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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

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HYDRAULIC LABORATORY REPORT NO. 165

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REPAIR AND RATING OF CURRENT METERS
DENVER HYDRAULIC LABORATORY

By

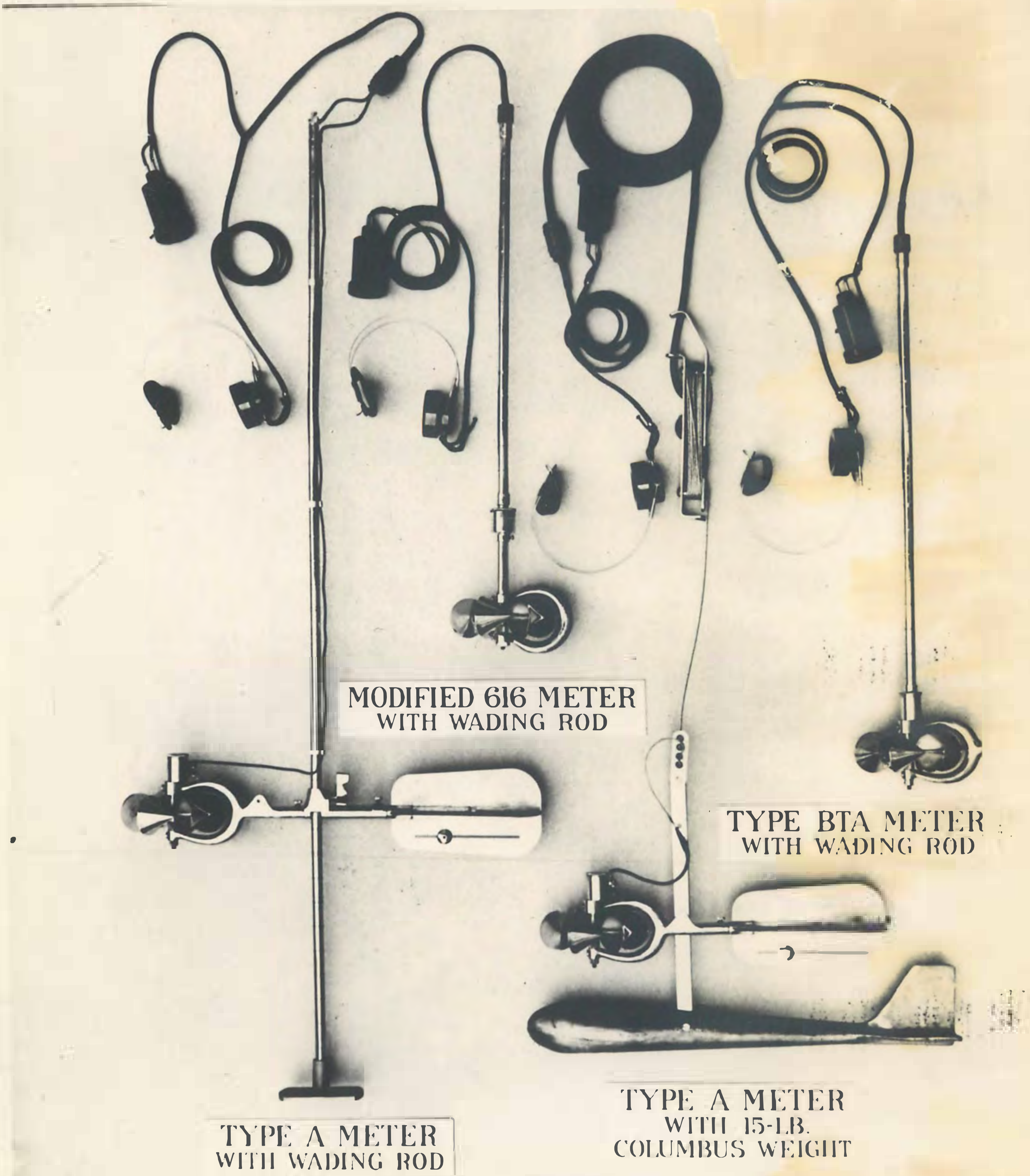
J. E. WARNOCK

- - -

Denver, Colorado
Feb. 15, 1945

HYD 165

HYD-165



CURRENT METER SUSPENSIONS

FOREWORD

This report was prepared to correlate and summarize the developments in the hydraulic laboratory of the Denver office from 1942 to date, on the repair and rating of current meters, as the result of the assignment of that duty by the Commissioner of the Bureau of Reclamation. The complete report contains a set of drawings of details of the type A current meter, a drawing of a wading rod for the acoustic 616 meter, a copy of the article "New Pivots and Bearings for Small Current Meters," a tabulation of current meter repairs and rating from June 1, 1942, to February 15, 1945, and an abstract of correspondence.

Since those items have a limited interest, and since it appeared desirable to give the report a wider distribution in an abridged form, that material was segregated in an appendix which has been omitted in the abridged edition.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Branch of Design and Construction
Engineering and Geological Control
and Research Division
Denver, Colorado
February 15, 1945

Laboratory Report No. 165
Hydraulic Laboratory

Compiled by: J. E. Warnock
Reviewed by: R. F. Blanks

Subject: Repair and rating of current meters - Denver Hydraulic Laboratory.

1. Introduction. In May 1942, the repair of the current meters belonging to the Bureau of Reclamation was transferred from the Division of Field Equipment of the Geological Survey in Washington, D. C., to the hydraulic laboratory of this Bureau in Denver, Colorado. In the interim, certain changes in procedure of handling and improvement of design have been made. The present practice is summarized in this report.

2. Improvements in repair of 623-type meters. As experience was gained by the hydraulic laboratory in the repair of the current meters, it became apparent that an improvement of equipment was needed to reduce the excessive repairs required. There was in use in the field seven different types of Small Price current meters: Acoustic 616, single contact 617, penta contact 621, combination 623, improved 622, type A, and type AA. There were also in use three different types of current meter weights: Torpedo, elliptical, and Columbus. With the different sizes of these weights and with rod ratings, there were 29 different ways of rating meters (figure 3). Penta=5

Repair parts for the older types of meters were difficult to obtain and the single contact 617, penta contact 621, and combination 623 meters were obsolete, their use having been discontinued by the Geological Survey in 1925, at the time of the adoption of the improved 622 which has since been developed into the type A. The type AA was of a more recent development but was never widely distributed and the few in use in the Bureau have been converted to the type A by changing the shaft and pivot. Torpedo weights were outmoded by the Geological Survey in 1926 and elliptical weights in 1934. The reasons for these various improvements are discussed in considerable detail in "Stream-Gaging Procedure - A Manual Describing Methods and Practices of the Geological Survey" Geological Water Supply Paper 888, copies of which have been sent to all project offices.

Early in 1944, a program was formulated whereby the Bureau current-meter equipment could be modernized and standardized to keep pace with the developments in the Geological Survey. Plans were made so that all the old style meters and accessories in the Bureau could be recalled eventually for replacement by the type A meter and its suspension equipment without any disruption of service.

By consultation with the hydrographers in the Denver office of the Geological Survey and an interpretation of the descriptive material in Geological Survey Water-Supply Paper 888, 1943, pages 168 to 184, inclusive, figure 1 (40-D-3631) was prepared showing the general assemblies of equipment using wading-rod and hand-line suspensions.

It was impossible to obtain delivery of certain repair parts. Accordingly, drawings were prepared showing the assembly (figure 2) and details (figures 9 to 13, inclusive, appendix) of the parts of a type A meter so that unavailable parts could be made in the laboratory. Specifications in General Schedule of Supplies, Class 18, for items 18-M-1210 and 1210-100, were followed in preparing these drawings. Subsequently, shafts (12), pivots (17), pivot bearings (16), yokes (8), tailpieces (10), and balance weights (11) have been made in sufficient quantity to supply urgent needs and alleviate delay in repair of meters.

The most difficult material to obtain was that for the pivot and pivot bearing. According to information from the Geological Survey, A-metal was used for this purpose. One piece each of 3/8-inch, 5/16-inch, and 7/16-inch round bar 10 feet long, C. M. special alloy "A" metal, annealed, was obtained from the Universal Cyclops Steel Corporation, Titusville, Pennsylvania, at approximately $0.50 per pound. The studies leading to the adoption of this particular metal are described in "New Pivots and Bearings for Small Price Current Meters" by R. L. Atkinson, Civil Engineering, July 1935, page 392 and 393.

The specifications for the pivot require that 1/8 inch of the pivot be hardened and tempered to a Rockwell hardness of not less than C-57 and not more than C-59. It also is required that the bearing be from the same material as the pivot, that it shall be highly polished with a mirror finish, and have a Rockwell hardness of not less than C-61.

A stock of 15-lb. bronze and 30-lb. lead Columbus-type current meter weights was purchased from the Denver Metals Foundry (Mr. James Renaldo), 1723 Blake Street, who has a complete set of patterns for current-meter weights.

With this small stock of material on hand, as the old-style meters were received for repairs and rating, the project was contacted as to the possible exchange for a modern type A meter. If a type A meter was received with a request for a rating above a torpedo or elliptical weight, the project was requested to exchange those for Columbus weights. This program has progressed to the point where approximately 30 percent of the 623-type meters and all of torpedo and elliptical weights have been junked and new equipment supplied.

As the 623-type meters were junked, usable parts were salvaged. The salvageable parts are usually the bucketwheel and tailpiece. The nickel plating was stripped by a reverse current process. The bucketwheels were straightened, resoldered, and rebalanced; the tailpieces straightened; and all the parts buffed, polished, and replated. The reclaimed parts were then used in the assembly of type A meters.

Instead of a table (figure 3) of "Coefficients for Obtaining Cable Ratings from Standard Round Rod Ratings" with 27 different methods of cable suspension, a simplified table (figure 4) (issue of July 6, 1944) has only six methods of cable suspension. Of the six methods the first two are requested most frequently. To avoid the necessity of computing rating tables based on these corrections, unless otherwise specified by the project, all type A meters are sent to the Bureau of Standards with the request that they be rated as follows:

Rod with sliding support
5.3 inches above a 15-pound Columbus weight
4.9 inches above a 30-pound Columbus weight

Since the coefficient for a suspension 9.8 inches above a 50-, 75-, or 100-pound Columbus weight is 1.00, the rating table for "rod with sliding support" can be used with no correction for those suspensions. An occasional request is received from a project for a rating 9.8 inches above a 50-pound Columbus weight.

3. Improvement in repair of the acoustic 616 meters. In the repair of the acoustic meter, difficulty was encountered in obtaining a satisfactory adjustment on the small clapper or grasshopper which strikes the diaphragm on every tenth revolution of the bucketwheel to make the sound from which the meter derives its name - Acoustic. The meter could be adjusted to a good spin test without the grasshopper, but upon its insertion, the drag of the clapper slows the meter appreciably. Indications are that hydrographers have had difficulty in keeping these meters in working condition. The diaphragm is susceptible to rusting due to moisture in the chamber above it. The possibility of modifying the meter to obtain an electrical contact instead of a mechanical contact was considered. Indications on a couple of old meters were that others had attempted, unsuccessfully, such a conversion.

Meter BR-375, an old acoustic meter in stock in the hydraulic laboratory, was rebuilt by removing the grasshopper and inserting an electrical contact and gear to indicate every fifth revolution (figure [illegible]). The gear is the same as used in the 623-type meter. The diaphragm was replaced by an electrical contact which completed a circuit with the wading rod as one side and an insulated wire suspended through the rod as the other side. By using headphones attached through a special connector at the top of the wading rod (figure 13), the meter can be used in the same manner as a type A meter.

To distinguish between this meter and the regular acoustic meter which is referred to by the W. and L. E. Gurley Co., as the acoustic 616, the new meter is called the modified 616 (frontispiece), which designates the tailless yoke and the conversion from acoustic to electric.

Meter BR-875, the first modified 616 meter, was sent to the Rio Grande project for trial use during the season of 1944. According to a report from the project, its behavior under field conditions has been satisfactory. A request from the project for the conversion of three additional meters has been completed and six more meters in stock have been converted.

In supplying a requisition for sleeve-jointed wading rods for use with acoustic meters, it was necessary to make them in the laboratory shop. Both ends of these rods were reamed during machining for later installation of the wiring equipment for use with the modified 616. The design of this rod is shown in the appendix as figure 14.

4. Development of a new tailless yoke current meter. The reaction in the field to the modified 616 current meter was that the elimination of the grasshopper and diaphragm and the substitution of an electrical contact was a general improvement, but that there were a number of other improvements that could be made. The long slender shaft of the acoustic meter was subject to vibration and wear, the 623-type pivot and bearing were not sufficiently sturdy to withstand the hard usage in the hands of relatively inexperienced personnel. The idea of a sturdy tailless yoke meter had been discussed frequently in the hydraulic laboratory, but time had not permitted detailed studies.

So as to retain the excellent qualities of the type A current meter, the tailpiece and hanger support was removed from that meter and a new contact chamber and cap designed whereby the wading rod can be attached to the cap. Electrical connection between the meter and the headphones is made through the wired wading rod designed as an improvement in the modified 616 wading rod. So the new meter has the acceptable features of the type A and the modified 616 meter. The new meter is referred to as the BTA meter, BTA denoting "bob-tail A" (frontispiece).

The wading rod will be the wired rod used with the modified 616. The BTA meter will have the same pivot, hub assembly, and shaft as the type A which means that it will no longer be necessary to maintain two sets of repair parts as at present. The parts on the type A and the BTA will be interchangeable except for the yoke and the contact chamber.

In the development of this new meter consideration is also being given to a device to be mounted on the upper end of the wading rod to replace the headphones. As presently conceived, it will be an electrically operated clapper striking a diaphragm. The clapper will be actuated through the electrical circuit in the wired rod. It can be powered by a small battery housed in the device and will obviate the use of the headphones with their cumbersome attachments. This will simplify the assembly of the equipment as the sound apparatus can be left connected to a section of the wading rod at all times. To prepare the meter for use will only require the assembly of the meter and the rod.

5. Acquisition of auxiliary equipment. A number of items of auxiliary equipment such as sliding supports, Morgan reels, and type A cranes for bridge measurements have been available previously only from the equipment shop operated by the District Office of the Geological Survey in Columbus, Ohio. They have in the past three years been unable to supply the needed parts.

In the case of a recent inquiry to them concerning the availability of type A cranes, they supplied construction drawings instead. Material for the fabrication of five units has been requisitioned, three to fill a project requisition and two for stock.

6. Difficulties in repairs of meters. In the course of the development of the repair and conversion program, a few difficulties have been encountered, all of which have been corrected.

One of the first was the shipment of meters in cardboard boxes. It was to cover this situation that the third paragraph of General Order No. 1282, a copy of which is included in this report, said "All meters must be shipped in their wooden carrying cases to avoid even slight damage in shipping which might impair the accuracy of the rating." Shipping cases have been made in the Denver shops so that each project has enough to ship meters for repairs. These cases are sturdily built and some of them have made a number of round trips from project to Denver and return via Washington. To hold the type A meters firmly in their carrying cases, an anchor was designed and constructed which is installed in all new carrying cases, and is being installed in all old carrying cases as they pass through the repair shop.

In a few instances the type A pivots failed in service after a short period. That trouble was traced to a supply of pivots shipped from Washington to Denver in May 1942, apparently purchased from General Schedule of Supplies, Class 18, David White Co., Milwaukee, Wisconsin. On close examination the hardness of the pivot point was found to be less than Rockwell C-52, which was considerably below that required according to the specifications. As mentioned previously, A-metal was secured and the pivots and bearings are now machined, hardened, ground, and polished according to specifications. An endurance test was made on one of the inferior pivots and on one of the Bureau-made pivots. The inferior pivot failed after 200 hours of test, while the other showed no signs of failure after 1,000 hours and the test was discontinued. The Bureau pivots which have had a season of use in the field show the same trend as to durability.

There have been a few cases of mistreatment of meters in the field mainly in connection with the bucketwheel raising nut on the acoustic 616 and type A meters. This nut has a left-hand instead of the normal right-hand thread. Scars on the instruments show too free use of pliers when the fingers would have been sufficient had the operator realized that the thread was left hand. Stickers have been inserted in many of the carrying cases to call attention to the left-hand thread.

In a few instances, there has been carelessness in not cleaning and oiling the pivot and bearing with a high-grade instrument oil after each discharge measurement. Attention has been called to that on the sticker in the carrying case.

7. Revision of rating tables. The rating table as formerly issued by the Washington office (figure 5) contained 14 columns, was on legal size paper, and covered the range from 5 to 200 revolutions. All values of velocity below 1.00 foot per second were carried only to two decimals which meant that the values in the lower left corner were constant over a range of time. A revised table (figure 6) was prepared following the style of the Geological Survey and covering the range from 3 to 350 revolutions. All values below 1.00 foot per second were carried to three decimals. The new table was prepared for single-space typing on a standard typewriter and so that it would reduce to 8 by 10½ inches for notebook filing and folding in the middle to fit into the carrying case.

The records as received from Washington contained a blueprint for each rating as far back as 1926. Since the originals of these blueprints are on file in the Bureau of Standards under appropriate test numbers, the rating equations contained thereon were tabulated according to date, meter number, and test number, and are filed in the hydraulic laboratory for the period prior to June 1, 1942. The blueprints were then destroyed as superfluous. During the first year of operation in the hydraulic laboratory, the Bureau of Standards furnished a blueprint for each rating. Since this was an unnecessary procedure, they were requested to furnish the equations only and include them in the letter of transmittal. Those data are maintained in tabular form and the complete repair and rating records from June 1, 1942, to February 15, 1945, are available in tabular form for future reference.

8. Improvement of shipping time. The shipping procedure in the past had been for the project to ship the meter to the Washington office of the Bureau, where it was delivered first to the Geological Survey for repair, then to the Bureau of Standards for rating, after

which it was shipped to the project. When the repair was transferred to Denver, the procedure was similar, except that the meter was shipped from the project to Denver from where it was reshipped to the Bureau of Standards who sent it directly to the project. The rating equation was sent to this office for preparation of the rating tables.

As sufficient material was accumulated, a pool of spare meters has been developed. A sturdy shipping case was built which holds four type A meters. Insofar as possible, that shipping case is kept in use between Denver and Washington carrying repaired meters to the Bureau of Standards and returning rated meters from them. A backlog of repaired and rated meters has been accumulated in the hydraulic laboratory from which an exchange can be made. By exchange, a project can be supplied with a repaired and rerated meter within a week.

9. References.

Grover and Harrington, "Stream Flow," John Wiley and Sons, Inc., 1943, pages 119-137.

R. F. Broat, "Characteristics of Cup and Screw Current Meters," Trans. A. Soc. C. E., Vol. 76, pages 819-870.

Yarnell and Nagler, "Effect of Turbulence on Registration of Current Meters," Trans. A. Soc. C. E., Vol. 95, pages 766-860.

Geological Water Supply Paper No. 888, "Stream-Gaging Procedure, A Manual Describing Methods and Practices of the Geological Survey," 1943 and reprint 1945.

