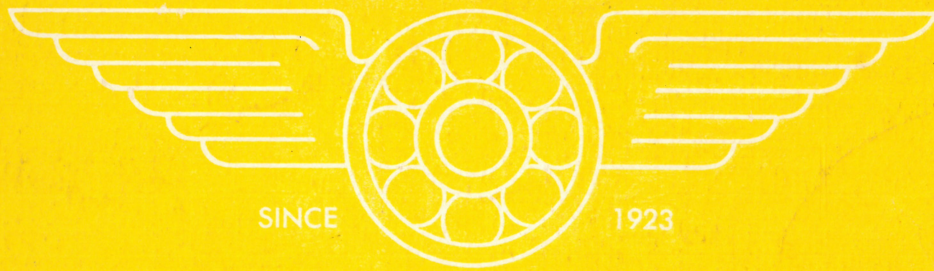


MINIATURE BALL BEARINGS

CATALOG
49

For precision mechanisms

MPB



RADIAL



PIVOT



THRUST



ANGULAR CONTACT

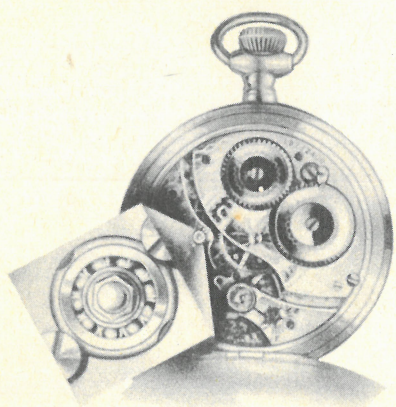
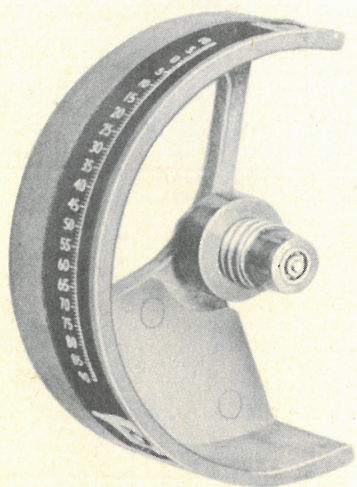
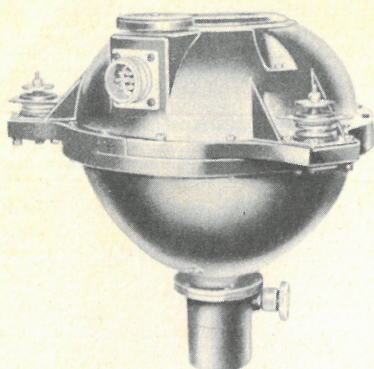


SPECIAL TO ORDER

MINIATURE PRECISION BEARINGS

INCORPORATED

KEENE, NEW HAMPSHIRE, U. S. A.



for 20 years

M P B is proud that for more than twenty years our bearings have contributed to the operation of precision devices manufactured not only in large quantities, but have also been found useful in research and development work where a limited quantity of mechanisms has been produced.

engineering service

Back of M P B bearings, and available for assistance in solution of your bearing problems are a wealth of engineering experience and practical knowledge acquired from years of association with the anti-friction bearing industry, and intimate contact with a variety of original mechanical developments. Our completely air-conditioned plant is equipped with the most modern machinery, gauging, inspection and quality control methods. Technical assistance is offered on any bearing problem not covered herein (it is of course impossible to make this a complete catalog) and we are fully equipped to design and fabricate special bearings.

more than 40

A few applications of our bearings are shown in the center of this page and in the pages following will be found full specifications on more than forty different types and sizes of M P B bearings which are normally available from stock.

3 metals

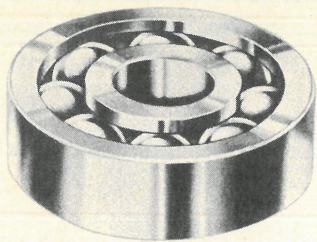
All M P B bearings are manufactured of high carbon chrome bearing steel (SAE52100) carefully inspected at each stage of fabrication. A number of bearings are also available in 440 stainless and beryllium copper — these are indicated on the next page. All balls are Grade 1 triple inspected.

close tolerances

M P B Bearings are only manufactured to high precision tolerances. Bearings which do not meet our exacting requirements are destroyed — not offered as a second line. It is poor economy — and even dangerous in critical instruments (in the aviation or medical field for instance) to compromise on anything less than the best. More than 20 years of fine bearing manufacture are your assurance of dependability when you specify M P B bearings.

