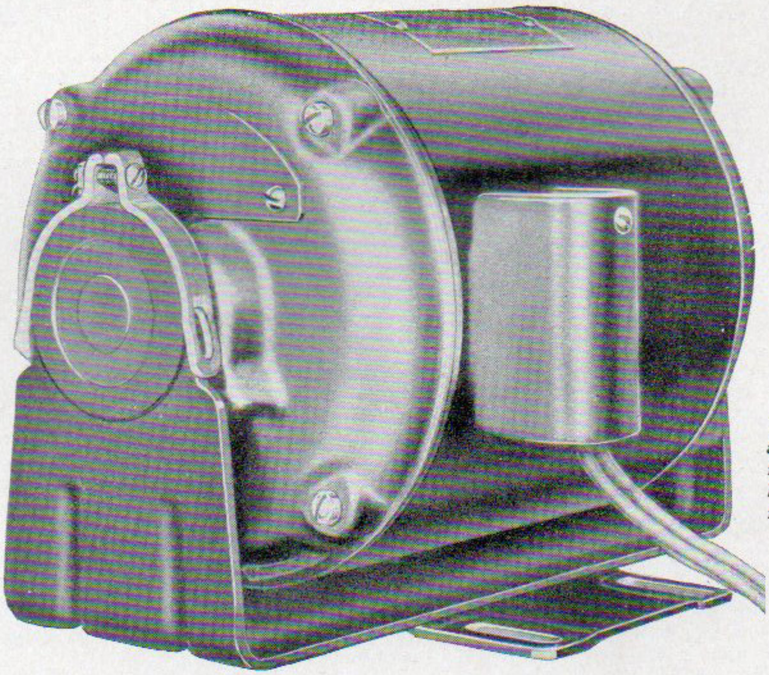
Bulletin MU-7B
APRIL, 1942

SERVICE INSTRUCTIONS

for

smaller sizes of
Repulsion-Start-Induction Brush-Lifting Motors



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SERVICE INSTRUCTIONS FOR REPULSION-START-INDUCTION BRUSH-LIFTING MOTORS

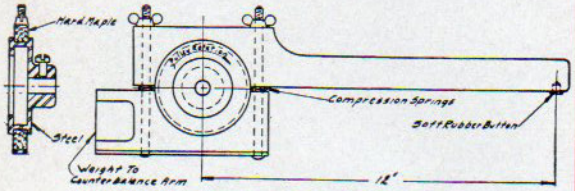
PROBLEM	PROBABLE CAUSE	TEST AND REMEDY
(A) FAILURE TO START	1. Fuses blown.	1. Check capacity of fuses. They should not be greater in ampere capacity than recommended by appliance manufacturer and in no case smaller than full-load ampere rating of motor, and a voltage capacity equal to or greater than voltage of supply circuit.
	2. No voltage or low voltage.	2. Measure volts at motor terminals with switch closed. See that it is within 10% of voltage stamped on nameplate of motor.
	3. Open-circuited field or armature.	3. Indicated by excessive sparking in starting, or refusal to start at certain positions of rotor, or by humming sound when switch is closed. Examine for broken wires, loose connections or burned segments in commutator at point of loose or broken connection. Inspect commutator for foreign metallic substance which might cause short between commutator segments.
	4. Improper current supply — Incorrect voltage or frequency.	4. Requires new motor built for operation on local power supply. D.C. motors will not operate on A.C. circuit or vice versa.
	5. Worn brushes or sticking brushes.	5. When brushes are not making proper contact with commutator, the motor will be weak in starting torque. This can be caused by brushes worn, brushes sticking in holders, brush springs weak, or commutator dirty. Commutator should be polished with fine sandpaper (never use emery) (commutator should never be oiled or greased).
	6. Improper brush setting.	6. Unless a new armature has been installed the brushholder or rocker arm indicator should be opposite index and locked in position. If new armature has been installed the position may be slightly off original marking.
	7. Improper line connection.	7. See that connections are exactly like connection diagram which is sent with motor. Motor may through error be connected for higher voltage and connected to lower voltage supply.
	8. Excessive load.	8. If the motor starts idle and if all the above conditions are O.K. then failure to start is most likely due to excessive load. To determine this definitely, make or have a reliable electric shop make a test of starting torque. Wagner fractional horsepower repulsion-induction motors have a starting torque of 350% or more of full load torque. If the load requires more than this a larger motor is required.

