TECHNICAL MANUAL

OPERATION'S, ORGANIZATIONAL, DIRECT SUPPORT

AND GENERAL SUPPORT MAINTENANCE

MANUAL INCLUDING REPAIR PARTS LIST

FOR

MEASURING INSTRUMENT

MODEL 5920230G1, TYPE B

(GENERAL ELECTRIC) (NSN 4940-00-959-1880)

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1980

TECHNICAL MANUAL
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASH INGTON, DC, 29 December 1980

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find my mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028&2, located in the back of this manual direct to: Commander, US Army Armament Material Readiness Command, ATIN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished directly to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this measuring instrument is issued.

Manufactured by: General Electric
1 River Road
Schenectady, NY 12345

Procured under Contract No. DAAA09-7C-4612

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS

NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

1 - Manufacturer's Federal Supply Code Number - 89473

2 - Manufacturer's Part Number exactly as listed herein.

3 - Nomenclature exactly as listed herein, including dimensions, if necessary.

4 - Manufacturer's Model Number - Model 5920230G1, Type B

5 - Manufacturer's Serial Number (End Item)

6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.

7 - If 00 Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

(a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - followed by a colon and manufacturer's Part Number for the repair part.

(b) Complete Remarks field as follows: Noun: (nomenclature of repair part) For: NSN: 4940-00-959-1880 Manufacturer: General Electric

Model: 5920230G1, Type B Serial: (of end item)

Any other pertinent information such as Frame Number, Type, Dimensions, etc.

INTRODUCTION

The Type. B thickness gage is design primarily for measuring the thickness of nonmagnetic finishes such as enamel and paint, on the surface of mild steel. It is also adapted for measuring the thickness of non magnetic materials, such as mica, celluloid, and paper, when placed on a smooth steel surface. In the latter case, the non-magnetic material being measured must adhere to the surface of the steel backing; otherwise, the thickness of the intervening air gap will also be measured.

Thickness gages are available with various scale ranges up to 0.300 inch. All ranges are available with special calibrations (see Operating Limitations).

The thickness gage allows measurements to be made over a wide range with good accuracy. Because of this wide range, it is necessary to relax the accuracy requirement covering the entire range and to substitute a simple calibrating system to give minimum accuracy over part of the range. The net effect is the same as that obtained by using several short-range instruments of good accuracy, except that they are all contained in on cam. Therefore, the user may choose hit own range to meet the job requirements.

All thickness gage are provided with 1 inch diameter measuring heads except for the -G7 models which are provided with a 1/2 inch diameter right-angle head Several thickness standards are available to cover all the scale ranges, and each ha its measured thickness stamped on it The voltage and frequency rating of each thickness gage is shown on the nameplate of the device

The gage can be used to measure coatings on cylindrical surfaces having a radius of curvature of' 3 inches or more with little, if any, correction. For best results, on these or on surfaces having compound curvature, it is necessary to first adjust the gage on an uncoated piece of steel of the same shape and compassion The gage can also be used on internal cylindrical surfaces having a radius of curvature as small as 1 inch, or on external surfaces whose radius is as small as 1/2 inch provided a correction chart is made and applied to the scale readings for each surface.

The minimum area required to make a measurement is a 2-inch diameter circle. The gage head must be centered in this area (if the metal does not extend beyond the circle) to avoid edge effect

A special calibration is required when measurement low-resistively metallic coatings such as silver, copper, aluminum, zinc, brass, etc. The effect of different coatings on the instrument readings is shown in Fig. 4.

REQUIREMENTS

The full range of the thickness gage can be used, without a special calibration or a correction curve ,to measure the thickness of non magnetic-nonmetallic films provided the backing materials is:

1. Either soft or low-carbon steel.
2. 0.020 in thick or more.
3. Flat, or convex (with radius of curvature 1-1/2 in. or more), or concave (with radius of curvature 3 in. or more).

A special calibration or a correction curve is required, for best accuracy, if the backing material is: L. Either a high carbon steel, or a nickel or chromium alloy.

2. Less than 0.020 inches thick
3. Convex (with a radius of curvature less than 1-1/2 in.), or concave (with a radius of curvature less than 3 in.).

