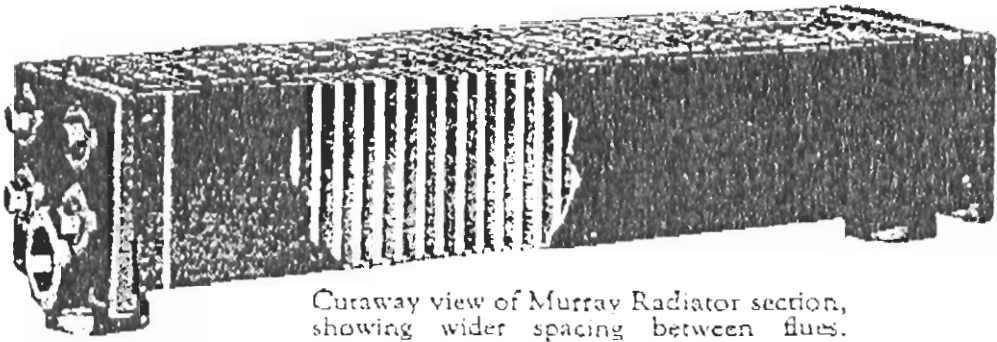
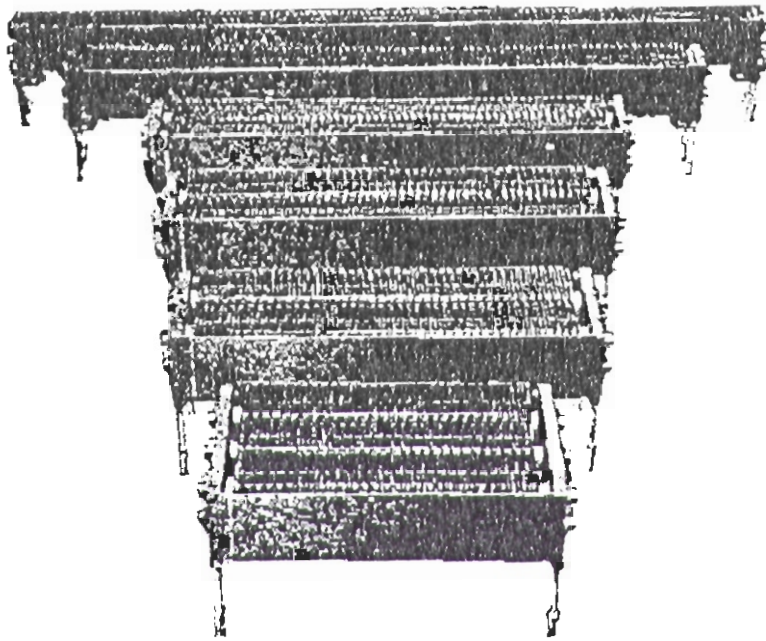


AMERICAN RADIATORS

NEW MURRAY RADIATORS



Cutaway view of Murray Radiator section, showing wider spacing between flues.

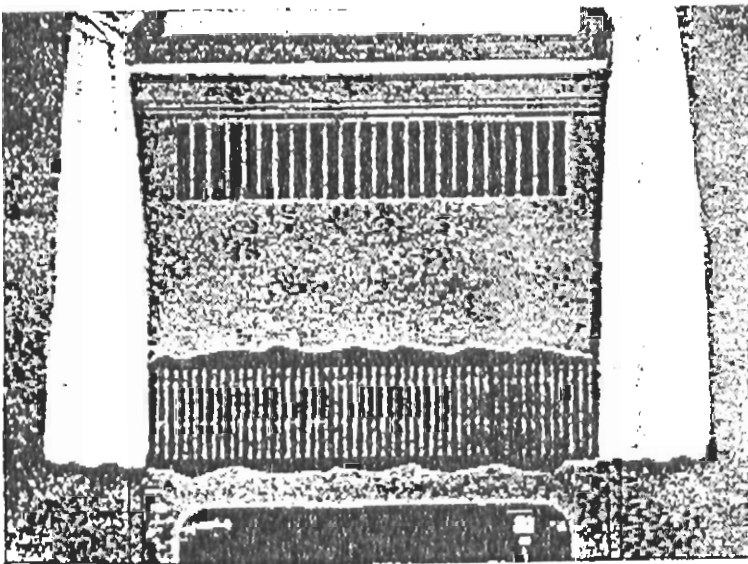


In the field of non-ferrous type radiation, the New Murray Radiator has achieved outstanding success. Years of designing and testing in our laboratories have placed it on a high level of service in point of efficient and hygienic operation.

The New Murray Radiator is made in six widths — No. 2, $2\frac{3}{8}$ " wide; No. 3, $3\frac{3}{4}$ " wide; No. 5, 5" wide; No. 6, $6\frac{3}{8}$ " wide; No. 7, $7\frac{3}{4}$ " wide; and No. 10, $10\frac{3}{8}$ " wide.

It is equally well adapted for one or two pipe steam, vapor or hot water systems and, when installed with Arco Enclosures, combines high heating efficiency with attractive appearance.

Arco Enclosures similar to those shown for the Arco Convector on pages 30-43, are made specially for New Murray Radiators. Correctly designed and proportioned, they assure ease of installation and utmost efficiency.

