

·DATA·  
·FOR·  
·HEATING · ENGINEERS·  
·AND·  
·ARCHITECTS·  
·FOR THE · DESIGN · OF ·  
·VAPOR · HEATING · SYSTEMS·

ASSOCIATED COMMERCIAL ENGINEERS  
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·LA · CROSSE·  
·WISCONSIN·

## ·INTRODUCTORY·

·THE PURPOSE OF THIS BOOK IS TO PLACE IN THE HANDS OF ARCHITECTS  
·AND ENGINEERS RELIABLE DATA AND INFORMATION FOR USE  
·IN PLANNING AND DESIGNING VAPOR HEATING SYSTEMS.

·THE MANY ADVANTAGES OF STEAM AT ATMOSPHERIC PRESSURE  
·AS A MEDIUM OF HEAT TRANSMISSION HAVE BEEN CONVINCINGLY  
·DEMONSTRATED; PARTICULARLY IN THE DEVELOPMENTS OF  
·RECENT YEARS; AND THE INFORMATION ON THE FOLLOWING PAGES  
·IS NOT ONLY THE RESULT OF SCIENTIFIC CALCULATIONS AND  
·LABORATORY TESTS ALONG THE LINES OF THE BEST ACCEPTED  
·THEORIES IN HEATING ENGINEERING; BUT IS, AS WELL; THE  
·DEVELOPMENT OF YEARS OF PRACTICAL EXPERIENCE WITH  
·HEATING PROBLEMS OF EVERY KIND. ALL CALCULATIONS ARE BASED  
·ON UNQUESTIONED HEATING AUTHORITIES; ADAPTED IN OUR OWN  
·ENGINEERING DEPARTMENT TO THE PARTICULAR REQUIREMENTS  
·OF VAPOR HEATING; AND THEIR CORRECTNESS AMPLY DEMONSTRATED  
·IN THOUSANDS OF PRACTICAL APPLICATIONS.

·NO UNIQUE OR FREAK FEATURES HAVE EVER BEEN CLAIMED FOR TRANE  
·VAPOR HEATING. IT IS SIMPLE AND DIRECT; AND ITS CONTINUED SUCCESS  
·MAY BE DIRECTLY ATTRIBUTED TO THE CORRECTNESS OF THE ENGI-  
·NEERING PRINCIPALS UNDERLYING; NOT ONLY THE LAYOUTS RECOM-  
·MENDED FOR TRANE SYSTEMS BUT THE DESIGN AND MANUFACTURE  
·OF TRANE VAPOR HEATING SPECIALTIES.

·THE TRANE COMPANY·

THESE SHEETS ARE INTENDED FOR THE CONVENIENCE OF ARCHITECTS AND HEATING ENGINEERS AND WILL GIVE

INFORMATION NECESSARY TO DESIGN  
 A TRANE SYSTEM OF  
 VAPOR HEATING

HOW TO FIGURE RADIATION

THE FOLLOWING TABLE IS BASED UPON STANDARD HEAT LOSS COEFFICIENTS AND ORDINARY 13" BRICK WALL OR GOOD FRAME CONSTRUCTION.

SELECT DIVISORS FOR CONTENTS, WALL AND GLASS IN COLUMN HEADED BY PROPER COLDEST OUTSIDE TEMPERATURE AND ADD RESULTS FOR 70° INSIDE.

LOWEST OUTSIDE TEMP	-20	-15	+10	+5	0	-5	-10	-15	-20	-25	-30	-35
DIVIDE CONTENTS BY	2.51	2.28	2.10	1.95	1.80	1.69	1.58	1.48	1.40	1.33	1.26	1.20
DIVIDE GLASS BY	4.6	4.2	3.8	3.5	3.3	3.	2.9	2.7	2.6	2.4	2.3	2.2
DIVIDE NET WALL BY	14.8	13.5	12.4	11.	10.6	9.9	9.3	8.7	8.3	7.8	7.4	7.0

FOR TEMPERATURES OTHER THAN 70° MULTIPLY BY THE FOLLOWING FACTORS.

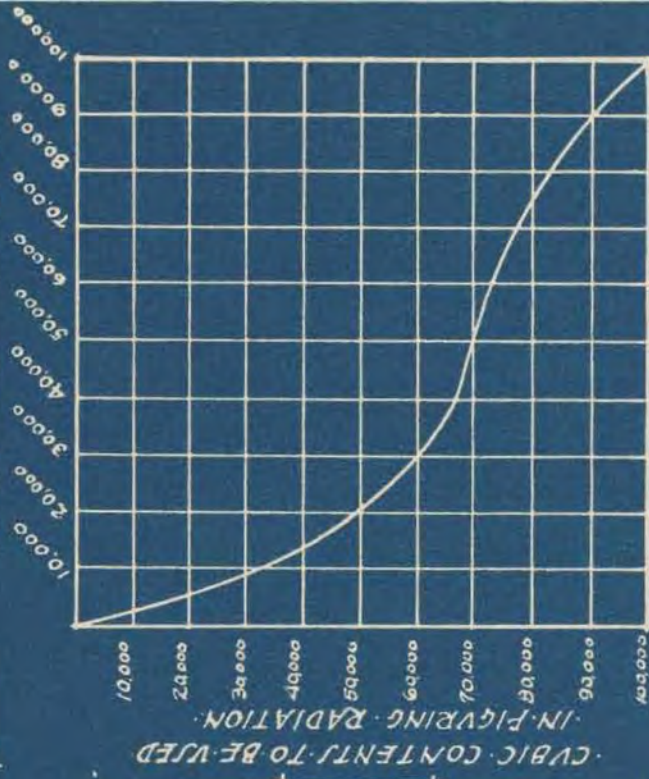
REQUIRED TEMPERATURE	LOWEST OUTSIDE TEMPERATURE												
	+20	+15	+10	+5	0	-5	-10	-15	-20	-25	-30	-35	
35°	.24	.29	.33	.37	.4	.43	.45	.47	.49	.50	.51	.54	
40°	.32	.37	.41	.44	.47	.49	.51	.52	.54	.55	.57	.61	
45°	.42	.46	.49	.52	.54	.57	.58	.59	.60	.61	.63	.67	
50°	.52	.55	.58	.60	.62	.64	.65	.66	.66	.67	.69	.71	
55°	.63	.66	.68	.70	.71	.72	.73	.74	.75	.75	.76	.79	
60°	.74	.76	.77	.79	.80	.80	.81	.82	.83	.83	.84	.85	
65°	.87	.88	.89	.89	.89	.89	.90	.91	.91	.91	.92	.92	
75°	1.14	1.13	1.13	1.12	1.12	1.11	1.10	1.10	1.09	1.09	1.09	1.09	
80°	1.29	1.27	1.25	1.24	1.23	1.22	1.21	1.20	1.19	1.18	1.18	1.18	
85°	1.46	1.43	1.4	1.38	1.36	1.34	1.33	1.30	1.29	1.29	1.29	1.28	
90°	1.63	1.6	1.56	1.52	1.50	1.48	1.46	1.43	1.43	1.40	1.39	1.39	
95°	1.82	1.77	1.73	1.69	1.65	1.62	1.60	1.57	1.56	1.53	1.52	1.51	
100°	2.04	1.97	1.91	1.86	1.82	1.78	1.75	1.72	1.70	1.67	1.66	1.64	
125°	3.46	3.29	3.16	3.04	2.94	2.85	2.78	2.71	2.65	2.60	2.56	2.52	
150°	6.07	5.73	5.41	5.21	5.00	4.82	4.67	4.53	4.41	4.29	4.2	4.1	

NOTE...  
 THE ORDINARY ALLOWANCES AND ADDITIONS ARE TO BE MADE FOR EXPOSURES UNUSUAL CONDITIONS, ETC.