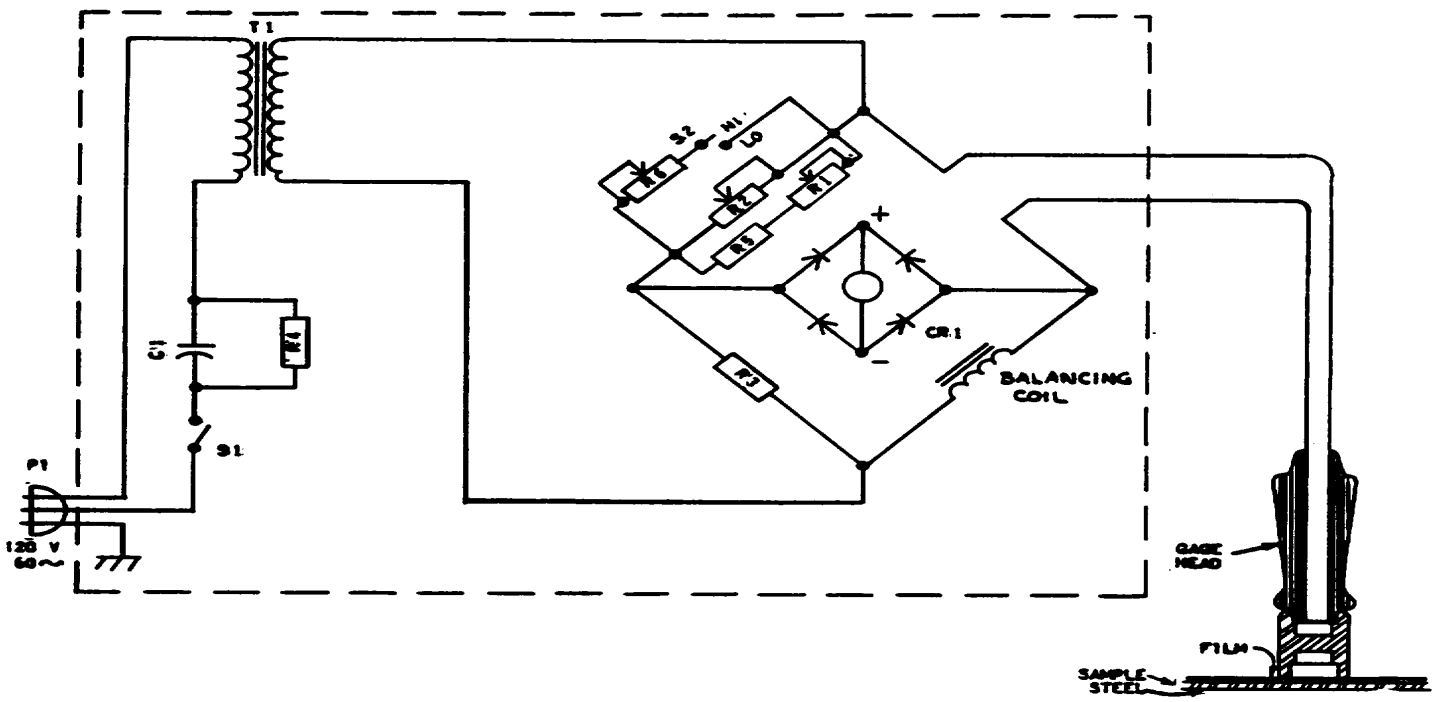

Fig. 1

31	LINE SWITCH
32	HIGH-LOW SWITCH
R1	400 OHMS SCALE ADJUST
R2	50 OHMS 10W FACTORY ADJUSTMENT
R3	25 OHMS 10W
R4	220,000 OHMS 1/2W
R5	500 OHMS1/2W
R6	150 OHMS, FACTORY LOW RANGE ADJUSTEMENT 10W
I	INSTRUMENT 0.2 TO 1.2 MA
CR1	FULL WAVE,RECTIFIER
C1	1.0 UF 600 VOC 330 VAC
T1	INPUT TRASFORMER
P1	INPUT LINE PLUG

SUMMARY OF APPUCATIONS

Example of nonmagnetic materials whose thickness can be measured if backing material is magnetic.