who uses them

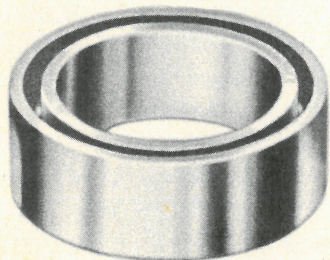
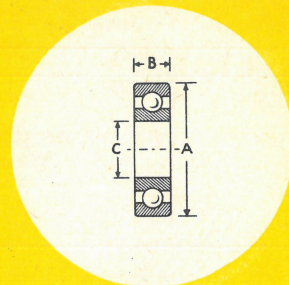
We can refer you to thousands of users of M P B bearings, probably to some in your own type of business. Some of our oldest customers include Bendix Aviation Corp., Fairchild Camera & Instrument Corp., General Electric Co., Sperry Gyroscope Co. etc.



radial series

The five bearings in this series range from $\frac{1}{8}$ " to $\frac{3}{16}$ " outside diameter, and are deep-groove, full-race, radial-type bearings of heavy duty design.

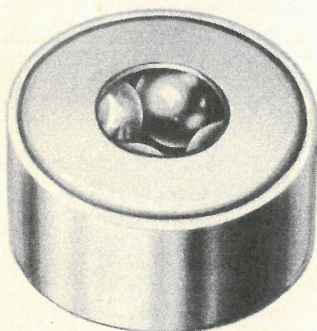
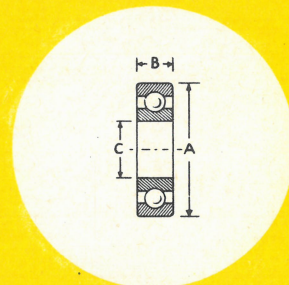
The races conform within extremely close limits to radii of curvature determined to combine large load capacity with a minimum of friction.



super-light series

A special radial series developed to accommodate larger shafts while retaining the small o. d. of $\frac{3}{16}$ " and $\frac{1}{4}$ ". Bores range from $\frac{1}{8}$ " to $\frac{1}{32}$ " in the five sizes offered. Manufactured by the same methods and to the same tolerances as our standard radial series.

Substantially perfect operating concentricity is assured as an inherent part of the manufacturing processes we have devised, in which all annular surfaces of each raceway are finished at the same time, on a single setting. Dimensional tolerances and operating clearances are likewise held to extremely low limits.

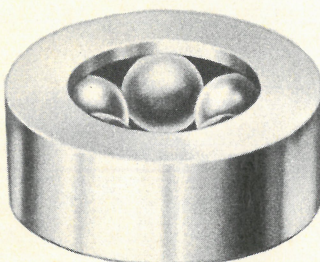
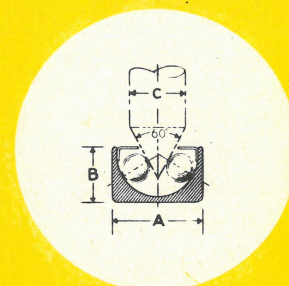


pivot series

To answer the need for a precision anti-friction bearing to fulfill the purpose of jewel pivots in applications where strength of the latter is insufficient, MPB developed this series of self-aligning pivot bearings.

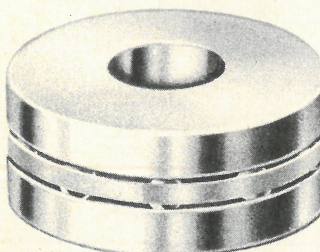
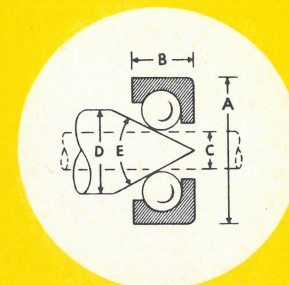
The usual application of pivot bearings is in opposed pairs, with adjustment for takeup at one end. The massive section under the raceway accommodates heavy loads and shock.