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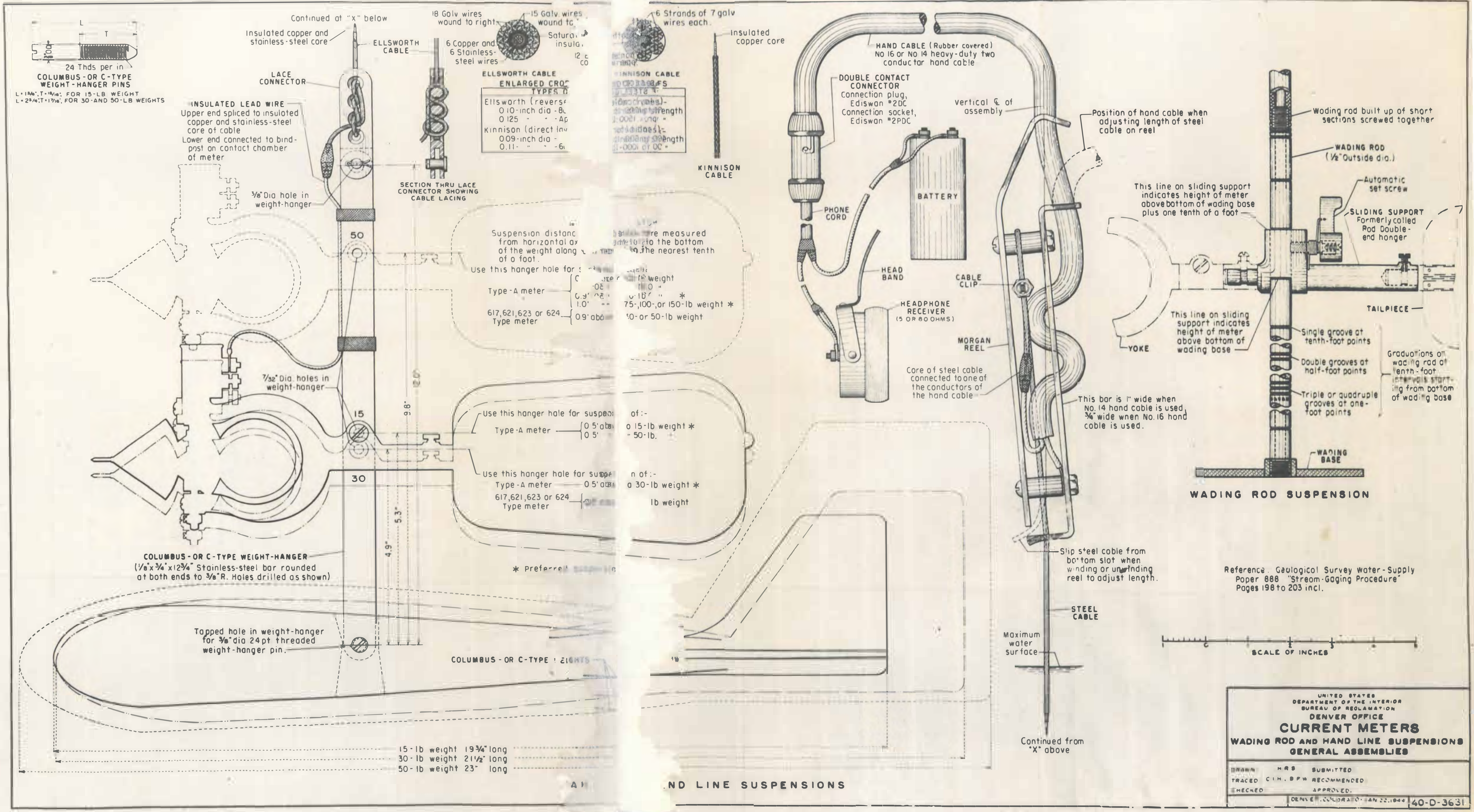
FIGURE 1



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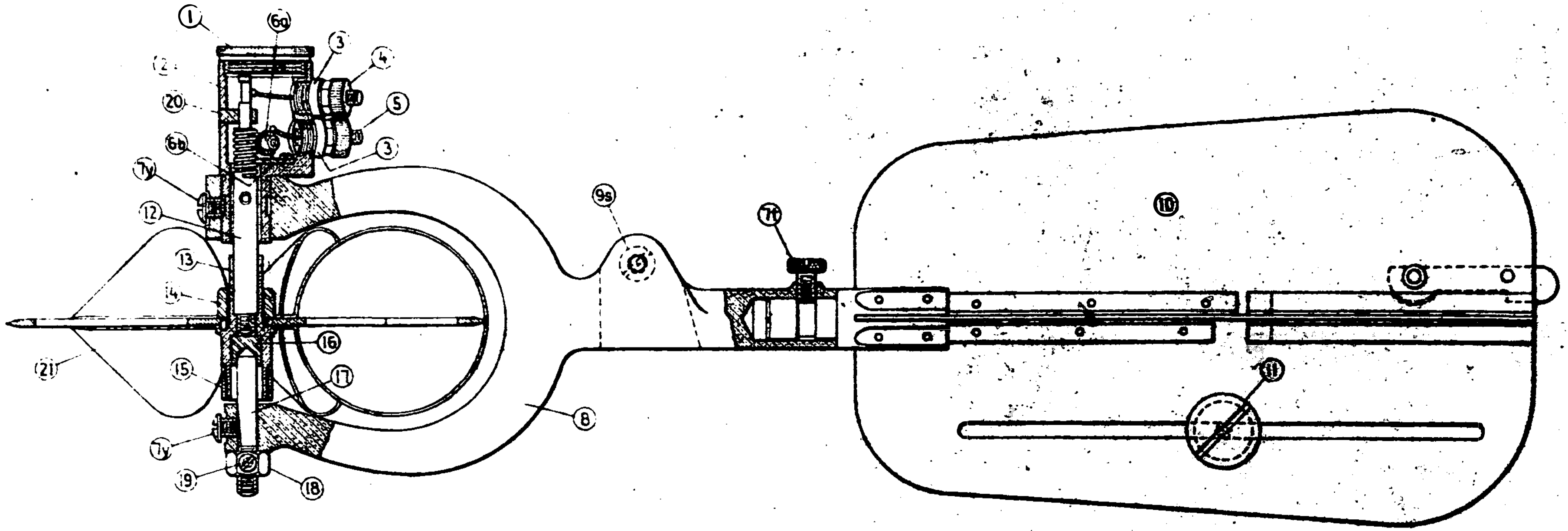

ASSEMBLY

LIST OF PARTS

2a { 1 Cap for contact chamber
2 Contact chamber (Includes bearing lug 20)
4a { 4 Single-contact binding post with contact and nut
4a, 5a { 3 Insulating bushing for contact binding posts
5a { 5 Penta-contact binding post with contact and nut
6 { 6a Penta gear complete with shaft
6 { 6b Penta gear pad with pad screw
20 Bearing lug }

8a { 8 Yoke
7t Set screw for tailpiece
7y Set screw for yoke
9s Hanger screw }

10a { 10 Tailpiece
11 Balance weight }

12 Shaft

13a { 13 Bucket-wheel hub (Includes pivot bearing 16)
14 Bucket-wheel hub nut
15 Raising nut
16 Pivot bearing }

17a { 17 Pivot
18a { 18 Pivot adjusting nut
19 Keeper screw for pivot adjusting nut } }

21 Bucket wheel

TYPE A CURRENT METER

SHEET 1 OF 6

FIGURE 2

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Figure 3

COEFFICIENTS FOR OBTAINING CABLE RATINGS FROM STANDARD ROUND ROD RATINGS

SINGLE CONTACT (617), PENTA CONTACT (621) AND COMBINATION (623) METERS

SUSPENSION AND TYPE OF WEIGHT	REVOLUTIONS PER SECOND												
	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.5	2.0	3.0	4.0	5.0
4.7" above 15-lb. T.	1.052	1.028	1.021	1.018	1.017	1.016	1.017	1.017	1.020	1.022	1.023	1.025	1.025
4.7" above 30-lb. T.	1.055	1.027	1.017	1.014	1.013	1.013	1.014	1.014	1.015	1.015	1.016	1.016	1.016
4.25" above 15-lb. T.	1.039	1.022	1.015	1.015	1.016	1.017	1.018	1.019	1.019	1.018	1.018	1.018	1.018
4.25" above 30-lb. T.	1.050	1.030	1.021	1.019	1.017	1.017	1.019	1.020	1.024	1.026	1.028	1.029	
8.5" above lower one of two 30-lb. T's.	1.041	1.023	1.017	1.014	1.014	1.014	1.016	1.018	1.020	1.022	1.025	1.027	
4.7" above 15-lb. E.	1.067	1.038	1.028	1.025	1.024	1.024	1.023	1.023	1.022	1.021	1.021	1.020	1.020
4.7" above 30-lb. E.	1.051	1.035	1.031	1.027	1.029	1.030	1.031	1.032	1.033	1.034	1.035	1.036	
6.7" above 15-lb. E.	1.029	1.016	1.012	1.011	1.010	1.009	1.010	1.009	1.009	1.009	1.009	1.009	1.009
6.7" above 30-lb. E.	1.028	1.015	1.010	1.009	1.009	1.010	1.009	1.009	1.010	1.009	1.009	1.009	1.009
5.3" above 15-lb. C.	1.004	0.992	0.988	0.987	0.985	0.984	0.984	0.983	0.986	0.989	0.989	0.990	0.992
4.9" above 30-lb. C.	1.030	1.006	0.997	0.993	0.992	0.993	0.994	0.995	0.999	1.001	1.002	1.004	1.004
9.8" above 30-lb. C.	1.030	0.998	0.987	0.982	0.983	0.989	0.996	1.002	1.003	1.006	1.007	1.008	1.008
9.8" above 50-lb. C.	1.016	1.009	1.006	1.004	1.003	1.002	1.002	1.001	1.004	1.006	1.008	1.008	1.008

IMPROVED (622) AND TYPE A METERS

SUSPENSION AND TYPE OF WEIGHT	REVOLUTIONS PER SECOND												
	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.5	2.0	3.0	4.0	5.0
4.7" above 30-lb. T.	1.032	1.022	1.018	1.016	1.016	1.017	1.017	1.017	1.019	1.020	1.021	1.022	1.023
4.7" above 15-lb. E.	1.043	1.031	1.027	1.025	1.026	1.027	1.028	1.029	1.028	1.027	1.026	1.026	1.026
4.7" above 30-lb. E.	1.041	1.045	1.047	1.047	1.048	1.048	1.049	1.049	1.051	1.053	1.055	1.057	
6.7" above 15-lb. E.	1.029	1.014	1.008	1.007	1.009	1.010	1.011	1.012	1.013	1.013	1.013	1.013	1.013
6.7" above 30-lb. E.	1.046	1.024	1.015	1.012	1.011	1.011	1.012	1.012	1.014	1.014	1.014	1.015	1.015
9.75" above 50-lb. E.	1.024	1.013	1.009	1.008	1.009	1.009	1.010	1.010	1.010	1.011	1.012	1.013	1.012
9.75" above 75-lb. E.	1.062	1.024	1.012	1.004	1.004	1.004	1.002	1.002	1.003	1.004	1.004	1.004	1.004
5.3" above 15-lb. C.	1.009	0.994	0.988	0.986	0.986	0.987	0.989	0.990	0.993	0.994	0.996	0.997	0.997
9.8" above 15-lb. C.	0.997	0.994	0.993	0.994	0.996	0.998	1.000	1.000	1.003	1.005	1.006	1.007	1.007
4.9" above 30-lb. C.	1.025	1.008	1.002	0.998	0.998	0.997	0.996	0.995	1.000	1.002	1.004	1.005	1.005
9.8" above 30-lb. C.	1.033	1.014	1.009	1.006	1.006	1.005	1.005	1.004	1.005	1.005	1.007	1.008	1.008
5.3" above 50-lb. C.	1.049	1.012	0.998	0.992	0.991	0.991	0.990	0.990	0.990	0.992	0.992	0.994	0.994
9.8" above 50-lb. C.	1.035	1.002	0.991	0.989	0.991	0.992	0.994	0.995	0.999	1.001	1.002	1.003	1.004
9.8" above 75-lb. C.	1.018	1.004	0.998	0.996	0.996	0.995	0.995	0.995	0.998	0.999	1.001	1.002	1.002

T = Torpedo E = Elliptical C = Columbus

Figure 4

COEFFICIENT FOR OBTAINING CABLE RATINGS WITH COLUMBUS WEIGHTS FROM STANDARD ROUND ROD RATINGS FOR TYPE A CURRENT METERS

Columbus Weight	Suspension		Velocity, ft. per second	Coefficient
	Center of meter pin to center of weight pin	Axis of meter to bottom of weight		
15-lb.	5.3 in.	0.5 ft.	0.25	1.01
			0.5 to 2.9	0.99
			3.0 and up	0.995
30-lb.	4.9 in.	0.5 ft.	0.25	1.015
			0.5 and up	1.005
50-lb.	9.8 in.	0.9 ft.		
75-lb.	9.8 in.	1.0 ft.	0.5 and up	1.00
100-lb.	9.8 in.	1.0 ft.		
150-lb.	9.8 in.	1.0 ft.	0.5 and up	0.995

Coefficient data obtained from U. S. Geological Survey.
Coefficients for velocities not shown may be obtained by interpolation.
Suspension distances are shown on drawing 40-D-3681.

Denver 2, Colorado. July 6, 1944.

COEFFICIENT FOR OBTAINING CABLE RATINGS WITH COLUMBUS WEIGHTS FROM STANDARD ROUND ROD RATINGS FOR TYPE A CURRENT METERS

Columbus Weight	Suspension		Velocity, ft. per second	Coefficient
	Center of meter pin to center of weight pin	Axis of meter to bottom of weight		
15-lb.	5.3 in.	0.5 ft.	0.25	1.01
			0.5 to 2.9	0.99
			3.0 and up	0.995
30-lb.	4.9 in.	0.5 ft.	0.25	1.015
			0.5 and up	1.005
50-lb.	9.8 in.	0.9 ft.		
75-lb.	9.8 in.	1.0 ft.	0.5 and up	1.00
100-lb.	9.8 in.	1.0 ft.		
150-lb.	9.8 in.	1.0 ft.	0.5 and up	0.995

Coefficient data obtained from U. S. Geological Survey.
Coefficients for velocities not shown may be obtained by interpolation.
Suspension distances are shown on drawing 40-D-3681.

Denver 2, Colorado. July 6, 1944.

DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

FIGURE 5

RATING TABLE FOR

METER NO.

RATED 19 AT BUREAU OF STANDARDS, WASHINGTON, D.C.

CONDITION OF METER

SUSPENSION

RATING EQUATIONS: V = 2.20 N + .06 FOR HIGHER VALUES OF N. V = 2.20 N + .06 FOR LOWER VALUES OF N. P.I. AT N =

TIME IN SECONDS	VELOCITY IN FEET PER SECOND														TIME IN SECONDS
	5 REVS.	10 REVS.	15 REVS.	20 REVS.	30 REVS.	40 REVS.	50 REVS.	60 REVS.	70 REVS.	80 REVS.	90 REVS.	100 REVS.	150 REVS.	200 REVS.	
40	.34	.61	.88	1.16	1.71	2.26	2.81	3.36	3.91	4.46	5.01	5.56	8.31	11.06	40
41	.33	.60	.86	1.13	1.67	2.21	2.74	3.28	3.82	4.35	4.89	5.43	8.11	10.79	41
42	.32	.58	.85	1.11	1.63	2.16	2.68	3.20	3.73	4.25	4.77	5.30	7.92	10.54	42
43	.32	.57	.83	1.08	1.59	2.11	2.62	3.13	3.64	4.15	4.66	5.18	7.73	10.29	43
44	.31	.56	.81	1.06	1.56	2.06	2.56	3.06	3.56	4.06	4.56	5.06	7.56	10.06	44
45	.30	.55	.79	1.04	1.53	2.02	2.50	2.99	3.48	3.97	4.46	4.95	7.39	9.84	45
46	.30	.54	.78	1.02	1.49	1.97	2.45	2.93	3.41	3.89	4.36	4.84	7.23	9.63	46
47	.29	.53	.76	1.00	1.46	1.93	2.40	2.87	3.34	3.80	4.27	4.74	7.08	9.42	47
48	.29	.52	.75	.98	1.44	1.89	2.35	2.81	3.27	3.73	4.18	4.64	6.94	9.23	48
49	.28	.51	.73	.96	1.41	1.86	2.30	2.75	3.20	3.65	4.10	4.55	6.79	9.04	49
50	.28	.50	.72	.94	1.38	1.82	2.26	2.70	3.14	3.58	4.02	4.46	6.66	8.86	50
51	.28	.49	.71	.92	1.35	1.79	2.22	2.65	3.08	3.51	3.94	4.37	6.53	8.69	51
52	.27	.48	.69	.91	1.33	1.75	2.18	2.60	3.02	3.44	3.87	4.29	6.41	8.52	52
53	.27	.48	.68	.89	1.31	1.72	2.14	2.55	2.97	3.38	3.80	4.21	6.29	8.36	53
54	.26	.47	.67	.87	1.28	1.69	2.10	2.50	2.91	3.32	3.73	4.13	6.17	8.21	54
55	.26	.46	.66	.86	1.26	1.66	2.06	2.46	2.86	3.26	3.66	4.06	6.06	8.06	55
56	.26	.45	.65	.85	1.24	1.63	2.02	2.42	2.81	3.20	3.60	3.99	5.95	7.92	56
57	.25	.45	.64	.83	1.22	1.60	1.99	2.38	2.76	3.15	3.53	3.92	5.85	7.78	57
58	.25	.44	.63	.82	1.20	1.58	1.96	2.34	2.72	3.09	3.47	3.85	5.75	7.65	58
59	.25	.43	.62	.81	1.18	1.55	1.92	2.30	2.67	3.04	3.42	3.79	5.65	7.52	59
60	.24	.43	.61	.79	1.16	1.53	1.89	2.26	2.63	2.99	3.36	3.73	5.56	7.39	60
61	.24	.42	.60	.78	1.14	1.50	1.86	2.22	2.58	2.95	3.31	3.67	5.47	7.27	61
62	.24	.41	.59	.77	1.12	1.48	1.83	2.19	2.54	2.90	3.25	3.61	5.38	7.16	62
63	.23	.41	.58	.76	1.11	1.46	1.81	2.16	2.50	2.85	3.20	3.55	5.30	7.04	63
64	.23	.40	.58	.75	1.09	1.44	1.78	2.12	2.47	2.81	3.15	3.50	5.22	6.94	64
65	.23	.40	.57	.74	1.08	1.41	1.75	2.09	2.43	2.77	3.11	3.44	5.14	6.83	65
66	.23	.39	.56	.73	1.06	1.39	1.73	2.06	2.39	2.73	3.06	3.39	5.06	6.73	66
67	.22	.39	.55	.72	1.05	1.37	1.70	2.03	2.36	2.69	3.02	3.34	4.99	6.63	67
68	.22	.38	.55	.71	1.03	1.35	1.68	2.00	2.32	2.65	2.97	3.30	4.91	6.53	68
69	.22	.38	.54	.70	1.02	1.34	1.65	1.97	2.29	2.61	2.93	3.25	4.84	6.44	69
70	.22	.37	.53	.69	1.00	1.32	1.63	1.95	2.26	2.57	2.89	3.20	4.77	6.35	70
	5 REVS.	10 REVS.	15 REVS.	20 REVS.	30 REVS	40 REVS.	50 REVS.	60 REVS.	70 REVS.	80 REVS.	90 REVS.	100 REVS.	150 REVS	200 REVS.	

DEPARTMENT OF INTERIOR - BUREAU OF RECLAMATION

RATING TABLE FOR TYPE ______________ METER BR ______________

SUSPENSION ______________ RATED ______________

EQUATIONS: $V = 2.20\ N + 0.04 \quad N < 1.00$

$V = 2.22\ N + 0.02 \quad N > 1.00$

Limits of Actual Rating ______ to ______ ft. per sec.
at Bureau of Standards, Washington, D.C.

Condition of Meter

BR

Time, Seconds	VELOCITY IN FEET PER SECOND — Revolutions 3	5	7	10	15	20	25	30	40	Time, Seconds
40	0.205	0.315	0.425	0.590	0.865	1.14	1.42	1.69	2.24	40
41	.201	.308	.416	.577	.845	1.11	1.38	1.65	2.19	41
42	.196	.302	.407	.564	.825	1.09	1.35	1.61	2.14	42
43	.194	.295	.399	.553	.808	1.06	1.32	1.57	2.09	43
44	.190	.291	.390	.539	.790	1.04	1.29	1.54	2.04	44
45	.187	.284	.383	.528	.773	1.02	1.26	1.51	2.00	45
46	.183	.280	.374	.517	.757	0.997	1.23	1.47	1.95	46
47	.181	.273	.368	.509	.742	.977	1.21	1.44	1.91	47
48	.176	.269	.361	.498	.726	.957	1.19	1.42	1.87	48
49	.174	.264	.355	.489	.713	.938	1.16	1.39	1.84	49
50	.172	.260	.348	.480	.700	.920	1.14	1.36	1.80	50
51	.170	.256	.341	.471	.687	.902	1.12	1.33	1.77	51
52	.168	.251	.337	.462	.674	.887	1.10	1.31	1.73	52
53	.165	.247	.330	.456	.663	.869	1.08	1.29	1.70	53
54	.163	.245	.326	.447	.652	.854	1.06	1.26	1.67	54
55	.161	.240	.319	.440	.641	.841	1.04	1.24	1.64	55
56	.159	.236	.315	.434	.630	.825	1.02	1.22	1.61	56
57	.157	.234	.311	.425	.619	.812	1.01	1.20	1.58	57
58	.154	.229	.306	.418	.610	.799	0.988	1.18	1.56	58
59	.152	.227	.302	.412	.599	.786	.973	1.16	1.53	59
60	.150	.223	.297	.407	.590	.773	.957	1.14	1.51	60
61	.148	.220	.293	.401	.582	.762	.942	1.12	1.48	61
62	.146	.218	.289	.394	.572	.751	.927	1.10	1.46	62
63	.146	.214	.284	.390	.564	.737	.913	1.09	1.44	63
64	.143	.212	.280	.383	.555	.726	.900	1.07	1.42	64
65	.141	.209	.278	.379	.548	.718	.887	1.06	1.39	65
66	.139	.207	.275	.374	.539	.707	.874	1.04	1.37	66
67	.139	.205	.269	.368	.533	.698	.861	1.03	1.35	67
68	.137	.203	.267	.363	.526	.687	.850	1.01	1.33	68
69	.135	.198	.262	.359	.517	.678	.836	0.997	1.32	69
70	.135	.196	.260	.355	.511	.669	.825	.984	1.30	70
	3	5	7	10	15	20	25	30	40	

Time, Seconds	VELOCITY IN FEET PER SECOND — Revolutions 50	60	80	100	150	200	250	300	350	Time, Seconds
40	2.80	3.35	4.46	5.57	8.34	11.12	13.90	16.67	19.44	40
41	2.73	3.27	4.35	5.43	8.14	10.85	13.56	16.26	18.97	41
42	2.66	3.19	4.25	5.31	7.95	10.59	13.23	15.88	18.52	42
43	2.60	3.12	4.15	5.18	7.76	10.35	12.93	15.51	18.09	43
44	2.54	3.05	4.06	5.07	7.59	10.11	12.63	15.16	17.68	44
45	2.49	2.98	3.97	4.95	7.42	9.89	12.35	14.82	17.29	45
46	2.43	2.92	3.88	4.85	7.26	9.67	12.09	14.50	16.91	46
47	2.38	2.85	3.80	4.74	7.11	9.47	11.83	14.19	16.55	47
48	2.33	2.80	3.72	4.64	6.96	9.27	11.58	13.90	16.21	48
49	2.29	2.74	3.64	4.55	6.82	9.08	11.35	13.61	15.88	49
50	2.24	2.68	3.57	4.46	6.68	8.90	11.12	13.34	15.56	50
51	2.20	2.63	3.50	4.37	6.55	8.73	10.90	13.08	15.26	51
52	2.16	2.58	3.44	4.29	6.42	8.56	10.69	12.83	14.96	52
53	2.12	2.53	3.37	4.21	6.30	8.40	10.49	12.59	14.68	53
54	2.08	2.49	3.31	4.13	6.19	8.24	10.30	12.35	14.41	54
55	2.04	2.44	3.25	4.06	6.07	8.09	10.11	12.13	14.15	55
56	2.00	2.40	3.19	3.98	5.97	7.95	9.93	11.91	13.90	56
57	1.97	2.36	3.14	3.91	5.86	7.81	9.76	11.70	13.65	57
58	1.94	2.32	3.08	3.85	5.76	7.68	9.59	11.50	13.42	58
59	1.90	2.28	3.03	3.78	5.66	7.55	9.43	11.31	13.19	59
60	1.87	2.24	2.98	3.72	5.57	7.42	9.27	11.12	12.97	60
61	1.84	2.20	2.93	3.66	5.48	7.30	9.12	10.94	12.76	61
62	1.81	2.17	2.88	3.60	5.39	7.18	8.97	10.76	12.55	62
63	1.79	2.14	2.84	3.54	5.31	7.07	8.83	10.59	12.35	63
64	1.76	2.10	2.80	3.49	5.22	6.96	8.69	10.43	12.16	64
65	1.73	2.07	2.75	3.44	5.14	6.85	8.56	10.27	11.97	65
66	1.71	2.04	2.71	3.38	5.07	6.75	8.43	10.11	11.79	66
67	1.68	2.01	2.67	3.33	4.99	6.65	8.30	9.96	11.62	67
68	1.66	1.98	2.63	3.28	4.92	6.55	8.18	9.81	11.45	68
69	1.63	1.95	2.59	3.24	4.85	6.45	8.06	9.67	11.28	69
70	1.61	1.93	2.56	3.19	4.78	6.36	7.95	9.53	11.12	70
	50	60	80	100	150	200	250	300	350	

FIGURE 6

G. O. No. 1282

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Denver, Colorado

June 25, 1942.