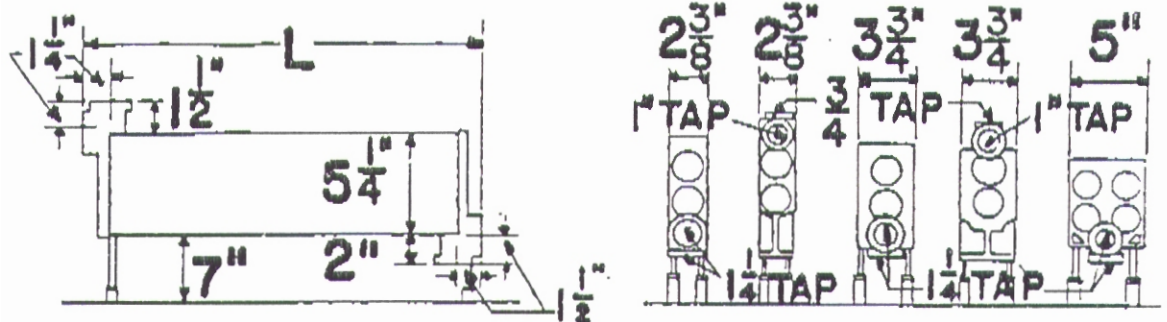


AMERICAN RADIATORS

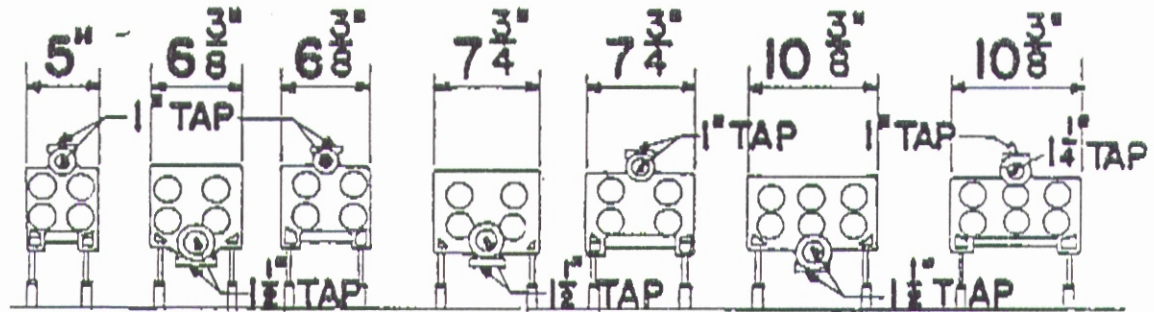
NEW MURRAY RADIATOR DIMENSIONS AND ASSEMBLAGES

TYPICAL RADIATOR ELEVATION

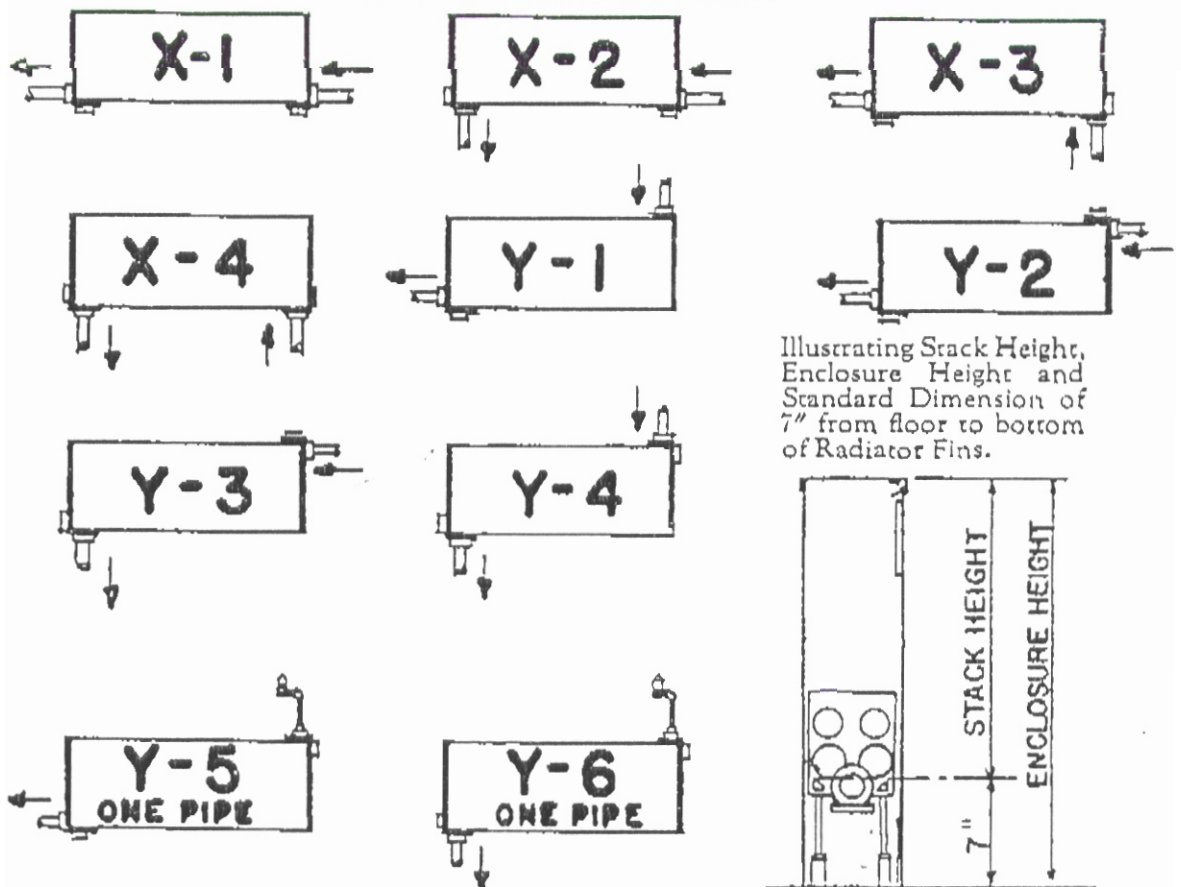
END VIEWS—SIX AVAILABLE WIDTHS



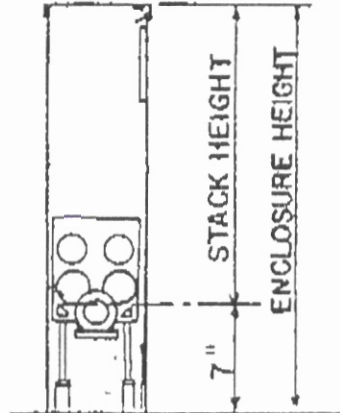
END VIEWS—SIX AVAILABLE WIDTHS



PIPING CONNECTIONS



Illustrating Stack Height, Enclosure Height and Standard Dimension of 7" from floor to bottom of Radiator Fins.



AMERICAN RADIATORS

NEW MURRAY STEAM AND WATER RADIATOR RATINGS

*Output in Sq. Ft. Equivalent Direct Radiation

Radiator No. 2 (2³/₈" Wide)

Radiator No. 3 (3³/₄" Wide)

Length in Inches	Radiator No. 2 (2 ³ / ₈ " Wide)																			
	12 1/2	15	17 1/2	20	22 1/2	25	27 1/2	30	32 1/2	35	37 1/2	40	42 1/2	45	47 1/2	50	52 1/2	55	57 1/2	60
18	5.9	7.2	8.5	9.9	11.2	12.5	13.9	15.2	16.5	17.8	19.2	20.5	21.8	23.1	24.4	25.7	27.1	28.4	29.7	31.0
20	6.1	7.5	8.8	10.2	11.6	13.0	14.3	15.7	17.1	18.4	19.8	21.1	22.5	23.8	25.2	26.5	27.9	29.3	30.6	31.9
22	6.3	7.7	9.1	10.5	11.9	13.3	14.7	16.2	17.6	18.9	20.3	21.7	23.1	24.4	25.9	27.3	28.7	30.0	31.4	32.8
