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NEW VARIAC® SPEED CONTROLS IN 1 and 1½ hp RATINGS

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During the two years since the announcement of the TYPE 1704-A and 1705-A Variac® Speed Controls,¹ rated 1 and 1½ hp respectively, the need has become apparent for simpler controls without the expensive magnetic contactors for starting, stopping and reversing. The unmounted controls, TYPE 1704-AW and 1705-AW, announced about a year later,² were

primarily for machine manufacturers who would mount the controls in the cabinets of their machines and provide their own switching for reversing and dynamic braking as desired. But a lower-priced, complete control suitable for the general user was still much needed.

Such a control requires a rugged inexpensive switch, and the so-called "drum" controller, which had been used increasingly with Variac Speed

¹ W. N. Tuttle, "Five New Variac Speed Controls Round Out the Line," *General Radio Experimenter*, XXVIII, 7, December, 1953.

² "Unmounted Motor Speed Controls for Assembly into Other Equipment," *General Radio Experimenter*, XXIX, 5, October, 1954.

Figure 1. The new Type 1704-B Variac Speed Control installed on a bench lathe. The controller is installed just below the headstock where it is conveniently accessible, and the Variac, which is the speed adjustment control, is below the controller, on the bench cabinet. The chassis, which carries the transformers and rectifiers, is inside the cabinet.



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Controls installed in our own plant, proved to be just what was needed. Ample switching capacity can be provided in a small unit, and contacts are available for dynamic braking. The new controls consist of the drum switch, the rectifier chassis, and the Variac adjustable transformer controlling the speed. Overload protection of the Klixon type with appropriate time-delay characteristics is incorporated in the Variac. The new chassis differ from the older stripped-down versions, TYPE 1704-AW and 1705-AW, in that a dynamic braking resistor and dust cover are included.

The complete 1-hp control as supplied is shown in Figure 2. A line switch or cutout box is the only additional component required. The control operates on 230 volts a-c input, but terminals are provided so that a pilot light, if desired, can be operated on 115 volts. The control cabinet can be mounted out of the way in any location where there is adequate ventilation, as access to it is required only for maintenance. When an overload trips the breaker, resetting is done at the Variac, which is handy to the operator. The drum switch is sufficiently small to permit mounting in the frame of the driven machine. In production work it may be desirable to have the control lever at the hand of the operator and the speed adjustment knob farther away. Separate units for these functions give flexibility to meet such requirements.

An inside view of the drum controller

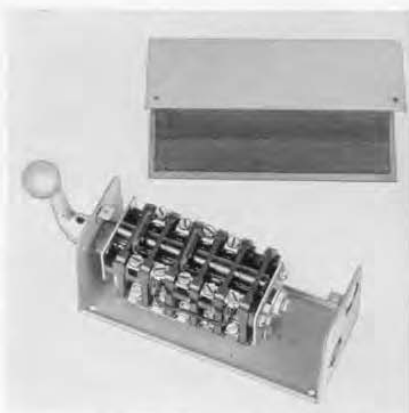


Figure 3. Interior view of the controller.

is shown in Figure 3. The contacts are cam-operated and there is only enough wiping action to keep them clean. Wear is minimized and long life results. The cam design gives a fast break, with very little sparking. Two a-c contacts and four d-c contacts operate in series to make or break the armature current, as indicated in the wiring diagram, Figure 4.

The new controls, like the others of the Variac Speed Control line, are suitable for a wide variety of applications. The 1 and 1½ hp ratings, however, are particularly suitable for small lathes. A back-gear lathe requires only a simple single-ratio belt drive to handle work of all sizes within its capacity. A lathe without back gears can be used for small-diameter cuts with only a single drive ratio but should have a second



Figure 2. View of the Type 1704-B Variac Speed Control (1 horsepower), showing the three elements: chassis, Variac, and controller. The basic model, Type 1704-BW, consists of chassis and Variac only, with the switching to be supplied by the customer. The 1½ hp models, Type 1705-B and Type 1705-BW, are identical in dimensions and external appearance with those shown here.