From Acting Chief Engineer

To All Field Offices

Subject: Repair and rating of current meters.

1. For a number of years this office has forwarded the Bureau's current meters to the Geological Survey in Washington, D. C., for repair and standardization, after which they were rated by the Bureau of Standards. Because of increased war work and depleted personnel, the Geological Survey is no longer able to recondition meters for the Bureau of Reclamation. In the future this work will be performed in the laboratory shops in this office, after which the meters will be sent to the Bureau of Standards for rating. The meters will be returned directly to the project. The rating curves will be sent to this office for preparation of the rating tables which will then be forwarded to the project.

2. To expedite and simplify handling of all current meters - whether for (1) rating as received, (2) rating as received, repair and rating, or (3) repair and rating - it is requested that the attached mimeographed form letter be used in triplicate. One copy will be detached in this office for record purposes; the second copy may be detached by the Bureau of Standards; and the third copy will be returned to the project with the meter. When the meter is received at the project, this third copy should be properly endorsed and forwarded to this office as acknowledgment of the receipt of the meter.

3. All meters must be shipped in their wooden carrying cases to avoid even slight damage in shipping which might impair the accuracy of their rating. Carrying cases for new meters will be furnished by this office.

4. It is considered advisable for each project carefully to inspect the current meters now in stock and to send any that are considered beyond repair to this office where the parts can be used in the repair and standardization of other meters.

- - -

Walker R. Young

Encl.

Key words:
Current meters - repair and rating.
Equipment - current meters.

HYD-165

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Date ____________

From

To Chief Engineer

Subject: Current meter shipped to Denver office for repairs and rating.

1. The current meter described below is being shipped by express on attached bill of lading.

Type ______________________________ Meter Number BR ________

Manufacturer ______________________

Meter to be rated (new) (as received) (reconditioned)

Method of rating suspension desired ____________________________

____

Address to which meter is to be shipped from the Bureau of Standards

Official in charge ______________, Title ____________
Bureau of Reclamation
Field Office ______________
Address ______________

2. Remarks and suggestions for repairs:

3. The outside of the carrying case containing this meter has been marked with the name of the project and the meter number.

	Bill of lading number
Shipped from project ____________	I- ____________
Received in Denver office ____________	
Shipped to Bureau of Standards ______	____________
Received at Bureau of Standards ______	
Shipped to project ____________	____________
Received at project ____________	

- - -

In trip.

G. O. No. 1491

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Denver 2, Colorado.

November 15, 1945.

From Acting Chief Engineer

To All Field Offices

Subject: Repair and rating of current meters.

1. General Order No. 1282 promulgated a mimeographed form for use as a letter of transmittal in forwarding current meters to this office for repairs and rating.

2. In order that vouchers may be prepared for the cost of repair parts and labor required for this work, all field offices are requested to indicate on the form letter appropriation symbol and title chargeable.

3. A check of the records here indicates many of the field offices are not using the repair facilities of this office in the reconditioning of current meters. Furthermore, meters not in use should be shipped here to permit the maintenance of a reserve stock and to provide a supply of salvaged parts useful in reconditioning of other meters.

4. The instructions contained in subparagraph (c) of General Order No. 283, dated January 7, 1924, are hereby renewed, requiring that all projects transmit to this office at the close of each calendar year report listing Bureau numbers of all current meters on hand, class of work on which used, repairs, if any, during the year, and date of last rerating.

- - -

Walker R. Young.

Key words:
Repair and rating of current meters.
Current meters, repair and rerating of.
Inventory, annual, current meters.

APPENDIX

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain practical or ingenious suggestions from engineers both young and old, should prove helpful in the solution of many troublesome problems.

New Pivots and Bearings for Small Current Meters

By R. L. Atkinson

Chief, Division of Field Equipment, U.S. Geological Survey, Washington, D.C.

FOR many years the U.S. Geological Survey has been experimenting to find a steel alloy that would retain its shape and hardness in the pivots and pivot bearings of the small Price current meter (Fig. 1), the standard current meter of the Survey. Since the pivot and its bearing play a very important part in the operation of the meter, great care must be exercised in hardening and tempering the bearing surfaces. In the past the point of the pivot was ground to a radius of 0.005 in. before the meter was rated by the U.S. Bureau of Standards. It was usual to have a point radius of 0.01 in. on completion of such rating. Examination of meters that had seen considerable service in the field showed that this radius increased, owing to wear under average working conditions, to as much as 0.03 in. Spin tests in air with the pivot in this condition have shown an apparent decrease in sensitivity of more than 80 per cent. The spin test consists in bringing the meter cups to a constant speed in the draft from an electric fan. Then the fan is shut off and the length of time required for the cups to cease revolving is recorded. A standard meter, well adjusted, will spin slightly over three minutes.

With the new steel alloys it has been found possible to grind the point of the pivot to an initial radius of 0.01 in., which changes but little with extended field use. The sensitiveness of the meter has also been increased, for repeat ratings have been found to be quite consistent with the original one.

Before starting the production of these parts, the U.S. Geological Survey made a quantitative study of the nature of the wear of the bearing surfaces. The variable factors in this study were the choice and design of materials, the conditions under which the pivot and its bearing were operated, and the element of time. The conditions of field operation could be closely approximated in the laboratory, but the time factor presented difficulties. The method finally evolved was to place on the pivot a heavy circular metal disk, the equivalent of a load of 90 tons per sq in. on the bearing surfaces, or 106 times the normal load. The pivot was then allowed to spin in its bearing, which was immersed in water, for 46 hr. At frequent intervals the pivot and bearing were removed, placed in a meter (the same one was used throughout the test), and subjected to spin tests under strictly comparable conditions. This procedure corresponded to thousands of hours of usage under normal field conditions, and was found to serve three useful purposes, as follows:

1. It demonstrated that a newly ground pivot will wear rapidly at first, the rate decreasing with use until practically no wear is apparent, as shown in Fig. 2. Therefore the pivot should not be given too sharp a point, except possibly for measuring sluggish streams that are free of silt.
2. The useful life of pivots and their bearings was indicated in a short period of time.
3. It provided a quick and dependable method for comparative studies of different types of steel and made it possible to find the optimum degree of hardness and brittleness for pivots and their seats.

The materials and elements of design finally adopted were decided upon largely from the results obtained by these ultra-severe tests. A steel alloy, designated A-Metal, containing the following elements, has proved the best suited for the making of pivots and their bearings: 0.95 per cent carbon, 0.275 silicon, 1.07 manganese, 0.54 chromium, 0.16 vanadium, and 0.64 tungsten.

The heat treating is done in a gas furnace, where the pivot is brought slowly to a temperature of 1,450 F, at which it is allowed to soak. It is then quenched in oil for 0.1875 in. from the point. This gives a Rockwell hardness of C-58 within 0.125 in. of the point. Next, the pivot is reground to eliminate any warping that may have taken place during the heating operation. Great care must be taken in grinding and polishing the point to reduce the heat of friction to a minimum

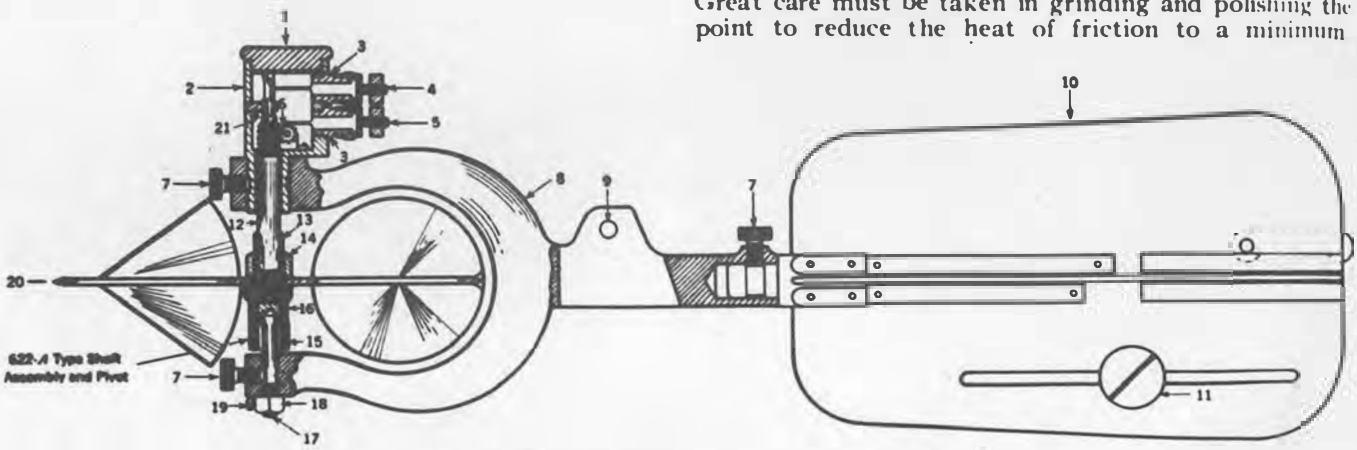


Fig. 1. Small Price Current Meter with Improved Pivot and Bearing

622-A Type of Assembly

Otherwise the bearing surface, approximately 0.010 in., might become annealed.

The pivot bearing or seat, 0.3125 by 0.3125 in., is drilled to a diameter of 0.201 in. and a depth of 0.1875 in. The bottom of this seat, after hardening, is ground to a diameter of 0.205 in., an angle of 105 deg at the

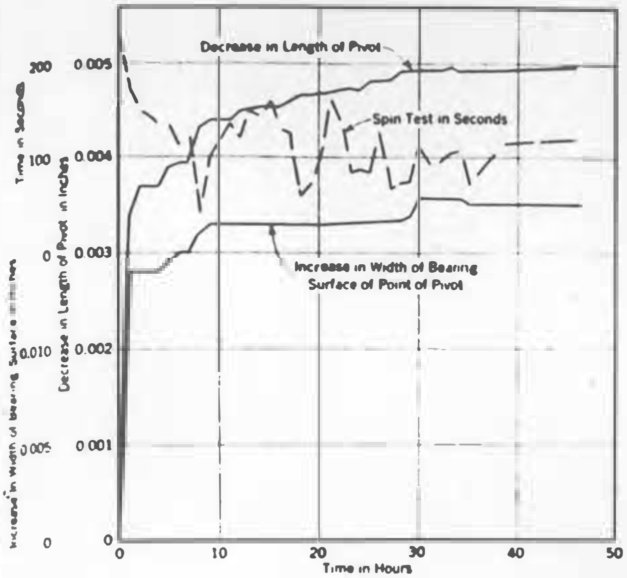


Fig. 2. Results of Test Run for 46 Hr (414,000 Revolutions) Pivot of A-Metal, of C-58 Hardness, and a Radius of 0.005 In.; Bearing of A-Metal, of C-61 Hardness. Pivot and Bearing Were Inspected and Measured Every Hour During Test

bottom and a radius of 0.025 in. at the apex. In heat treating, the pivot seat is heated slowly to 1,575 F and allowed to soak until the whole bearing has a uniform temperature. The tongs used to remove the seat from the furnace are heated to the same temperature so as to prevent cooling of the bearing between furnace and quench bath. When the seat is quenched in oil, care is taken to hold it upright lest the liquid fail to reach the bearing surface. The quench bath is immersed in a tank of running water so that its temperature remains low. After removal from the bath the parts are tested for hardness. Any seats having a Rockwell hardness under C-60 are rejected. The accepted seats are then placed in the lapping machine, where the final polishing is done.

Like the pivot, the bearing is given a glass-smooth finish, and the heat from friction is reduced to a minimum. The sides as well as the apex of the pivot seat are polished, because at high velocity the bearing assembly is lifted off the pivot but the sides of the bearing remain in contact with the sides of the pivot. The pivot bearing then acts as a simple cylindrical bearing. In every lot of bearings several are broken in half so that a hardness reading can be taken just above the apex of the bearing surface. This reading must be the same as that on the outside surface.

Experiments were also made with case-hardened pivots and bearings, that is, those hardened by cyanide compounds or nitride. Three objections to case-hardening were found. First, there is the mechanical difficulty of pr[illegible]ing from the effects of the process the threads and s[illegible]e where the set-screw bears. Such surfaces must be covered with clay, a slow and costly operation, which at best is not dependable. Second, case hardening, like any other hardening process, causes distortion, but grinding cannot be resorted to because it removes the hardened surfaces. Third, either this original grinding, to remedy distortion, or the subsequent grinding by silt-laden water, will remove the hardened surfaces. When wear has penetrated to the base metal, the least shock will cause a case-hardened surface to crack or flake off. In shaking the water out of a meter it will often be swung up and down, and even this movement will cause flaking. The bearing surface is so small that a very slight fracture will slow up the meter. The pivot bearing is unlike a ball bearing or cylindrical bearing in which the bearing surfaces constantly change. For these reasons, case-hardening was rejected as impracticable.

For the pivots and pivot bearings of these Price meters, I have recently utilized the steel alloys for which the formula has been given, after proper hardening, as here described. As a result there has been a distinct increase in the length of service of meters, and their ratings for low velocities have improved. Extended laboratory tests have shown that the frictional resistance in the meters has been decreased to such an extent that the spin test in air shows very consistent results, even after long use.

The Reynolds Number

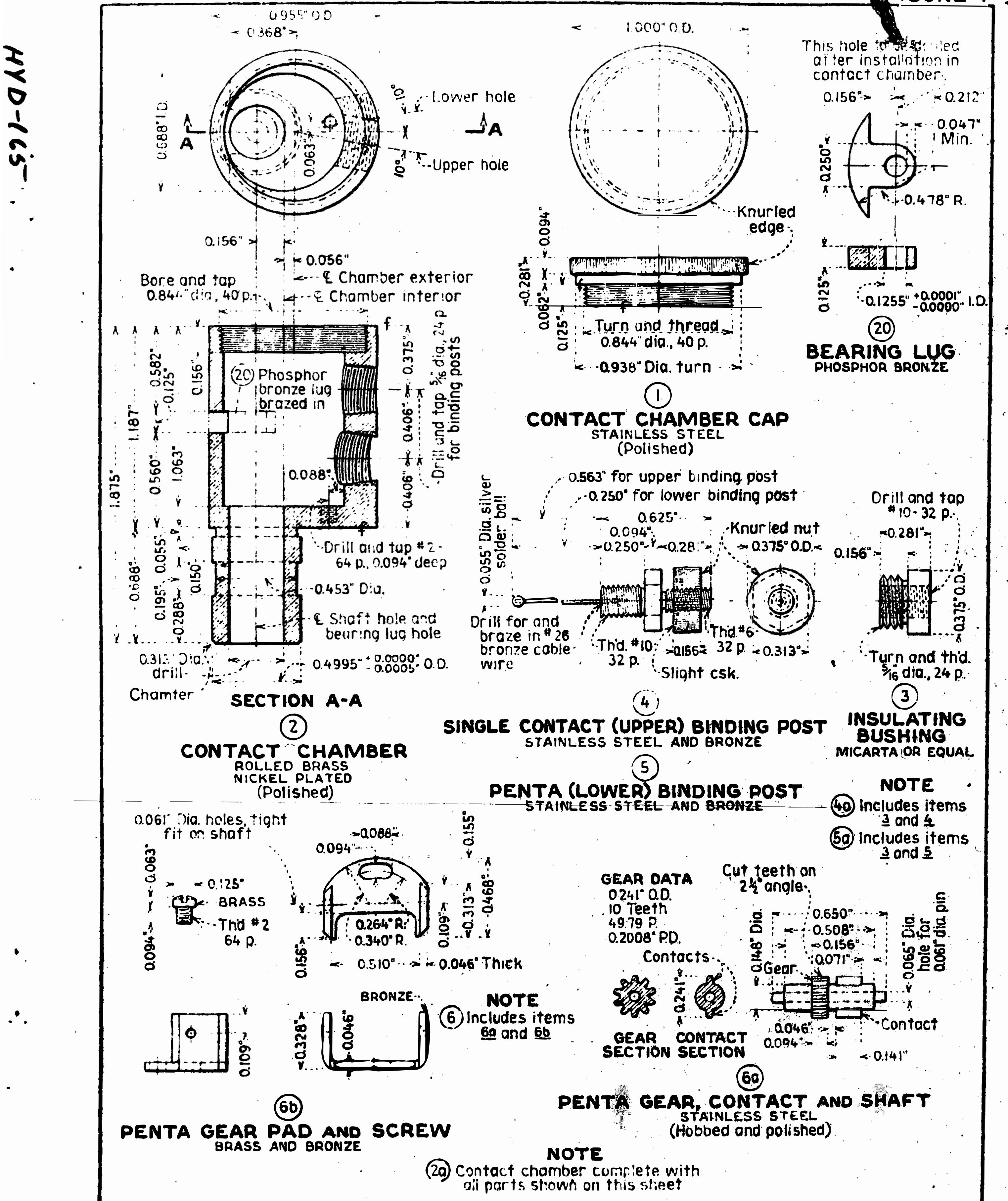
By Robins Fleming
Consulting Engineer, New York, N.Y.

In their monographs, "Wind Stresses on Structures" (Scientific Paper No. 523 of the U.S. Bureau of Standards) and "Wind Pressure on a Model of a Mill Building" (Research Paper No. 301 of the U.S. Bureau of Standards), Hugh L. Dryden and George C. Hill refer to the Reynolds number. It is mentioned in many books on physics and usually in books on hydraulics. Stanley Dunkerley, who succeeded Reynolds in a professorship, entitles a chapter of his *Hydraulics*, "Professor Osborne Reynolds' Researches." Also the Reynolds number is given a prominent place in books on aerodynamics. However, it seems to be but little known to structural engineers and is not mentioned in books on structural engineering. An explanation of it therefore may not be out of place.