SEE FOLLOWING PAGE.

# ALLOWANCES AND ADDITIONS FOR RADIATION

ACTUAL CVBIC CONTENTS.



PERCENT OF RADIATION TO BE ADDED TO CALCULATED AMOUNT AS FOUND IN TABLE No. 1.

- FOR NORTH & NORTHWEST EXPOSURE: 10%.
- NORTHEAST & WEST EXPOSURE: 7%; ROOMS WITH A FIREPLACE: 10%; RADIATION UNDER SEATS: 20%.
- FLOORS & CEILINGS EXPOSED TO WEATHER TO BE FIGURED AS WALL; FLOORS AND CEILINGS EXPOSED TO UNHEATED ROOMS TO BE FIGURED AS 1/2 WALL; CEILINGS IN ONE STORY COTTAGES TO BE FIGURED AS 1/2 WALL.
- OPEN PRINCIPAL ROOMS WITH LARGE OPEN HALLWAY LEADING TO 2ND FLOOR ADD AT LEAST 20%.
- BATH ROOMS FIGURING 10 SQ. FT. OR LESS ADD 100%.
- LARGER BATHS SHOULD BE INCREASED 25%.

- LONG-NARROW STORES EXPOSED ON NARROW ENDS ONLY WITH 2ND FLOOR HEATED FIGURE 1/2 CONTENTS.
- LONG NARROW STORES EXPOSED ON 3 or 4 SIDES; DOUBLE CONTENTS.
- SCHOOL ROOMS NOT VENTILATED DOUBLE CONTENTS WHEN DIRECT INDIRECT IS USED.
- ADD 35% WHEN INDIRECT IS USED ADD AT LEAST 75%.
- FOR CHURCHES FIGURE ENTIRE ROOF AS WALL; FIGURE CONTENTS & USE CHART TO OBTAIN CONTENTS TO BE FIGURED FROM ACTUAL CONTENTS.
- CHART SHOWS THAT CONTENTS SHOULD BE INCREASED IN ALL CHURCHES WITH LESS THAN 90,000 CU. FT.
- EX. - IN A CHURCH WITH 30,000 CU. FT. USE 60,000 CU. FT. AS CONTENTS TO BE FIGURED.

## EXAMPLES FOR USING TABLES No. 1, 2 AND ADDITIONS.

1. FIND RADIATION REQUIRED FOR A N.W. ROOM TO BE HEATED TO 70° AT 10° BELOW ZERO. CONTENTS - 1440 CU. FT., GLASS - 60 SQ. FT. WALL - 200 SQ. FT.  
SEE TABLE No. 1 - COLUMN HEADED (-10)  
 $\frac{1440}{158} = 9.12$      $\frac{200}{93} = 2.15$      $\frac{60}{280} = 0.215$   
 $9.12 + 2.15 + 0.215 = 11.485$   
ADD 10% FOR N.W. EXPOSURE  
 $11.485 \times 1.1 = 12.6335$

2. FIND RADIATION TO HEAT ABOVE ROOM TO 80° AT 10° BELOW ZERO.  
WE FOUND 5750 FT. REQUIRED FOR 70° IN TABLE No. 2 IN COLUMN HEADED (-10) OPPOSITE (80°), WE FIND 121.  
 $57 \times 1.21 = 69.57$  FT. REQUIRED.



## RISER SIZES

ESTIMATE LENGTH OF MAIN FROM BOILER TO EACH RISER; USING TABLE NO. 1. FOR ADDITIONS AND SELECT RISE FROM THAT COLUMN OF TABLE NO. 3 CORRESPONDING TO ESTIMATED LENGTH OF MAIN. RISER MAY BE REDUCED AS RADIATION IS TAKEN OFF. (SEE SAME COLUMN.)

### TABLE 3

SQUARE FT. OF RADIATION	MAXIMUM LENGTH OF MAIN IN FEET INCLUDING ADDITIONS FOR FITTINGS (SEE TABLE NO. 1)													
	10	20	30	40	50	60	70	80	90	100	150	200	400	800
20	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1"	1"
35	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"
45	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"
55	1"	1"	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
80	1"	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
99	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
110	1"	1"	1"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
150	1"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
200	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
300	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
400	2"	2"	2"	2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
500	2"	2"	2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
600	2"	2"	2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
700	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
800	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
900	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"
1000	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"

## RETURN RISERS

### RADIATION

0-100	SQUARE FEET	3/4 INCH
100-300	"	1 1/4 "
300-600	"	1 1/2 "
600-1200	"	1 1/2 "

REDUCTIONS MAY BE MADE ACCORDING TO TABLE AS RADIATION IS TAKEN OFF.

### LATERALS OR SUPPLY ARMS

3/4" AND 1" RISERS TAKE SUPPLY ARMS TWO SIZES LARGER. LARGER RISERS TO BE INCREASED ONE SIZE. NO. 3 STUBS FOR FIRST FLOOR RADIATORS TO BE SAME SIZE AS VALVES EXCEPT WHERE RADIATORS ARE 109 SQ. FT. OR OVER AND REQUIRE 1 1/4" OR LARGER STUBS ACCORDING TO TABLE NO. 3. SUCH RADIATORS TO HAVE 1 1/4" STUBS AND A REDUCER AT THE 1" VALVE.

## HOW TO SELECT BOILER SIZE - ROUND BOILERS.

TO BE ABSOLUTELY LIBERAL ON ROUND CAST IRON BOILERS. ADD 20% FOR HEAT LOSS IN PIPING AND 40-50% OF THE SVM FOR EXCESS. SELECT LOWEST BOILER IN A SERIES FOR SOFT COAL AND A LOW CHIMNEY WITH A 35-40 FOOT CHIMNEY. THE SECOND IN THE SERIES MAY BE USED FOR HARD COAL. THE SECOND IN THE SERIES IS GOOD; THE HIGHEST IN THE SERIES IS ONLY GOOD FOR ESPECIALLY HIGH CHIMNEYS.

## SQUARE BOILERS.

AVOID LONG BOILERS. SOFT COAL IS USUALLY BURNED IN SQUARE BOILERS. HENCE IT IS WELL TO BE A LITTLE MORE LIBERAL WITH THE SIZE.

## STEEL BOILERS.

FIRE BOX BOILERS ARE RATED TO CARRY THEIR ACTUAL RADIATING SURFACE AND IN SELECTING THE SIZE 25-30% EXCESS IS SUFFICIENT.

## DOWNDRAFT BOILERS.

SPECIAL ATTENTION MUST BE PAID TO HEIGHT AND SIZE OF CHIMNEY. USE MANUFACTURER'S RECOMMENDATIONS.

## CHIMNEYS.

USE MANUFACTURER'S SIZES. MANY RESIDENCES ARE SPOILED BY 8x12 FLYES. ORDINARY 8-10 ROOM HOMES REQUIRE 12x12 FLYES.

## A METHOD FOR SELECTING THE PROPER LAYOUT -

MOST ALL INSTALLATIONS CAN BE CORRECTLY DESIGNED ACCORDING TO ONE OF THE TWO GENERAL PLANS, DEPENDING UPON THE LOCATION OF THE BOILER WITH REFERENCE TO THE PRINCIPAL EXPOSURES AS SHOWN ON PLANS ONE AND TWO.



PLAN NUMBER ONE  
 BOILER IN THE SOUTH OR  
 UNEXPOSED PART OF HOUSE.