They may be run on 60° machined and hardened steel cones or, for the best performance and longest life on hardened and ground high-carbon chrome bearing steel cones.



angular contact series

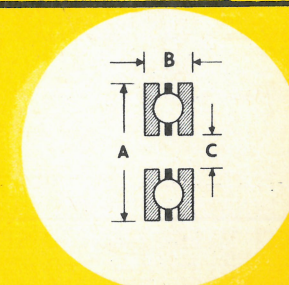
Offered in four sizes with self-retaining feature eliminating the friction effect of retainers and the need for caps. A versatile radial or thrust bearing of greater load capacity than the pivot series, with the advantage of complete selectivity for the optimum cone angle of a compound load, from 60° to a straight cylindrical through shaft.



thrust series

Demand for a low-friction miniature thrust bearing has led to our #2T and #4T. They fulfill the purposes of the familiar "thrust washer" types, with the advantages of the deep groove ball race feature for heavy duty capacity and the ability to carry location loads in the radial sense.

Accurate alignment of shaft at 90° to housing seat is important to insure full capacity of the bearing. For higher speeds or doubtful situations our Engineering Department should be consulted.



miniature precision bearings

actual sizes

Bearing No.	2		2½		★ 3		★ ▼ 4		★ ▼ 5	
O. D. (A)	1/8"	.1250"	5/32"	.1562"	3/16"	.1875"	1/4"	.2500"	5/16"	.3125"
Width (B)	3/64"	.0469"	1/16"	.0625"	5/64"	.0781"	3/32"	.0937"	7/64"	.1094"
Bore (C)	.0400"		3/64"		.0550"		5/64"		3/32"	
Balls	8 - 1/32"		10 - 1/32"		8 - 3/64"		8 - 1/16"		10 - 1/16"	
Fillets	.005"		.005"		.005"		.008"		.008"	
Weights (grams)	.035		.085		.15		.33		.69	
Load Rating (lbs.) 1000 rpm	1.8		2.4		4.8		9.0		10.0	
Load Rating (lbs.) 5000 rpm	1.16		1.4		3.0		5.8		6.4	

TOLERANCES (A) +.0000" - .0002" (B) +.000" - .001" (C) +.0000" - .0002" Eccentricity .0002" Max.

actual sizes

Bearing No.	★ 418		★ ▼ 518		★ 5532		★ 5632		★ 5732	
O. D. (A)	1/4"	.2500"	5/16"	.3125"	5/16"	.3125"	5/16"	.3125"	5/16"	.3125"
Width (B)	3/32"	.0937"	7/64"	.1094"	7/64"	.1094"	7/64"	.1094"	7/64"	.1094"
Bore (C)	1/8"	.1250"	1/8"	.1250"	5/32"	.1562"	3/16"	.1875"	7/32"	.2187"
Balls	15 - 1 mm.		11 - 1/16"		15 - 3/64"		16 - 3/64"		26 - 1/32"	
Fillets	.008"		.008"		.008"		.005"		.005"	
Weights (grams)	.28		.625		.56		.43		.36	
Load Rating (lbs.) 1000 rpm	5.6		6.3		5.6		5.6		3.8	
Load Rating (lbs.) 5000 rpm	3.4		4.4		3.6		3.6		2.5	

TOLERANCES SAME AS STANDARD RADIAL SERIES

actual sizes

Bearing No.	2P		3P		★ 4P		★ ▼ 5P		★ ▼ 7½P		★ ▼ 10P	
O. D. (A)	2mm.	.0787"	3mm.	.1181"	4mm.	.1575"	5mm.	.1968"	7.5mm.	.2953"	10mm.	.3937"
Width (B)	1.2mm	.0472"	1.8mm	.0709"	2.4mm.	.0945"	3mm.	.1181"	4.5mm.	.1772"	6mm.	.2362"
Shaft (C) Min.	.020"		.030"		.040"		.050"		.075"		.100"	
Balls	4 - 1/64"		4 - 1/32"		4 - 3/64"		4 - 1/16"		4 - 3/32"		4 - 1/8"	
Weights (grams)	.025		.080		.165		.32		1.00		2.56	
Load Rating (lbs.) T 1000 rpm	.29		1.1		3.1		5.8		13.		23.2	
Load Rating (lbs.) R 1000 rpm	.07		.46		1.2		2.3		5.2		9.0	
Load Rating (lbs.) T 5000 rpm	.18		.76		2.0		3.7		8.4		15.0	
Load Rating (lbs.) R 5000 rpm	.04		.30		.8		1.5		3.4		5.2	

TOLERANCES (A) +.0000" - .0002" (B) + or - .002" ECCENTRICITY DEPENDS ON SHAFT, RACEWAY AND O. D.