24	6.4	7.8	9.3	10.7	12.2	13.6	15.1	16.5	18.0	19.4	20.8	22.2	23.7	25.1	26.5	27.9	29.4	30.8	32.2	33.6
26	6.6	8.0	9.5	11.0	12.4	13.9	15.4	16.8	18.3	19.7	21.2	22.7	24.2	25.6	27.1	28.5	30.0	31.5	33.0	34.4
28	6.8	8.3	9.8	11.3	12.8	14.3	15.8	17.3	18.8	20.2	21.8	23.3	24.8	26.3	27.8	29.3	30.9	32.4	33.9	35.3
30	6.9	8.5	10.0	11.6	13.1	14.6	16.2	17.7	19.3	20.8	22.4	23.9	25.5	27.0	28.5	30.0	31.6	33.1	34.7	36.2
32	7.1	8.6	10.2	11.8	13.3	15.0	16.5	18.0	19.6	21.2	22.8	24.3	25.9	27.5	29.1	30.6	32.2	33.8	35.4	37.0
34	7.2	8.8	10.4	12.0	13.5	15.2	16.8	18.4	20.0	21.6	23.2	24.8	26.4	27.9	29.5	31.1	32.7	34.3	36.0	37.6
36	7.3	8.9	10.5	12.2	13.8	15.4	17.1	18.7	20.3	21.9	23.6	25.2	26.8	28.4	30.1	31.7	33.4	35.0	36.6	38.2
38	7.4	9.0	10.7	12.3	14.0	15.6	17.3	18.9	20.6	22.2	23.9	25.5	27.2	28.8	30.5	32.1	33.8	35.4	37.1	38.7
40	7.4	9.2	10.9	12.5	14.2	16.0	17.6	19.3	21.0	22.7	24.4	26.0	27.7	29.4	31.1	32.7	34.4	36.1	37.8	39.4
42	7.6	9.3	11.0	12.7	14.4	16.3	17.8	19.5	21.2	22.9	24.6	26.3	28.0	29.7	31.4	33.1	34.8	36.4	38.1	39.8