NONMAGNETIC		METALLIC		NOTE Nickel is a magnetic material; there the thickness of nickel plating on iron or steel cannot be measured with this gage. However, nickel does not have a permeability high enough to warrant its use as a backing materials>
AIR	Paper	Copper	Zinc	
Paint	Mica	Silver	Cadmium	
Lacquers	cellophane	Aluminum	Chromium	
Enamels	Plastic	Tin	Brass	
Glass		Lead		
		Some stainless steels		

DESCRIPTION

The gage consists of a gage head (A) Fig. 2, and an indicating unit (B). The gage-head lead and the po4r-supply lad are permanently attached to the back cover of the indicating unit - shown in Fig 3. Typical internal connections of the indicating units are shown in Fig. 1. The gage operates at the voltage and frequency ratings stamped on the back of the thickness-gage cover. When the gage head Is placed on the surface of the material to be measured, the thickness can be read in mils (thousandths of an inch) di-

rectly on the indicating instrument

A line switch (C), Fig 2, is provided in the input circuit of the indicating unit Two scales are usually furnished on the indicating instrument; a scale-selector switch (D) is provided to adapt the instrument for either of its two ranges. The switch is marked HI for the upper scale, covering the high range, and LO for the lower scale, covering the low range It is important that the selector switch be turned to the proper scale range for the thickness to be measured. When only one scale is furnished on the indicating instrument, the scale-selector switch is omitted.

The indication of the 'gage depends on the thickness of the non-magnetic material upon which the gage head is placed. and, to some extent, on the thickness and magnetic qualities of the steel backing For this reason it is necessary, in order to obtain accurate readings, to adjust the device by putting the gage head on a thickness standard placed over the same kind and thickness of magnetic material as that of the backing under the material to be measured. (See OPERATION.)

OPERATION

Proceed as follows:

1. Connect the plug (F) Fig. 2, to a power supply in accordance with the voltage and frequency rating on the nameplate.
2. Turn switch (C) to ON. This should be done at least 15 minutes before using the gage if accurate results are to be obtained, or preferably, the gage can be left connected at all times (The total power required is approximately 3 watts No harm will result if it is connected continuously to the power supply.)
3. Estimate the approximate thickness of the nonmagnetic material to be measured, and then choose the standard which is closest to it.
4. Set the HI-LO toggle switch to the correct scale.

NOTE The HI-LO toggle switch is omitted on instruments having only one scale.

5. Place the chosen standard on a smooth sample of the uncoated magnetic base material.
6. Place the gage head on the standard with light pressure and with both disks in contact.
7. Adjust rheostat (E) until the instrument pointer indicates the thickness marked on the standard The gage can now be used to measure thickness within :50% of the set point.
8. Place the gage head on the sample to be measured and read instrument

The gage should not be used outside of the ranges marked on the scales without special calibration. If it is desired to change the scale range, simply choose another suitable standard and repeat the steps out-lined in OPERATION.

The accuracy of the gage within =-50% of the calibration point, will be -5% to = 10'% of the calibrated value, or 0.2 mils whichever is greater. The greatest accuracy will be obtained at the center of the calibrated range.

OPERATING LIMITATIONS

The thickens gage may be used over a wide temperature range; moreover, the temperature of the gage head may differ from that of the indicating unit The accuracy of the instrument will be within the stated limits if the gage is calibrated under the same temperature conditions those under which it will be used However, if the temperature differential (which may be zero) between the gage head and the balancing coil changes after initial calibration, an error will be introduced into the reading. This error can be eliminated by recalibrating the instrument at the new temperature differential by following Steps S, 6 and 7 under OPERATION.