If this figure is 350% of full load torque on a new motor (may be slightly less on a used motor) consult the nearest Wagner Branch, inasmuch as this would indicate either a misapplication of the motor, resulting in too great a load or an increased load due to faulty driven apparatus.

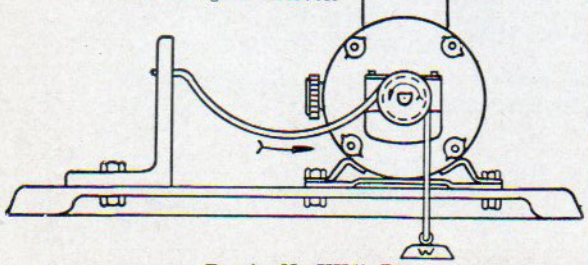
To determine the starting torque, either of the following methods may be used:

a. PRONY BRAKE (See Drawing No. XX570A). This method is probably the most generally used. It requires a pulley, brake arm and scale (may be either platform scale or spring balance, if platform scale be sure that load is applied to center of platform, if spring balance is used the pull must always be at right angle to the brake arm, and in either case scale must have small enough variations to accurately read torque on smaller rated motors). Brake arm should be made up so that the distance between center of pulley and contact point where load is measured is exactly 12 inches. Scale reading will then be in pounds feet. BEFORE STARTING TEST MAKE SURE THAT DIRECTION OF ROTATION IS SUCH THAT BRAKE ARM WILL BE MOVED AGAINST BALANCE. In order to measure starting torque clamp arm to pulley tight enough to allow pulley to turn very slowly—read scale when slowly turning. To measure pull in torque release clamp until motor is just able to throw off brushes and pull up to speed. Read scale just as brushes are leaving commutator. The true pull in torque is the highest scale reading for which the brushes will throw off and stay off the commutator.

b. ROPE AND WEIGHT (See Drawing No. XX570B). This method gives equally satisfactory results and yet does not require the equipment of the Prony Brake method. It requires a smooth faced flanged iron pulley, rope and weight. Tie one end of the rope to the projection from the test bench so that the rope will be at 90° to the shaft. Wrap the rope around the pulley opposite to the pulley rotation and hang a weight on the free end of the rope. Wrap sufficient turns around the pulley so that the tied end of the rope will be slack when the weight is lifted and the pulley rotates. To prevent the rope from gripping the pulley, oil or paraffin the rope slightly. Be sure that the hanging weight does not touch the floor or test bench. SOME PROTECTIVE MEASURES SHOULD BE TAKEN TO PREVENT