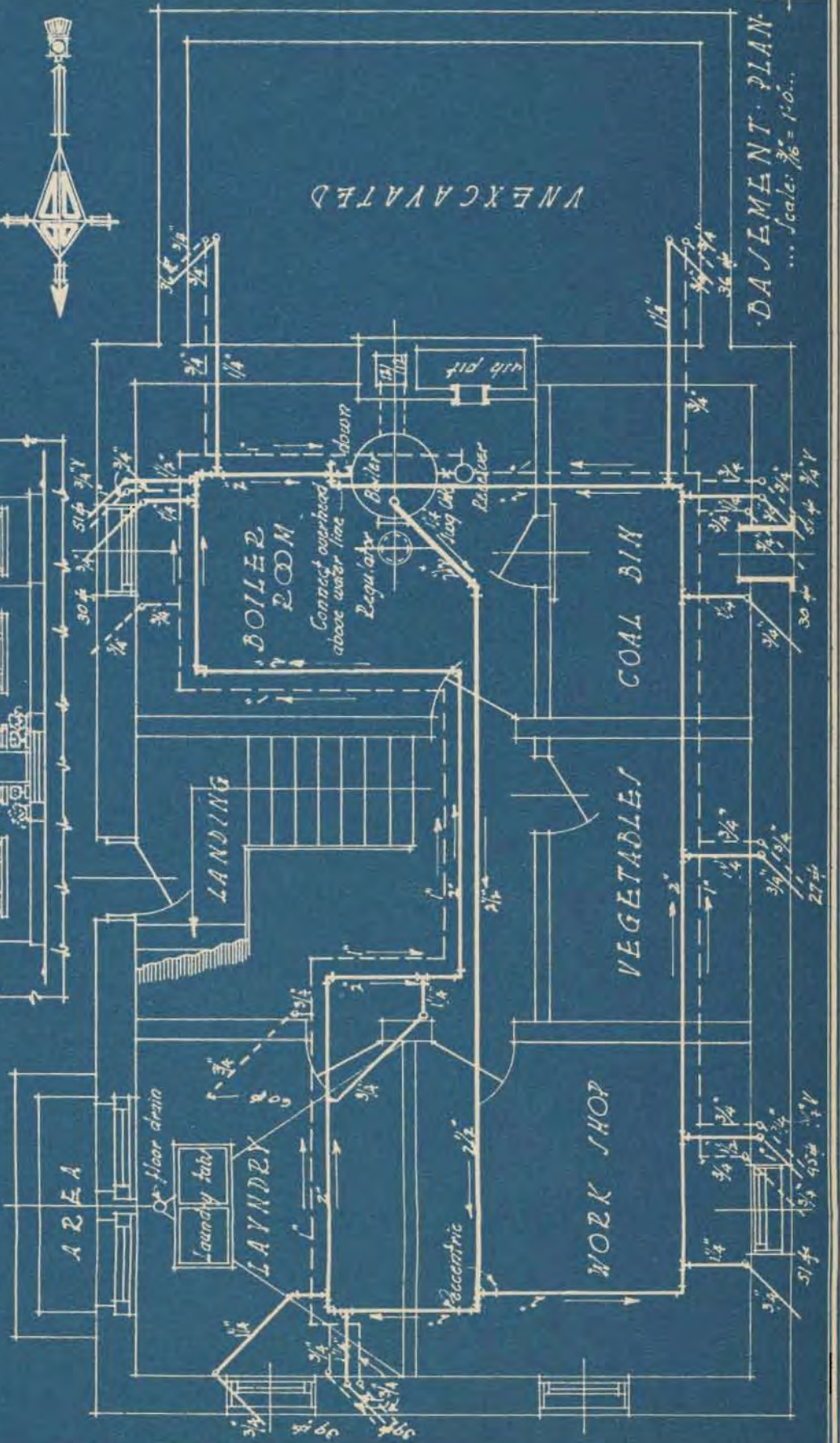
SECOND FLOOR PLAN.

Scale:  $\frac{1}{16} = 1'-0"$



FIRST FLOOR PLAN.

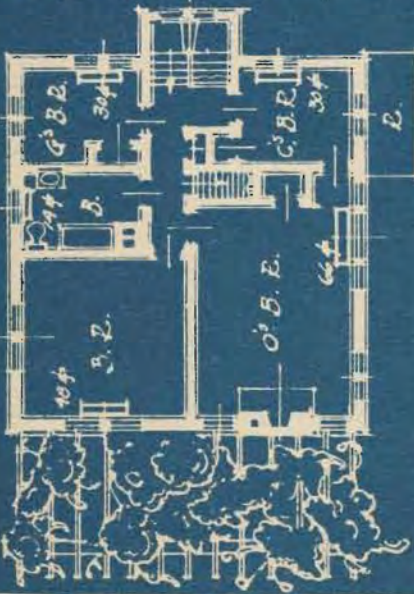
Scale:  $\frac{1}{16} = 1'-0"$



BASEMENT PLAN

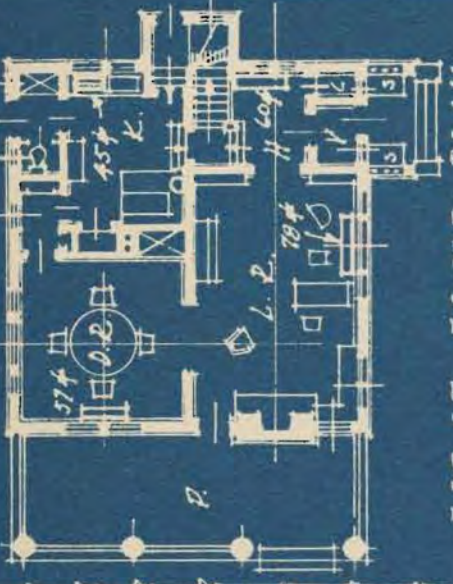
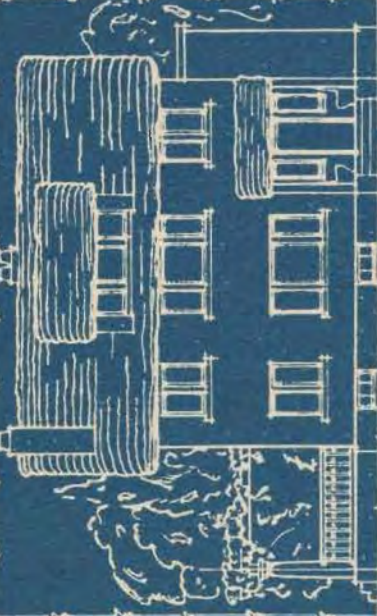
Scale:  $\frac{1}{16} = 1'-0"$