Osborne Reynolds (1842–1912), a noted English physicist of the last century, was Professor of Civil Engineering at Owens College, Manchester, for nearly forty years. In the announcement of his death, *Engineering* (London) for February 23, 1912, says, "On the scientific side of engineering he occupies a very high position and, like Rankine, he suffered from an indisposition to make his researches easily intelligible to practical men." Of his many scientific papers, the one by which he is best known is "An Experimental Investigation of the Circumstances Which Determine Whether the Motions of Water Shall Be Direct or Sinuous, and of the Law of Resistance in Parallel Channels," published in the *Philosophical Transactions* of the Royal Society, Vol. 174, 1883; also in Vol. 2, pages 51–105, of Reynolds' *Papers on Mechanical and Physical Subjects.*

The theory of hydrodynamics did not explain, among other things, why the resistance to the flow of water in tubes of small diameter was proportional to the first power of the velocity, while in large tubes and pipes it varied nearly as the second power. Reynolds set about investigating this phenomenon, with far-reaching results affecting fields undreamed of in his day. By introducing colored filaments into water flowing through glass tubes,

FIGURE 7



TYPE A CURRENT METER

SHEET 2 OF 6

FIGURE 8

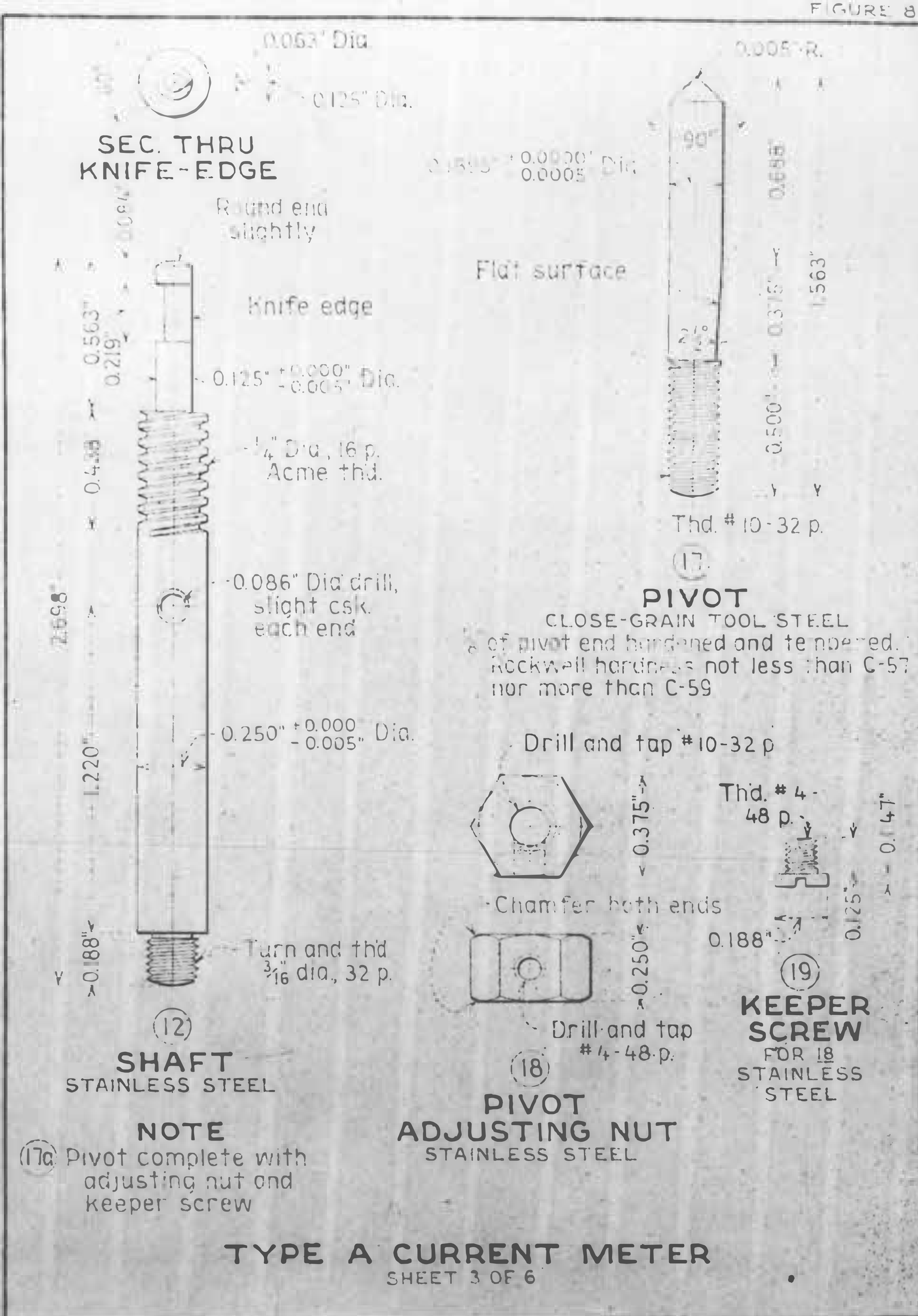
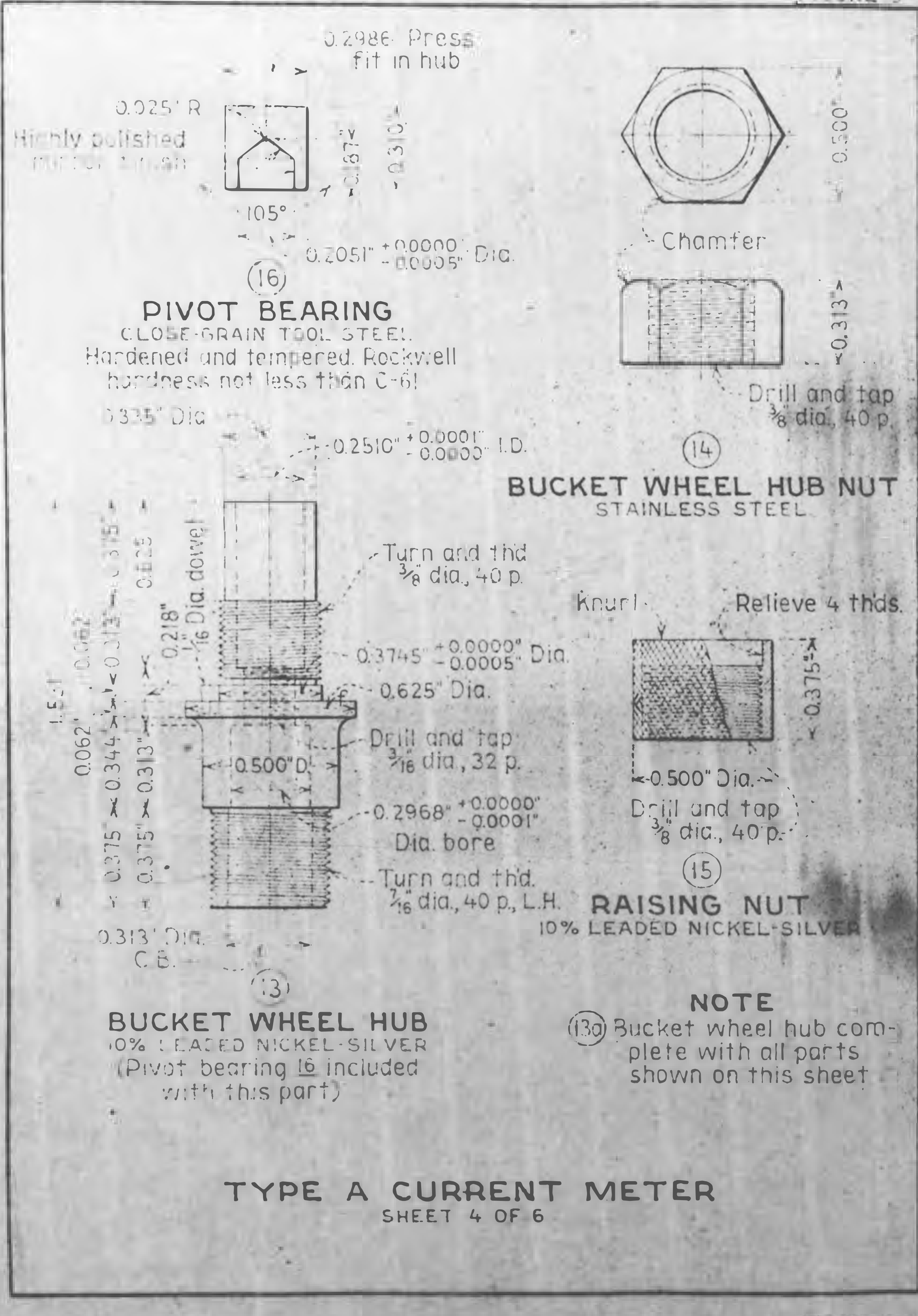
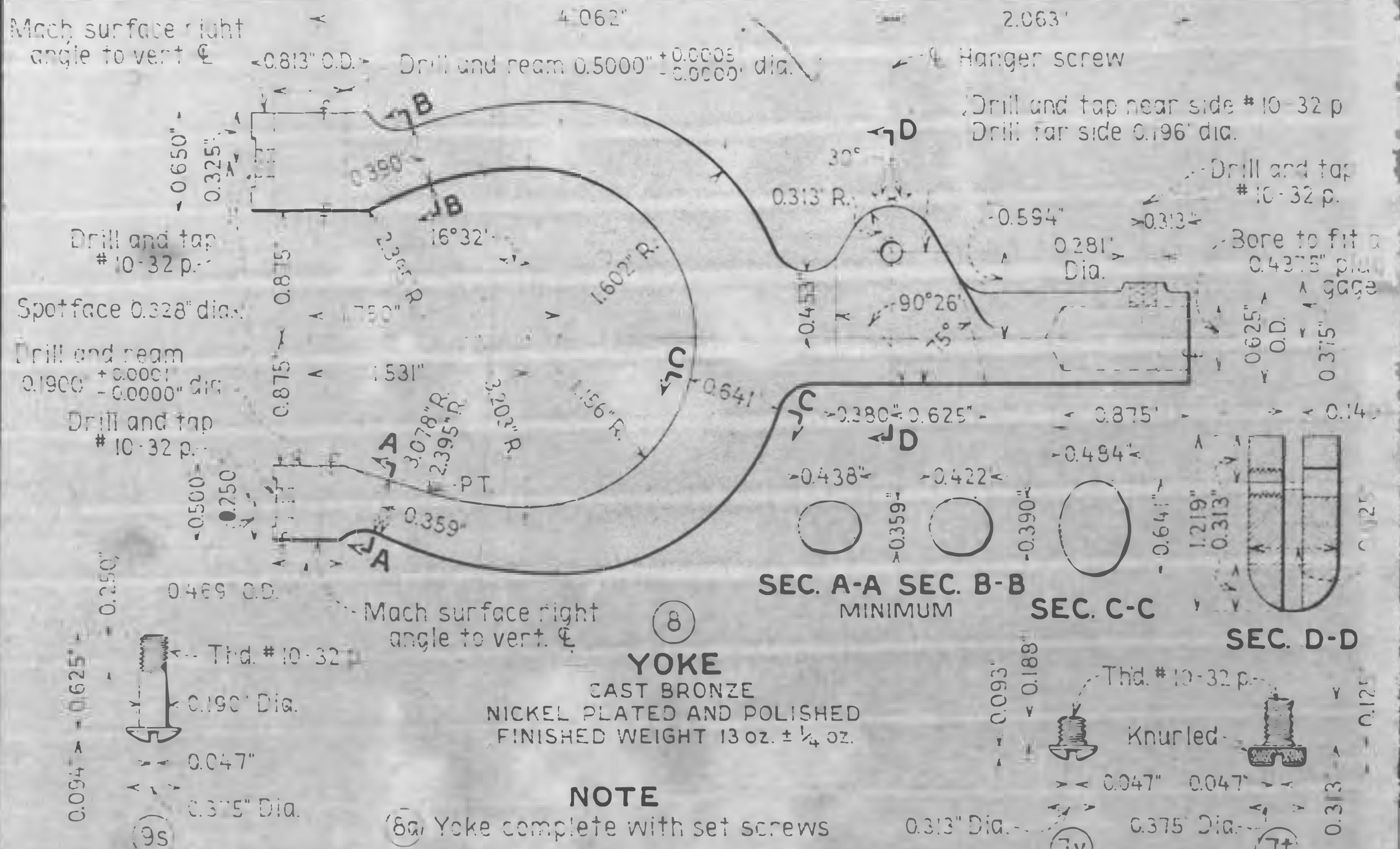

0.063" Dia.
0.125" Dia.
SEC. THRU KNIFE-EDGE
Round end slightly
Knife edge
0.563"
0.219"
0.125" +0.000" -0.005" Dia.
¼" Dia., 16 p. Acme thd.
0.086" Dia. drill, slight csk. each end
2.698"
1.220"
0.250" +0.000" -0.005" Dia.
0.188"
Turn and thd 3/16 dia., 32 p.
(12)
SHAFT
STAINLESS STEEL
0.005" R.
90°
0.0000" 0.0005" Dia.
0.688"
Flat surface
21°
0.375"
1.563"
0.500"
Thd. # 10 - 32 p.
(17)
PIVOT
CLOSE-GRAIN TOOL STEEL
of pivot end hardened and tempered. Rockwell hardness not less than C-57 nor more than C-59
Drill and tap # 10-32 p
0.375"
Chamfer both ends
0.250"
Drill and tap # 4-48 p.
(18)
PIVOT
ADJUSTING NUT
STAINLESS STEEL
Thd. # 4 - 48 p.
0.147"
0.125"
0.188"
(19)
KEEPER SCREW
FOR 18
STAINLESS STEEL
NOTE
(17a) Pivot complete with adjusting nut and keeper screw
TYPE A CURRENT METER
SHEET 3 OF 6

FIGURE 9


0.2986" Press fit in hub
0.025" R
Highly polished
105°
0.187"
0.310"
0.2051" +0.0000" -0.0005" Dia.
16
PIVOT BEARING
CLOSE-GRAIN TOOL STEEL
Hardened and tempered. Rockwell hardness not less than C-61
0.500"
Chamfer
0.313"
Drill and tap 3/8" dia., 40 p.
14
BUCKET WHEEL HUB NUT
STAINLESS STEEL
0.335" Dia
0.2510" +0.0001" -0.0000" I.D.
Turn and th'd 3/8" dia., 40 p.
1/16 Dia. dowel
0.218"
0.625
0.313"
0.062"
0.344"
0.375"
0.3745" +0.0000" -0.0005" Dia.
0.625" Dia.
Drill and tap 3/16 dia., 32 p.
0.500" D.
0.2968" +0.0000" -0.0001" Dia. bore
Turn and th'd. 7/16" dia., 40 p., L.H.
0.313" Dia. C.B.
13
BUCKET WHEEL HUB
10% LEADED NICKEL-SILVER
(Pivot bearing 16 included with this part)
Knurl
Relieve 4 th'ds.
0.375"
0.500" Dia.
Drill and tap 3/8" dia., 40 p.
15
RAISING NUT
10% LEADED NICKEL-SILVER
NOTE
13a Bucket wheel hub complete with all parts shown on this sheet
TYPE A CURRENT METER
SHEET 4 OF 6



YOKE

CAST BRONZE
NICKEL PLATED AND POLISHED
FINISHED WEIGHT 13 oz. ± 1/4 oz.