If the temperature differential does not remain reasonably constant (SF-IOF) frequent calibrations must be made to obtain accurate results. This may be impractical if rapid changes in differential temperature are encountered. The errors caused by minor temperature changes are small and may be neglected

Ordinarily, measurements should not be made closer than 1/2 inch from an edge. It is possible in some cases however, where the size of the work necessitates measurements closer than this, to place the gage head with the end of its spool as close as 1/4 inch from the edge and still obtain reasonably
accurate results

Where the magnetic properties of the backing material are found to vary at different points on any piece of material, the greatest accuracy can be obtained by first setting the gage with a thickness standard on the reverse side of the material (if this is uncoated), and as nearly opposite to the point of measurement as possible. The gage can be used with the axis of the spool either parallel to or across the grain of the material. However, it should always be used in the same relative position, with respect to the grain, a the position in which it was set

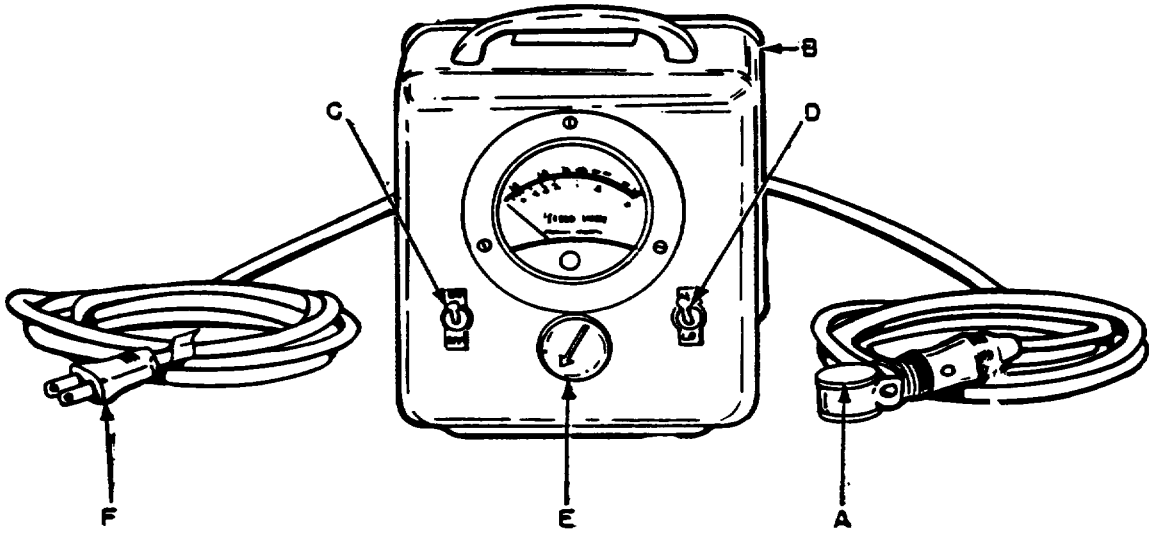

Fig. 2 Thickness gage

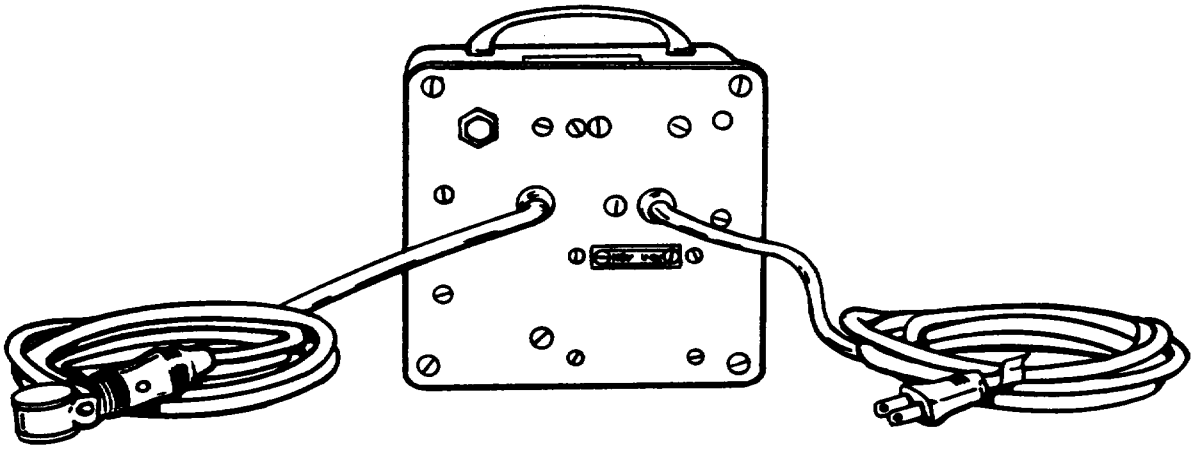

Fig. 3 Thickness gage, rear view

The thickness gage can be adapted for use on other magnetic materials, such as alloy steels high-carbon steel some grades of cast iron, and on sheet steel less than 0.020-inc thick, but the calibration as usually furnished for use on mild steel will not give correct results If the page is to be used on any one of these materials exclusively, it should be calibrated at the factory on a sample of that material The gage will then give accurate measurement of coatings on that material only. If production requirements do not warrant this, a calibration can be made by the user on a sample of the material, and a correction curve plotted from which the thickness can be read corresponding to the marked scale divisions

If it is necessary to make a thickness measurement nearer than 1/2 Inch to the edge of the metallic coating, calibrations should be made with the gage head used in certain definite positions that changes in gage readings due to position of the bead may be, taken into account

CAIIBRATING THE GAGE FOR SPECIAL CONDITIONS

Curved Surface, Near Edges, or Alloy-steel Backing Materials

To make a calibration, use enough thickness standards to cover the range of the gage. Take for example, the calibration of the 0-to-8 scale for paint coatings on the convex surface of a steel part having a I 1nck radius of curvature

The steps for calibrating the gage are as follows:

1. Select an unpainted steel part which has a clean smooth surface.
2. Set the scale-selector switch on LO.
3. Place the gage head on the a steel with the axis of the gage-head spool parallel to the axis of the curved surface.
4. Set the control (E) on the point which brings the instrument pointer to zero.
