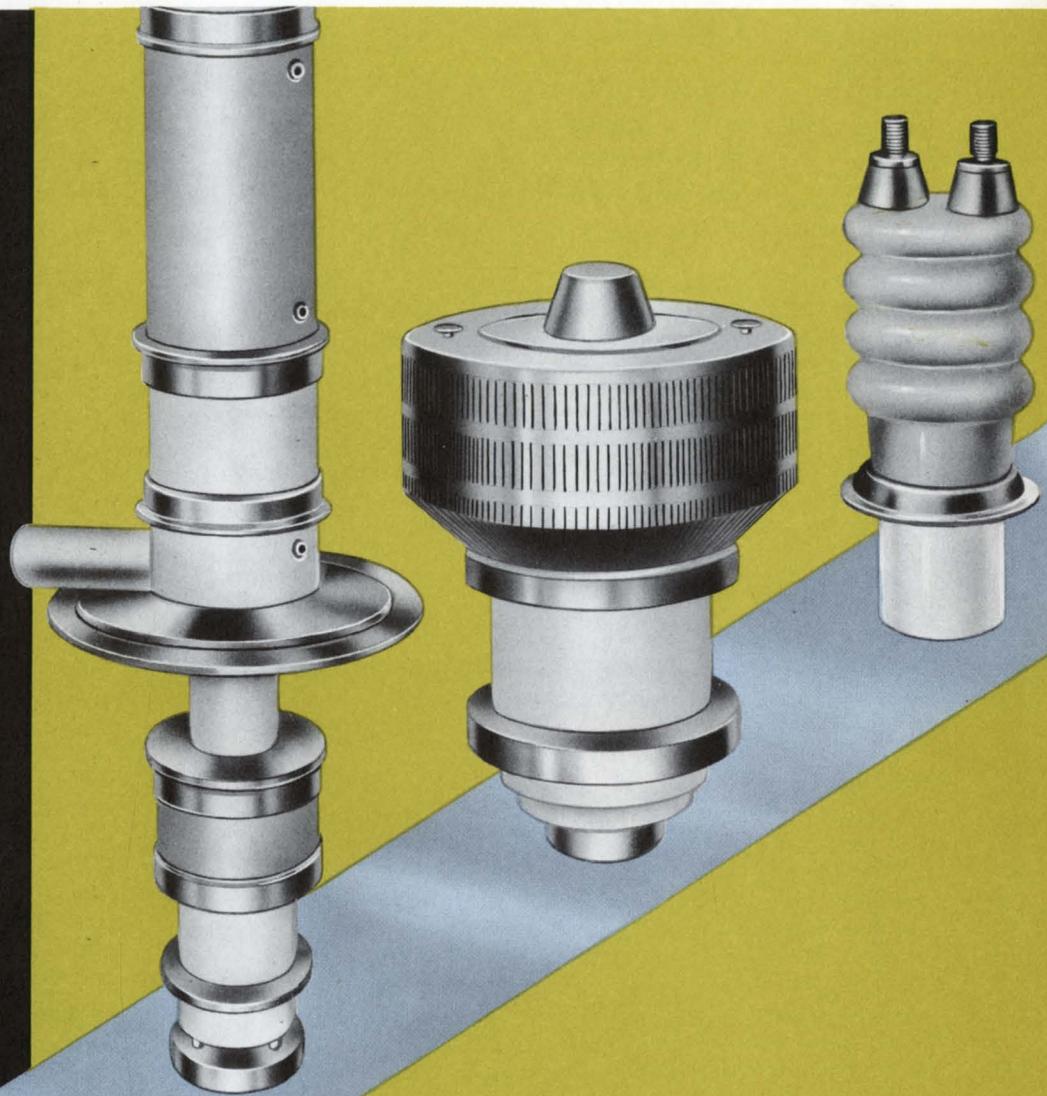


CERAMISEAL®

— the modern
metal for
**HIGH
ALUMINA
CERAMIC —**
TO-METAL
sealing
by WBD



CERAMISEAL — An iron, nickel, cobalt alloy specially designed and suited for ceramic-to-metal sealing. This WBD sealing alloy has expansion characteristics closely matching those of high temperature alumina ceramics. The low thermal conductivity of CERAMISEAL, which approximates that of ceramics, minimizes thermal stresses during the rapid heating and cooling cycles.