NOTE

(8a) Yoke complete with set screws

HANGER SCREW

STAINLESS STEEL

YOKE SET SCREW

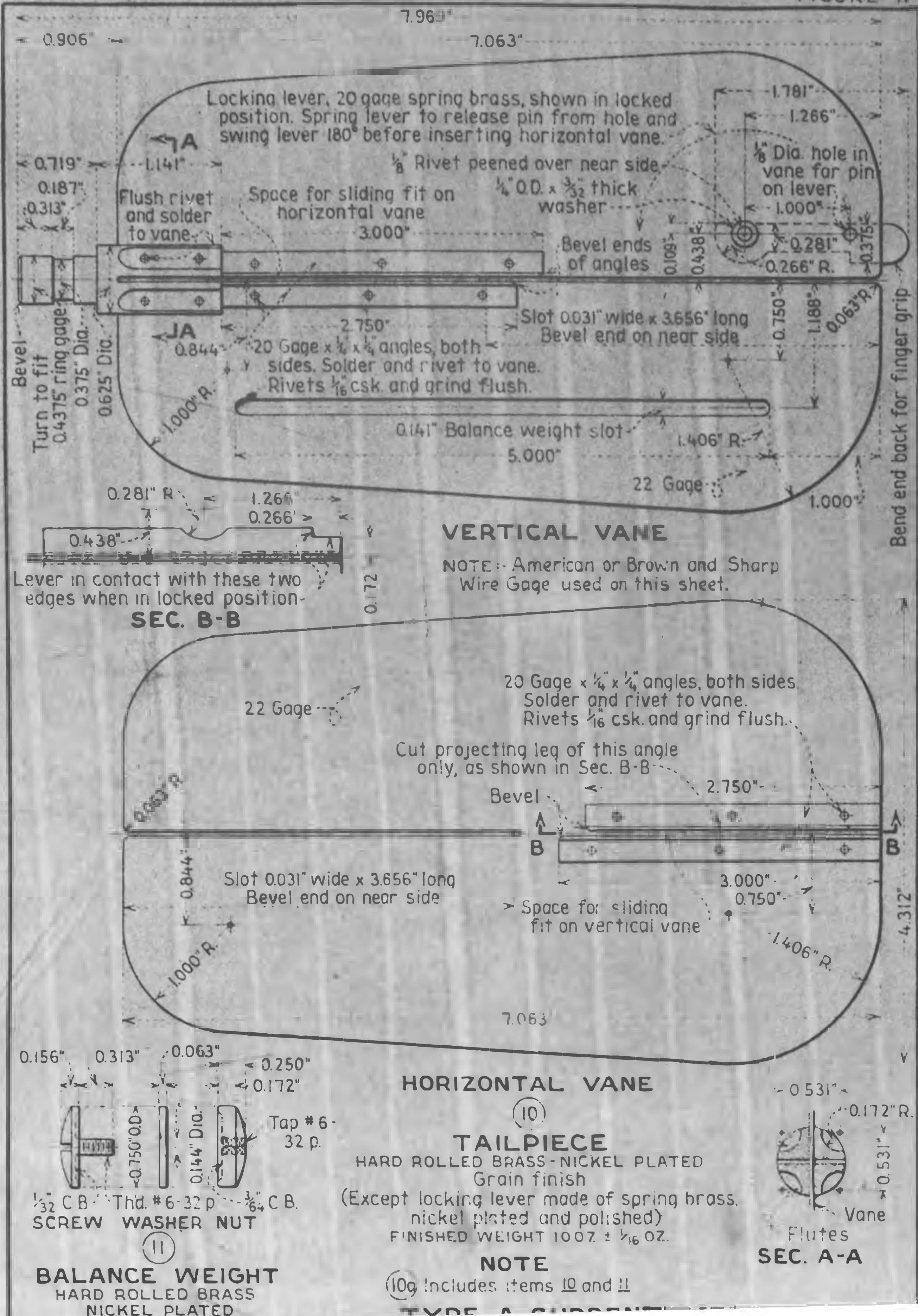
TAILPIECE SET SCREW

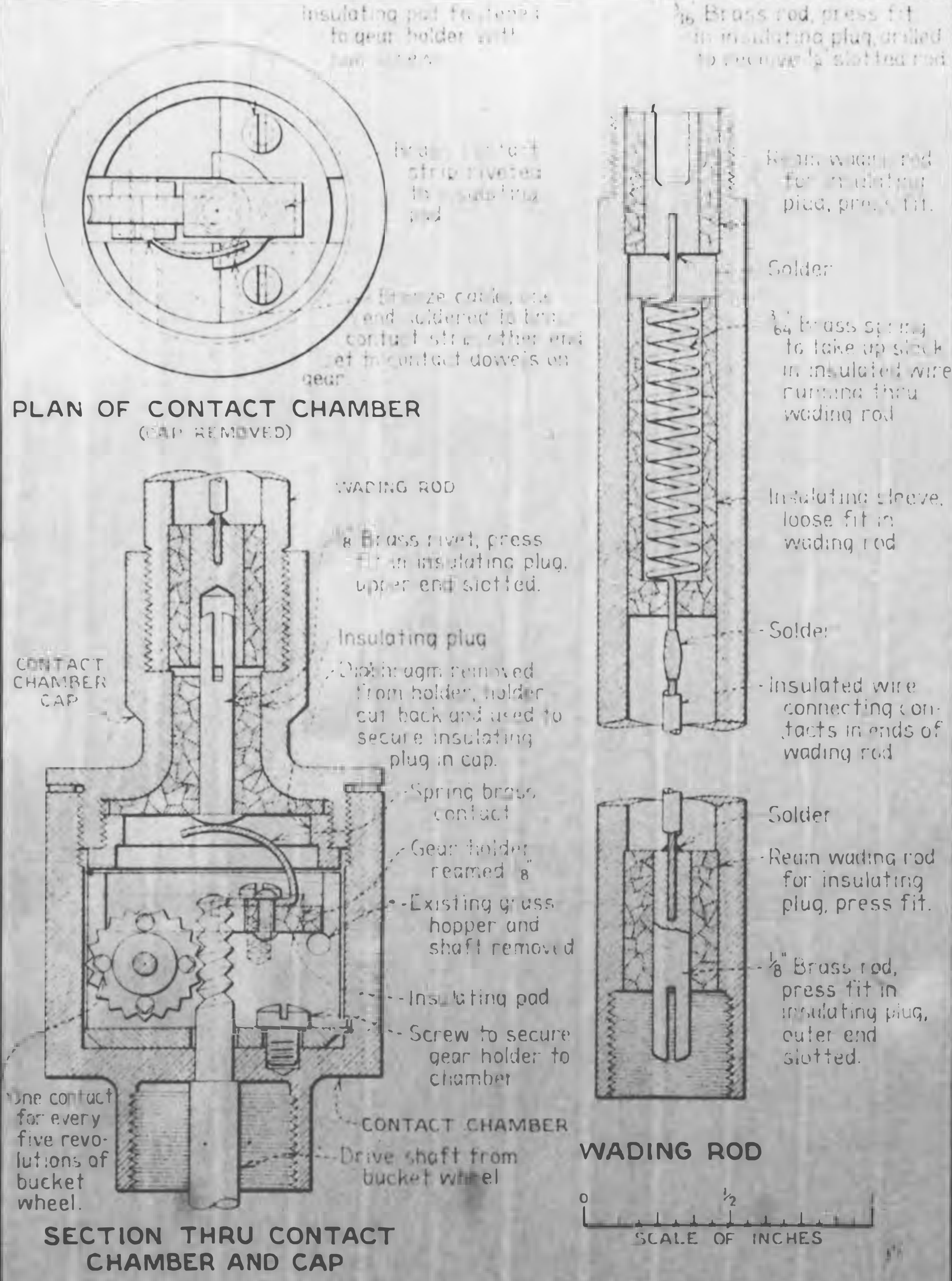
STAINLESS STEEL

TYPE A CURRENT METER

SHEET 5 OF 6

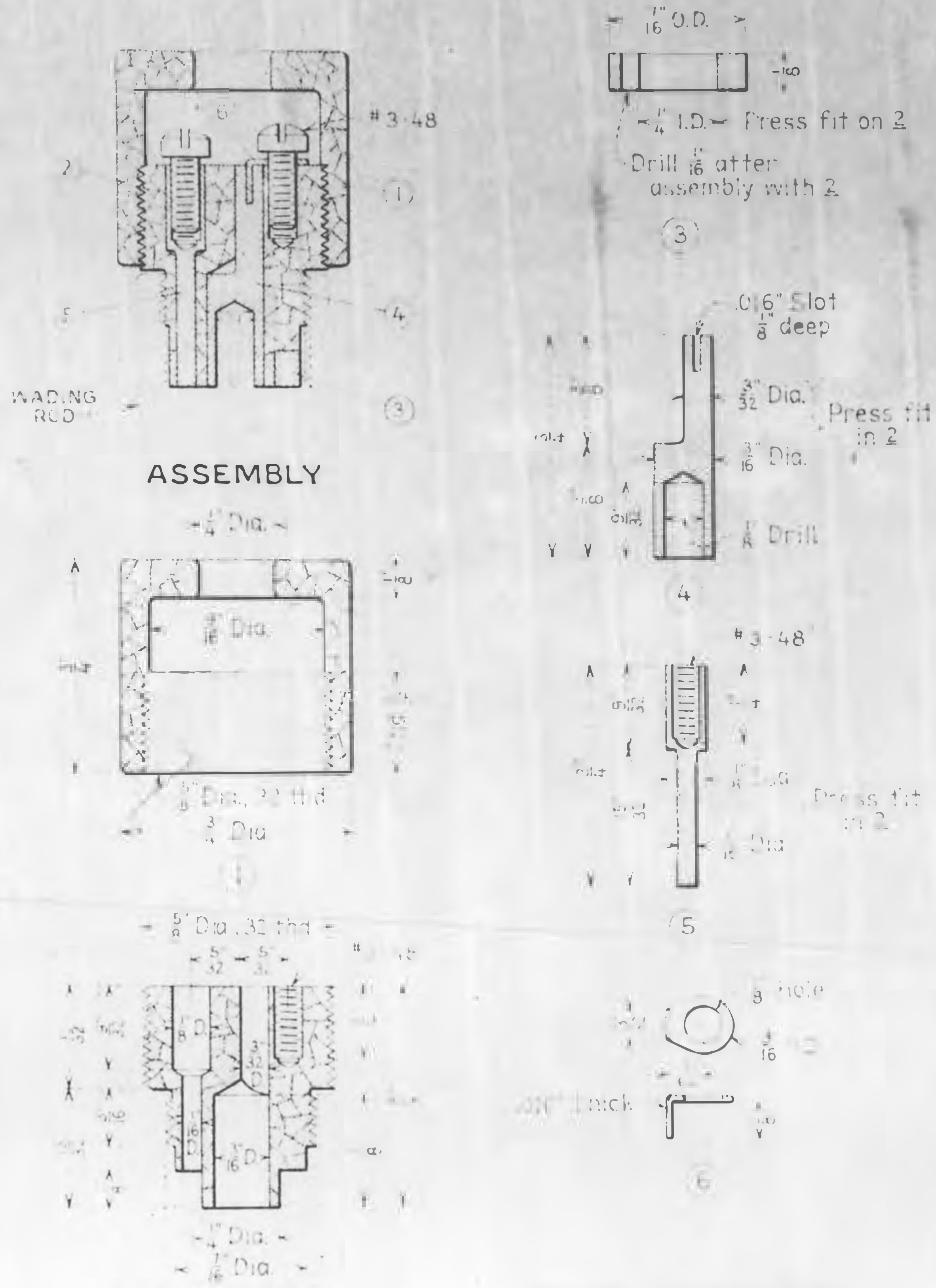
FIGURE 11


7.969"
0.906"
7.063"
Locking lever, 20 gage spring brass, shown in locked position. Spring lever to release pin from hole and swing lever 180° before inserting horizontal vane.
1.781"
1.266"
1/8" Rivet peened over near side
1/8" Dia. hole in vane for pin on lever
1/4" O.D. x 3/32" thick washer
1.000"
0.719"
1.141"
0.187"
0.313"
Flush rivet and solder to vane
Space for sliding fit on horizontal vane
3.000"
Bevel ends of angles
0.109"
0.438"
0.281"
0.375"
0.266" R.
0.750"
1.188"
0.063" R.
Bevel
Turn to fit 0.4375" ring gage
0.375" Dia.
0.625" Dia.
A
A
2.750"
0.844"
Slot 0.031" wide x 3.656" long Bevel end on near side
20 Gage x 1/4" x 1/4" angles, both sides. Solder and rivet to vane. Rivets 1/16" csk. and grind flush.
1.000" R.
0.141" Balance weight slot
1.406" R.
5.000"
22 Gage
1.000"
Bend end back for finger grip
0.281" R
1.266"
0.266"
0.438"
0.172"
Lever in contact with these two edges when in locked position
SEC. B-B
VERTICAL VANE
NOTE: - American or Brown and Sharp Wire Gage used on this sheet.
20 Gage x 1/4" x 1/4" angles, both sides. Solder and rivet to vane. Rivets 1/16" csk. and grind flush.
22 Gage
Cut projecting leg of this angle only, as shown in Sec. B-B
2.750"
Bevel
0.063" R.
B
B
0.844"
Slot 0.031" wide x 3.656" long Bevel end on near side
3.000"
0.750"
Space for sliding fit on vertical vane
4.312"
1.406" R.
1.000" R.
7.063"
0.156"
0.313"
0.063"
0.250"
0.172"
0.750" O.D.
0.144" Dia.
Tap #6-32 p.
1/32" C B
Thd. #6-32 p
3/64" C B.
SCREW WASHER NUT
11
BALANCE WEIGHT
HARD ROLLED BRASS
NICKEL PLATED
HORIZONTAL VANE
10
TAILPIECE
HARD ROLLED BRASS-NICKEL PLATED
Grain finish
(Except locking lever made of spring brass, nickel plated and polished)
FINISHED WEIGHT 10 OZ. ± 1/16 OZ.
NOTE
10a Includes items 10 and 11
0.531"
0.172" R.
0.531"
Vane
Flutes
SEC. A-A



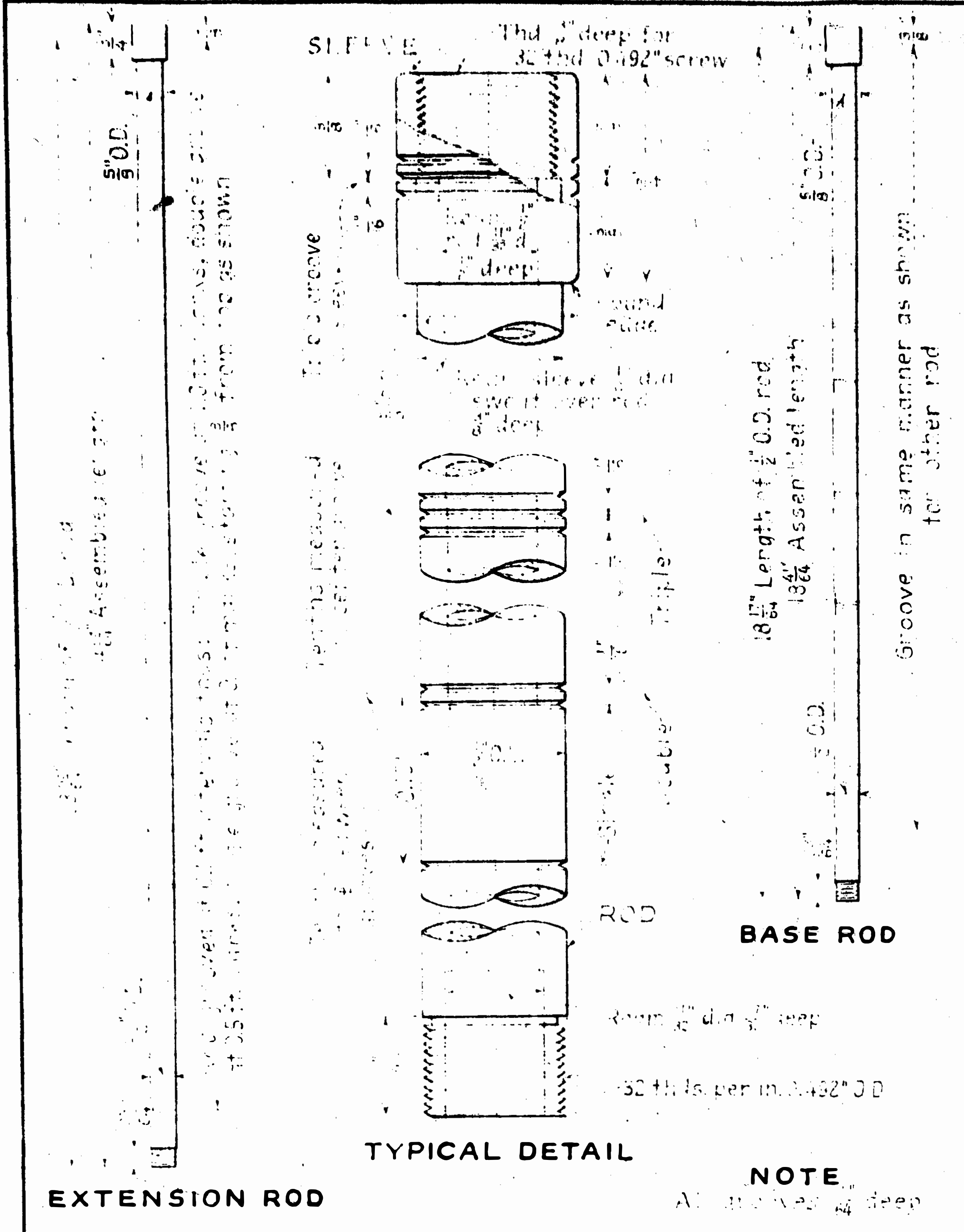
#616 ACOUSTIC CURRENT METER

DETAILS FOR CONVERTING TO ELECTRIC TYPE METER



PHONE CONNECTOR
FOR
CONVERTED ACOUSTIC METER

FIGURE 14



WADING ROD FOR ACOUSTIC TYPE METER

CURRENT METER REPAIR RECORD

Project	Type	Meter No.	Mfr.	Rec'd. Denver	Shipped to B. of S.	Condition of meter	Rating rec'd.	Rating mailed	Remarks
Boise	Penta 621	909	Gurley	6-1-42	6-26-42	Recond.	7-14-42	7-17-42	
Central Valley	A	1,062	White	6-1-42	6-26-42	New	7-14-42	7-17-42	
Yakima	A	1,063	White	6-1-42	6-26-42	New	7-14-42	7-17-42	
Klamath	Single contact 617	815	Gurley	6-1-42	6-26-42	Recond.	7-14-42	7-17-42	
Klamath	Penta 621	809	Gurley	6-1-42	6-26-42	Recond.	7-14-42	7-17-42	
North Platte	Penta 621	808	Gurley	6-1-42	7- 6-42	Recond.	7-27-42	7-31-42	
Owyhee	Improved 622	4,043	White	6-1-42	7- 6-42	Recond.	8- 3-42	8-12-42	
Denver - Gen.Inv.	A	1,005	Gurley	6-12-42	6-26-42	Recond.	7-14-42	7-17-42	
Rio Grande	A	4,057	Gurley	6-1-42	7- 6-42	Recond.	8- 3-42	8-12-42	
Rio Grande	Penta 621	827	Gurley	6-1-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Penta 621	851	Gurley	6-1-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Penta 621	890	Gurley	6-1-42	8-15-42	Recond.	9- 8-42	9-15-42	
Rio Grande	A	4,056	White	6-1-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Acoustic 616	821	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	869	Gurley	6-1-42	8-15-42	Recond.	9-8-42	9-15-42	
Rio Grande	Acoustic 616	870	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	883	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	892	Gurley	6-1-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Acoustic 616	901	Gurley	6-1-42	8-15-42	Recond.	9- 8-42	9-15-42	
Rio Grande	Acoustic 616	906	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	907	Gurley	6-1-42	7-20-42	Recond.	8-14-42	8-24-42	
Rio Grande	Acoustic 616	908	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	4,000	Gurley	6-1-42	10-19-42	Recond.	11-16-42	11-23-42	
Rio Grande	Acoustic 616	4,004	Gurley	6-1-42	8-31-42	Recond.	9- 2-42	10- 3-42	
Rio Grande	Acoustic 616	4,054	Gurley	6-1-42	8-15-42	Recond.	9- 8-42	9-15-42	
Rio Grande	Penta 621	886	Gurley	7-7-42	8-15-42	Recond.	9- 8-42	9-15-42	
Rio Grande	Penta 621	891	Gurley	7-7-42	8- 4-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Penta 621	4,011	Gurley	7-7-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Improved 622	2	White	7-7-42	7-20-42	Recond.	8-14-42	8-24-42	
Rio Grande	Acoustic 616	4,001	Gurley	7-7-42	7-28-42	Recond.	9- 2-42	9-15-42	
Rio Grande	Acoustic 616	4,055	Gurley	7-7-42	7-28-42	Recond.	9- 2-42	9-15-42	
Trans. from Upper Snake River	Penta 621	796	Gurley	9-3-40	11-14-42	Recond.	12- 3-42	12-16-42	Trans. to Minidoka 3-23-43
Trans. from Pine River	Improved 622	4,068	Gurley	12-20-41	7-20-42	Recond.	8-14-42	8-24-42	Trans. to Sacramento 10-28-42
Trans. from Uncompahgre	A	1,026	Gurley	7-14-42	7-20-42	Recond.	8-14-42	8-24-42	Trans. to Sacramento 10-28-42
Rapid Valley	A	1,025	Gurley	7-28-42	8- 4-42	Recond.	9- 2-42	9- 8-42	
Klamath Fall	Penta 621	829	Gurley	7-28-42	8- 4-42	Recond.	9- 2-42	9- 8-42	
North Platte	Penta 621	810	Gurley	8- 7-42	8-31-42	Recond.	9-29-42	10- 3-42	
Rio Grande	Penta 621	4,025	Gurley	9- 8-42	9-18-42	Recond.	10-20-42	11- 2-42	
Sunnyside	Penta 621	745	Gurley	9-15-42	9-21-42	Recond.	11- 4-42	11- 7-42	
Trans. from Rapid Valley	A	4,075	White	9-28-42	10-19-42	Recond.	11-14-42	12- 1-42	Trans. to Gen. Inv.
Hydraulic Engineer, Denver	A	4,076	White	10-10-42	10-19-42	Recond.	11-14-42	12- 1-42	
Rio Grande	A	4,064	White	11- 7-42	11-14-42	Recond.	12-14-42	12-17-42	
Rio Grande	Penta	818	Gurley	11- 7-42	11-14-42	Recond.	12- 4-42	12-17-42	
Rio Grande	Penta 621	746	Gurley	11- 7-42	11-14-42	Recond.	12- 4-42	12-17-42	
Minidoka	A	1,045	White	11- 6-42	11-14-42	Recond.	12-15-42	12-18-42	
Yakima	Penta 621	863	Gurley	1-22-43	2- 2-43	Recond.	2-19-43	2-27-43	
Yakima	Penta 621	923	Gurley	1-22-43	2- 2-43	Recond.	2-19-43	2-27-43	
Minidoka	A	1,018	Gurley	1-28-43	2- 2-43	Recond.	2-19-43	2-17-43	
Yuma	A	1,010	Gurley	2- 1-43	2- 6-43	Recond.	2-20-43	2-27-43	
Hydraulic Engineer, Denver	A	1,038	White	3-19-43	3-24-43	Recond.	4-13-43	4-21-43	
Belle Fourche	Penta 621	748		3- 9-43	3-24-43	Recond.	4-13-43	4-21-43	
Belle Fourche	Acoustic 616	4,016		3- 9-43	3-24-43	Recond.	4-13-43	4-21-43	
Central Valley	A	1,029	Gurley	5-11-43	6- 1-43	Recond.	5-20-43	5-26-43	
Rio Grande	Penta 621	888	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Rio Grande	A	4,065	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	

CURRENT METER REPAIR RECORD (Continued)