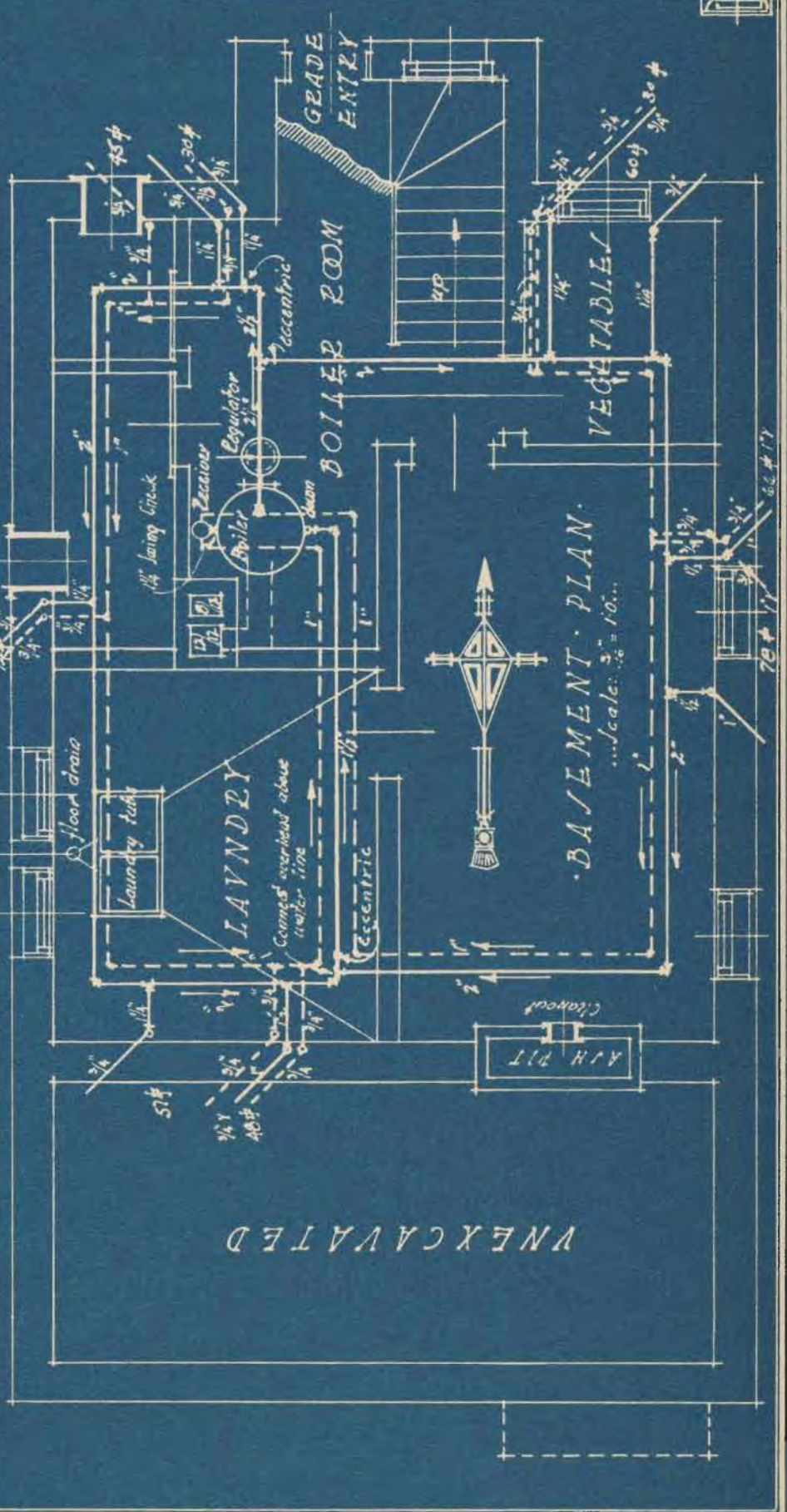


SECOND FLOOR PLAN  
Scale: 1/8" = 1'-0"

PLAN NUMBER TWO  
BOILER IN THE NORTH OR  
EXPOSED PART OF HOUSE.



FIRST FLOOR PLAN  
Scale: 1/8" = 1'-0"



BASEMENT PLAN  
Scale: 3/16" = 1'-0"

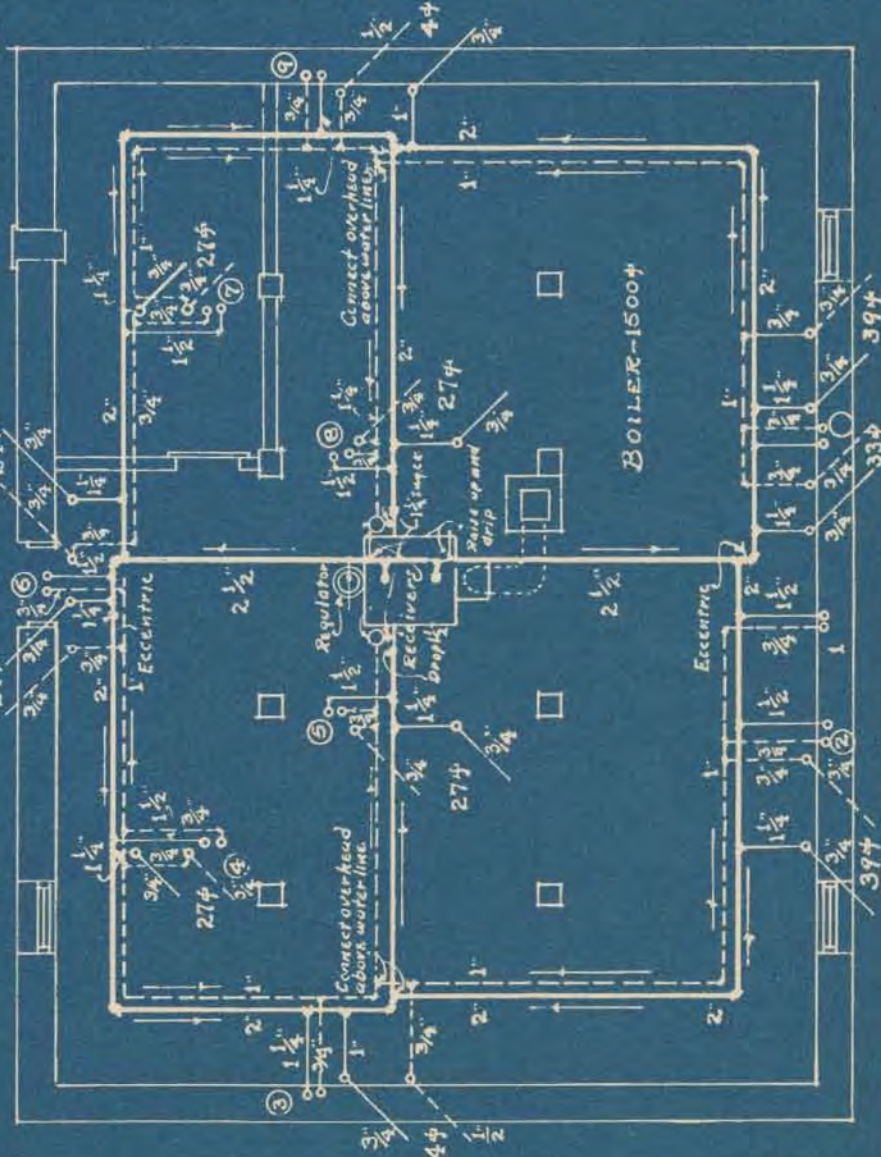
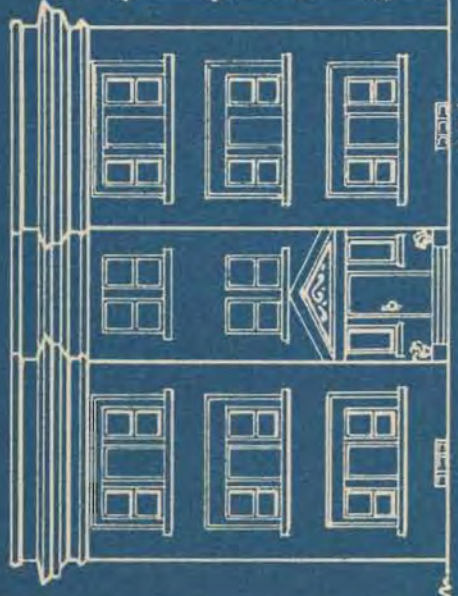
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PLAN NUMBER THREE  
AN APARTMENT BLDG.