WILBUR B. DRIVER COMPANY



CERAMISEAL®

Deep Drawing

CERAMISEAL is normally supplied in the annealed condition with a fine grain suitable for deep drawing. It can be produced in other tempers if desired. In general, drawing techniques for CERAMISEAL are similar to those used for mild steel.

An annealing or stress-relieving treatment should be given between and after deep drawing operations. Stress-free metal is less susceptible to intergranular penetration by brazing alloys.

Drawing lubricants should be selected with care to eliminate the possibility of any residue remaining after a degreasing operation. At right is a list of drawing lubricants recommended by some electron tube manufacturers for electron tube parts.

1. Water soluble compound (Brooks Oil Co. Grade OW).
2. International Chemical No. 1093 (Light work).
3. International Chemical No. 484 (Heavy work).
4. Houghton Steel Draw No. 40.
5. Chlorinated paraffin base mineral oil (International Chemical Co. No. 1211).
6. Lard oil.
7. Castor oil.
8. Sulfur-free mineral oil (Fiske S-377).
9. Water soluble paste (W.L. Spencer Draw-soluble 501).

Machining

Machining CERAMISEAL can best be accomplished with tools of high speed steel, Stellite or cemented carbide having smaller cutting angles than normally used for steel. Speed is slower, and feed somewhat lighter, than for mild steel. In general, the machining properties of CERAMISEAL are similar to "R"* Monel.

Sulphurized oil is generally preferred and should be used as a cutting lubricant with high speed tool steels for boring, drilling and tapping, provided it can be completely removed. Water soluble oils may be used for lathe work, and are preferred lubricants for Stellite or carbide tools. Some of the oils listed below have been found to be satisfactory.

1. Fiske Refining Co. "S-277" (Sulfur-free mineral oil).
2. Lard oil.
3. Commercial coolant "Socony NC-704" (4 to 7% S).
4. Union Carbide Corp. "UCON-660".

**Reg. Trademark, International Nickel Co.*

Pickling

Pickling techniques will generally be used to effect removal of heavy oxide formations. Possible procedures are:

1. (A) Degrease in trichlorethylene or equivalent.
- (B) Immerse in following solution:
 Ferric ammonium sulfate.....50 gm
 Sulfuric acid (1.84 sp.gr.).....125 ml

Hydrochloric acid (1.16 sp.gr.) 150 ml
 Water to make 1 liter
 Temperature 60-80°C
 Time 10-60 min.

- (C) Rinse in chromic acid solution:
 Chromium trioxide 100 gm
 Sulfuric acid (1.84 sp.gr.) 30 ml
 Water to make 1 liter

2. (A) Degrease in trichlorethylene or equivalent.
- (B) Immerse in following solution:
 Concentrated hydrochloric acid 99%
 With Rodine No. 50 inhibitor 1%
 Temperature 80-85°C
- (C) Rinse in running water.

3. (A) Degrease in trichlorethylene or equivalent.
 - (B) Immerse in following solution:
- | | Per cent
by volume |
|------------------------------------|-----------------------|
| Hydrochloric acid, 20° Be. | 25 |
| Phosphoric acid, 75% | 5 |
| Nitric acid, 42° Be. | 1 |
| Water | 69 |
| Temperature | 82°C |
- (C) Rinse in running water.

Bright Dip Solutions

In the production of headers, or in other instances where CERAMISEAL might not be copper plated, a bright dip solution may be required. Possible bright

READILY JOINED TO METALLIZED CERAMICS WITH BRAZING ALLOYS EXCELLENT DEEP DRAWING AND WELDING PROPERTIES

PHYSICAL PROPERTIES OF CERAMISEAL (PATENT PENDING)

Chemical Analysis	25%Co, 48%Fe, 27%Ni	Melting Point	1421°C, 2590°F
Density295 lb/in ³	Specific Gravity	8.17

Specific Heat (calculated):

Temperature °C	-100	0	20	100	200	300	400	500
Cal/gm/°C	.095	.111	.112	.119	.125	.131	.136	.141

Thermal Conductivity:

.040 Cal/cm ² /sec/cm	at 20°C
.057 Cal/cm ² /sec/cm	at 600°C

Electrical Resistivity:

222 ohms per cir. mil ft.	at 20°C
174 ohms per sq. mil ft.	at 20°C
36.9 micro-ohm-cm	at 20°C