Drawing No. XX570A



Drawing No. XX570B

SERVICE INSTRUCTIONS FOR REPULSION-START-INDUCTION BRUSH-LIFTING MOTORS

PROBLEM	PROBABLE CAUSE	TEST AND REMEDY
		THE WEIGHT FROM INJURING THE OPERATOR IN CASE THE ROPE GRIPS TOO TIGHT. Proceed to test as follows: Increase the weight until the motor will just start, then calculate as follows: For example to test a ¼ H.P., 1725 R.P.M. motor select a 4″ pulley, ⅛″ rope, and necessary weight. If assortment of graduated weights not handy, use bucket and sand (or shot) adding weight so that pulley is slowly turning. Brake Arm $= \frac{\text{Pulley dia. in inches} + \text{rope dia. in inches}}{12 \times 2} = \frac{4 + .125}{24}$ ft. Starting Torque in Lb. Ft. = Brake Arm X Wt. hung on rope $= \frac{4.125 \times W}{24}$ Full Load Torque in Lb. Ft. $= \frac{\text{Full Load H.P.} \times 5250}{\text{Full Load R.P.M.}} = \frac{.25 \times 5250}{1725} = .76$ Lb. Ft Starting Torque in Per Cent of F.L. Torque $= \frac{\text{Starting Torque}}{\text{Full Load Torque}}$ While both of these methods are widely used by small service organizations for checking test values on electric motors of all sizes, it should be specially noted that both methods do contain an element of danger to the operator and should be used with extreme care from the standpoint of both safety to operator and accuracy of test results.
	9. Shorted stator.	9. See D-2 below.
	10. Shorted rotor.	10. Remove brushes from commutator and impress full voltage on the stator. If there are one or more points at which the rotor "hangs" or fails to revolve easily when turned, the rotor is shorted. By forcing the rotor to the position where it is most difficult to hold, the short can be located as the shorted coil will become hot. Do not hold in position too long or coil will burn out.
(B) MOTOR OPERATES WITHOUT RELEASING BRUSHES (Brushes should leave commutator in 5 seconds. Troubles result from delayed operation.)	1. Dirty commutator.	1. Clean with a piece of fine sandpaper. (Do not use emery.)
	2. Governor mechanism or brushes sticking or brushes worn too short for good contact.	2. See that brushes move freely in slots and that governor mechanism operates freely by hand. Replace worn brushes with new.
	3. Frequency of supply circuit incorrect.	3. Run motor idle. After brushes throw off, speed should be slightly in excess of full-load speed shown on nameplate. An idle speed varying more than 10% from nameplate speed indicates that motor is being used on a supply frequency for which it is not designed, and a different motor will be required.
	4. Low voltage.	4. See that voltage is within 10% of nameplate voltage with the switch closed.
	5. Line connection improperly or poorly made.	5. See that contacts are good and that connections correspond with diagram sent with motor.
	6. Incorrect brush setting.	6. Check to see that rocker arm setting corresponds with index mark.
	7. Incorrect adjustment of governor spring.	7. The governor should operate and throw off brushes at approximately 75% of speed stamped on nameplate. Below 65% or over 85% indicates incorrect spring tension.
	8. Excessive load.	8. An excessive load may be started and not be carried to and held at full load speed which is beyond where the brushes throw off. Tight motor bearing may contribute to overload. This is sometimes indicated by brushes coming off and on commutator. See also A-8.
	9. Shorted stator.	9. See D-2.
(C) EXCESSIVE BEARING WEAR	1. Belt tension too great; unbalanced or out-of-line coupling; eccentric or too closely meshed gears.	1. Correct mechanical condition.
	2. Improper, unclean or insufficient oil.	2. The lubrication system of Wagner small motors provide for supplying the right amount of filtered oil to bearing. It is only necessary for the user to keep wool yarn saturated with a good grade of machine oil.
	3. Dirty bearings.	3. When bearings get clogged with dirt motor may need protection from excessive dust. Application may be such that especially constructed motor should be used—Consult Wagner.