ENCLOSURE HEIGHT
STACK HEIGHT INCHES

Length in Inches	Radiator No. 3 (3 ³ / ₄ " Wide)																			
	12 1/2	15	17 1/2	20	22 1/2	25	27 1/2	30	32 1/2	35	37 1/2	40	42 1/2	45	47 1/2	50	52 1/2	55	57 1/2	60
18	8.0	9.8	11.6	13.4	15.2	16.9	18.8	20.6	22.4	24.2	26.0	27.8	29.7	31.5	33.3	35.1	36.9	38.6	40.5	42.3
20	8.1	10.1	11.9	13.8	15.6	17.4	19.3	21.1	23.0	24.9	26.7	28.5	30.4	32.2	34.1	35.9	37.8	39.6	41.5	43.3
22	8.3	10.3	12.2	14.1	16.0	17.8	19.7	21.6	23.5	25.4	27.3	29.2	31.1	32.9	34.8	36.6	38.6	40.5	42.4	44.2
24	8.6	10.5	12.4	14.4	16.3	18.2	20.1	22.0	24.0	25.9	27.8	29.7	31.7	33.6	35.5	37.4	39.5	41.6	43.4	45.1
26	8.8	10.7	12.7	14.6	16.6	18.5	20.5	22.4	24.4	26.3	28.3	30.3	32.2	34.1	36.1	38.1	40.1	42.0	44.0	45.9
28	9.1	11.1	13.0	15.0	16.9	18.9	20.9	22.9	24.9	26.8	28.9	30.9	32.9	34.9	36.9	38.8	40.9	42.9	44.9	46.9
30	9.3	11.3	13.3	15.3	17.3	19.3	21.4	23.3	25.4	27.4	29.5	31.5	33.5	35.5	37.6	39.6	41.7	43.7	45.7	47.7
32	9.3	11.3	13.4	15.5	17.6	19.6	21.7	23.8	25.9	27.9	30.0	32.0	34.1	36.2	38.3	40.3	42.4	44.4	46.5	48.6
34	9.4	11.6	13.6	15.7	17.8	19.9	22.0	24.1	26.3	28.4	30.5	32.6	34.7	36.8	38.9	40.9	43.0	45.1	47.1	49.5
36	9.6	11.8	13.9	16.0	18.0	20.2	22.3	24.5	26.7	28.8	31.0	33.1	35.3	37.4	39.5	41.6	43.8	45.9	48.1	50.2
38	9.7	11.9	14.1	16.2	18.3	20.5	22.7	24.9	27.1	29.2	31.4	33.6	35.7	37.8	40.0	42.2	44.4	46.5	48.7	50.9
40	9.9	12.1	14.3	16.5	18.7	20.9	23.1	25.3	27.5	29.7	31.9	34.1	36.4	38.6	40.8	43.0	45.2	47.4	49.6	51.8
42	10.0	12.2	14.4	16.6	18.9	21.1	23.3	25.5	27.8	30.0	32.2	34.4	36.7	38.9	41.1	43.3	45.6	47.9	50.2	52.4

Above ratings based on front outlet enclosures. For top outlet rating see table on page 29.

Standard Enclosure Heights are Stack Height Plus 7"

*To determine size of radiator divide total heat loss in B.t.u. by 240 for steam at 215°, or by 150 B.t.u. for water at 170°. For other water temperatures, see page 54.

AMERICAN RADIATORS

NEW MURRAY STEAM AND WATER RADIATOR RATINGS

*Output in Sq. Ft. Equivalent Direct Radiation

Radiator No. 5 (5" Wide)

Radiator No. 6 (6 $\frac{3}{8}$ " Wide)

Length in Inches	Radiator No. 5 (5" Wide)										Radiator No. 6 (6 $\frac{3}{8}$ " Wide)											
	Unit No.	512	515	517	520	522	525	527	530	532	535	537	540	542	545	547	550	552	555	557	60	560
18	ENCLOSURE HEIGHT	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0
20	ENCLOSURE HEIGHT	11.2	11.7	12.2	12.7	13.2	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2
22	ENCLOSURE HEIGHT	11.4	11.9	12.4	12.9	13.4	13.9	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4
24	ENCLOSURE HEIGHT	11.7	12.2	12.7	13.2	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2	21.7
26	ENCLOSURE HEIGHT	11.9	12.4	12.9	13.4	13.9	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4	21.9
28	ENCLOSURE HEIGHT	12.1	12.6	13.1	13.6	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.6	21.1	21.6	22.1
30	ENCLOSURE HEIGHT	12.3	12.8	13.3	13.8	14.3	14.8	15.3	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.3
32	ENCLOSURE HEIGHT	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5
35	ENCLOSURE HEIGHT	12.7	13.2	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2	21.7	22.2	22.7
38	ENCLOSURE HEIGHT	12.8	13.3	13.8	14.3	14.8	15.3	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.3	22.8
40	ENCLOSURE HEIGHT	12.9	13.4	13.9	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4	21.9	22.4	22.9
42	ENCLOSURE HEIGHT	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0
44	ENCLOSURE HEIGHT	13.1	13.6	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.6	21.1	21.6	22.1	22.6	23.1
46	ENCLOSURE HEIGHT	13.2	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2	21.7	22.2	22.7	23.2
48	ENCLOSURE HEIGHT	13.3	13.8	14.3	14.8	15.3	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.3	22.8	23.3
50	ENCLOSURE HEIGHT	13.4	13.9	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4	21.9	22.4	22.9	23.4
52	ENCLOSURE HEIGHT	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5
54	ENCLOSURE HEIGHT	13.6	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.6	21.1	21.6	22.1	22.6	23.1	23.6
56	ENCLOSURE HEIGHT	13.7	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2	21.7	22.2	22.7	23.2	23.7
58	ENCLOSURE HEIGHT	13.8	14.3	14.8	15.3	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.3	22.8	23.3	23.8
60	ENCLOSURE HEIGHT	13.9	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4	21.9	22.4	22.9	23.4	23.9
62	ENCLOSURE HEIGHT	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0
64	ENCLOSURE HEIGHT	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.6	21.1	21.6	22.1	22.6	23.1	23.6	24.1
66	ENCLOSURE HEIGHT	14.2	14.7	15.2	15.7	16.2	16.7	17.2	17.7	18.2	18.7	19.2	19.7	20.2	20.7	21.2	21.7	22.2	22.7	23.2	23.7	24.2
68	ENCLOSURE HEIGHT	14.3	14.8	15.3	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.3	22.8	23.3	23.8	24.3
70	ENCLOSURE HEIGHT	14.4	14.9	15.4	15.9	16.4	16.9	17.4	17.9	18.4	18.9	19.4	19.9	20.4	20.9	21.4	21.9	22.4	22.9	23.4	23.9	24.4

Above ratings based on front outlet enclosures. For top outlet rating see table on page 29.

Standard Enclosure Heights are Stack Height Plus 7"

*To determine size of radiator divide total heat loss in B.t.u. by 240 for steam at 215°, or by 150 B.t.u. for water at 170°. For other water temperatures, see page 54.

