4" Pipe				
AN900-10		Gasket - Elbow Clamp Bolt	1			
AN960-10		Washer - Dowel	1			
AN960-416		Washer	5			
AN960-516		Washer - Stud	4			
SK1651		Spring - Speeder				
SK1651-1		Spring - Speeder				
50409		Plug - Engine Valve				
50411		Gear - Drive				
50558		Cover - Bearing Thrust				
50559		Gasket - Bearing Thrust Cover				
50588		Plug - Body	1			
50612		Plug - Engine Valve				
50613		Plug - Engine Valve				
50635		Sleeve - Drive Gear				
50641		Washer - Control Shaft Packing				
50642		Nut - Control Shaft Packing Washer	1			Superseded by 53265
50643		Bushing - Oil Pressure Relief Valve	1			
50644		Bushing - Control Shaft	1			
50646		Clamp - Control Pulley Cable	1			
50648		Cover - Assembly	1			
50648-1		Cover	1			Superseded by 53295 Superseded by 53295-1
50649		Base				
50651		Shaft - Control				
50654		Valve - Pilot				
50656		Dowel - Base and Control				
50658		Plug - Oil Control	2			
50659		Gear - Idler Pump	1			
50661		Spring - Control Shaft	1			
50665		Spring - Speeder	1			
50667		Cup - Flyball Head	1			
50668		Ball Bearing - Pilot Valve	1			
50669		Flyball	2			
50671		Pin - Flyball Head Hinge	2			
50672		Gasket - Body and Cover	1			
50673		Gasket - Engine Mount				
50674		Washer - Control Shaft (Inner)	1			
50692		Shaft - Idler Gear	1			
50693		Screw - Bearing Thrust Cover				

CHECKER ISSUED

Mat. Div. A. C. 176-Wright Field 12-8-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	5210B	1B6-6L	REMARKS (STATE SUPERCEDURES AND WHEN AFFECTING)
			Replace parts are listed on		
50794		Gear - Unit Drive			
50830		Type 2 Base Assembly			
50832		Type 1 Base Assembly			
51176		Nut - Stud			Superseded by AN315-5R
51179		Palnut - Dowel			Superseded by AN356-1032
51180		Stud - Cover	2		
51181		Nut - Cover Stud			Superseded by AN315-4R
51182		Nut - Control Shaft Pulley Retaining			Superseded by AN310-4
51183		Palnut - Cover Stud			Superseded by AN356-428
51186		Nut - Control Pulley Cable Clamp			Superseded by AN310-3
51192		Stud - Base and Unit			
51195		Palnut - Stud			Superseded by AN356-524
51198		Bearing Thrust			
51201		Liner			
51211		Nut - Dowel			Superseded by AN315-3R
51218		Wire - Lock	10"		
51219		Gear - Drive			
51243		Pulley - Control	1		Superseded by 53242
51321		Plug - Body Taper Screw	1		
51427		Stud			Superseded by 53221
51428		Nut - Stud			Superseded by AN310-5
51471		Gasket - Oil Seal	1		
51475		Type 6 Base Assembly			
51476		Base			
51477		Valve	1		
51479		Gasket - Valve Plug	1		
51480		Spring - Valve			Superseded by 53387
51481		Ball - Valve	1		
51482		Pulley - Control			
51574		Pin - 1/8" Diam. x 15/16" long			Superseded by 53166
51686		Rack - Speeder Spring Adjusting			Superseded by 53346
51692		Stud - Cover	2		
51710		Plunger - Oil Pressure Relief Valve			
51737		Spring - Oil Pressure Relief Valve	1		Superseded by 53529
51738		Nut - Stud			
51742		Base			
51866		Valve - Pilot	1		Superseded by 53947
51884		Spacer - Spring Collar			Superseded by 53392
51885		Type 1 Head Assembly 4" Pulley			Superseded by 53298
51888		Type A Body Assembly			Superseded by 53394
51891		Type C Body Assembly			Superseded by 53395
51963		Type 1 Head Assembly 3" Pulley			Superseded by 54361
52109		Pin - 1/16" Diam. x 1/4" long			
52110		Bushing	1		
52115		Plug - Oil Hole	1		
52121		Ring - Snap	1		
52141		Shaft - Drive Gear			Superseded by 53940
52142		Shaft - Drive Gear	1		
52143		Head - Flyball	1		
52146		Spacer - Spring Collar			Superseded by 53393
52150		Type E Body Assembly			Superseded by 53425
52155		Flyball Assembly	1		
52203		Body			Superseded by 53971 In M.P.O. Governors
52203-1		Body			Superseded by 53971-1 " " " " "