Project	Type	Meter No.	Mfr.	Rec'd. Denver	Shipped to B. of S.	Condition of meter	Rating rec'd.	Rating mailed	Remarks
Rio Grande	Acoustic 616	4,051	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Rio Grande	Acoustic 616	4,052	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Rio. Grande	Penta 621	882	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Rio Grande	Penta 621	888	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Rio Grande	Penta 621	890	Gurley	5-20-43	6- 1-43	Recond.	6-19-43	7- 3-43	
Hydraulic Engineer, Denver	A	1,019	Gurley	6-10-43	6- 1-43	Recond.	6-19-43	7- 2-43	
Rio Grande	Penta 621	827	Gurley	6-10-43	6-15-43	Recond.	7- 3-43	7-16-43	
Rio Grande	A	4,072	Gurley	6-10-43	6-15-43	Recond.	7- 3-43	7-16-43	
North Platte	A	4,037	Gurley	6- 5-43	6-15-43	Recond.	7- 3-43	7-16-43	
~~Klamath~~	Comb. 623	815	Gurley	6- 5-43	6-15-43	Recond.	7- 3-43	7-16-43	
Hydraulic Engineer, Denver	A	1,034	White	6- 8-43	6-15-43	Recond.	7- 3-43	7-16-43	
Provo River	A	4,058	Gurley	6-16-43	6-29-43	Recond.	7- 7-43	7-16-43	
Yakima	Imp. 622	4,039	Gurley	7-26-43	8- 3-43	Recond.	8-21-43	8-26-43	Converted to Type A
Hyd.Eng.-Denver	A	4,076	White	8- 3-43	8- 6-43	Recond.	8-30-43	9- 3-43	
Rio Grande	A	2	White	9- 9-43	9-16-43	Recond.	10- 5-43	10- 9-43	
Rio Grande	Comb. 623	818	Gurley	9- 9-43	9-16-43	Recond.	10- 5-43	10-9-43	
Yakima	A	1,065	Gurley	9-16-43	10- 9-43	Rebuilt	10-29-43	11- 8-43	Formerly single Contract BR-824
Yakima	Penta 621	863	Gurley	9-16-43	10- 9-43	Recond.	10-29-43	11- 8-43	
Yakima	A	1,064	Gurley	9-16-43	10- 9-43	Rebuilt	10-29-43	11- 8-43	Formerly single contract special - no number
Hyd.Eng.-Denver	A	4,063	White	10- 4-43	10- 9-43	Recon.	11- 8-43	11-10-43	
Rio Grande	Comb. 623	891	Gurley	10-17-43	10-25-43	Recon.	11- 8-43	11-10-43	
Rio Grande	Acoustic	906	Gurley	10-17-43	10-25-43	Recon.	11- 8-43	11-10-43	
Rio Grande	Acoustic	4,003	Gurley	10-17-43	10-25-43	Recon.	11- 8-43	11-10-43	
Klamath	Penta 621	829	Gurley	11- 8-43	11-13-43	Recon.	11-27-43	11-30-43	
Minidoka	A	1,045	White	11-22-43	11-30-43	Recon.	12-24-43	1- 4-43	
Provo River	A.	4,066	Gurley	11-22-43	11-30-43	Recon.	12-24-43	1- 4-43	
Proj. Planning	A	4,061	Gurley	11-23-43	11-30-43	Recon.	12-24-43	1- 4-43	
Proj. Planning	A	1,023	White	11-23-43	11-30-43	Recon.	Returned by B. of S. for repairs		
Shoshone	Penta 621	840	Gurley	12- 4-43	12-17-43	Recon.	1-17-44	1-29-44	
Rio Grande	Acoustic 616	4,055	Gurley	12- 4-43	12-17-43	Recon.	1-17-44	1-29-44	
Rio Grande	Acoustic 616	929	Gurley	12- 4-43	12-17-43	Recon.	1-17-44	1-29-44	
Rio Grande	Acoustic 616	4,001	Gurley	12- 4-43	12-17-43	Recon.	1-17-44	1-29-44	
~~Rio Grande~~	~~Acoustic 616~~	~~4,004~~	~~Gurley~~	~~12- 4-43~~	~~12-17-43~~	~~Recon.~~	~~1-17-44~~	~~1-29-44~~	
Rio Grande	Comb. 623	746	Gurley	12- 4-43	12-17-43	Recon.	1-17-44	1-29-44	
Colo.-Big Thomp.	A	1,020	Gurley	12- 2-43	12-17-43	Recon.	1-17-44	1-29-44	
Proj. Planning	A	1,016	Gurley	12- 9-43	12-17-43	Recon.	1-17-44	1-29-44	
Proj. Planning	A	1,006	White	12-28-43	1- 25-44	Recon.	2-21-44	3-1 -44	
Proj. Planning	A	1,014	Gurley	12-28-43	1- 25-44	Recon.	2-21-44	3-1 -44	
Proj. Planning	A	1,035	White	12-28-43	1- 25-44	Recon.	2-21-44	3-1 -44	
Proj. Planning	A	1,017	Gurley	1- 7-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Proj. Planning	A	1,023	White	12-24-43	1- 25-44	Recon.	2-21-44	3-1 -44	
Carlsbad	A	1,008	Gurley	1-11-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Proj. Planning	A	1,052	White	1- 2-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Yakima	A	4,039	Gurley	1-11-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Yakima	Penta 621	895	Gurley	1-11-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Yuma	Acoustic 616	4,033	Gurley	1-18-44	1- 25-44	Recon.	2-21-44	3-1 -44	
Shoshone	Penta 621	925	Gurley	1-23-44	1- 28-44	Recon.	2-15-44	2-19-44	
Rio Grande	Acoustic 616	884	Gurley	1-28-44	2- 10-44	Recon.	3-24-44	3-31-44	
Rio Grande	Acoustic 616	903	Gurley	1-28-44	2- 10-44	Recon.	3-24-44	3-31-44	
Rio Grande	A	1,066	Rebuilt	1-28-44	2- 10-44	Rebuilt	3-24-44	3-31-44	Old meter BR-734
Proj. Planning	A	4,042	Gurley	1-29-44	2- 16-44	Recon.	3-24-44	3-31-44	
Klamath	A	1,067	Rebuilt	2- 4-44	2- 10-44	Rebuilt	3-24-44	3-31-44	Old meter BR-809
Proj. Planning	A	1,051		1-29-44	2- 16-44	Recon.	3-24-44	3-31-44	
Proj. Planning	A	1,003		1-29-44	2- 16-44	Recon.	3-24-44	3-31-44	
Rio Grande	Acoustic 616	931	Gurley	2-14-44	2-26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	932	Gurley	2-14-44	2-26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	933	Gurley	2-14-44	2- 26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	4,000	Gurley	2-14-44	2- 26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	4,005	Gurley	2-14-44	2- 26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	4,024	Gurley	2-14-44	2- 26-44	Recon.	3-28-44	3-31-44	
Rio Grande	Acoustic 616	4,029	Gurley	7-13-42	7- 20-42	Recon.	8-14-42	8-19-42	Exchange for BR-822 2-28-44

CURRENT METER REPAIR RECORD (Continued)

Project	Type	Meter No.	Mfr.	Rec'd Denver	Shipped to B. of S.	Condition of meter	Rating rec'd.	Rating mailed	Remarks
Rio Grande	Acoustic 616	4053	Gurley	2-14-44	2- 26-44	Recon.	3-28-44	3-31-44	
Rio Grande	A	4056	White	2-14-44	2- 66-44	Recon.	3-28-44	3-31-44	
Yakima	A	1068	Rebuilt	2-21-44	2- 22-44	Rebuilt	3- 7-44	3-13-44	Old meter BR-832
Provo	A	4058	Gurley	3-2- 44	3- 6-44	Recon.	3-28-44	3-31-44	
Hyd.Lab.	Modified 616	875	Gurley	---	3- 27-44	Modified			Converted from acoustic to electric Loaned to Rio Grande
Hyd.Lab.	A	4059	White	---	4- 24-44	Recon.	6- 1-44		
Hyd.Lab.	A	1055	White	---	4- 24-44	Recon.	6- 1-44		
Hyd.Lab.	A	1069	Rec.	---	4- 24-44	New	6- 1-44		
Yakima	A	1070	Rec.	---	4- 24-44	New	6-1-44	7- 6-44	See Entry on BR-863
Yakima	A	1071	Rec.	---	5- 26-44	New	6-26-44	7- 6-44	See Entry on BR-1065
Hyd.Lab.	A	1072	Rec.	---	5- 26-44	New	6-26-44		
Hyd.Lab.	A	1073	Rec.	---	5- 26-44	New	6-26-44		
Proj. Planning	A	1053	White	---	5- 26-44	Recon.	6-26-44	6-30-44	
Rio Grande	Penta 621	4010		5-25-44	6- 2-44	As recd.	6-26-44	7- 1-44	
Rio Grande	A	4073		5-25-44	6- 2-44	As recd.	6-26-44	7- 1-44	
Rio Grande	623	818		5-25-44					Exchanged for meter BR-4013, 6-12-44
Rio Grande	623	851		5-25-44					Exchanged for meter BR-737, 6-12-44
Rio Grande	623	890	Gurley	5-25-44					Exchanged for meter BR-852, 6-12-44
Rio Grande	616	908	Gurley	5-25-44	6- 12-44	Recond.	7- 5-44	7-10-44	
Rio Grande	616	4012	Gurley	5-25-44	6- 12-44	Recond.	7- 5-44	7-10-44	
Rio Grande	A	4064		5-25-44	6- 12-44	Recond.	7- 5-44	7-10-44	
Rio Grande	Penta 621	737	Gurley	7-13-42	11-14-42	Recond.	12-3-42	12-16-42	See entry on BR-851
Rio Grande	Penta 621	852	Gurley	8- -38	9-18-42	Recond.	10-20-42	10-24-42	See entry on BR-890
Rio Grande	Penta 621	4013	Gurley	---	9-18-42	Recond.	10-20-42	10-24-42	See entry on BR-818
North Platte	A	4037	Gurley	6- 9-44	6- 12-44	Recond.	7- 5-44	7-10-44	
All-American	A	1048		6-26-44	7- 3-44	Recond.	7-14-44	7-21-44	
Yakima	Penta 621	863		6-27-44					BR-1071 sent in exchange
Yakima	A	1065		6-27-44					BR-1070 sent in exchange
Proj. Planning	A	1004		6-21-44	7- 6-44	Recond.	7-28-44		
Central Valley	A	1012		6-30-44	7- 6-44	Recond.	7-28-44		
Hyd.Lab.	A	1074		---		New	7-28-44		
Hyd.Lab.	A	1075		---		New	7-28-44		
Hyd.Lab.	A	1076		---		New	~~8-28-44~~		
Hyd.Lab.	A	1077		---		New	8-28-44		
Hyd.Lab.	A	1078		---		New	8-28-44		
Hyd.Lab.	A	1079		---		New	8-28-44		
Central Valley	A	1002		8-14-44	---	---	---		BR-1069 sent in exchange
Central Valley	A	1029		8-11-44	---	---	---		BR-4059 sent in exchange
Central Valley	A	1080		8-14-44	---	---	---		BR-1055 sent in exchange
All-American	A	4080		8-18-44	8-26-44	Recond.	9-14-44	9-20-44	
Hyd.Lab.	A	1002		---	8- 8-44	Recond.	10-11-44		
Hyd.Lab.	A	1029		---	8- 8-44	Recond.	10-11-44		To Valley Gravity Canal & Storage, Texas
Hyd.Lab.	A	1080		---	8- 8-44	Recond.	10-11-44		
Hyd.Lab.	A	1080		---	8- 8-44	New	10-11-44		
Central Valley	A	1026		9-27-44					BR-1076 sent in exchange
Central Valley	A	4088		9-27-44					BR-1077 sent in exchange
Hyd.Lab.	Acoustic	4028			10-2-44	Recond.	10-27-44		
Grand Valley	Acoustic	921			10-2-44	Recond.	11- 4-44	11-7-44	
Hyd.Lab.	A	1026		9-27-44	10-14-44	Recond.	11-11-44		
Hyd.Lab.	A	1058			10-14-44	Recond.	11-11-44		
Hyd.Lab.	A	1082			10-14-44	Recond.	11-11-44		
Hyd.Lab.	A	4088			10-14-44	Recond.	11-11-44		

CURRENT METER REPAIR (Continued)

Project	Type	Meter No.	Mfr.	Rec'd Denver	Shipped to B. of S.	Condition of Meter	Rating Rec'd	Rating Mailed	Remarks
Central Valley	A	1057		10- 2-44					BR-1065 sent in exchange
Central Valley	A	1058		10- 2-44					BR-1074 sent in exchange
Central Valley	A	1049		10-27-44					BR-1060 sent in exchange
Hyd.Lab.	A	1049			10-30-44	As Rec'd	11- 8-44		
Yuma	Acoustic	4031		10- 1-44	10- 3-44	Recond.	11- 4-44	11- 7-44	
Yuma	Penta 621	4014		10- 1-44					BR-1073 sent in exchange
All-American	A	1048		10- 1-44	10- 3-44	Recond.		11- 7-44	
Riverton	Acoustic	873			10-17-44	Recond.	11-11-44		
Grand Valley	Penta 621	799		10-19-44					BR-1002 sent in exchange
Hyd.Lab.	A	4071			11-20-44	Recond.	12- 4-44		
Hyd.Lab.	A	1049			11-20-44	Recond.	12- 4-44		
Hyd.Lab.	A	1057			11-20-44	Recond.	12- 4-44		
Hyd.Lab.	A	1081			11-20-44	Recond.	12- 4-44		
All-American	A	1010		11-20-44		Recond.	12-13-44		
Yakima	A	1063			11-30-44	As Rec'd	12-19-44	1- 4-45	
Tucumcari	A	1047		12- 2-44	12- 6-44	Recond.	12-21-44	1- 4-45	
Yakima	A	1063		12-21-44		Recond.		1-19-45	
Hyd.Lab.	A	1083			12-22-44	New	2- 6-45		
Hyd.Lab.	A	1084			12-22-44	New	2- 6-45		
Hyd.Lab.	A	1085			12-22-44	New	2- 6-45		
Hyd.Lab.	A	1086			12-22-44	New	2- 6-45		
Rio Grande	Penta 621	862		1- 2-45					BR-4066 sent in exchange
Rio Grande	Penta 621	4011		1- 2-45					BR-4071 sent in exchange
Rio Grande	Penta 621	4025		1- 2-45					BR-1026 sent in exchange
Rio Grande	Acoustic 616	821		1- 2-45					BR-4050 (modified 616) sent in exchange via B. of S.
Rio Grande	Acoustic 616	883		1- 2-45					BR-4028 sent in exchange
Rio Grande	Acoustic 616	906		1- 2-45					BR-4030 (modified 616) sent in exchange via B.of S.
Rio Grande	Acoustic 616	4001		1- 2-45	1-26-45	Recond.	2-15-45		
Rio Grande	A	4072		1- 2-45	1-26-45	Recond.	2-15-45		
Rio Grande	A	4065		1- 2-45	1-26-45	Recond.	2-15-45		
Rio Grande	Acoustic 616	4051		1- 2-45	1-26-45	Recond.	2-15-45		
Shoshone	Penta 621	925		2- 2-45					BR-1056 (type A) sent in exchange
Hyd. Lab.	Modified 616	4006			2-13-45	Rebuilt	2-28-45		
Hyd. Lab.	Modified 616	4007			2-13-45	Rebuilt	2-28-45		
Hyd. Lab.	Modified 616	4008			2-13-45	Rebuilt	2-28-45		
Hyd. Lab.	Modified 616	4009			2-13-45	Rebuilt	2-28-45		
Hyd. Lab.	Modified 616	4032			2-13-45	Rebuilt	2-28-45		
Hyd. Lab.	Modified 616	4034			2-13-45	Rebuilt	2-28-45		
Yakima	Penta 621	895		2-15-45	2-16-45	Rebuilt			BR-1061 (type A) sent in exchange via B. of S.
Yakima	Penta 621	923		2-15-45	2-16-45	Rebuilt			BR-1087 (type A) sent in exchange via B. of S.
Hyd. Lab.	A	1088			2-28-45	New			
Hyd. Lab.	A	1089			2-28-45	New			
Hyd. Lab.	A	1090			2-28-45	New			
Hyd. Lab.	A	1091			2-28-45	New			
Central Valley	Hoff	200							

CURRENT METER RATING RECORD

Project	Type	Meter No.	Method of Rating	Equation	N	Equation	Date	Test No.
Boise	Penta	909	Rod, double end hanger	V =2.209N+0.009	1.00	V =2.1[illegible]N+0.030	7-10-42	611-26-28
Central Valley	A	1062	Rod, double end hanger	=2.205N+0.015	1.00	=2.19[illegible]N+0.022	7-10-42	611-26-28
Yakima	A	1063	Rod, double end hanger	=2.184N+0.023	1.00	=2.173N+0.034	7-10-42	611-26-28
Klamath	S. Cont.	815	Rod, double end hanger	=2.188N+0.03[illegible]	1.00	=2.176N+0.021	7-10-42	611-26-28
Klamath	Penta	809	Rod, double end hanger	=2.261N+0.033	1.00	=2.266N+0.028	7-10-42	611-26-28
North Platte	Penta	808	Rod, double end hanger	=2.175N+0.037	1.00	=2.222N-0.010	7-18-42	611-27-5
Owyhee	Improved	4043	Rod, double end hanger	=2.216N+0.023	1.00	=2.176N+0.033	7-28-42	611-27-5
Denver-Gen.Inv.	A	1005	Rod, double end hanger	=2.188N+0.013	1.00	=2.193N+0.008	7-10-42	611-26-28
Rio Grande	A	4097	Rod, double end hanger	=2.264N+0.022	1.00	=2.24[illegible]N+0.032	7-28-42	611-27-5
			6.7" above 15# elliptical	=2.277N+0.019	1.00	[illegible]+0.011	7-28-42	611-27-5
			6.7" above 30# elliptical	=2.296N+0.015	1.00	=2.303N+0.008	7-28-42	611-27-5
			9.8" above 50# Columbus	=2.247N+0.023	1.00	=2.294N+0.016	7-28-42	611-27-5
Rio Grande	Penta	[illegible]	Rod, double end hanger	=2.162N+0.013	1.00	=2.177N+0.018	8-20-42	611-28-4
Rio Grande	Penta	851	Rod, double end hanger	=2.122N+0.023	1.00	=2.139N+0.006	8-20-42	611-28-4
Rio Grande	Penta	[illegible]	Rod, double end hanger	=2.170N+0.026			9-2-42	611-28-13
Rio Grande	A	[illegible]	Rod, double end hanger	=2.265N+0.022	1.00	=2.297N+0.030	8-20-42	611-28-4
			6.7" above 15# elliptical	=2.278N+0.022	1.00	=2.[illegible]N+0.012	8-20-42	611-28-4
			6.7" above 30# elliptical	=2.306N+0.008	1.00	=2.295N+0.019	8-20-42	611-28-4
			9.8" above 50# Columbus	=2.[illegible]N+0.017	1.00	=2.29[illegible]N+0.026	8-20-42	611-28-4
Rio Grande	Acoustic	821	Rod	=2.167N + 0.027			10-31-42	611-210-11
Rio Grande	Acoustic	869	Rod	=2.164N + 0.039	1.00	=2.203N	9-2-42	611-28-13
Rio Grande	Acoustic	870	Rod	=2.121N + 0.027	1.13	=2.145N	10-31-42	611-210-11
Rio Grande	Acoustic	883	Rod	=2.133N + 0.019	1.00	=2.152N	10-31-42	611-210-11
Rio Grande	Acoustic	892	Rod	=2.131N + 0.029	1.00	=2.152N + 0.008	8-20-42	611-28-4
Rio Grande	Acoustic	901	Rod	=2.123N + 0.032	1.00	=2.148N + 0.007	9-2-42	611-28-13
Rio Grande	Acoustic	906	Rod	=2.128N + 0.028	1.00	=2.151N + 0.005	10-31-42	611-210-11
Rio Grande	Acoustic	907	Rod	=2.097N + 0.024	1.00	=2.133N - 0.012	8-7-42	611-27-13
Rio Grande	Acoustic	908	Rod	=2.100N + 0.030	1.16	=2.143N - 0.020	10-31-42	611-210-11
Rio Grande	Acoustic	4000	Rod	=2.118N + 0.022			10-31-42	611-210-11
Rio Grande	Acoustic	4024	Rod	=2.125N + 0.024	1.00	=2.160N - 0.011	9-24-42	611-29-6
Rio Grande	Acoustic	4054	Rod	=2.224N + 0.025	1.00	=2.235N + 0.014	9-2-42	611-28-13
Rio Grande	Penta	[illegible]	Rod, double end hanger	=2.139N + 0.025			9-2-42	611-28-13
Rio Grande	Penta	891	Rod, double end hanger	=2.104N + 0.025	1.00	=2.124N + 0.005	8-24-42	611-28-8
Rio Grande	Penta	4011	Rod, double end hanger	=2.200N + 0.020	1.00	=2.227N - 0.007	8-20-42	611-28-4
Rio Grande	Improved	2	Rod, double end hanger	=2.169N + 0.016			8-7-42	611-27-13
			6.7"above 15# elliptical	=2.192N + 0.020	1.00	=2.187N + 0.025	8-7-42	611-27-13
			6.7"above 30# elliptical	=2.189N + 0.019			8-7-42	611-27-13
			9.75"above 50# elliptical	=2.194N + 0.017	1.00	=2.158N + 0.053	8-7-42	611-27-13
Rio Grande	Acoustic	4001	Rod	=2.122N + 0.028	1.00	=2.142N + 0.008	8-20-42	611-28-4
Rio Grande	Acoustic	4055	Rod	=2.206N + 0.015			8-20-42	611-28-4
Minidoka	Penta	796	Rod, double end hanger	=2.145N + 0.025	1.14	=2.167N	11-27-42	611-211-7
~~Central Valley~~	Improved	4068	Rod, double end hanger	=2.306N + 0.020			8-7-42	611-27-13
Central Valley	Improved	1026	Rod, double end hanger	=2.306N + 0.019	1.00	=2.289N + 0.036	8-7-42	611-27-13
Rapid Valley	Improved	1025	Rod, double end hanger	=2.295N + 0.025			8-24-42	611-28-8
Klamath	~~Penta~~	829	Rod, double end hanger	=2.144N + 0.027	1.00	=2.179N - 0.008	8-24-42	611-28-8
North Platte	Penta	810	Rod, double end hanger	=2.203N + 0.028	1.00	=2.212N + 0.019	9-24-42	611-29-6
Rio Grande	Penta	4025	Rod, double end hanger	=2.217N + 0.017			10-8-42	611-29-12
Yakima	Penta	745	Rod, double end hanger	=2.192N + 0.022	1.00	=2.205N + 0.009	10-28-42	611-29-15
Denver-Gen.Inv.	A	4075	Rod, double end hanger	=2.178N + 0.029	1.00	=2.183N + 0.024	10-31-42	611-210-11
Denver-Gen.Inv.	A	4076	Rod, double end hanger	=2.173N + 0.021	1.04	=2.160N + 0.035	10-31-42	611-210-11
Rio Grande	A	4064	Rod, double end hanger	=2.321N + 0.016	1.00	=2.308N + 0.029	11-27-42	611-211-7
			6.7"above 15# elliptical	=2.354N + 0.014	1.00	=2.342N + 0.026	11-27-42	611-211-7
			6.7"above 30# elliptical	=2.364N + 0.016	1.00	=2.373N + 0.007	11-27-42	611-211-7
			9.8"above 50# Columbus	=2.330N + 0.038	1.00	=2.323N + 0.045	11-27-42	611-211-7
Rio Grande	Penta	818	Rod, double end hanger	=2.174N + 0.032	1.00	=2.165N + 0.041	11-27-42	611-211-7
Rio Grande	Penta	746	Rod, double end hanger	=2.176N + 0.025	1.00	=2.182N + 0.019	11-27-42	611-211-7
Minidoka	A	1045	Rod, double end hanger	=2.210N + 0.017	1.00	=2.181N + 0.046	12-9-42	611-212-2
Yakima	Penta	863	Rod, double end hanger	=2.234N + 0.025	1.00	=2.209N + 0.050	2-15-43	611-32-5
			4.25" above 30# torpedo	=2.233N + 0.037	1.00	=2.277N - 0.007	2-15-43	611-32-5
			8.5" above lower of two 30# torpedo weights .	=2.246N + 0.040	1.00	=2.278N + 0.008	2-15-43	611-32-5
Yakima	Penta	923	Rod, double end hanger	=2.225N + 0.025	1.00	=2.200N + 0.050	2-15-43	611-32-5
			4.25" above 30# torpedo	=2.234N +0.030	1.00	=2.249N + 0.015	2-15-43	611-32-5
			8.5" above lower of two 30# torpedo weights....	=2.156N + 0.047	0.34	=2.251N + 0.015	2-15-43	611-32-5
Minidoka	A	1018	Rod, double end hanger	=2.280N + 0.028			2-15-43	611-32-5
Yuma	A	1010	Rod, double end hanger	=2.296N + 0.027	1.00	=2.289N + 0.034	2-13-43	611-32-6
Denver-Gen.Inv.	A	1038	6.7"above 15# elliptical	=2.223N + 0.017	1.00	=2.210N + 0.030	4-6-43	611-34-1
			6.7"above 30# elliptical	=2.211N + 0.023	1.00	=2.219N + 0.015	4-6-43	611-34-1
Belle Fourche	Penta	748	Rod, double end hanger	=2.178N + 0.020			4-6-43	611-34-1
Belle Fourche	Acoustic	4016	Rod	=2.159N + 0.024	1.00	=2.183N	4-6-43	611-34-1
Central Valley	A	1029	4.9" above 30# Columbus	=2.161N + 0.039	1.00	=2.185N + 0.015	5-13-43	611-35-10
					3.60	=2.267N - 0.280		
Rio Grande	Penta	886	Rod, double end hanger	=2.134N + 0.016			6-14-43	611-36-3
Rio Grande	A	4065	6.7" above 15# elliptical	=2.138N + 0.019			6-14-43	611-36-3
			6.7" above 30# elliptical	=2.342N + 0.016	1.00	=2.334N + 0.024	6-14-43	611-36-3