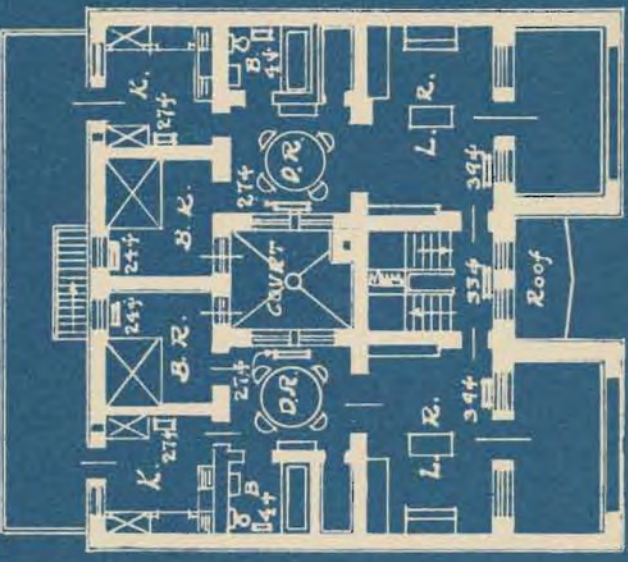
NOTE THAT THIS IS A COMBINATION OF TWO LAYOUTS LIKE PLAN NUMBER TWO.



RISER DIAGRAM  
Scale: 1/16" = 1' 0"



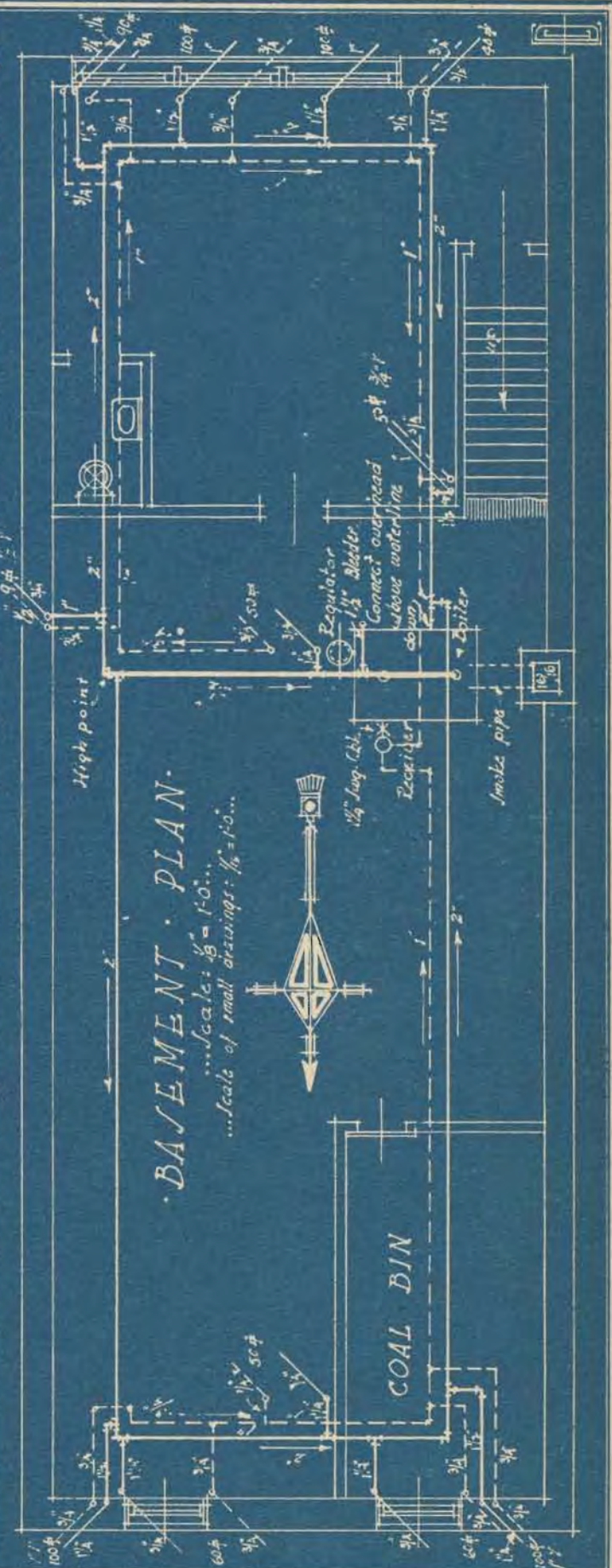
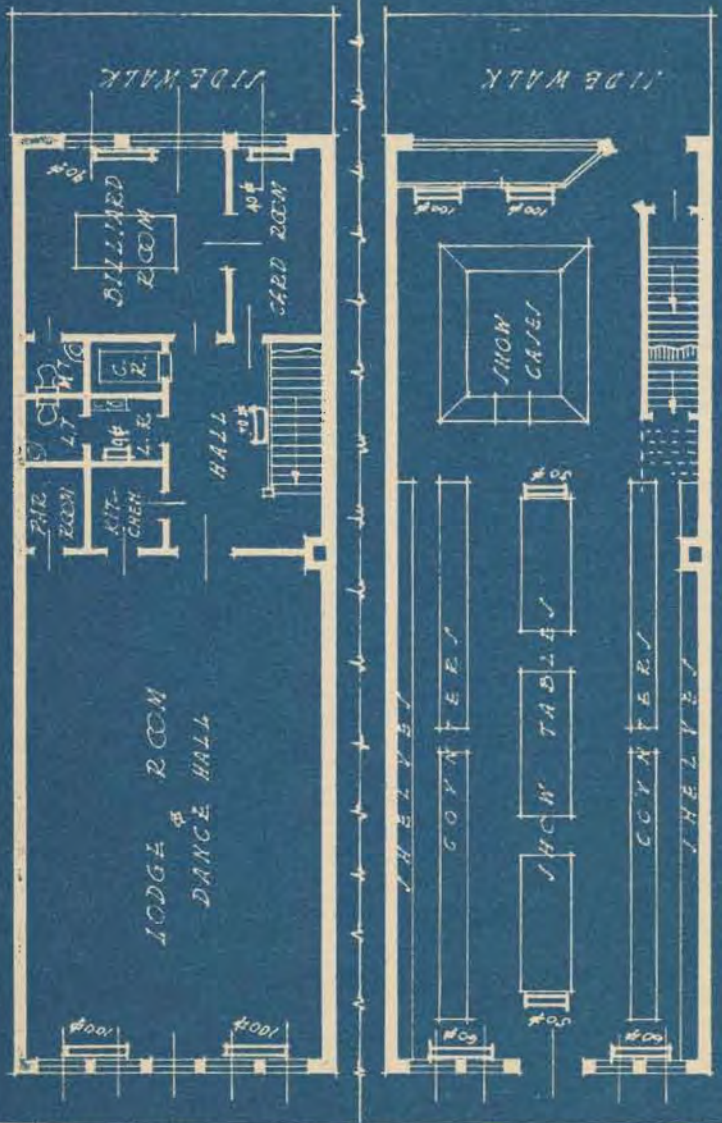
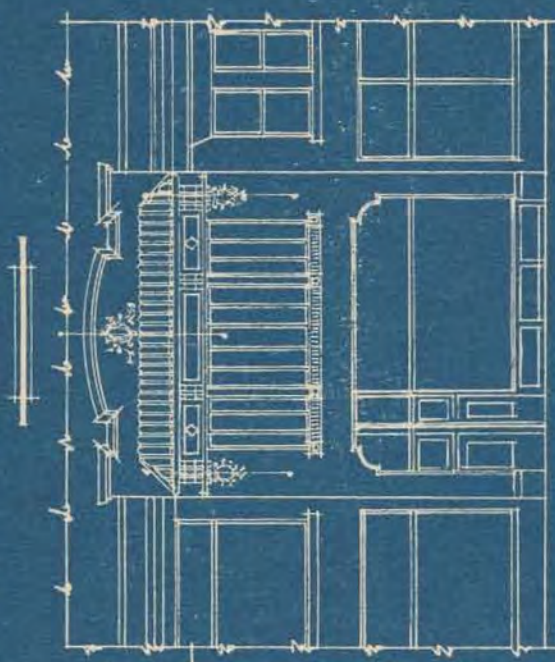
BASMENT PLAN  
Scale: 1/8" = 1' 0"