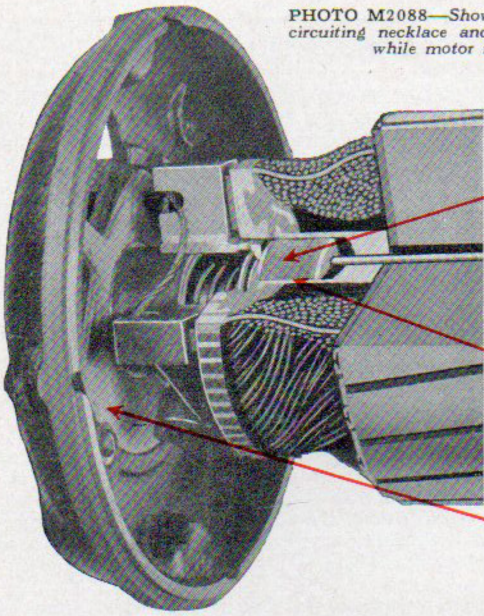
SERVICE INSTRUCTIONS FOR REPULSION-START-INDUCTION BRUSH-LIFTING MOTORS

PROBLEM	PROBABLE CAUSE	TEST AND REMEDY
(D) MOTOR RUNS HOT (Don't judge motor temperature by feel of hand. Measure it with a thermometer and check with temperature rise stamped on nameplate.)	1. Bearing trouble.	1. See condition under C.
	2. Short - circuited coils in stator.	2. Best check is separate wattmeter reading on each of two halves of stator winding. Sometimes shorted coil may be located by fact that one coil feels much hotter than other. Very great increase over normal in magnetic noise may also indicate shorted stator.
	3. Rotor rubbing stator.	3. Some extraneous matter may be between rotor and stator, or bearings may be badly worn.
	4. Excessive loads.	4. Be sure proper pulleys are on motor and machine. Driving the load at higher speed requires more horsepower. Take an ammeter reading. If current draw exceeds nameplate amperes for full-load, the answer is evident.
	5. Low voltage.	5. Measure voltage at motor terminals with switch closed. Should not vary more than 10% from value stamped on nameplate.
	6. High voltage	6. See No. (5).
	7. Incorrect line connection to motor leads.	7. Check with connection diagram sent with motor.
(E) MOTOR BURNS OUT	1. Frozen bearing.	1. Causes may be same as under (C).
	2. Some condition of prolonged excessive overload.	2. It is important that the load be examined carefully before the burned out motor is replaced so as to locate and remove the cause of the overload. Certain jobs such as refrigerators, which represent heavy load, will under unusual conditions of operation, apply prolonged overloads which may destroy a motor and which may be difficult to locate unless examined carefully. On jobs where it is assumed somewhat intermittent service will normally prevail and which consequently are closely motored, the load cycle should be especially checked, as a change in this feature will easily produce excessive overload for the motor. Examine carefully to determine mechanical condition of the driven appliance.
(F) MOTOR IS NOISY	1. Unbalanced rotor.	1. When transportation handling has been so rough as to damage the heavy Wagner shipping case, it is well to test motor for unbalanced conditions at once. It is even possible (though it rarely happens) that a shaft may be sprung. In any case the rotor should be rebalanced dynamically.
	2. Worn bearings.	2. If unduly frequent, examine for cause. See (C).
	3. Rough commutator or brushes not "seating" well.	3. This noise occurs only during starting period, but conditions should be corrected to avoid consequent trouble.
	4. Excessive endplay.	4. Endplay should be approximately 0.005 inch. Washers supplied by factory should be used. Be sure to tell factory all figures involved. Remember, too little endplay is at least as bad as too much.
	5. Motor not properly aligned with driven machine.	5. Correct mechanical condition.
	6. Motor not firmly fastened to mounting base.	6. All Wagner small motors have steel bases so they can be firmly bolted to mounting without fear of breaking. It is of course not to be expected that the base should be strained out of shape in order to make up for roughness in mounting base.
	7. Loose accessories on motor.	7. Such parts as oil covers, guards, if any, on endplate, etc., should especially be checked for security if they have been removed for investigation of any sort. The condulet box should be tightened when top is fitted after connections are made.
	8. Air gap not uniform.	8. This results from sprung shaft or unbalanced rotor. (See No. 1 above.)
	9. Amplified motor noises.	9. When this condition is suspected, set motor on a firm floor, and if motor is quiet, then the mounting is acting as an amplifier to bring about certain noises in the motor. This may occur even though mounting is quite firm in structure. The use of rubber-mounted type motors almost invariably eliminates the amplification of motor noises.
(G) EXCESSIVE BRUSH WEAR	1. Dirty commutator.	1. Clean with piece of fine sandpaper. (Never use emery.)
	2. Poor contact with commutator.	2. See that brushes are long enough to reach commutator, that they move freely in slots, and that brush spring tension gives firm but not excessive pressure.