AMERICAN RADIATORS

NEW MURRAY STEAM AND WATER RADIATOR RATINGS

*Output in Sq. Ft. Equivalent Direct Radiation

Radiator No. 7 ($7\frac{3}{4}$ " Wide) Radiator No. 10 ($10\frac{3}{8}$ " Wide)

Length in Inches	Radiator No. 7 ($7\frac{3}{4}$ " Wide)																Radiator No. 10 ($10\frac{3}{8}$ " Wide)																						
	12 1/2	15	17 1/2	20	22 1/2	25	27 1/2	30	32 1/2	35	37 1/2	40	42 1/2	45	47 1/2	50	52 1/2	55	57 1/2	60	12 1/2	15	17 1/2	20	22 1/2	25	27 1/2	30	32 1/2	35	37 1/2	40	42 1/2	45	47 1/2	50	52 1/2	55	57 1/2
ENCLOSURE HEIGHT	20	15.3	18.8	22.2	25.7	29.3	32.7	36.2	39.7	43.2	46.6	50.1	53.6	57.1	60.5	64.0	67.4	70.9	74.4	77.9	81.4	84.9	88.4	91.9	95.4	98.9	102.4	105.9	109.4	112.9	116.4	119.9	123.4	126.9	130.4	133.9	137.4	140.9	
	22	15.6	19.1	22.6	26.1	29.6	33.1	36.6	40.1	43.6	47.1	50.6	54.1	57.6	61.1	64.6	68.1	71.6	75.1	78.6	82.1	85.6	89.1	92.6	96.1	99.6	103.1	106.6	110.1	113.6	117.1	120.6	124.1	127.6	131.1	134.6	138.1	141.6	
	24	16.0	19.5	23.0	26.5	30.0	33.5	37.0	40.5	44.0	47.5	51.0	54.5	58.0	61.5	65.0	68.5	72.0	75.5	79.0	82.5	86.0	89.5	93.0	96.5	100.0	103.5	107.0	110.5	114.0	117.5	121.0	124.5	128.0	131.5	135.0	138.5	142.0	145.5
	26	16.2	19.8	23.4	27.1	30.7	34.3	37.9	41.5	45.1	48.7	52.3	55.9	59.5	63.1	66.7	70.3	73.9	77.5	81.1	84.7	88.3	91.9	95.5	99.1	102.7	106.3	109.9	113.5	117.1	120.7	124.3	127.9	131.5	135.1	138.7	142.3	145.9	149.5
	28	16.5	20.2	23.9	27.6	31.3	35.0	38.7	42.4	46.1	49.8	53.5	57.2	60.9	64.6	68.3	72.0	75.7	79.4	83.1	86.8	90.5	94.2	97.9	101.6	105.3	109.0	112.7	116.4	120.1	123.8	127.5	131.2	134.9	138.6	142.3	146.0	149.7	153.4
	30	16.7	20.6	24.3	28.0	31.7	35.4	39.1	42.8	46.5	50.2	53.9	57.6	61.3	65.0	68.7	72.4	76.1	79.8	83.5	87.2	90.9	94.6	98.3	102.0	105.7	109.4	113.1	116.8	120.5	124.2	127.9	131.6	135.3	139.0	142.7	146.4	150.1	153.8
STACK HEIGHT	22	17.3	21.2	25.1	28.9	32.9	36.7	40.7	44.6	48.5	52.4	56.3	60.2	64.1	68.0	71.9	75.8	79.7	83.6	87.5	91.4	95.3	99.2	103.1	107.0	110.9	114.8	118.7	122.6	126.5	130.4	134.3	138.2	142.1	146.0	149.9	153.8	157.7	
	24	17.5	21.6	25.5	29.5	33.4	37.4	41.4	45.3	49.3	53.3	57.3	61.2	65.2	69.1	73.1	77.1	81.1	85.0	89.0	92.9	96.9	100.8	104.8	108.7	112.7	116.6	120.5	124.4	128.3	132.2	136.1	140.0	143.9	147.8	151.7	155.6		
	26	17.9	22.0	26.0	30.0	34.0	38.1	42.1	46.2	50.2	54.2	58.2	62.2	66.2	70.2	74.2	78.2	82.2	86.2	90.2	94.2	98.2	102.2	106.2	110.2	114.2	118.2	122.2	126.2	130.2	134.2	138.2	142.2	146.2	150.2	154.2	158.2	162.2	
	28	18.5	22.6	26.8	31.0	35.1	39.3	43.5	47.6	51.8	55.9	60.1	64.2	68.4	72.5	76.6	80.7	84.8	88.9	93.0	97.1	101.2	105.3	109.4	113.5	117.6	121.7	125.8	129.9	134.0	138.1	142.2	146.3	150.4	154.5	158.6	162.7	166.8	
	30	18.8	23.1	27.4	31.7	35.9	40.2	44.4	48.7	53.0	57.2	61.5	65.8	70.1	74.4	78.6	82.8	87.1	91.4	95.7	100.0	104.3	108.6	112.9	117.2	121.5	125.8	130.1	134.4	138.7	143.0	147.3	151.6	155.9	160.2	164.5	168.8	173.1	
	32	19.2	23.6	28.0	32.3	36.6	40.9	45.2	49.5	53.8	58.1	62.4	66.7	71.0	75.3	79.6	83.9	88.2	92.5	96.8	101.1	105.4	109.7	114.0	118.3	122.6	126.9	131.2	135.5	139.8	144.1	148.4	152.7	157.0	161.3	165.6	169.9	174.2	

Above ratings based on front outlet enclosures. For top outlet rating see table on page 29.