CONCENTRIC WITHIN .0002"

actual sizes

Bearing No.	2A		★ 3A		★ ▼ 4A		★ ▼ 6A	
O. D. (A)	1/8"	.1250"	3/16"	.1875"	1/4"	.2500"	3/8"	.3750"
Width (B)	3/64"	.0469"	.0700"		3/32"	.0937"	9/64"	.1406"
Shaft (C) Max.	.032"		.048"		.063"		.094"	
P Shaft (D) Min.	.042"		.062"		.085"		.124"	
Cone (E) Max.	60°		60°		60°		60°	
Balls	6 - 1/32"		6 - 3/64"		6 - 1/16"		6 - 3/32"	
Weights (grams)	.053		.17		.425		1.49	
Ld. Rat'g. (lbs.) R 1000 rpm	1.4		3.7		6.9		15.5	
Ld. Rat'g. (lbs.) 60° T 1000 rpm	1.7		4.7		8.7		19.0	

TOLERANCES (A) +.0000" - .0002" (B) +.000" - .002" Eccentricity Same As For Pivots.

Consult Engineering Department for other angles and speeds.

actual sizes

Bearing No.	2T		★ 4T	
O. D. (A)	1/8"	.1250"	1/4"	.2500"
Width (B)	1/16"	.0625"	3/32"	.0937"
Bore (C)	.0400"		3/32"	
Ball	8 - 1/32"		8 - 3/64"	
Weights (grams)	.065		.495	
Load Rating (lbs.) 1000 rpm	1.4		3.2	
Load Rating (lbs.) 5000 rpm	.9		2.0	

TOLERANCES (A) +.0000" - .0002" (B) +.000" - .002" (C) +.0002" - .0000"

Fillets: Inner and outer race corner radii for fillet clearance

Weights: Average dry weight in grams (1 gram = 0.00220462 lb.)

convenient bearing numbering system

radial bearings are numbered with reference to their outside diameter in 16ths of an inch thus # 2 has 2/16" o. d.

super-light bearings carry additional numbers — the first digit indicates the o. d. in 16ths of an inch (as above), the second digit should be read with a slant bar with the succeeding digits as a divisor indicating the bore, thus # 5532 = 5/16" o. d., 5/32" bore.

pivot bearings are numbered with reference to their outside diameter in millimeters — thus 4P has 4mm o. d.

angular contact and thrust bearings are catalogued by the same method as radial bearings (16ths of outside diameter).

prefixes indicate material: Standard material is high carbon chrome bearing steel (SAE 52100) with no prefix. Rockwell 60-64

★ Indicates also available in 440 Stainless. Order with prefix "SS"

▼ Indicates also available in Beryllium 25. Order with prefix "NM". Rockwell 42 prox.

suffixes indicate type of bearing

P — pivot
A — angular-contact
T — thrust

Load ratings given are for SAE 52100. Reduce by 15% for stainless and by 75% for beryllium. Weights given are for SAE 52100. Stainless and beryllium are only slightly different. Complete table on request.

design factors

selection of a bearing — must be tempered with considerable judgment. We urge users to submit full data on survey sheet (additional copies on request) for recommendations without obligation by our engineering department.

M P B load ratings — are derived from empirical formulae, contemplating a useful life of 5000 hours which will be reduced by unusual conditions of shock, dirt, temperature, lubrication, vibration, alignment, etc. Our own test results indicate they are conservative and when all characteristics of a given application are known it is possible to increase them considerably (maintaining of course an adequate safety factor). The ratings should be considered only as *general averages* for typical requirements and *not* as specific recommendations for any particular application. Thrust loads (in addition to radial loads) up to 50% of actual radial load applied are permissible with the radial limit unchanged.

static non-brinell ratings — because of the variety of conditions under which this might have to be considered, we prefer to have our engineering department give you advice on specific applications, however, an acceptable average rule is approximately 4x the 1000 rpm. rating.

shaft and housing fits — shaft tolerances of .0000-.0002" from nominal bearing bore size are recommended adhering as closely as possible to the upper range, to obtain a light press fit. The advantages of selective assembly may be used to accomplish this where necessary.

Housing bores should be +.0000 — .0002" of nominal bearing o. d. size favoring the lower range, and —.0003" may not be excessive in average machined housings.

Greater interference fits are admissible where mountings of more flexible materials such as aluminum, hard rubber, plastics, etc. are used.

Mounting should provide for slight axial movement of either the bearing or the shaft to allow for temperature variations and it should also be borne in mind that preload will be developed by heavy press fits which if required should be compensated for by adjustment of internal clearance.