SERVICE INSTRUCTIONS FOR REPULSION-START-INDUCTION BRUSH-LIFTING MOTORS

PROBLEM	PROBABLE CAUSE	TEST AND REMEDY
	3. Excessive load.	3. If brush wear is due to overload, it can usually be checked by noting the time required for lifting the brushes from the commutator. Proper time is not in excess of 10 seconds.
	4. Failure to throw off promptly and stay off during the running period.	4. Examine for conditions listed under (B).
	5. High mica.	5. Examination will show this condition and the remedy is to take a very light cut off commutator face and polish with fine sandpaper.
	6. Rough commutator.	6. See (5).
(H) BRUSHHOLDER OR ROCKER ARM WEAR	1. Failure to throw off properly and stay off during the running period.	1. No noticeable wear of this part should occur during life of motor. Troublesome wear indicates faulty operation. See under (B).
(I) Protector (motor mounted) trips after the motor starts but before it changes to the Induction winding.	1. Low voltage.	1. Measure the voltage at the motor-terminals while the motor is operating; it should be within 10% of the voltage stamped on the motor nameplate.
	2. The driven machine requires excessive torque. This may be due to high inertia or heavy load.	2. Measure the time required for the motor to come from zero to a constant speed. This acceleration period should not exceed 5 seconds. It usually is on the order of 0.5 to 1.0 second. If the long acceleration period cannot be overcome by oiling and greasing bearings, correcting obvious mechanical defects, etc., take the matter up with the appliance manufacturer.
	3. Too frequent starting.	3. It is difficult to establish the maximum number of starts per hour which will not trip out the protector since there are so many different types of load to which motors are applied. In general, however, too frequent starting may be a possible cause of trouble if the motor is starting 6 or more times per hour. If it is thought that this is the trouble, contact Wagner, giving complete details.
	4. Defective protector.	4. First be sure that steps No. 1, No. 2 and No. 3 have been checked and remedied if necessary; they probably will have rectified the trouble. But if the application is still unsatisfactory, record each of the "on" times of the motor for 10 successive attempts to start. If two or more of these "on" times are less than 1¼ seconds, replace the protector with a new unit of the rating called for on the motor nameplate. Operate the motor on the appliance under actual load conditions. If the application is still unsatisfactory, transmit *all* the information obtained to Wagner.
(J) Protector (motor mounted) trips after the motor has come up to speed.	1. Low voltage.	1. See I-1.
	2. Excessive room temperature.	2. The current input to the motor, which the protector will allow continuously without tripping, decreases ½ to 1% for every degree Centigrade of room temperature above 40°C. (For room temperatures below 40°C the continuous input current which the protector will allow is increased by approximately the same amount.) Therefore, the allowable load as determined by step No. 3 (below) should be corrected for room temperature *at the motor*.
	3. Excessive load.	3. The protector on standard Fractional Horsepower, General Purpose, Open Type motors is designed to allow the motor to carry at least 140% of full load horsepower in a room temperature of 40°C; the current input at this load is approximately 125% of the nameplate current. Take an ammeter reading. If the current drawn exceeds the 125% of full load value, refer the trouble with complete details to Wagner.
	4. Too frequent starting.	4. See I-3.
	5. Defective (motor mounted) protector.	5. First be sure that steps No. 1, No. 2, No. 3, and No. 4 have been checked and remedied if necessary. Look at the protector; if it is obvious that it is physically damaged (for example, cracked or broken bakelite), replace it with a new protector of the same rating as called for on the motor nameplate. If, after a complete investigation as outlined in the various steps above, the trouble has not been found, refer the matter to Wagner with *all* the information obtained.

PHOTO M2088—*Shows position of short-circuiting necklace and brush mechanism while motor is starting.*