SECOND FLOOR PLAN  
Scale: 1/16" = 1' 0"



PLAN NUMBER FOUR  
 A STORE BUILDING  
 PROTECTED ON TWO SIDES

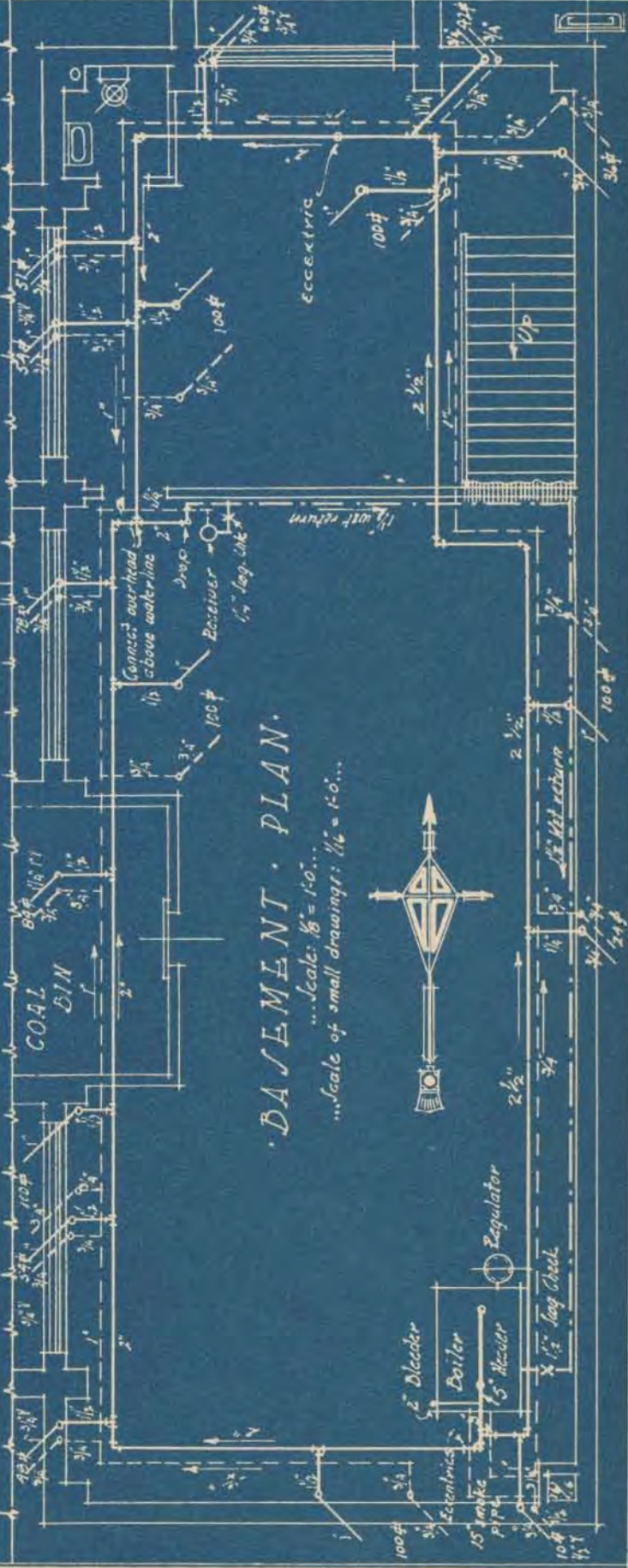
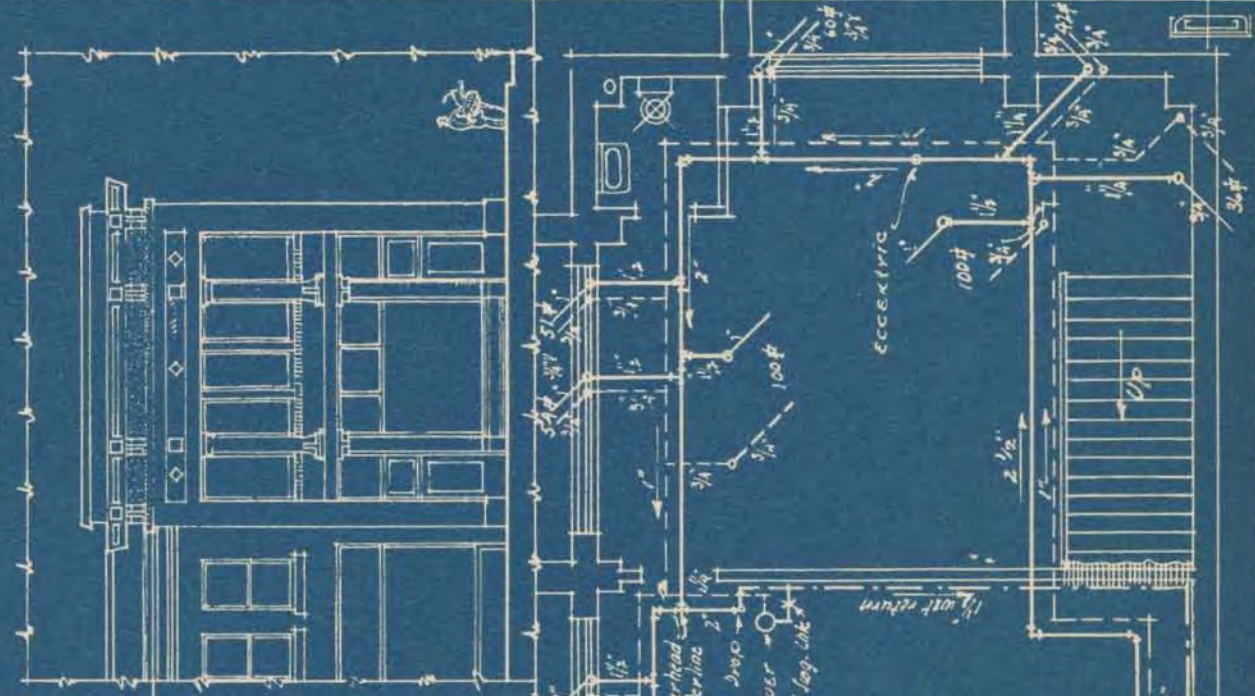
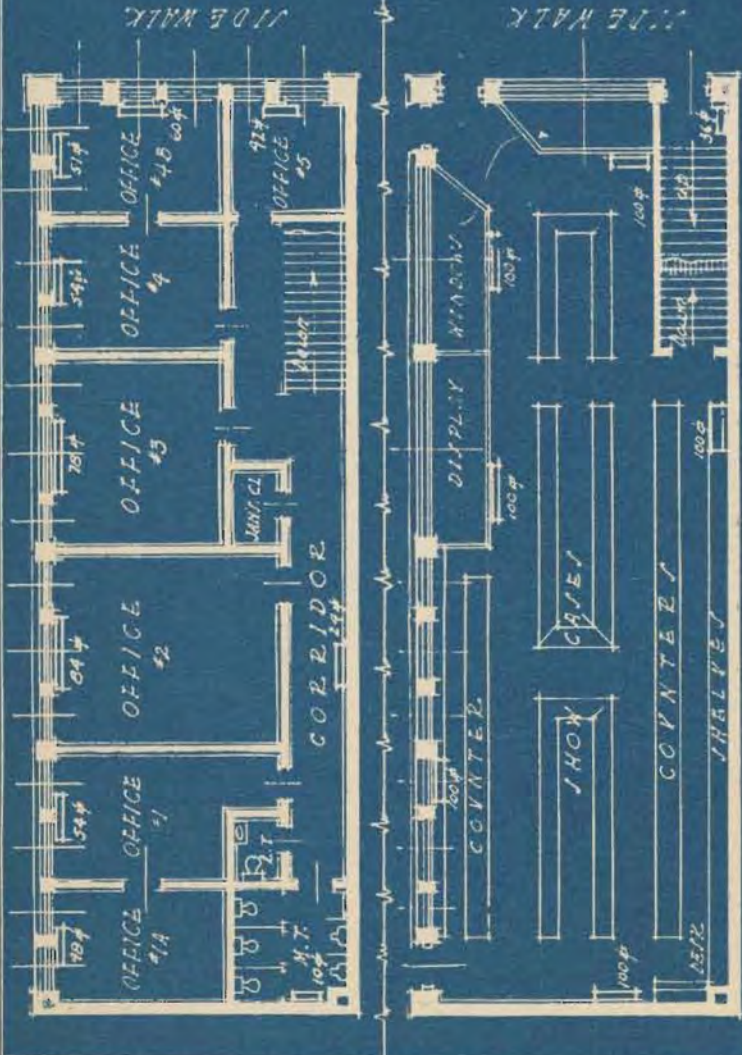