The general rule is the greater the load and the higher the speed, the tighter the fit should be.

shaft shoulders — should not be above the land bore of the outer race and preferably not less than 2/3 the

typical applications

Shown to the right are some of the methods employed in utilizing M P B Bearings in precision mechanisms. These are offered merely to indicate a few of the many combinations possible. The designing engineer will appreciate that they represent only a fraction of the uses devised.



The basic support of a shaft between two radial bearings. If a step shaft, bearings of different bores might be selected. Or instead of radial bearings one or both bearings might be from the angular contact series.



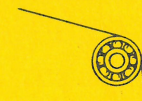
Here, one end of the shaft is supported by a pivot bearing — reducing the cost, and particularly valuable in a vertical shaft installation where thrust loads are encountered.

design variations

Miniature Precision Bearings, Inc. began operations many years ago as a manufacturer of special bearings. From this grew our standard lines of miniature ball bearings. We have continued year after year to do a great deal of custom designing and manufacturing of special bearings and parts. We invite the opportunity to work on special problems in this direction (within our size range).



Variations may be minor such as forming grooves of various shapes: semi-circular, V grooves, etc. in the outer races of standard bearings (o. d. may have to be increased to maintain safe section of outer race over ball groove).



These may be used for guiding wire, textile filaments, etc. Reversing the process, an outer race may be formed to follow a track. Special materials may be used in manufacture because of the nature of the application, such as silver plating of races, glass balls, etc.

width of the inner race land diameter, if used for axial location.

housing shoulders — should not be smaller than the land of the inner race and not larger than to expose 1/3 of the outer race. Collars may be used to increase or decrease shoulders and will be useful in removing bearings from their housings. Table of recommended shaft and housing sizes will be furnished on request.

tolerances

Tolerances stated (under each series of bearings) are inspection limit tolerances. They are in all respects equal to ABEC Grade 5 or better. We can supply, where required, bearings to even closer tolerances or select bearings at any position within the tolerance limits. We have supplied standard bearings with plus tolerances where normally negative tolerances would be indicated and vice versa.

Normal Tolerances, All Sizes (Inspection limits)

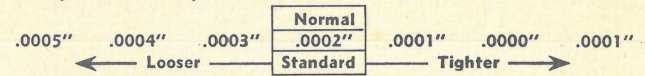
Bore	O. D.	Width	Eccentricity
Plus .0000"	Plus .0000"	Plus .000"	.0002" max.
Minus .0002"	Minus .0002"	Minus .001"	

Where required for special conditions, closer tolerances are available.

clearances

M P B Bearings are normally supplied with .0002"

radial clearance. We are glad however to vary this standard on request. We can furnish any of our bearings from negative (pre-load) clearance to maximum adjustment (flow-meter type). There is no additional charge for such variations, and our engineering department will be glad to consult with you on the applications where they may be indicated. Other than normal clearances should be specified on your order:



Axial clearances naturally vary with the amount of radial clearance to approximately .0018 at .0005". Since the axial clearance also depends on the size of balls and race curvature used in each bearing it is impossible to briefly summarize all possible combinations. Our bearings however are designed to give approximately .001 axial clearance at normal (.0002") radial clearance.

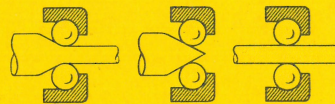
eccentricity

In all radial bearings the outer surface of the outer race and the bore of the inner race must, when installed, conform to the housing bore and shaft mounting (which of course must be perfect circles) irrespective of the heat treating distortion that may be released during grinding and finishing operations. An outstanding feature of M P B

Continued next page



Both ends of the shaft are supported by pivot bearings. The housings for these bearings may be misaligned to 4° without adversely affecting operation. Maximum thrust (and capacity of bearing) either to right or left. Provisions for adjusting fit of shaft should be made in the housing of one of the bearings.



Three uses of the angular contact bearing which may be used in conjunction with bearings from the radial, pivot or thrust series depending on the various design factors involved. Our engineering department is at all times anxious to assist you.



Bearings of any series may be fabricated, on special order, with integral flanges with assembly location advantages. The pivot type bearing above also has a two point contact seat.



Here the inner race is formed integral with the shaft, the outer being employed as a cam follower. Sometimes this is combined with the forming of the outer race as described in the illustrations to the left.



M P B Bearings are often employed as components of larger anti-friction movements. Illustrated, is a roller used in the glass industry. Maximum protection for the bearings is easily provided in an installation such as this.