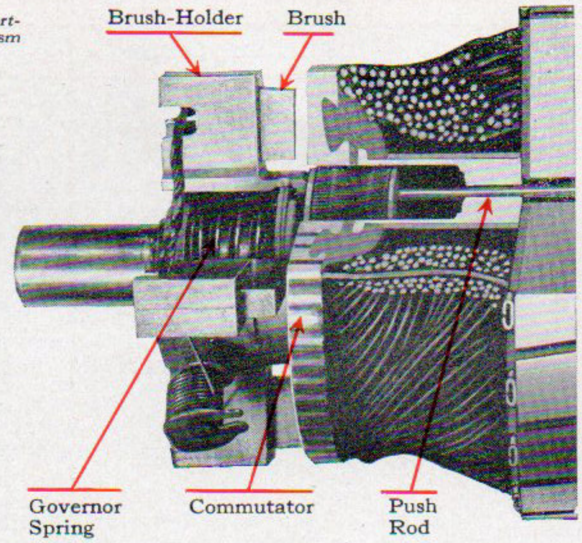
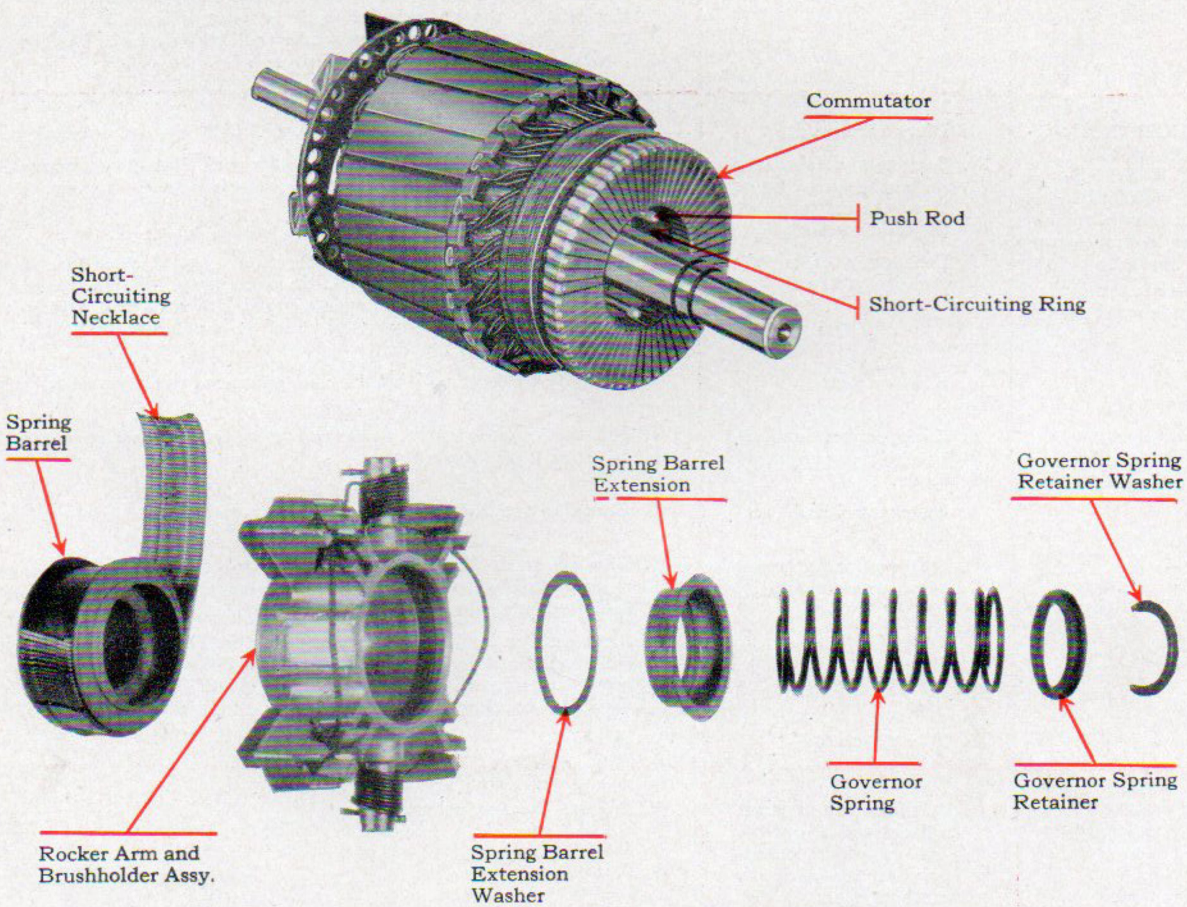


PHOTO N435 — *Shows position of short-circuiting necklace and brush mechanism after governor weights have operated.*



PHOTOS 4177 and EB7—*Dismantled rotor showing various items making up short-circuiting and brush-lifting mechanism. Governor weights (not shown) are at opposite end of rotor.*