Standard Enclosure Heights are Stack Height Plus 7"

*To determine size of radiator divide total heat loss in B.t.u. by 240 for steam at 215°, or by 150 B.t.u. for water at 170°. For other water temperatures, see page 54.

Dec. 13, 1932.

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1,890,620

RADIATOR AND THE LIKE

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2 Sheets-Sheet 1

Fig. 1.

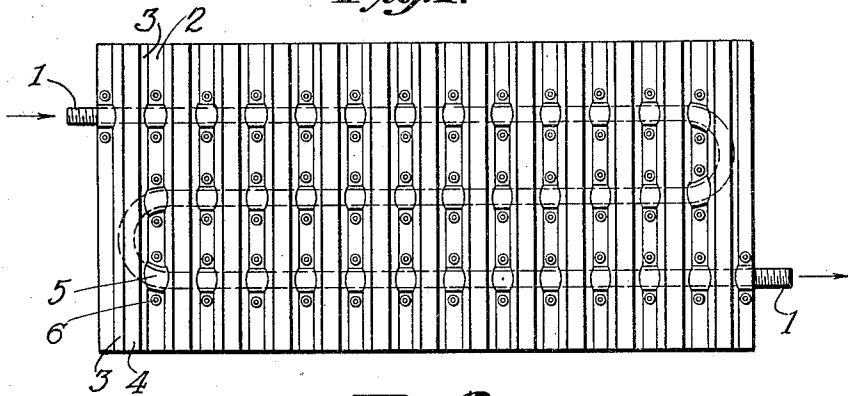


Fig. 2.

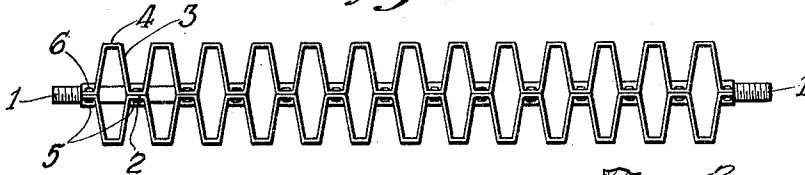


Fig. 3.

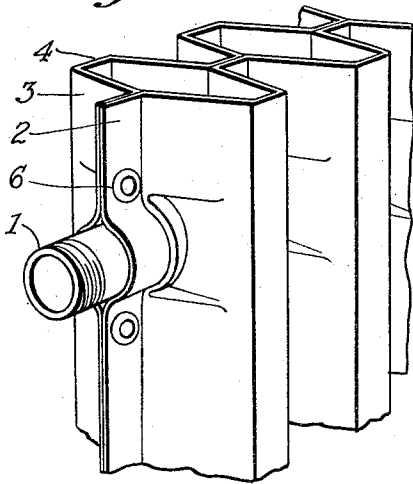


Fig. 7.

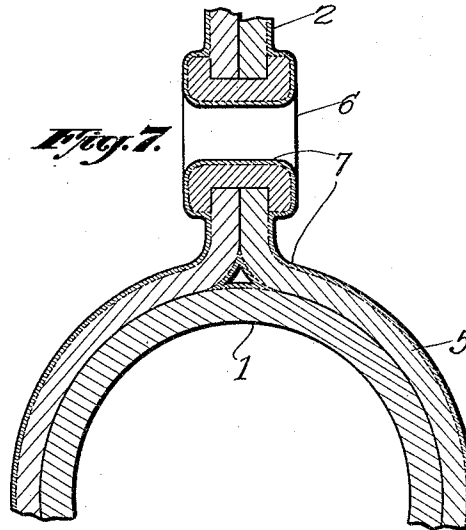


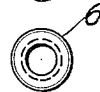
Fig. 4.



Fig. 5.



Fig. 6.



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2 Sheets-Sheet 2

Fig. 8.

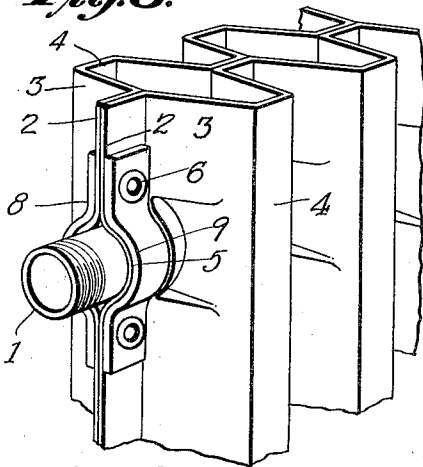


Fig. 9.

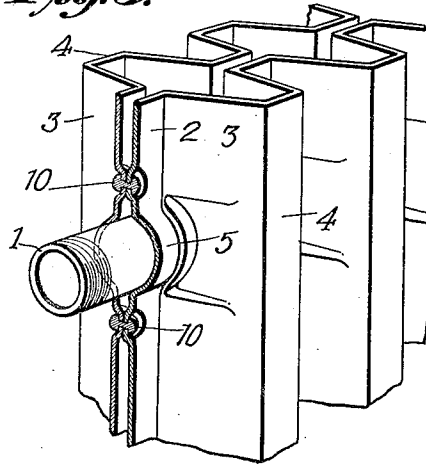


Fig. 10.

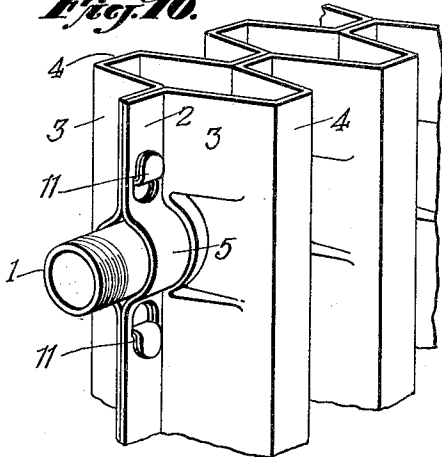


Fig. 11.