Electrical Conductivity 4.679% IACS at 20°C

Thermal EMF vs Cu (0°-100°C) - .039MV/°C

Temperature Coefficient of Resistance from 20°C to Temperature

Temperature °C	-80	0	100	200	300	400	500	600
T.C./°C ref. 20°C	.0030	.0030	.0038	.0039	.0039	.0037	.0034	.0030

Curie Temperature °C 525 to 550

Modulus of Rigidity 7,100,000 psi

Modulus of Elasticity 19,000,000 psi

Transformation Temperature below -80°C

Average Thermal Coefficient of Expansion from 20°C to Temperature:

Temperature °C	100	200	300	400	500	600	700	800	900	1000
Coeff. x 10 ⁻⁶ /°C	8.80	8.70	8.39	7.96	7.65	8.32	9.46	10.47	11.34	12.12

dip solutions for essentially oxide-free parts are:

1. (A) Degrease if necessary.
- (B) Immerse in following solution (*must stir*):

Acetic acid	750 cc
Nitric acid	250 cc
Hydrochloric acid	15 cc
Oakite No. 12	10 cc
Temperature	115 to 120°F
Time	20 to 30 sec.
	or 2 to 3, 10 to 15 sec. dips
- (C) Rinse in running water.
2. (A) Degrease if necessary.
- (B) Immerse in following solution:

Ferric ammonium sulfate	50 gm
Sulfuric acid (1.84 sp.gr.)	30 ml
Hydrochloric acid (1.16 sp.gr.)	150 ml
Nitric acid (1.42 sp.gr.)	150 ml
Water to make	1 liter
Temperature	60°C
- (C) Rinse in chromic acid solution (see above).

Cleaning Solutions

CERAMISEAL parts must be thoroughly degreased, and all evidences of organic or carbonaceous matter removed, to produce a clean surface for subsequent brazing or plating. Possible cleaning solutions for removing all surface contamination and organic matter are:

1. Hydrogen peroxide method for cleaning electron tube parts.

A. Solution consisting of the following:

- (1) C.P. 30% hydrogen peroxide Merck "Super OxyI" without stabilizer.
- (2) De-ionized water or distilled water in order of preference.

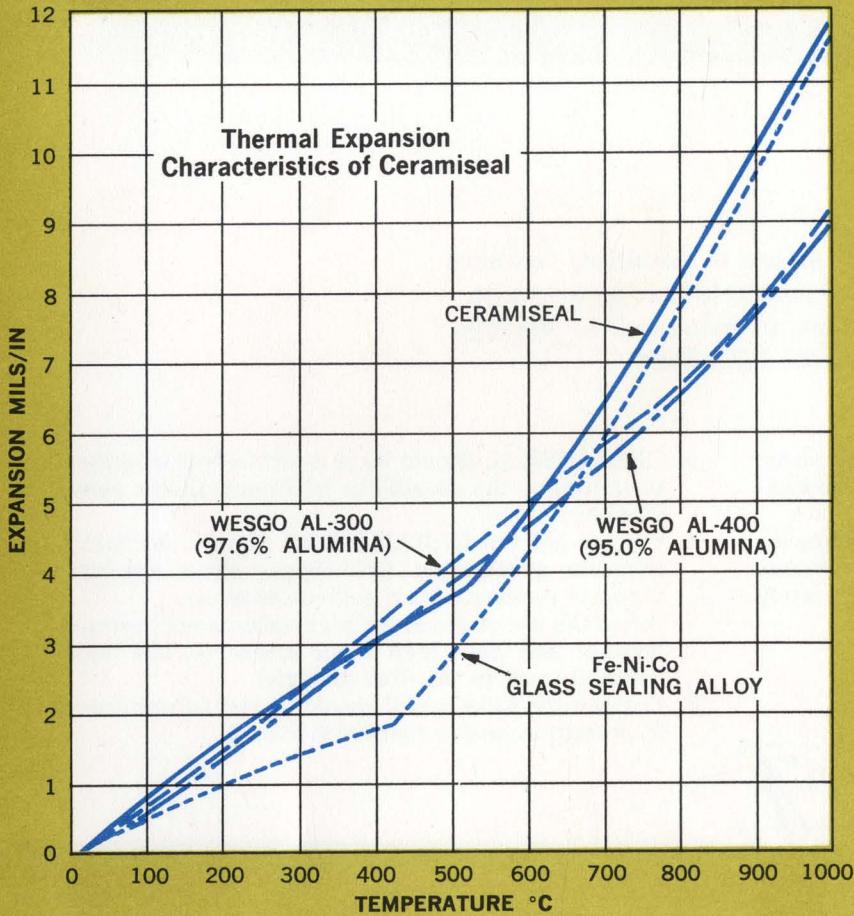
B. Procedure:

- (1) Immerse parts in de-ionized water, bring to boil, adding enough peroxide to make a 5% solution.
- (2) Boil 20-30 minutes.
- (3) Overflow rinse with tap water.
- (4) Rinse in de-ionized water.
- (5) Dry in air furnace.
- (6) Store parts in glass containers previously cleaned by the hydrogen peroxide method.

2. Ultrasonic agitated aqueous detergent solutions.

NOTE: It has been observed that ceramics cleaned with trichlorethylene are left with an undesirable conductive coating.

The above list of pickling, bright dip and cleaning solutions is given as a guide. They are in use in the sealing and electron tube industries today. The solutions may be used in various combinations to achieve the desired effect with CERAMISEAL, and can also be used for RODAR®, a WILBUR B. DRIVER glass-to-metal sealing alloy.

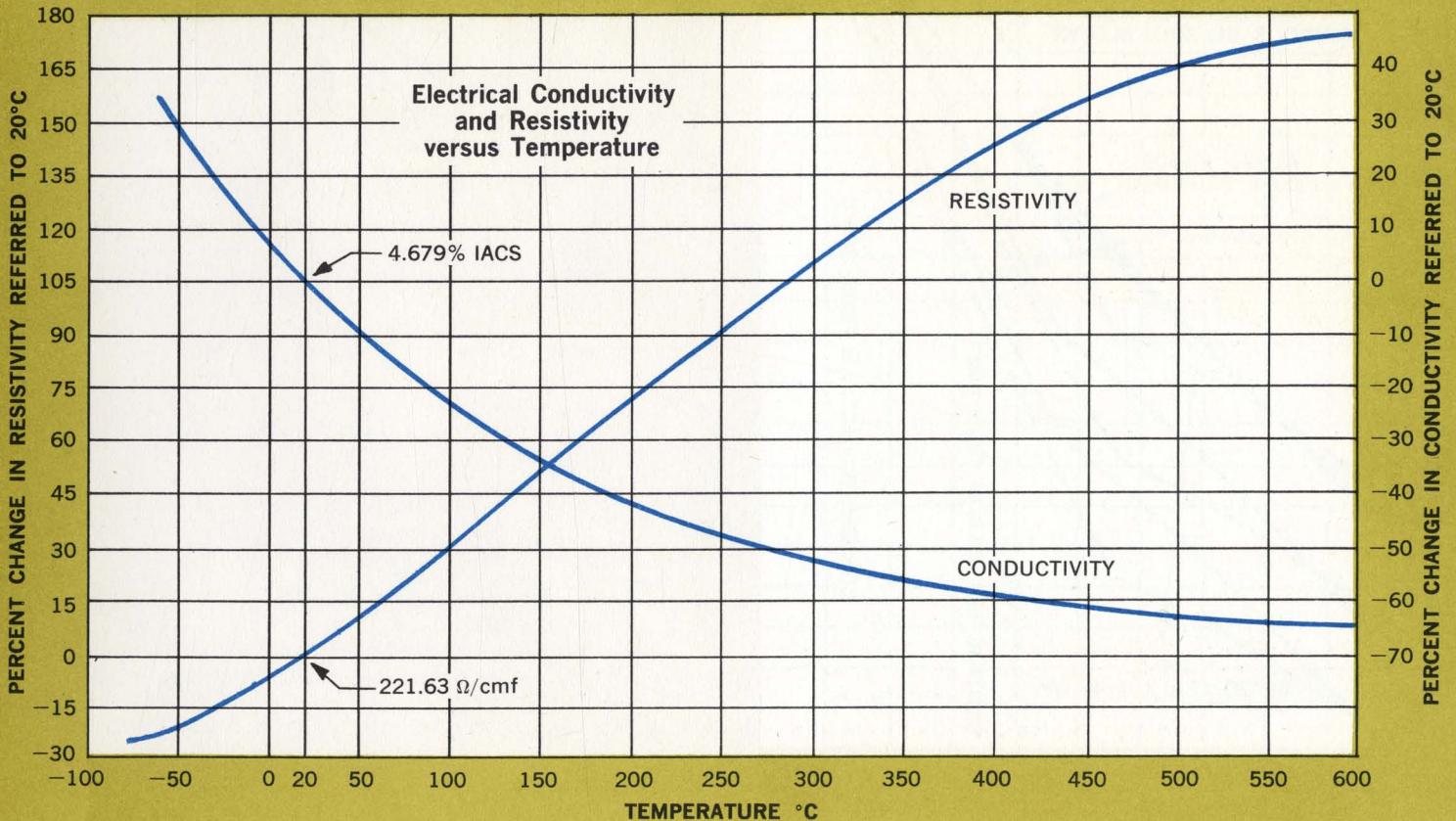