SPECIFICATIONS

		Type 1704-B			Type 1704-BW			Type 1705-B			Type 1705-BW		
Motor Horsepower Range:		1			1			1½			1½		
Power Supply Single-Phase	Volts	230			230			230			230		
	Full-Load Amperes	6.5			6.5			8.5			8.5		
Line-Voltage Limits	At 60 Cycles	210-250			210-250			210-250			210-250		
	At 50 Cycles	210-250 ²			210-250 ²			210-250 ²			210-250 ²		
Input Power In Watts	Full Load	1500			1500			1950			1950		
	Standby	90			90			90			90		
Motor Control Output DC	Armature	4.5			4.5			6.0			6.0		
	Field	0-230			0-230			0-230			0-230		
		0.5			0.5			0.5			0.5		
Speed Range		230	160	128	230	160	128	230	160	128	230	160	128
		0 to 0 to 0 to	1.12 1.25	0 to 0 to 0 to	1.12 1.25	0 to 0 to 0 to	1.12 1.25	0 to 0 to 0 to	1.12 1.25	0 to 0 to 0 to	1.12 1.25	0 to 0 to 0 to	1.12 1.25
		rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated	rated × rated × rated
Dynamic Braking		Automatic in stop position			Braking resistor furnished			Automatic in stop position			Braking resistor furnished		
Armature-Overload Protection		Circuit Breaker in Variac			Circuit Breaker in Variac			Circuit Breaker in Variac			Circuit Breaker in Variac		
Control Station		Variac and drum switch furnished			Variac furnished, Switching to be provided by user			Variac and drum switch furnished			Variac furnished, Switching to be provided by user		
Over-all Dimensions in Inches ¹	Chassis Variac Controller (supplied with cabinet model only)	20½ × 13¾ × 5½											
		7½ × 5¼ × 9¼											
Net Weight in Pounds	Chassis	38½			38½			44½			44½		
	Variac Controller	21¼			21¼			21¼			21¼		
	Code Word ²	WEEDY			FAVOR			WAXER			SAXON		
Prices Net F.O.B. Factory	1 to 4 units	\$330.00			\$308.00			\$380.00			\$358.00		
	5 to 19 units	\$316.00			\$294.00			\$365.00			\$343.00		
	20 Units and up	302.00			280.00			350.00			328.00		

MOTORS FOR USE WITH ABOVE VARIAC SPEED CONTROLS⁴

Motor ratings: open drip proof, reversible, 40C, rise continuous, horizontal, rigid base. General Radio Designation	Compound with Interpoles MOD-9		Compound with Interpoles MOD-10	
	1	N-203	1½	N-204
Horsepower	1	1	1½	1½
Frame Size ¹	N-203	N-203	N-204	N-204
Speed RPM	1750	1750	1750	1750
Leads (brought out separately)	6	6	6	6
Bearings	Ball	Ball	Ball	Ball
Net Weight — Pounds	75 lbs.	75 lbs.	87 lbs.	87 lbs.
Code Word ²	MOTOR	MOTOR	MOTOR	MOTOR
Price	\$185.00	\$185.00	\$210.00	\$210.00

¹ Dimension drawings available on request.

² To order motor with Variac Speed Control, use compound code word, WINDYMOTOR, AMAZEMOTOR, etc. Motors are not sold separately.

³ Special Variac required; hp rating reduced 11%.

⁴ Motor specifications not critical. Any motor within control ratings can be used.

drive ratio available for heavy cuts on large-diameter pieces. For most of the work the control would be used over a wide range of working speeds without shifting the belt. The range of speeds covered is continuous, and the speed giving the fastest production can be set quickly. In our own plant we have obtained substantially increased production from lathes equipped with Variac Speed Controls.

Figure 1 shows the drum controller supplied with the new controls installed on a Rivett Model 908 Bench Lathe. Very little space is required and the location is particularly convenient for production work.