CURRENT METER RATING RECORD

Project	Type	Meter No.	Method of Rating	Equation	N	Equation	Date	Test No.
Rio Grande	Acoustic	4051	Rod	V=2.223N + 0.017			6-14-43	611-36-3
Rio Grande	Acoustic	4052	Rod	=2.240N + 0.023	1.00	V=2.249N + 0.014	6-14-43	611-36-3
Rio Grande	Penta	862	Rod, double end hanger	=2.184N + 0.013	1.00	=2.178N + 0.019	6-14-43	611-36-3
Rio Grande	Penta	888	Rod, double end hanger	=2.268N + 0.044	1.00	=2.276N + 0.036	6-14-43	611-36-3
Rio Grande	Penta	890	Rod, double end hanger	=2.178N + 0.020	1.00	=2.156N + 0.042	6-14-43	611-36-3
Denver-Gen.Inv.	A	1019	6.7"above 15#elliptical	=2.292N + 0.019	1.00	=2.270N + 0.041	6-14-43	611-36-3
			6.7"above 30#elliptical	=2.299N + 0.018	1.00	=2.288N + 0.029	6-14-43	611-36-3
Rio Grande	Penta	827	Rod, double end hanger	=2.163N + 0.025	1.00	=2.174N + 0.014	6-26-43	611-36-12
Rio Grande	A	4072	Rod, double end hanger	=2.264N + 0.015	1.00	=2.257N + 0.022	6-26-43	611-36-12
			6.7"above 15#elliptical	=2.285N + 0.024			6-26-43	611-36-12
			6.7"above 30#elliptical	=2.312N + 0.022			6-26-43	611-36-12
North Platte	A	4037	Rod, double end hanger	=2.243N + 0.020			6-26-43	611-36-12
Klamath	Single Contact	815	Rod, double end hanger	=2.153N + 0.032	1.00	=2.185N	6-26-43	611-36-12
Denver-Gen.Inv.	A	1034	6.7"above 15#elliptical	=2.216N + 0.017	1.00	=2.224N + 0.009	6-26-43	611-36-12
			6.7"above 30#elliptical	=2.210N + 0.016			6-26-43	611-36-12
Provo River	A	4058	Rod, double end hanger	=2.284N + 0.023	1.00	=2.262N + 0.045	--	611-37-1
Denver-Hyd.Lab.	Penta	852	Rod, double end hanger	=2.117N + 0.031	1.00	=2.135N + 0.013	10- 8-42	611-29-12
Denver-Hyd.Lab.	Penta	4013	Rod, double end hanger	=2.188N + 0.021			10- 8-42	611-29-12
Central Valley	Comb.	4027	Rod, double end hanger	=2.191N + 0.023	1.00	=2.199N + 0.015	10- 8-42	611-29-12
Denver-Hyd.Lab.	Penta	737	Rod, double end hanger	=2.140N + 0.024	1.00	=2.172N - 0.008	11-27-42	611-211-7
Denver-Hyd.Lab.	Acoustic	4029	Rod	=2.169N + 0.023	1.00	=2.198N - 0.006	8 -7-42	611-27-13
Yakima	A	4039	Rod, double end hanger	=2.241 N+ 0.017	1.00	=2.231N + 0.027	8-16-43	611-38-13
			4.25" above 30# torpedo	=2.233N + 0.030	0.38	=2.371N - 0.022	8-16-43	611-38-13
					1.00	=2.334N + 0.015		
			8.5" above lower of two	=2.188N + 0.034	0.36	=2.353N - 0.025	8-16-43	611-38-13
			30# torpedo weights		1.00	=2.297N + 0.031		
Denver-Gen.Inv.	A	4076	Rod, double end hanger	=2.180N + 0.020	1.00	=2.150N + 0.050	8-23-43	611-38-14
			6.7"above 15#elliptical	=2.210N + 0.010	1.00	=2.180N + 0.030	8-23-43	611-38-14
			6.7"above 30#elliptical	=2.210N + 0.010	1.00	=2.190N + 0.030	8-23-43	611-38-14
Rio Grande	A	2	Rod, double end hanger	=2.168N + 0.020			9-27-43	611-39-13
			6.7"above 15#elliptical	=2.173N + 0.025	1.00	=2.191N + 0.007	9-27-43	611-39-13
			6.7"above 30#elliptical	=2.204N + 0.017	1.00	=2.190N + 0.031	9-27-43	611-39-13
			9.75"above 50#Columbus	=2.180N + 0.016	1.00	=2.161N + 0.035	9-27-43	611-39-13
Rio Grande	Penta	818	Rod, double end hanger	=2.153N + 0.025			9-27-43	611-39-13
Yakima	A	1065	Rod, double end hanger	=2.193N + 0.014	1.00	=2.184N + 0.023	10-26-43	611-310-4
			4.25" above 30# torpedo	=2.259N + 0.017	1.00	=2.248N + 0.028	10-26-43	611-310-4
Yakima	Penta	863	Rod, double end hanger	=2.209N + 0.033	1.00	=2.216N + 0.026	10-26-43	611-310-4
			4.25"above 30# torpedo	=2.268N + 0.023			10-26-43	611-310-4
Yakima	A	1064	Rod, double end hanger	=2.264N + 0.019	1.00	=2.249N + 0.034	10-26-43	611-310-4
			6.7"above 30#elliptical	=2.279N + 0.029	1.00	=2.287N + 0.021	10-26-43	611-310-4
Hyd.Eng.-Denver	A	4063	Rod, double end hanger	=2.186N + 0.019	1.00	=2.179N + 0.026	11-6- 43	611-310-4
Rio Grande	Comb.	891	Rod, double end hanger	=2.100N + 0.023	1.00	=2.134N - 0.011	11- 6-43	611-311-2
Rio Grande	Acoustic	906	Rod	=2.111N + 0.032	1.00	=2.162N - 0.019	11- 6-43	611-311-2
Rio Grande	Acoustic	4003	Rod	=2.121N + 0.025	1.00	=2.146N	11- 6-43	611-311-2
Klamath	Penta	829	Rod, double end hanger	=2.163N + 0.025			11-24-43	611-311-8
Minidoka	A	1045	Rod, double end hanger	=2.185N + 0.025			12-21-43	611-312-6
			4.9" above 30# Columbus	=2.207N + 0.015	1.00	=2.183N + 0.039	12-21-43	611-312-6
Provo River	A	4066	Rod, double end hanger	=2.307N + 0.015	1.00	=2.276N + 0.046	12-21-43	611-312-6
			4.9" above 30# Columbus	=2.321N + 0.027			12-21-43	611-312-6
Proj. Planning	A	4061	5.3" above 15# Columbus	=2.259N + 0.018	1.00	=2.241N + 0.036	12-21-43	611-312-6
			4.9" above 30# Columbus	=2.299N + 0.018	1.00	=2.261N + 0.056	12-21-43	611-312-6
Rio Grande	Penta	746	Rod, double end hanger	=2.197N + 0.023	1.00	=2.220N	1-12-44	611-312-13
Shoshone	Penta	840	4.9" above 30# Columbus	=2.159N + 0.025			1-12-44	611-312-13
Proj. Planning	A	1016	Rod, double end hanger	=2.293N + 0.026	1.00	=2.284N + 0.035	1-12-44	611-312-13
Colo.-Big Thomp	A	1020	Rod, double end hanger	=2.326N + 0.026	1.00	=2.288N + 0.064	1-12-44	611-312-13
			4.9" above 30# Columbus	=2.334N + 0.027	1.00	=2.300N + 0.061	1-12-44	611-312-13
Rio Grande	Acoustic	929	Rod	=2.139N + 0.039	1.00	=2.178N	1-12-44	611-312-13
Rio Grande	Acoustic	4001	Rod	=2.141N + 0.036	1.00	=2.148N + 0.029	1-12-44	611-312-13
Rio Grande	Acoustic	4004	Rod	=2.123N + 0.039	1.00	=2.154N + 0.008	1-12-44	611-312-13
Rio Grande	Acoustic	4055	Rod	=2.183N + 0.038	1.00	=2.226N - 0.005	1-12-44	611-312-13
Proj. Planning	A	1006	Rod, double end hanger	=2.259N + 0.020	1.00	=2.237N + 0.042	2-18-44	611- 42- 3
Proj. Planning	A	1014	Rod, double end hanger	=2.274N + 0.026	1.00	=2.252N + 0.048	2-18-44	611- 42- 3
Proj. Planning	A	1035	Rod, double end hanger	=2.205N + 0.022	1.00	=2.190N + 0.037	2-18-44	611- 42- 3
Proj. Planning	A	1017	Rod, double end hanger	=2.252N + 0.027	1.00	=2.226N + 0.053	2-18-44	611- 42- 3
Proj. Planning	A	1023	5.3" above 15# Columbus	=2.267N + 0.035			2-18-44	611- 42- 3
			4.9" above 30# Columbus	=2.317N + 0.026	1.00	=2.306N + 0.037	2-18-44	611- 42- 3
Carlsbad	A	1008	Rod, double end hanger	=2.151N + 0.024	1.00	=2.160N + 0.015	2-18-44	611- 42- 3
Proj. Planning	A	1052	Rod, double end hanger	=2.238N + 0.022	1.00	=2.217N + 0.043	2-18-44	611- 42- 3
Yakima	A	4039	Rod, double end hanger	=2.247N + 0.025			2-18-44	611- 42- 3
			4" above 30# torpedo	=2.314N + 0.023	1.00	=2.343N - 0.006	2-18-44	611- 42- 3
			4.9" above 30# Columbus	=2.256N + 0.020	1.00	=2.264N + 0.012	2-18-44	611- 42- 3

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CURRENT METER RATING RECORD

Project	Type	Meter No.	Method of Rating	Equation	N	Equation	Date	Test No.
Yakima	Penta	895	Rod, double end hanger	V =2.163N + 0.020	1.00	V =2.152N + 0.031	2-18-44	611-42-3
			4½" above 30# torpedo	=2.209N + 0.018	1.00	=2.233N - 0.006	2-18-44	611-42-3
			4.9" above 30# Columbus	=2.139N + 0.032	1.00	=2.166N + 0.005	2-18-44	611-42-3
Yuma	Acoustic	4033	Rod	=2.204N + 0.037	1.00	=2.220N + 0.021	2-18-44	611-42-3
Shoshone	Penta	925	4.9" above 30# Columbus	=2.110N + 0.027	1.00	=2.137N	2-12-44	611-42-4
Rio Grande	Acoustic	884	Rod	=2.134N + 0.037	1.00	=2.162N + 0.009	3-22-44	611-42-7
Rio Grande	Acoustic	903	Rod	=2.103N + 0.034	1.00	=2.117N + 0.020	3-22-44	611-42-7
Rio Grande	A	1066	Rod, double end hanger	=2.209N + 0.023	1.00	=2.198N + 0.034	3-22-44	611-42-7
			5.3" above 15# Columbus	=2.197N + 0.021	1.00	=2.171N + 0.047	3-22-44	611-42-7
Klamath	A	1067	Rod, double end hanger	=2.284N + 0.027	1.00	=2.276N + 0.035	3-22-44	611-42-7
			4.9" above 30# Columbus	=2.312N + 0.028	1.00	=2.297N + 0.043	3-22-44	611-42-7
Proj. Planning	A	4042	Rod, double end hanger	=2.259N + 0.027	1.00	=2.241N + 0.045	3-22-44	611-42-10
Proj. Planning	A	1051	Rod, double end hanger	=2.208N + 0.024	1.00	=2.216N + 0.016	3-22-44	611-42-10
			4.9" above 30# Columbus	=2.199N + 0.034	1.00	=2.226N + 0.007	3-22-44	611-42-10
Proj. Planning	A	1003	Rod, double end hanger	=2.258N + 0.021	1.00	=2.237N + 0.042	3-22-44	611-42-10
			4.9" above 30# Columbus	=2.250N + 0.030	1.00	=2.264N + 0.016	3-22-44	611-42-10
Rio Grande	Acoustic	931	Rod	=2.127N + 0.029	1.00	=2.161N - 0.005	3-25-44	611-43-4
Rio Grande	Acoustic	932	Rod	=2.127N + 0.032	1.00	=2.150N + 0.009	3-25-44	611-43-4
Rio Grande	Acoustic	933	Rod	=2.154N + 0.035	1.00	=2.174N + 0.015	3-25-44	611-43-4
Rio Grande	Acoustic	4000	Rod	=2.106N + 0.037	1.00	=2.184N - 0.041	3-25-44	611-43-4
Rio Grande	Acoustic	4005	Rod	=2.121N + 0.037	1.00	=2.167N - 0.009	3-25-44	611-43-4
Rio Grande	Acoustic	4024	Rod	=2.190N + 0.031	1.00	=2.215N + 0.006	3-25-44	611-43-4
Rio Grande	Acoustic	4029	Rod					
Rio Grande	Acoustic	4053	Rod	=2.228N + 0.036	1.00	=2.245N + 0.019	3-25-44	611-43-4
Rio Grande	A	4056	Rod, double end hanger	=2.277N + 0.025	1.00	=2.266N + 0.036	3-25-44	611-43-4
			6.7" above 15# E.	=2.313N + 0.024	1.00	=2.291N + 0.046	3-25-44	611-43-4
			6.7" above 30# E.	=2.333N + 0.017	1.00	=2.317N + 0.033	3-25-44	611-43-4
Yakima	A	1068	Rod, double end hanger	=2.264N + 0.019	1.00	=2.220N + 0.063	3-4-44	611-43-1
			4.9" above 30# Columbus	=2.262N + 0.023	1.00	=2.241N + 0.044	3-4-44	611-43-1
			5.3" above 15# Columbus	=2.232N + 0.024	1.00	=2.226N + 0.030	3-4-44	611-43-1
Provo	A	[illegible]58	Rod, double end hanger	=2.320N + 0.023	1.00	=2.252N + 0.091	3-25-44	611-43-4
			4.9" above 30# Columbus	=2.287N + 0.023	1.00	=2.300N + 0.010	3-25-44	611-43-4
Hyd.Lab.	Mod. 616	875	Rod	=2.173N + 0.025	1.00	=2.192N + 0.006	4-15-44	611-44-6
Hyd.Lab.	A	4059	Rod, double end hanger	=2.258N + 0.021	---	---	5-13-44	611-45-2
			5.3" above 15# Columbus	=2.238N + 0.021	1.00	=2.250N + 0.009	5-13-44	611-45-2
			4.9" above 30# Columbus	=2.283N + 0.020	---	---	5-13-44	611-45-2
Hyd.Lab.	A	1055	Rod, double end hanger	=2.232N + 0.014	1.00	=2.224N + 0.022	5-13-44	611-45-2
			5.3" above 15# Columbus	=2.215N + 0.028	---	---	5-13-44	611-45-2
			4.9" above 30# Columbus	=2.251N + 0.022	1.00	=2.239N + 0.034	5-13-44	611-45-2
Hyd.Lab.	A	1069	Rod, double end hanger	=2.196N + 0.026	---	---	5-13-44	611-45-2
			5.3" above 15# Columbus	=2.159N + 0.031	1.00	=2.183N + 0.007	5-13-44	611-45-2
			4.9" above 30# Columbus	=2.185N + 0.035	1.00	=2.200N + 0.020	5-13-44	611-45-2
Yakima	A	1070	Rod, double end hanger	=2.168N + 0.015	1.00	=2.150N + 0.033	5-13-44	611-45-2
			5.3" above 15# Columbus	=2.138N + 0.011	1.00	=2.154N - 0.005	5-13-44	611-45-2
				=2.172N + 0.025	0.50			
			4.9" above 30# Columbus	=2.136N + 0.043	1.00	=2.157N + 0.022	5-13-44	611-45-2
Project Planning Pueblo	A	1053	Rod suspension	=2.219N + 0.021	1.00	=2.228N + 0.012	6-21-44	611-46-4
Yakima	A	1071	Rod, double end hanger	=2.219N + 0.013	1.00	=2.198N + 0.034	6-21-44	611-46-4
			5.3" above 15# Columbus	=2.179N + 0.026	1.00	=2.185N + 0.020	6-21-44	611-46-4
			4.9" above 30# Columbus	=2.225N + 0.012	1.00	=2.209N + 0.028	6-21-44	611-46-4
Hyd.Lab.	A	1072	Rod, double end hanger	=2.271N + 0.021	1.00	=2.253N + 0.039	6-21-44	611-46-4
			5.3" above 15# Columbus	=2.215N + 0.023	1.00	=2.238N	6-21-44	611-46-4
			4.9" above 30# Columbus	=2.274N + 0.023	1.00	=2.268N + 0.029	6-21-44	611-46-4
Hyd.Lab.	A	1073	Rod, double end hanger	=2.198N + 0.021	1.00	=2.197N + 0.012	6-21-44	611-46-4
			5.3" above 15# Columbus	=2.149N + 0.032	1.00	=2.181N	6-21-44	611-46-4
			4.9" above 30# Columbus	=2.196N + 0.014	1.00	=2.190N + 0.020	6-21-44	611-46-4
Rio Grande	Penta 621	4010	Rod, double end hanger	=2.194N + 0.023	---	---	6-23-44	611-46-9
			4.9" above 30# Columbus	=2.173N + 0.038	1.00	=2.201N + 0.010	6-23-44	611-46-9
			9.8" above 50# Columbus	=2.144N + 0.062	1.00	=2.185N + 0.021	6-23-44	611-46-9
Rio Grande	A	4073	Rod, double end hanger	=2.277N + 0.021	---	---	6-23-44	611-46-9
			5.3" above 15# Columbus	=2.276N + 0.024	1.00	=2.248N + 0.052	6-23-44	611-46-9
			4.9" above 30# Columbus	=2.294N + 0.028	1.00	=2.313N + 0.009	6-23-44	611-46-9
Rio Grande	616	908	Rod	=2.104N + 0.024	1.00	=2.144N - 0.016	7-5-44	611-46-18
Rio Grande	616	4012	Rod	=2.113N + 0.027	1.00	=2.140N	7-5-44	611-46-18
Rio Grande	A	4064	Rod, double end hanger	=2.307N + 0.015	---	---	7-5-44	611-46-18
			4.9" above 30# Columbus	=2.327N + 0.021	1.00	=2.341N + 0.007	7-5-44	611-46-18
Rio Grande	621	737	Rod, double end hanger	=2.14N + 0.02	1.00	=2.17N - 0.01	11-27-42	611-211-7
Rio Grande	621	852	Rod, double end hanger	=2.12N + 0.03	1.00	=2.14N + 0.01	10-8-42	611-29-12
Rio Grande	621	4013	Rod, double end hanger	=2.19N + 0.02	---	---	10-8-42	611-29-12
North Platte	A	4037	Rod, double end hanger	=2.229N + 0.021	1.00	=2.245N + 0.005	7-5-44	611-46-18
All-American	A	1028	Rod, Double end hanger	=2.148N + 0.015	1.00	=2.163N	7-12-44	611-47-1
			5.3" above 15# Columbus	=2.108N + 0.028	1.00	=2.166N - 0.030	7-12-44	611-47-1
			4.9" above 30# Columbus	=2.143N + 0.025	1.00	=2.149N + 0.019	7-12-44	611-47-1