BASEMENT PLAN

Scale: 1/8" = 1'-0"  
 Scale of small drawings: 1/16" = 1'-0"



PLAN NUMBER FIVE  
 A STORE BUILDING  
 LOCATED ON A CORNER



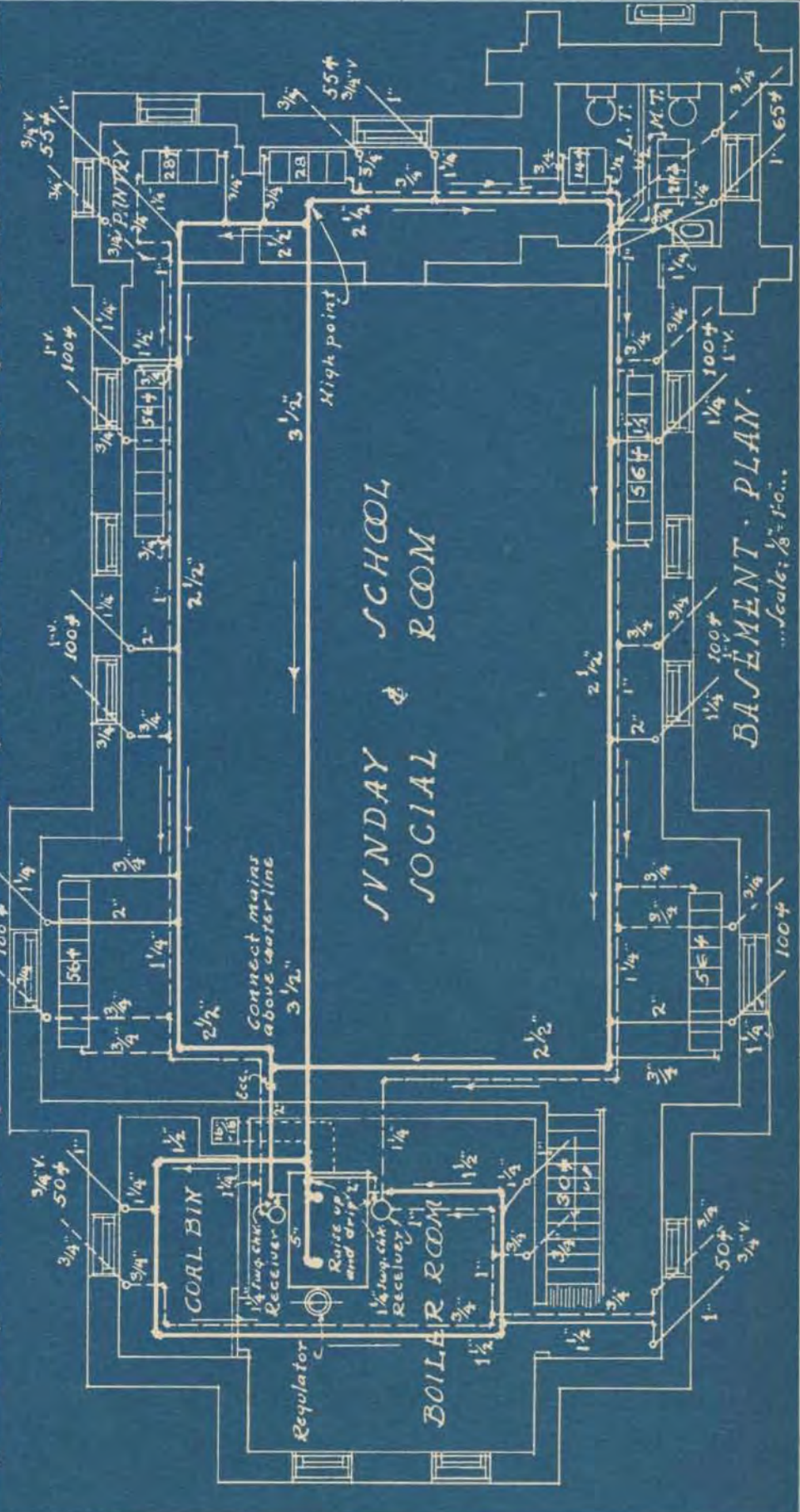
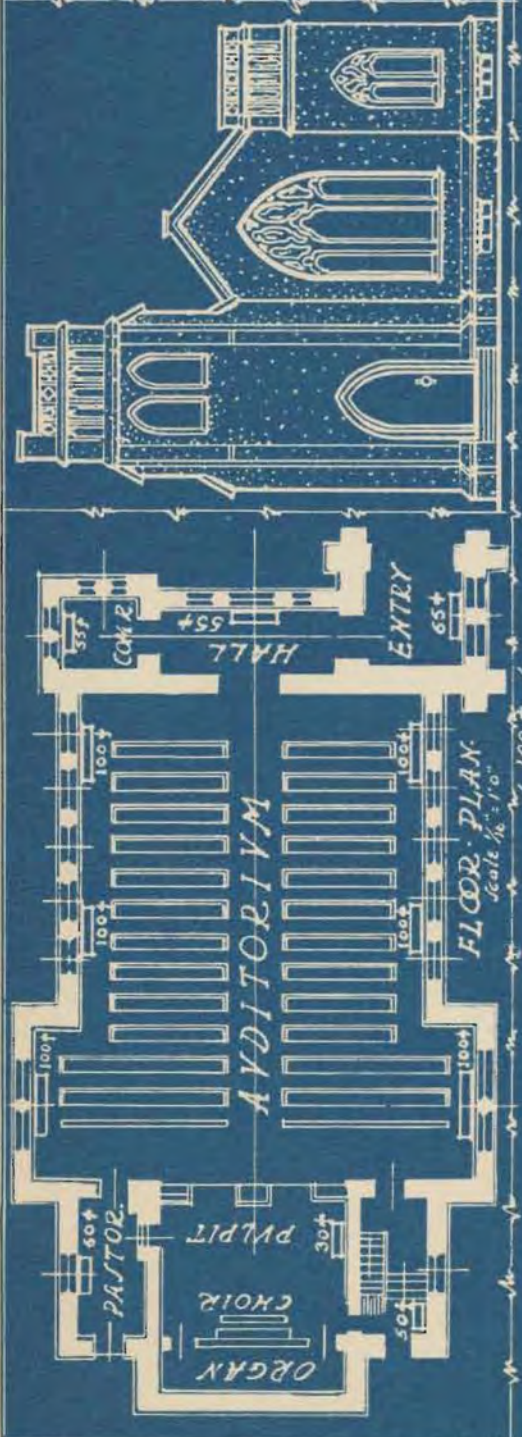
BASEMENT PLAN