5. Lift the gage head off the surface, slide a 0.000S-inch standard beneath the head and place the head firmly on the sample.

6 Record the reading for this standard.

7. Repeat this procedure for 0.001-, 0.003, and 0.005-inch standards, and for a combination of the 0.005- and 0.003-inch standards (to give 0.008-inch).

The tabulation obtained may serve as a correction chart with intermediate points filled in by proposition. or the data may be plotted to obtain a curve such as the one shown in Fig 4. The gage is now ready for use in measuring paint, (and any other non-metallic) coating on this grade of steel with the convex surface having a radius of curvature of approximately 1 inch. Just how much this radius can vary depends on the accuracy required for these measurements and should be determined by actual test.

Metallic Coatings

To make a calibration for metallic coatings on steel, it is necessary to have pieces of the metallic coating material, or material of equivalent electric resistively available. The thickness of these pieces should be accurately determined with a micrometer. These pieces of the metallic coating materials, which are to be used as standards, must have an area larger than the standards used for non-metallic coatings. This is necessary because the eddy currents, caused by the gage head, should be allowed to spread out. in order to obtain the highest accuracy possible. Therefore, for small objects (less than 4 lbs square) the metallic standards should be made large enough to cover the object However, for larger objects the standards need not be larger than 4 inches square.

The gage head should be placed on the center area of the standard when making a calibration. No Uncoated Base Material Available

When a portion of uncoated base material is not available the following procedure may be followed to calibrate the gage:

1. Estimate the thickness of the coating.
2. Place the gage head on the surface and adjust the gage to the value estimated in Step 1.
3. Lift the gage head off the surface, slide a known thickness standard (equal to approximately 1/2 of the estimated value) beneath the head and place the head firmly on the standard.
4. The gage should now read the sum of the known thickness standard plus the value estimated in Step 1 above.
5. If the gage does not equal the sum, repeat the above procedure using a higher or lower estimate as the case may require

MAINTENANCE

The gage is made for accurate measurements and will continue to give satisfactory results only if carefully handled The disks of the gage head are made of hardened steel, but precaution should be taken to se that they are not dropped or rubbed on the work, or the contact surfaces may be damaged. Rusting of the contact surfaces, which may occur when the gage is not in use, can be prevented by cleaning it occasionally, and coating with oil or petroleum jelly. The instrument reads off scale to the left when the power supply is disconnected This is normal and it must not be altered or the calibration will be destroyed.