Inner and outer races may be of different widths. Both, however, may be the same width but differing from standard. Double ball races may be specified.

bearings is the fact that due to the method of performing these operations at a single setting true concentricity is empirically assured in a mounted bearing.

We state the allowable eccentricity as .0002" (inspection limits). Occasionally a bearing is rejected by a customer not knowing of the above feature and erroneously assuming that a single measurement across the diameter is a valid check on the accuracy of the bearing.

pivot shafts

Though normally supplied by the customer we are prepared to undertake manufacture of pivot shafts to specifications. For best results pivots should be high carbon chrome steel, hardened and highly finished.

Where high precision and long life are not required, or where load and speed are light, machined, unhardened pivots may be used.

lubrication

Steel bearings are shipped in an excess of WS429 Aviation Instrument Oil. This oil is often suitable as an operating oil though of course should only be applied in minute quantities.

We recommend for semi-permanent lubrication, high

and low temperatures, etc. Elgin Watch Oil #M56b. Full specifications are available from the makers at Elgin, Illinois.

Research is currently being pursued on the use of other newly developed lubricants such as the silicones. We will be glad at any time to furnish you with latest information.

If your application requires provision for lubrication other than by obvious means, we suggest you write us giving full details. Methods such as reservoirs, wicking, oil mist, capillary attraction etc., which we have used may solve your problem.

Non-Magnetic bearings are packed dry and may be run without lubrication if necessary. Often the fluid in which they operate acts as a lubricant.

testing

In applying any coasting, vibration or "smoothness" tests to ball bearings it should be noted that bearings made of beryllium or stainless can never compare favorably with those fabricated of chrome bearing steel. This is predominately due to the nature of the material which cannot be hardened to such a high Rockwell and consequently will not accept as high a finish.

list of representatives

A representative, equipped with information on the latest developments, will be glad to call at your request.

Arizona	Phoenix	E. D. Maltby Co.	120 So. Fourth Ave.	3-3789
California	Los Angeles, 15	E. D. Maltby Co.	1718 South Flower St.	Richmond 7-9191
	San Diego, 2	E. D. Maltby Co.	1421 "B" St.	Franklin 6308
	San Francisco, 3	Albert M. Schweitzer	290 Ninth St.	Hemlock 1-2200
Connecticut	Springdale	Wm. L. Timmerman	15 Crestview Ave.	Stamford 4-7436
Illinois	Chicago, 5	Engis Equipment Co.	431 South Dearborn St.	Harrison 5176-77
Maryland	Baltimore	M. P. B., Inc.	50 Church St. (N. Y. C.)	Cortland 7-2863
Massachusetts	Cambridge, 40	Charles E. Washburne	1900 Mass. Ave.	Tr. 6-4660 Tr. 6-6178
Michigan	Detroit, 2	Richard O. Carter	6432 Cass Ave.	Madison 6300
Minnesota	Minneapolis, 15	Eiler Equipment Co.	637 Sexton Bldg.	Geneva 4275
	Buffalo, 8	Syracuse Bearing Co.	1541 Jefferson Ave.	Lincoln 4880
New York	New York, 7	M. P. B., Inc.	50 Church St. Rm. 2260	Cortland 7-2863
	Rochester, 13	Syracuse Bearing Co.	1459 Lake Ave.	Glenwood 2777
	Syracuse, 2	Syracuse Bearing Co.	415 E. Jefferson St.	3-1148
	Philadelphia	M. P. B., Inc.	50 Church St. (N. Y. C.)	Cortland 7-2863
Pennsylvania	Montreal, 3	Lyman Tube & Supply Co.	920 Ste. Sophie Lane	Lancaster 2145
	Toronto, 1	Lyman Tube & Supply Co.	309 Brock Bldg.	Adelaide 1471
	Vancouver	Lyman Tube & Supply Co.	850 W. Hastings St.	Marine 0934
England	London	Engis, Limited	25 Victoria St.	Abbey 2487
Hawaii	Honolulu	E. D. Maltby Co.	1358 Kapiolana Blvd.	Tel. 907115

"minimize with miniature"

FRICION, SPACE AND WEIGHT ARE MINIMIZED WHEN YOUR MECHANISMS ARE EQUIPPED WITH M P B BEARINGS

MAIN OFFICE & PLANT
Telephone Keene 2145

MINIATURE Precision BEARINGS
INCORPORATED
KEENE, NEW HAMPSHIRE, U. S. A.

CABLE—MINPREB

Printed
in U. S. A.

50M748