Although the cost of the complete controls is about 25 per cent lower than that of earlier models, the performance is unchanged. Rated torque of the motor is available for continuous operation



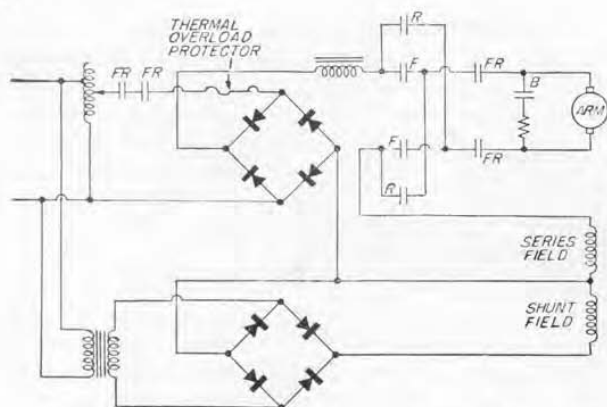


Figure 4. Basic circuit of the Variac Speed Control, showing the switching arrangement for forward, reverse, and stop (braking) operations.

over the entire range from rated speed to zero speed. Torque pulsations are negligible even in the most exacting work. Starting torque can be smoothly controlled in starting delicate operations, or fast high-torque starting can be

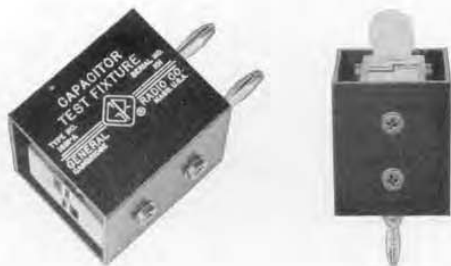
used for rapid production work. Over a period of years maintenance requirements of the Variac Speed Controls have proved almost negligible.

— W. N. TUTTLE

A CONVENIENT TEST FIXTURE FOR SMALL CAPACITORS

In the measurement of small capacitors of the disc-ceramic type, the wire leads attached to the capacitor can affect the measured value of capacitance unless a standard technique of connection, to eliminate lead capacitance, is used. A fixture for this purpose, described by Stout and Wonso¹ of Radio Materials Corporation, is designed to plug into a General Radio Precision Capacitor for measurements by a substitution method.

A new fixture, similar in concept, but modified to accept many different types of capacitors, is shown in Figure 1. This fixture, the TYPE 1691-A Capacitor Test Fixture, can be used with the various capacitors shown in Figure 3: disc-type ceramic, with either wire or tapered-tab leads; disc-type with molded jacket; encapsulated mica; and tubular paper. Length of usual leads is immaterial, since the leads are eliminated from the measurement.



¹ Earl Stout and John Wonso, "Measurement of Small Capacities," *RMC Discap Review*, Vol. 1, No. 3, May, 1954.

Figure 1. (left) View of the Type 1691-A Capacitor Test Fixture. (right) View showing disc-type ceramic inserted in fixture.



Figure 2. View of equipment for measuring disc-type capacitors at one megacycle. The Capacitor Test Fixture is installed on a Type 716-CS1 Capacitance Bridge. The generator is a Type 1330-A Oscillator, and the detector, a Type 1212-A Unit Null Detector. A one-megacycle filter is used at the input of the detector to reduce harmonics and noise.

Each lead slides into a hollow shield and is held by a spring clip, while an outer shield surrounds the entire assembly. The capacitor leads are pushed into the clips until the capacitor itself touches the fixture (see Figure 1), so that connection is made at the same point on every capacitor, regardless of lead length. The leads, from their ends to the point of connection, are completely covered by the shield and do not enter into the measurement.

The fixture terminals are TYPE 274 Plugs on $\frac{3}{4}$ -inch spacing, which plug directly into a TYPE 722 Precision Capacitor or into any of the several General Radio Capacitance Bridges.