CHECKER ISSUED

Mat. Div. A. C. 116-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	52498	53486-01	MODELS AFFECTED ARE UNDERLINED	REMARKS STATE SUPERCEDURES AND WHEN AFFECTING.
52204		Plug - Oil Pressure Relief Valve	1			
52205		Gasket - Relief Valve Plug	1			
52255		Operating Switch				
52422		Type 2 Head Assembly				
52423		Type 3 Head Assembly				
52471		Stud				Superseded by 53221
52546		Type 4 Head Assembly				Superseded by 53347
52549		Screw - Maximum RPM Adjusting				
52550		Screw - Minimum RPM Adjusting				Superseded by 54021
52551		Rack - Speeder Spring Adjusting				Superseded by 53346
52552		Collar - Spring				Superseded by 53468
52553		Body (50588 Plug Inserted)	1			Reworked from 52203 Body -Sup. by 53785
52553-1		Body	1			Superseded by 53785-1
52555		Plunger - Oil Pressure Relief Valve	1			Reworked 51710 - Superseded by 53531
52606		Base				
52637		Type B2 Body Assembly				Superseded by 53558
52701		Base (Flange Type)	1			Superseded by 53396
52702		Gasket - Engine Mount	1			
52703		Type 6 Base Assembly (Flange Type)	1			Superseded by 53572
52713		Type 1 Base Assembly (Flange Type)				
52765		Elbow - High Pressure Valve	1			Superseded by 54105
52766		Bolt - Elbow Clamp	1			
52879		Screen				
52880		Liner - Assembly				
53128		Bushing - Control Shaft (Inboard)	1			
53166		Pin - 3/16" Diam. x 15/16" long	2			
53203		Plug - Connection				
53221		Stud	4			
53242		Pulley				
53243		Screw - Low Pulley Stop				
53265		Washer - Control Shaft Packing	1			
53294		Bolt - Pulley Stop				
53295		Cover				
53295-1		Cover				
53298		Type 1A Head Assembly 4" Pulley				
53301		Pulley - Adjusting Stop Assembly				
53345		Shaft - Control	1			
53346		Rack - Speeder Spring Adjusting	1			
53347		Type 4A Head Assembly 4" Pulley				Superseded by 54118
53348		Rack - Speeder Spring Adjusting - Assy.				Superseded by 54022
53379		Nut - Pulley Stop Bolt				Superseded by AN315-3R
53387		Spring - Valve	1			
53388		Ring - Adjusting Screw Snap				
53389		Screw - Speeder Rack Adjusting				
53390		Rack - Speeder Spring Adjusting - Assy.				
53392		Spacer - Spring Collar				
53393		Spacer - Spring Collar				
53394		Type A5 Body Assembly				
53401		Screw - Base and Body	1			
53425		Type E5 Body Assembly				
53468		Collar - Spring	1			
53529		Spring - Oil Pressure Relief Valve				
53530		Plug - Oil Pressure Relief Valve				

CHECKER

ISSUED

Mat. Div. A. C. 176-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	53198	11B6-01	REMARKS STATE SUPERCEDURES AND WHEN AFFECTING.
53531		Plunger - Oil Pressure Relief Valve			Superseded by 53925
53542		Type B5 Body Assembly			Superseded by 53924
53558		Type B4 Body Assembly	1		
53574		Switch - Pressure Cutout			
53628		Coupling - Drive Gear Shaft			
53681		Collar - Spring			
53721		Base			
53770		Lock Plate			
53772		Base			
53773		Base			Superseded by 52553
53785		Body			
53785-1		Body			
53894		Body			Superseded by 54695
53895		Shaft - Drive Gear			
53896		Gear - Idler			Superseded by 54841
53897		Valve - Pilot Assy.			Superseded by 54696
53898		Valve			
53899		Plug - Pilot Valve			
53900		Pin - Pilot Valve Plug			
53901		Plunger - High Pressure Valve			
53902		Spring - High Pressure Valve (Outer)			
53903		Spring - High Pressure Valve (Inner)			
53904		Gasket - High Pressure Valve Plug			
53905		Plug - High Pressure Valve			
53906		Plunger - Relief Valve			
53907		Spring - Relief Valve			
53908		Plug - Relief Valve			
53909		Ball - Dump Valve			
53910		Spring - Pressure Dump Valve			
53911		Plug - Dump Valve			
53912		Plug - Oil Control			
53913		Wire - Shear Coupling Lock			
53914		Stud - Body and Base			
53915		Gasket - Base			
53917		Gasket - Pressure Switch Boss			
53924		Type K Body Assembly			
53925		Type K1 Body Assembly			
53933		Stud - Control Mounting			
53939		Ring - Snap - Shear Coupling			
53940		Shaft - Drive Gear			
53941		Ring - Oil Seal			
53942		Coupling - Shear Drive Gear Shaft			
53947		Valve - Pilot			
53967		Base Assembly - Type 12			Superseded by 52203 Exc. M, P, &Q Governors
53969		Base Assembly - Type 11			Superseded by 52203-1 " " " " "
53971		Body			Superseded by 54834
53971-1		Body			
53972		Type G Body Assembly			
53973		Type S Base Assembly			
53976		Type L Body Assembly			
53981		Stud - Body and Base			
54018		Type P Body Assembly			
54021		Screw - Minimum RPM Adjusting	1		

CHECKER ISSUED

Mat. Div. A. C. 176-Wright Field 12-9-37-2M

CONSTANT SPEED CONTROL ASSEMBLY

AIR CORPS, MATERIEL DIVISION - INTERCHANGEABLE PART LIST.

CONTRACTOR - HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT

PART NUMBER	SIZE	PART NAME	5-4155	1185-01	REMARKS (STATE SUPERCEDURES AND WHEN EFFECTIVE)
			MARK'S PARTS ARE USED ON		
5-4022		Rack - Assembly - High and Low Pitch Stop	1		
5-4103		Lock - Taper	1		
5-4104		Bolt - Swivel Clamp			
5-4105		Elbow - High Pressure Valve			
5-4109		Pulley			
5-4113		Pulley - Adjusting Stop Assembly			
5-4118		Type 4B Head Assembly 4" Pulley			
5-4251		Type 4B Head Assembly 3" Pulley			
5-4260		Type 4C Head Assembly 4" Pulley	1		
5-4348		Type H1 Body Assembly			
5-4361		Pin - 1/16" Diam. x 7/8" long	1		
5-4695		Shaft - Drive Gear			
5-4696		Valve			
5-8041		Valve - Pilot - Assembly			
5-8946		Switch - Pressure Cutout			
5-4959		Type 11B Base Assembly			
55016		Base Assembly			
55017-4		Switch - Pressure Cutout			
55111		Type 11D Base Assembly			

CHECKER | ISSUED