CERAMISEAL IS MANUFACTURED TO EXACTING STANDARDS —

This WBD sealing alloy is produced under extremely careful supervision with special consideration given to chemical analysis, metal cleanliness, grain size, thermal expansion, temper, surface quality and dimensional tolerances.

CERAMISEAL IS AVAILABLE IN WIRE OR STRIP —

Air or vacuum melted CERAMISEAL alloy is supplied in both wire and strip. Strip can be furnished in widths up to 12", wire to .001" diameter.

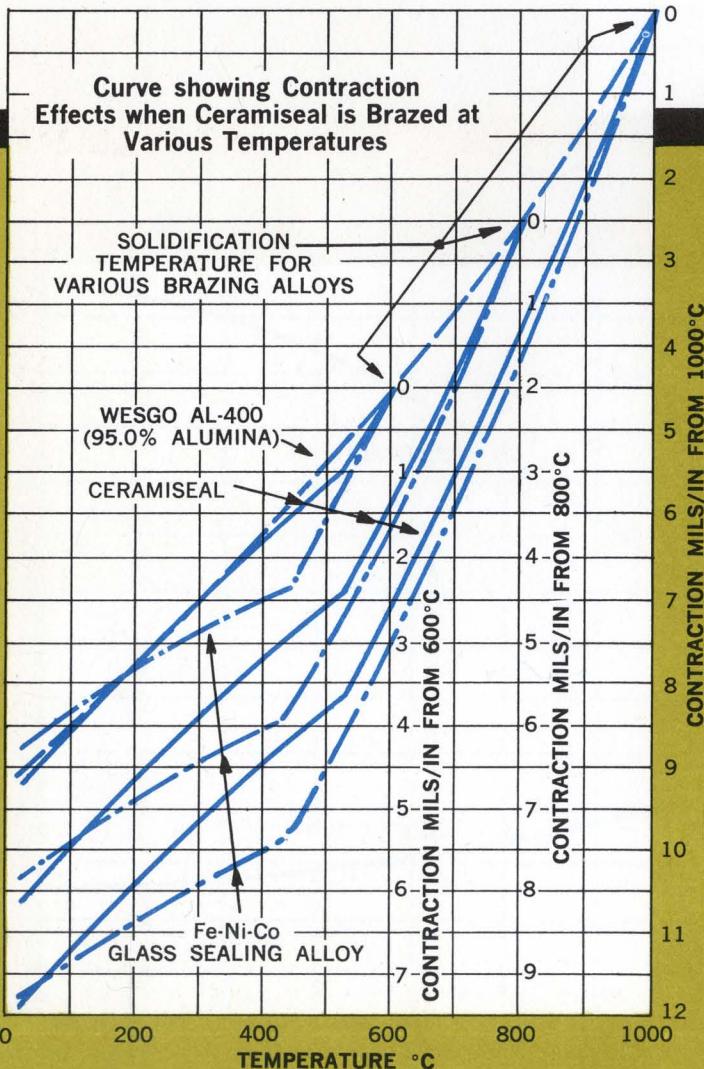


MANUFACTURED UNDER STRICT QUALITY
CONTROL STANDARDS
AVAILABLE IN AIR OR VACUUM MELTED
WIRE OR STRIP

Brazing

CERAMISEAL can be readily brazed to metallized ceramics with a number of commercially available brazing alloys. In order to properly process ceramic-to-metal seals by brazing, consideration must be given to the following:

1. The components to be joined must be absolutely clean.
2. The joint must be designed to have a high mechanical strength prior to bonding.
3. If possible, the thermal expansion of the brazing alloy should be close to that of the metal and ceramic.
4. Brazing time and temperature must be accurately controlled.
5. CERAMISEAL should be in a strain-free condition to minimize the possibility of intergranular penetration.
6. Copper plating CERAMISEAL diminishes intergranular penetration. Gold-copper alloys are less prone to penetrate than gold-silver alloys.
7. Avoid the use of fluxes for high vacuum applications because they have high vapor pressures, and leave harmful voids in the filler material.
8. Components to be sealed should be heated uniformly to prevent excessive thermal stressing.



OF SPECIAL INTEREST TO DESIGN ENGINEERS —

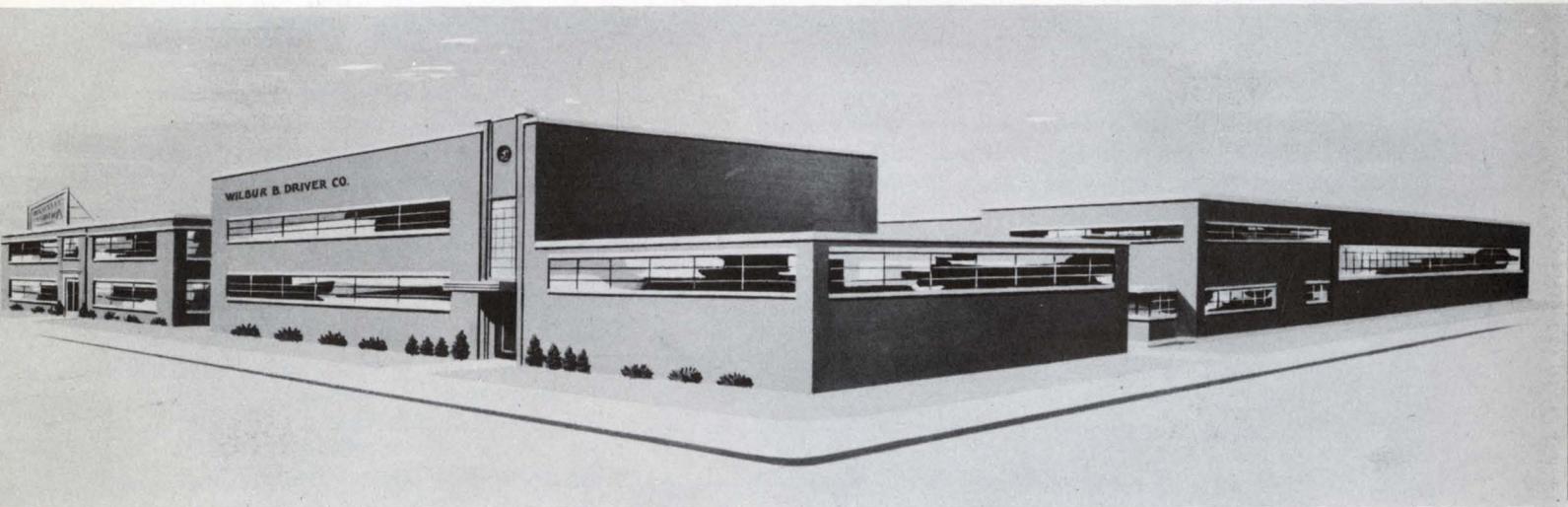
The contraction curve depicts the comparative contraction of CERAMISEAL and a typical alumina ceramic when joined at temperatures ranging from 600°C to 1000°C (depending upon the melting point of the brazing alloy used). CERAMISEAL improves the match between the metal and ceramic as compared to the conventional iron-nickel-cobalt glass sealing alloys.

Brochures on other WBD Alloys available—

The WILBUR B. DRIVER COMPANY produces wire and strip in electrical resistance, electronic, chemical, mechanical and glass sealing alloys. Specialized equipment produces ultra-fine gauges in both wire and strip. Complete specifications on all WBD precision alloys are available on request. Call or write for brochures, mentioning the type of alloy in which you are interested.

WILBUR B. DRIVER COMPANY

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MANUFACTURING PLANTS

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