Type B Thickness Cages

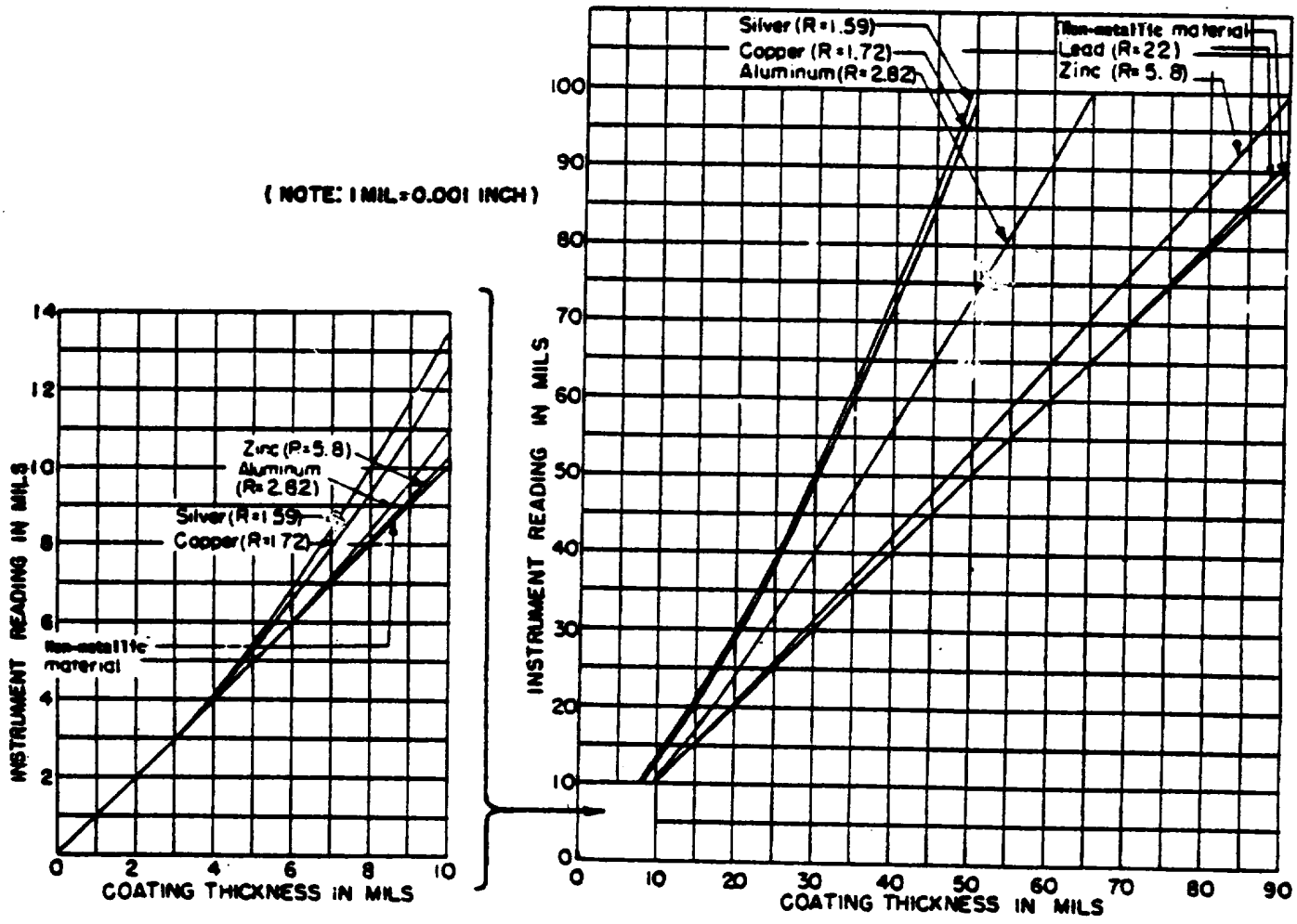

Fig. 4. Curves showing eddy-current effect on thickness-gage readings

By Order of the Secretary of the Army:

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Chief of Staff

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