CURRENT METER RATING RECORD

Project	Type	Meter No.	Method of Rating	Equation	N	Equation	Date	Test No.
Project Planning	A	1004	Rod, double end hanger	V=2.170N + 0.017	1.00	V=2.184N + 0.005	7-22-44	611-47-5
Central Valley	A	1012	Rod, double end hanger	=2.222N + 0.010			7-22-44	611-47-5
			5.3" above 15# Columbus	=2.186N + 0.011	1.00	=2.220N - 0.021		
			4.9" above 30# Columbus	=2.219N + 0.016	1.00	=2.235N		
Hydraulic Lab.	A	1074	Rod, double end hanger	=2.194N + 0.017	1.00	=2.186N + 0.025	7-22-44	611-47-5
			5.3" above 15# Columbus	=2.179N + 0.009				
			4.9" above 30# Columbus	=2.178N + 0.032	1.00	=2.173N + 0.037		
Hydraulic Lab.	A	1075	Rod, double end hanger	=2.185N + 0.020	1.00	=2.178N + 0.027	7-22-44	611-47-5
			5.3" above 15# Columbus	=2.157N + 0.023	1.00	=2.174N + 0.006		
			4.9" above 30# Columbus	=2.197N + 0.016	1.00	=2.179N + 0.034		
Hydraulic Lab.	A	1076	Rod, double end hanger	=2.180N + 0.016	1.00	=2.149N + 0.037	8-25-44	611-48-11
			5.3" above 15# Columbus	=2.158N + 0.021	1.00	=2.149N + 0.031		
			4.9" above 30# Columbus	=2.180N + 0.022	1.00	=2.168N + 0.034		
Hydraulic Lab.	A	1077	Rod, double end hanger	=2.179N + 0.020	1.00	=2.190N + 0.009	8-25-44	611-48-11
			5.3" above 15# Columbus	=2.148N + 0.025	1.00	=2.190N - 0.017		
			4.9" above 30# Columbus	=2.169N + 0.036	1.00	=2.209N - 0.014		
Hydraulic Lab.	A	1078	Rod, double end hanger	=2.197N + 0.016	1.00	=2.179N + 0.034	8-25-44	611-48-11
			5.3" above 15# Columbus	=2.165N + 0.021	1.00	=2.179N + 0.007		
			4.9" above 30# Columbus	=2.189N + 0.021	1.00	=2.198N + 0.011		
Hydraulic Lab.	A	1079	Rod, double end hanger	=2.221N + 0.019			8-25-44	611-48-11
			5.3" above 15# Columbus	=2.188N + 0.024	1.00	=2.221N - 0.008		
			4.9" above 30# Columbus	=2.212N + 0.024	1.00	=2.240N - 0.004		
All-American Canal	A	4080	Rod, double end hanger	=2.288N + 0.014			9-12-44	611-49-2
			4.9" above 30# Columbus	=2.277N + 0.020	1.00	=2.308N - 0.011		
			9.8" above 50# Columbus	=2.271N + 0.019	1.00	=2.285N + 0.025		
Hydraulic Lab.	A	1002	Rod with sliding support	=2.231N + 0.021			10- 7-44	611-49-12
			5.3" above 15# Columbus	=2.196N + 0.036	1.00	=2.251N - 0.006		
			4.9" above 30# Columbus	=2.220N + 0.027	1.00	=2.251N - 0.004		
Hydraulic Lab.	A	1029	Rod with sliding support	=2.210N + 0.015	1.00	=2.192N + 0.033	10- 7-44	611-49-12
			5.3" above 15# Columbus	=2.177N + 0.021	1.00	=2.192N + 0.008		
			4.9" above 30# Columbus	=2.200N + 0.021	1.00	=2.211N + 0.010		
Hydraulic Lab.	A	1060	Rod with sliding support	=2.169N + 0.019			10- 7-44	611-49-12
			5.3" above 15# Columbus	=2.159N + 0.023	1.00	=2.169N - 0.007		
			4.9" above 30# Columbus	=2.160N + 0.024	1.00	=2.189N - 0.004		
Hydraulic Lab.	A	1080	Rod with sliding support	=2.193N + 0.027	1.00	=2.215N + 0.007	10- 7-44	611-49-12
			5.3" above 15# Columbus	=2.161N + 0.032	1.00	=2.215N - 0.020		
			4.9" above 30# Columbus	=2.184N + 0.032	1.00	=2.232N - 0.016		
Grand Valley	Acoustic	921	Rod	=2.151N + 0.029	1.00	=2.175N - 0.015	10-24-44	611-410-6
Hydraulic Lab.	Acoustic	4029	Rod	=2.176N + 0.028	1.00	=2.202N + 0.006	10-24-44	611-410-8
Yuma	A	1048	Rod, double end hanger	=2.147N + 0.027	1.00	=2.167N + 0.007	10-25-44	611-410-9
			4.9" above 30# Columbus	=2.157N + 0.033	1.00	=2.186N - 0.016		
			9.8" above 50# Columbus	=2.151N + 0.032	1.00	=2.145N + 0.018		
Yuma	Acoustic	4031	Rod	=2.178N + 0.030	1.00	=2.197N + 0.011	10-25-44	611-410-9
Riverton	Acoustic	873	Rod	=2.129N + 0.030	1.00	=2.159N	11- 9-44	611-410-16
Hydraulic Lab.	A	1086	Rod with sliding support	=2.286N + 0.024	1.00	=2.294N + 0.015	11- 9-44	611-410-16
			5.3" above 15# Columbus	=2.252N + 0.029	1.00	=2.294N - 0.015		
			4.9" above 30# Columbus	=2.275N + 0.029	1.00	=2.314N - 0.010		
Hydraulic Lab.	A	1058	Rod with sliding support	=2.187N + 0.022	1.00	=2.194N + 0.015	11- 9-44	611-410-16
			5.3" above 15# Columbus	=2.155N + 0.027	1.00	=2.194N - 0.012		
			4.9" above 30# Columbus	=2.177N + 0.028	1.00	=2.213N - 0.008		
Hydraulic Lab.	A	1082	Rod with sliding support	=2.208N + 0.018	1.00	=2.202N + 0.024	11- 9-44	611-410-16
			5.3" above 15# Columbus	=2.176N + 0.023	1.00	=2.202N - 0.003		
			4.9" above 30# Columbus	=2.196N + 0.023	1.00	=2.221N + 0.001		
Hydraulic Lab.	A	4088	Rod with sliding support	=2.325N + 0.020			11- 9-44	611-410-16
			5.3" above 15# Columbus	=2.289N + 0.026	1.00	=2.323N - 0.008		
			4.9" above 30# Columbus	=2.312N + 0.026	1.00	=2.343N - 0.005		
Hydraulic Lab.	A	1049	Rod with sliding support	=2.196N + 0.025	1.00	=2.226N - 0.005	11- 6-44	611-411-6
			4.9" above 30# Columbus	=2.186N + 0.031	1.00	=2.245N - 0.028		
Hydraulic Lab.	A	1049	Rod with sliding support	=2.196N + 0.027	1.00	=2.206N + 0.017	12- 1-44	611-411-12
			5.3" above 15# Columbus	=2.164N + 0.032	1.00	=2.206N - 0.010		
			4.9" above 30# Columbus	=2.167N + 0.032	1.00	=2.225N - 0.006		
Hydraulic Lab.	A	1057	Rod with sliding support	=2.171N + 0.024	1.00	=2.165N + 0.010	12- 1-44	611-411-12
			5.3" above 15# Columbus	=2.140N + 0.029	1.00	=2.165N - 0.016		
			4.9" above 30# Columbus	=2.161N + 0.030	1.00	=2.204N - 0.013		
Hydraulic Lab.	A	1041	Rod with sliding support	=2.189N + 0.024			12- 1-44	611-411-12
			5.3" above 15# Columbus	=2.157N + 0.029	1.00	=2.164N - 0.005		
			4.9" above 30# Columbus	=2.180N + 0.029	1.00	=2.206N + 0.001		
Hydraulic Lab.	A	4071	Rod with sliding support	=2.231N + 0.019	1.00	=2.220N + 0.030	12- 1-44	611-411-12
			5.3" above 15# Columbus	=2.199N + 0.024	1.00	=2.220N + 0.003		
			4.9" above 30# Columbus	=2.221N + 0.025	1.00	=2.239N + 0.007		
All-American Canal	A	1010	Rod with sliding support	=2.316N + 0.016	1.00	=2.262N + 0.052	12-11-44	611-412-4
			4.9" above 30# Columbus	=2.305N + 0.024	1.00	=2.302N + 0.027		
			9.8" above 50# Columbus	=2.299N + 0.023	1.00	=2.256N + 0.064		

CURRENT METER RATING RECORD

Project	Type	Meter No.	Method of Rating	Equation	N	Equation	Date	Test No.
Riverton	Acoustic	873	Rod	V=2.129N + 0.030	1.00	V=2.159N	11- 9-44	611-410-18
Yakima	A	1063	Rod with sliding support	=2.179N + 0.026	1.00	=2.164N + 0.023	12-15-44	611-412-5
Tucumcari	A	1047	Rod with sliding support	=2.175N + 0.024	1.00	=2.196N + 0.001	12-16-44	611-412-10
			5.3" above 15# Columbus	=2.144N + 0.029	1.00	=2.196N - 0.025		
			4.9" above 30# Columbus	=2.165N + 0.030	1.00	=2.217N - 0.022		
Hydraulic Lab.	A	1083	Rod with sliding support	=2.133N + 0.027	1.00	=2.155N + 0.005	2- 2-45	611-51-1
			5.3" above 15# Columbus	=2.103N + 0.031	1.00	=2.155N - 0.021		
			4.9" above 30# Columbus	=2.124N + 0.032	1.00	=2.174N - 0.016		
Hydraulic Lab.	A	1084	Rod with sliding support	=2.193N + 0.025	1.00	=2.169N + 0.049	2- 2-45	611-51-1
			5.3" above 15# Columbus	=2.161N + 0.030	1.00	=2.169N + 0.022		
			4.9" above 30# Columbus	=2.164N + 0.030	1.00	=2.166N + 0.026		
Hydraulic Lab.	A	1085	Rod with sliding support	=2.213N + 0.023	1.00	=2.201N + 0.035	2- 2-45	611-51-1
			5.3" above 15# Columbus	=2.161N + 0.026	1.00	=2.201N + 0.008		
			4.9" above 30# Columbus	=2.204N + 0.026	1.00	=2.220N + 0.012		
Hydraulic Lab.	A	1086	Rod with sliding support	=2.201 + 0.029			2- 2-45	611-51-1
			5.3" above 15# Columbus	=2.169N + 0.034	1.00	=2.201N + 0.002		
			4.9" above 30# Columbus	=2.192N + 0.034	1.00	=2.220N + 0.006		
Yakima	A	1063	Rod with sliding support	=2.163N + 0.025			1- 9-45	611-51-7
			5.3" above 15# C.wt.	=2.152N + 0.030	1.00	=2.163N - 0.001		
			4.9" above 30# C.wt.	=2.173N + 0.031	1.00	=2.202N + 0.002		
Rio Grande	A	4065	Rod with sliding support	=2.316N + 0.024	1.00	=2.340N	2-13-45	611-52-3
			4.9" above 30# C.wt.	=2.305N + 0.030	1.00	=2.360N - 0.025		
			9.8" above 50# C.wt.	=2.299N + 0.029	1.00	=2.316N + 0.012		
Rio Grande	A	4072	4.9" above 30# C.wt.	=2.272N + 0.029	1.00	=2.269N + 0.012	2-13-45	611-52-3
			9.8" above 50# C.wt.	=2.265N + 0.029	1.00	=2.246N + 0.046		
Rio Grande	Acoustic	4001	Rod	=2.131N + 0.039	1.00	=2.176N - 0.006	2-13-45	611-52-3
Rio Grande	Acoustic	4051	Rod	=2.216N + 0.032	1.00	=2.277N - 0.027	2-13-45	611-52-3
Rio Grande	Modified	4030	Rod	=2.171N + 0.031	1.00	=2.233N - 0.031	2-13-45	611-52-3
Rio Grande	Modified	4050	Rod	=2.145N + 0.035	1.00	=2.187N - 0.007	2-13-45	611-52-3
Hydraulic Lab.	Modified	4006	Rod	=2.163N + 0.026	1.00	=2.199N - 0.010	2-26-45	611-52-7
Hydraulic Lab.	Modified	4007	Rod	=2.265N + 0.038	1.00	=2.296N + 0.007	2-26-45	611-52-7
Hydraulic Lab.	Modified	4008	Rod	=2.140N + 0.030	1.00	=2.207N - 0.037	2-26-45	611-52-7
Hydraulic Lab.	Modified	4009	Rod	=2.160N + 0.033	1.00	=2.201N - 0.008	2-26-45	611-52-7
Hydraulic Lab.	Modified	4032	Rod	=2.157N + 0.033	1.00	=2.200N - 0.010	2-26-45	611-52-7
Hydraulic Lab.	Modified	4034	Rod	=2.193N + 0.031	1.00	=2.241N - 0.017	2-26-45	611-52-7
Yakima	A	1081	Rod with sliding support	=2.166N + 0.023			2-28-45	611-52-11
			4.9" above 30# Columbus	=2.156N + 0.029	1.00	=2.185N		
			9.8" above 50# Columbus	=2.149N + 0.029	1.00	=2.144N + 0.034		
Yakima	A	1087	Rod with sliding support	=2.213N + 0.025	1.00	=2.254N - 0.016	2-28-45	611-52-11
			4.9" above 30# Columbus	=2.204N + 0.030	1.00	=2.273N - 0.039		
			9.8" above 50# Columbus	=2.197N + 0.030	1.00	=2.231N - 0.004		
Central Valley	Hoff	200	3-blade propeller & ½" rod	=0.913N + 0.100	1.12	=0.863N + 0.156	3-10-45	611-53-9
					2.60	=0.911N + 0.071		
			4-blade propeller & ½" rod	=0.834N + 0.086	0.64	=0.918N + 0.032		
					2.60	=0.923N + 0.019		
Hydraulic Lab.	A	1088	Rod with sliding support	=2.305N + 0.027			3-9-45	611-53-6
			5.3" above 15# Columbus	=2.272N + 0.032	1.00	=2.305N - 0.001		
			4.9" above 30# Columbus	=2.295N + 0.032	1.00	=2.325N + 0.002		
Hydraulic Lab.	A	1089	Rod with sliding support	=2.305N + 0.034	1.00	=2.315N + 0.024	3-9-45	611-53-6
			5.3" above 15# Columbus	=2.272N + 0.039	1.00	=2.315N - 0.004		
			4.9" above 30# Columbus	=2.295N + 0.039	1.00	=2.335N - 0.001		
Hydraulic Lab.	A	1090	Rod with sliding support	=2.274N + 0.024	1.00	=2.287N + 0.011	3-9-45	611-53-6
			5.3" above 15# Columbus	=2.240N + 0.030	1.00	=2.287N - 0.017		
			4.9" above 30# Columbus	=2.263N + 0.030	1.00	=2.307N - 0.014		
Hydraulic Lab.	A	1091	Rod with sliding support	=2.299N + 0.030			3-9-45	611-53-6
			5.3" above 15# Columbus	=2.265N + 0.036	1.00	=2.299N + 0.002		
			4.9" above 30# Columbus	=2.288N + 0.036	1.00	=2.319N + 0.005		
Hydraulic Lab.	A	1092	Rod with sliding support	=2.292N + 0.031	1.00	=2.331N - 0.008	3-27-45	611-53-14
			5.3" above 15# Columbus	=2.259N + 0.036	1.00	=2.331N - 0.036		
			4.9" above 30# Columbus	=2.281N + 0.037	1.00	=2.351N - 0.033		
Hydraulic Lab.	A	1093	Rod with sliding support	=2.282N + 0.032	1.00	=2.322N - 0.008	3-27-45	611-53-14
			5.3" above 15# Columbus	=2.248N + 0.038	1.00	=2.322N - 0.036		
			4.9" above 30# Columbus	=2.271N + 0.038	1.00	=2.342N - 0.033		
Hydraulic Lab.	A	1094	Rod with sliding support	=2.282N + 0.026	1.00	=2.287N + 0.021	3-27-45	611-53-14
			5.3" above 15# Columbus	=2.248N + 0.032	1.00	=2.287N - 0.007		
			4.9" above 30# Columbus	=2.271N + 0.032	1.00	=2.307N - 0.004		
Hydraulic Lab.	A	1095	Rod with sliding support	=2.306N + 0.032	1.00	=2.301N + 0.037	3-27-45	611-53-14
			5.3" above 15# Columbus	=2.272N + 0.038	1.00	=2.301N + 0.009		
			4.9" above 30# Columbus	=2.295N + 0.038	1.00	=2.321N + 0.012		

ABSTRACT OF CORRESPONDENCE

April 17, 1942	- Director of the Geological Survey to Commissioner of Bureau of Reclamation. Request for relief of responsibility for repair of current meters due to lack of capable personnel.
April 24, 1942	- Commissioner to Chief Engineer with copies to Director of Power, Boulder City, Nevada; Superintendent, El Paso, Texas; District Engineer, Sacramento, California; and Superintendent, Yakima, Washington. Request for comments and suggestions.
May 5, 1942	- Chief Engineer to Commissioner. Suggestion that repairs of current meters be handled in laboratory shop and hydraulic laboratory.
May 15, 1942	- Commissioner to Chief Engineer. Approval of repair of meters in Denver office with rating done in Denver under certain conditions, otherwise by Bureau of Standards as in the past.
May 15, 1942	- Commissioner to Director of Geological Survey. Instructions to ship current meters and repair parts to Denver office.
May 23, 1942	- Director of Geological Survey to Commissioner. Transmitting current meters and repair parts.
May 26, 1942	- Commissioner to Chief Engineer. Transmitting current-meter records available in Washington office.
May 29, 1942	- Commissioner to Chief Engineer. List of current meters on record in Washington office; present practice of numbering meters; instructions on BR-1062 and 1063, and on five meters on order from David White Co., Milwaukee, Wisconsin; and tabulation of information furnished each project on requests for ratings.
June 25, 1942	- General Order No. 1282. Repair and rating of current meters. Instructions for shipping. Form letter of instructions.
July 3, 1942	- Chief Engineer to Commissioner. Progress report on current-meter repair.
July 18, 1942	- Chief Engineer to Director of Geological Survey. Request for information on alloy A-metal for current-meter pivots and bearings.

July 24, 1942 - Director of Geological Survey to Chief Engineer. Reply to letter of July 18, 1942. A-metal available Universal Cyclops Steel Corporation, Titusville, Pennsylvania. Reference to article in Civil Engineering, July 1933, by R. L. Atkinson. A-metal rods should be 1/8-inch oversize to prevent heat-treatment cracks.

August 14, 1942 - Purchasing Agent to Universal Cyclops Steel Corporation. Inquiry of availability of A-metal, A-20, 136-T, August 27, 1942.

October 30, 1942 - Director of Bureau of Standards to Chief Engineer. Discussion of our complaint of unsatisfactory condition of meters.

February 12, 1943 - Director of Geological Survey to Chief Engineer. Reply to inquiry of February 1, 1943, concerning current-meter sounding weights and methods of current-meter suspensions. Transmitted prints of 15-, 30-, 50-, and 75-pound Columbus weights.

August 25, 1943 - Assistant Chief Designing Engineer to Superintendent, Yakima, Washington. Discussion of bad condition of meter BR-4039, and request for recall of obsolete meters.

November 10, 1943 - J. E. Warnock to D. M. Forester. Bad condition of meter BR-4063 from Grants Pass, Oregon.

November 15, 1943 - General Order No. 1491. Concerning vouchers, appropriation symbols, and title chargeable. Revival of General Order No. 283 covering annual inventory of current meters.

December 30, 1943 - Chief Engineer to Regional Director, Sacramento, California. Discussion of poor condition of equipment as received, particularly poor condition of pivots. Noted recent repair and rating of meters by University of California.

January 5, 1944 - Assistant Chief Designing Engineer to Superintendent, Powell, Wyoming. Plans for recalling old equipment.

January 11, 1944 - J. E. Warnock to D. M. Forester. Transfer of repair parts to hydraulic laboratory.

January 20, 1944 - G. H. Bolt to L. J. Moran. Claim for damage to current meter BR-1023 by express company.

February 1, 1944 - Assistant Chief Designing Engineer to Superintendent, El Paso, Texas. Recall of old equipment to be replaced by modern equipment. Similar letter to Yakima on January 9, 1944.

March 1, 1944 - Assistant Chief Designing Engineer to Superintendent, Yakima, Washington. Reply to project letter relating unsatisfactory experience with type A meter.

March 27, 1944 - Assistant Chief Designing Engineer to Superintendent, El Paso, Texas. Repair of acoustic current meters. Request for trial of BR-875, a modified 616 meter.

June 3, 1944 - J. E. Warnock to J. O. Daniel. Salvage of obsolete current meters.

October 3, 1944 - Acting Assistant Director to Superintendent, Grand Junction, Colorado. Salvage of obsolete current meter BR-799. Similar letter to Yuma, October 6, 1944.

October 7, 1944 - Chief Clerk to Regional Director, Sacramento, California. Renumbering 822 series meters.

January 24, 1945 - Chief Clerk, Branch of Fiscal and Administrative Management, Sacramento, California. To rectify error of shipments of meter equipment to Amarillo, Texas, and Sacramento, California.