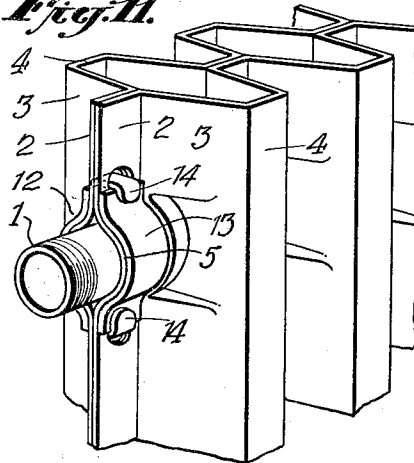


Fig. 13.

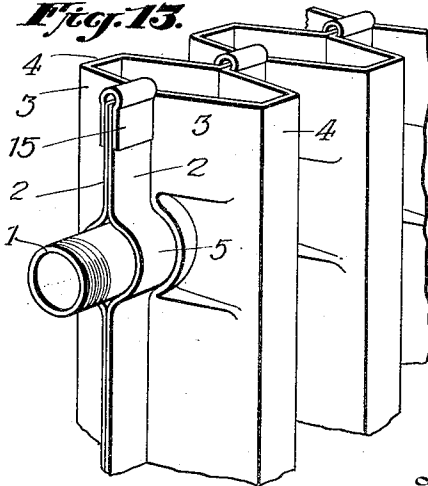
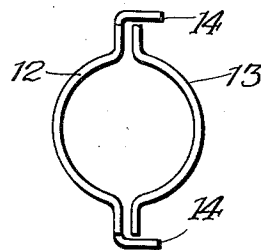


Fig. 12.



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UNITED STATES PATENT OFFICE

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK; JOSEPH BRADLEY MURRAY, THOMAS E. MURRAY, JR., AND JOHN F. MURRAY, EXECUTORS OF SAID THOMAS E. MURRAY, DECEASED, ASSIGNORS TO METROPOLITAN ENGINEERING COMPANY, A CORPORATION OF NEW YORK

RADIATOR AND THE LIKE

Application filed February 9, 1929. Serial No. 338,677.

In certain previous applications of myself and others there are described radiators of a general type comprising an elongated tubular structure adapted to carry steam or other heating fluid or encasing an electric resistance device and an extended area structure or structures applied to the sides thereof for taking off and distributing the heat. See for example my pending applications Ser. No. 709,080, filed April 26, 1924 and Ser. No. 168,871 filed February 17, 1927 which have now matured respectively into Patents No. 1,744,078 issued Jan. 21, 1932 and No. 1,731,472, issued Oct. 15, 1929. The present application is directed to certain improvements applicable to apparatus of the same class and directed particularly to economy in manufacture and efficiency in use.

The accompanying drawings illustrate embodiments of the invention.

Figs. 1 and 2 are respectively a front elevation and plan of the principal parts of a radiator;

Fig. 3 is a perspective view of one of the joints;

Figs. 4 and 5 are side elevations and Fig. 6 is a front elevation of a fastener;

Fig. 7 is an enlarged vertical section through a joint;

Figs. 8, 9 and 10 are perspectives of modified styles of joint;

Fig. 11 is a perspective of another modification;

Fig. 12 is an elevation of a pair of fasteners;

Fig. 13 is a perspective of another style of joint.

In Fig. 1 a pipe 1 is bent to form three successive vertical lengths so as to convey steam or other heating medium back and forth from its admission to its discharge end. Applied to each side of the pipe is an extended area structure composed of thin sheet metal corrugated to provide a succession of inner longitudinally extending portions 2 from the edges of which transverse plates 3 extend outward, leaving a flared space between them for access to the plates 2, the successive pairs of plates 3 being connected at their outer edges by longitudinal plates 4.

The corrugated plates are shaped to embrace and preferably to completely surround the pipe 1 at intervals in its length. As shown in Figs. 3, 7 and 8, the plates 2 are bent outward to form recessed portions 5 fitting around the pipe 1. Thus the plates 2 of the opposite corrugated sheets meet above and below the pipe. They are secured to each other, and thus to the pipe, by means of hollow rivets or eyelets 6 which pass through openings in the plates 2 above and below the pipe and are headed up and swaged so as to draw the plates 2 close together and to secure them tightly on the pipe. The extent of the recessed portions 5 of the plates in the direction of the length of the pipe provides a wide heat conducting path. This contact is repeated at brief intervals in the length of the pipe by the succession of plates 2 at short distances from each other. The eyelets 6 are shown separately, before swaging in Fig. 4, and after swaging in Figs. 5 and 6.

Copper tubing is preferred for the pipe 1, but various other metals may be used such as aluminum, brass, steel and so forth. In fact the steam chamber instead of being an ordinary elongated tube may be of any shape such as a box member of cast or pressed metal (like those described in applications of Murray and Phelps No. 9,185 filed February 14, 1925 and Bennett No. 305,337 filed September 12, 1928) or it may be a tube of oval, oblong or other cross section.

The extended area structure is also best made of copper for most purposes, but it may be of other metals such for example as aluminum, brass, iron or steel. It may be a continuous corrugated sheet as illustrated or it may consist of a number of transverse plates or fins with spaces between them open or closed at their edges.