For the measurement of disc-type

ceramic capacitors at one megacycle, the TYPE 716-CS1 Capacitance Bridge, shown in Figure 2, is recommended. With this bridge, dissipation factor as well as capacitance can be accurately measured at or near one megacycle. At lower frequencies, these and other low-capacitance units can be measured on the TYPE 716-C Capacitance Bridge.

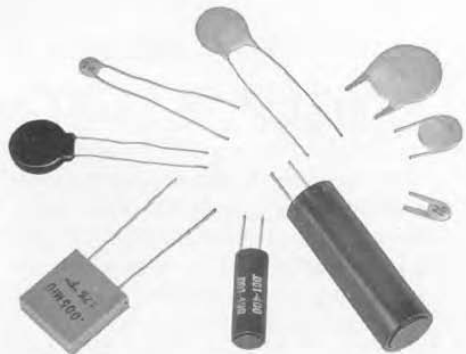


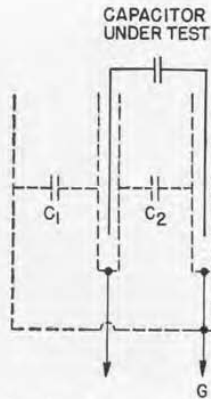
Figure 3. The Capacitor Test Fixture will accept all of the types of capacitors shown here.





Figure 4. The fixture plugs easily fit into the terminals of General Radio bridges or into other equipment having jack-top binding posts, spaced 3/4 inch. The bridge shown here is a Type 1611-A Capacitance Test Bridge, and the capacitor is a tubular paper type.

While lead capacitance is usually insignificant in the measurement of tubular paper capacitors, this fixture offers a convenient and standardized means of connection. Figure 4 shows the TYPE 1611-A Capacitance Test Bridge, with



$$C_0 = C_1 + C_2 = 8.7 \mu\mu f$$

Figure 5. Sketch showing the nature and magnitude of the zero capacitance. This capacitance does not enter the measurement when a substitution method is used.

fixture installed, for 60-cycle measurements. The fixture is equally useful with the TYPE 1604-B A-C Comparison Bridge.

SPECIFICATIONS

- Zero Capacitance:** 8.7 micromicrofarads.
- Terminals:** TYPE 274 Plugs on 3/4-inch spacing.
- Dimensions:** 1 1/2 x 1 1/2 x 2 1/2 inches, over-all, including plugs.
- Net Weight:** 4 ounces.

Type	Code Word	Price
1691-A Capacitor Test Fixture	EDICT	\$22.50

VARIACS® IN THREE-PHASE DELTA CIRCUITS

When Variac® Autotransformers are connected to supply a three-phase delta load, one of the circuits of Figure 1 is ordinarily used. In a typical application recently encountered, each leg of

the delta was rated at 20 amperes, 230 volts. In the circuit of Figure 1a, two 230-volt Variacs, each capable of supplying 34.5 amperes, would be required, while that of Figure 1b uses three 115-

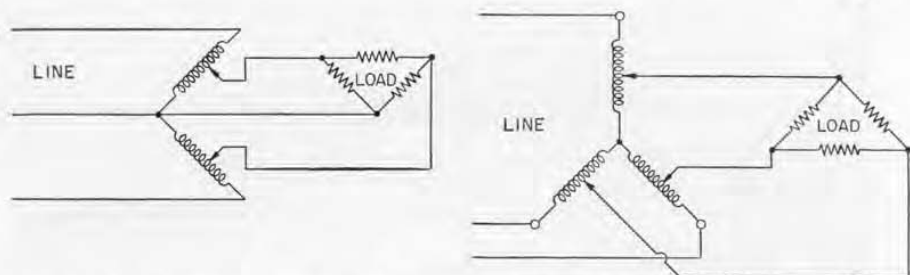


Figure 1. (a) Delta connection and (b) wye connection of Variacs to supply a 3-phase load.

volt units, supplying 34.5 amperes. This meant that TYPE 50 Variacs connected in wye, as in Figure 1b, become the only choice, since the 230-volt TYPE 50-B Variac is rated at 31 amperes.