The complete apparatus may be used in various ways as a heat exchanger. When used as a radiator for heating a room, steam or other heating medium is circulated through the tubular structure and the air is heated and rises with a strong induced draft traversing the heated extended area. Or it may be used to cool the air by circulating cold brine, ex-

panded gases or other cooling medium through the tubular structure.

Or it may be employed in refrigerator work, either as an evaporator in which a refrigerating liquid is allowed to volatilize in the pipe so as to remove heat from the surrounding atmosphere or as a condenser in which a refrigerating vapor is condensed within the pipe through the influence of the colder atmosphere. For examples of the latter see Phelps applications No. 141,065 filed October 12, 1926, and No. 239,875 filed December 14, 1927.

The apparatus is preferably for most purposes soldered or brazed as a whole when finished as above described in order to secure a more complete heat-conducting bond between the pipe and the corrugated plates and to reinforce the fastenings and stiffen the structure; though for many uses the coating of bonding metal (indicated at 7, Fig. 5) may be omitted. In the case of refrigerator work the coating should at the same time be of protective metal. It may be secured by dipping the apparatus in a bath of tin or solder, for example, which not only provides a good bond but also is resistant to action by food stuffs, animal acid and so forth.

The simple mechanical fasteners herein described are particularly useful in connection with a bonding coating. It is only necessary that the fasteners serve to align and hold the parts in proper assembled position during the dipping operation; which purpose is fully served by the simple and economical mechanical fasteners described herein.

Where a complete coating is not desired the joints may be reinforced by means of straps 8, Fig. 8, having portions 9 embracing the pipe and the recess plates 5 and having their ends above and below the pipe fastened by the rivets 6 passing through such ends and through the plates 2 which are clamped between them. The straps 8 strengthen the joint and stiffen the structure so that no coating is necessary to provide a further bond; though such a coating may be used and would generally be used in refrigerators and similar places. The additional straps may be used also with the several alternative forms hereinafter described.

According to Fig. 9 there are used small solid rivets 10 in place of the larger hollow rivets of Fig. 3. Fig. 9 also shows the plates 2 at opposite sides of the pipe separated from each other, a feature which may be used with the different fasteners shown in the other figures.

Fig. 10 illustrates an extreme simplification of the fasteners. The plates 2 being clamped together, ears 11 are lanced or punched out of them as shown in the upper part of the figure and are then clinched or riveted down as shown in the lower part.

According to Figs. 11 and 12 straps 12 and

13 are arranged to embrace the portions 5 of the plates 2 and to extend to holes punched in the plates, through which ears 14 on the ends of one of the straps are passed and bent over the ends of the other strap and pressed or riveted down to fasten the parts together.

According to Fig. 13 the fastener is a clip 15 bent over the upper ends of the assembled plates 2 and pressed together to hold the plates clamped about the pipe 1. Similar clips should be employed at the lower ends of the plates.

All the uses of the apparatus described may be with a natural or induced flow of the surrounding air over the extended area or a forced flow may be effected by fans or similar apparatus or a flow may be caused by pressure differences experienced in certain locations. In some locations and for some uses the extended area may be provided at only one side of the heating element.

Instead of the rivets and similar fasteners used, screws and nuts may be employed.

The coating is shown in Fig. 7 only on the outer faces of the structure. In practice it will enter within the very thin spaces between the tube and the corrugated plates. This portion of the coating is so very thin that it cannot be adequately illustrated on the scale of the drawings. But in fact there is a nearly continuous film of tin or solder between the tube and the corrugated plate, sweating them together and bonding them for heat conductivity.

Various other modifications may be made by those skilled in the art without departing from the invention as defined in the following claims:

1. An apparatus of the character described including in combination a tubular structure and an extended area structure embracing and secured to said tubular structure and a protective coating covering the entire faces of the aforesaid parts.

2. An apparatus of the character described including in combination a tubular structure and an extended area structure embracing the tubular structure, mechanical fasteners for holding said structures together and a protective and bonding coating on the exposed faces of said structures and fasteners, said coating being of metal and entering the spaces between the tubular structure and the extended area structure embracing it, and forming a continuous metal path for conducting heat from one structure to another.

3. An apparatus of the character described including in combination a tubular structure and extended area structures applied to opposite sides thereof and recessed so as to substantially surround the tubular structure and to meet above and below it, mechanical fasteners beyond the tubular structure for holding the aforesaid structures together and a protective coating covering the entire ex-

posed faces of said structures and fasteners.

4. An apparatus of the character described including in combination a tubular structure and extended area structures applied to opposite sides thereof and recessed so as to substantially surround the tubular structure and to meet above and below it, mechanical fasteners beyond the tubular structure for holding the aforesaid structures together and a bonding metal coating on the faces of said structure and fasteners, said coating entering the spaces between the tubular structure and the extended area structure embracing it, and forming a continuous metal path for conducting heat from one structure to the other.

5. An apparatus of the character described including in combination an elongated heating element and an extended area structure embracing and secured to said heating element and a protective coating covering the entire faces of the aforesaid parts.

6. An apparatus of the character described including in combination an elongated heating element and an extended area structure embracing said heating element, mechanical fasteners for holding said structures together and a protective and bonding coating on the exposed faces of the apparatus, said coating being of metal and entering the spaces between the tubular structure and the extended area structure embracing it and forming a continuous metal path for conducting heat from one structure to the other.

7. An apparatus of the character described including in combination an elongated heating element and extended area structures applied to opposite sides thereof and riveted to each other at points adjacent to the heating element and comparatively remote from the edges.

8. An apparatus of the character described including in combination an elongated heating element in a plurality of sections arranged alongside of each other in the same plane, extended area structures extending continuously across the plurality of sections at opposite sides thereof and riveted to each other at points beyond the heating element.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.

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