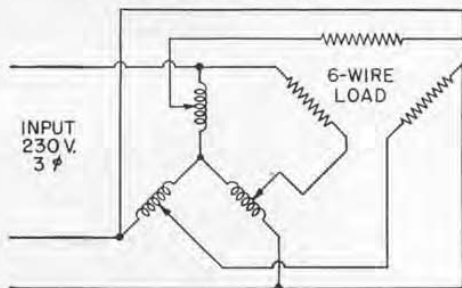
In this particular application, however, it was found that the load did not have to be connected in delta, but could be handled as three individual loads.

In addition, a maximum power variation of 3:1 was found to be adequate. With these modifications of the original requirements, the arrangement of Figure 2 was recommended. Here, the 20-ampere Variac, TYPE V20, could be used, which gave a considerable saving in cost over the TYPE 50 units of Figure 1b.

In general, a 3-gang assembly of a given size Variac is less expensive than

either the 2-gang or the 3-gang assembly of the next larger size. This saving is possible whenever the load can be connected as three single-phase elements and where a 1.6:1 range of voltage adjustment is adequate.

Figure 2. Connection for separate loads and limited range of adjustment.

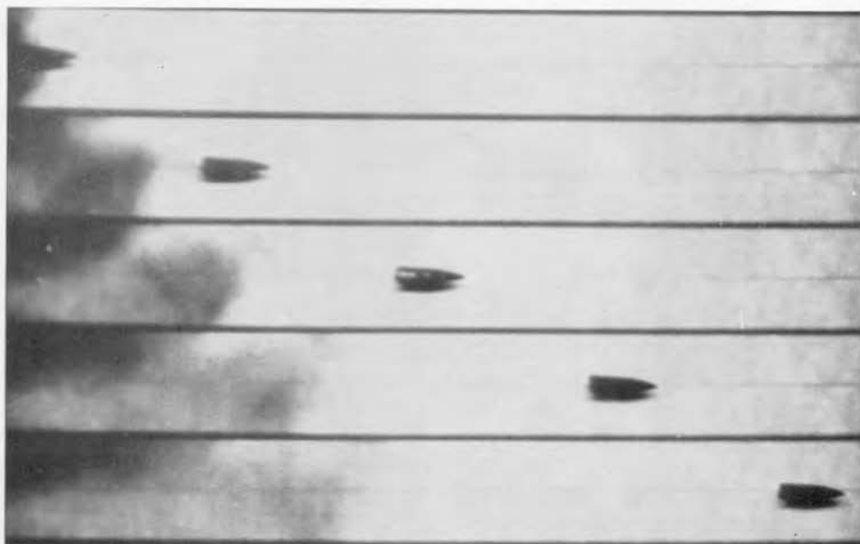


GR EXHIBITS IN NOVEMBER

East Coast Conference on Airborne and Navigational Electronics, Lord Baltimore Hotel, Baltimore, Maryland, October 31 and November 1. In Booths 36 and 37, General Radio will have on display sweep drives, pulsers, oscillators, bridges and other new products recently announced in the *Experimenter*.

Chicago Exposition of Power and Mechanical Engineering, Chicago Coliseum November 14-18. Come to Booth 151 to see GR motor speed controls, stroboscopes, noise-measuring instruments and other items for the power and mechanical industries.





This photograph, taken with a General Radio Type 651 Recorder, shows the flight of a 30-caliber bullet, fired from a T44 rifle. The illumination was supplied by a high-speed stroboscope, manufactured by Edgerton, Germeshausen, and Grier, Incorporated, operating at 10,000 flashes per second.

Camera aperture was $f/1:5$ with Background X Panchromatic Negative film. The stroboscopic lamp was mounted directly above the recorder lens and the bullet was photographed against a "Scotchlite" background. The bullet speed was 10,000 feet per second.

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