...Scale: 1/8" = 1'-0"  
 ...Scale of small drawings: 1/16" = 1'-0"



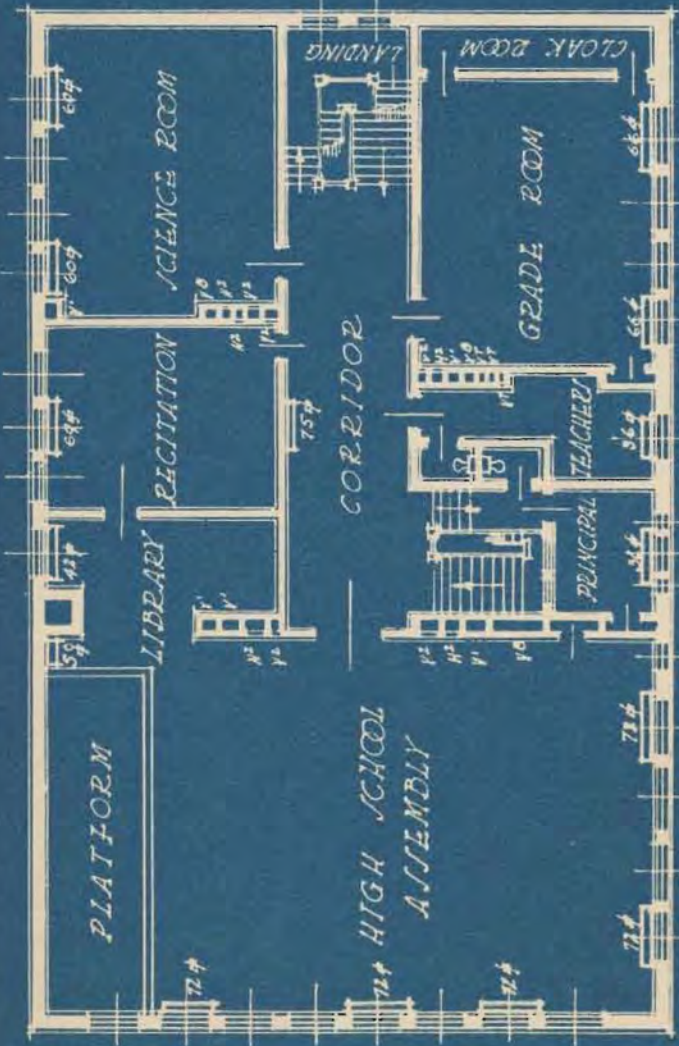
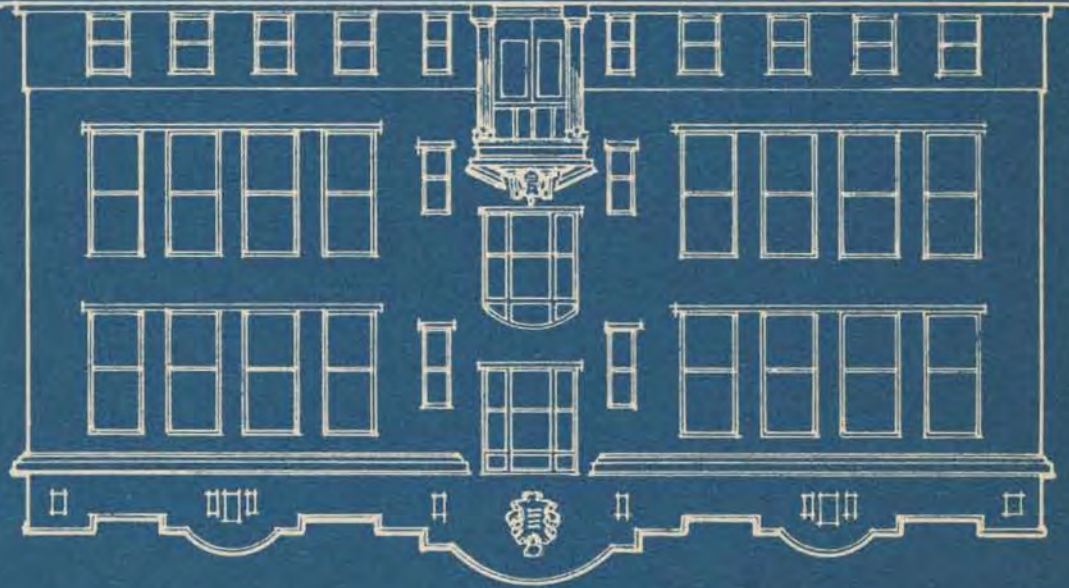
PLAN NO. SIX  
A. CHVRCH.

NOTE THE WE. OF  
THREE CIRCVITS.  
IN THIS LAYOVT.

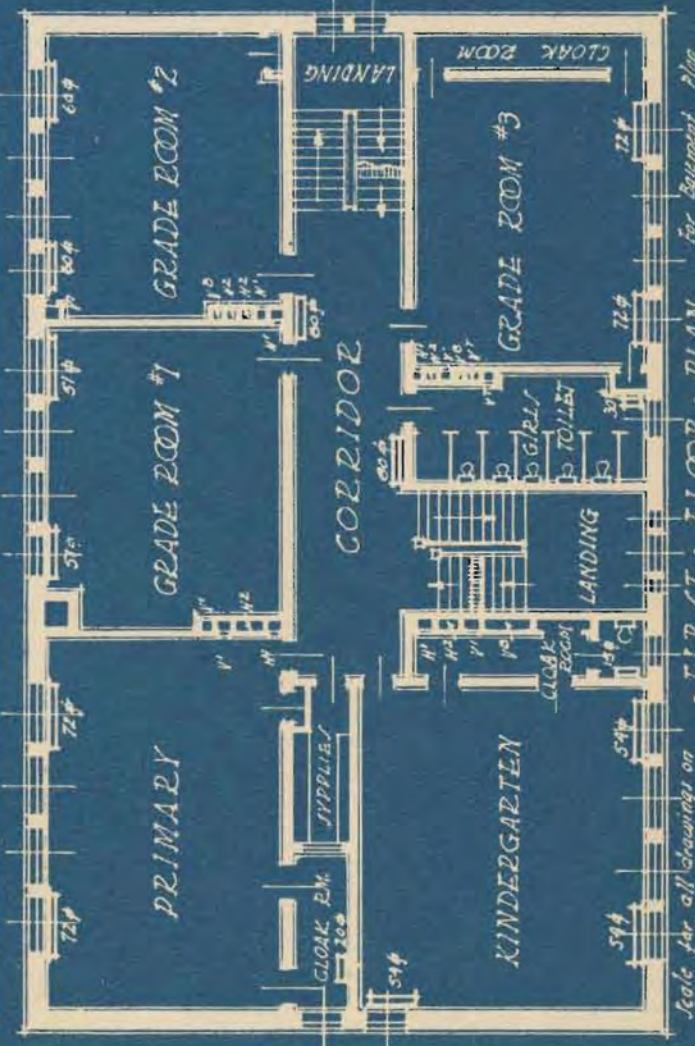


SHEET NUMBER ONE  
 PLAN NUMBER SEVEN  
 SCHOOL BUILDING

SHOWING THE USE OF A FAN SYSTEM IN COMBINATION WITH DIRECT RADIATION.  
 REDRAWN FROM AN INSTALLATION.



SECOND FLOOR PLAN



FIRST FLOOR PLAN

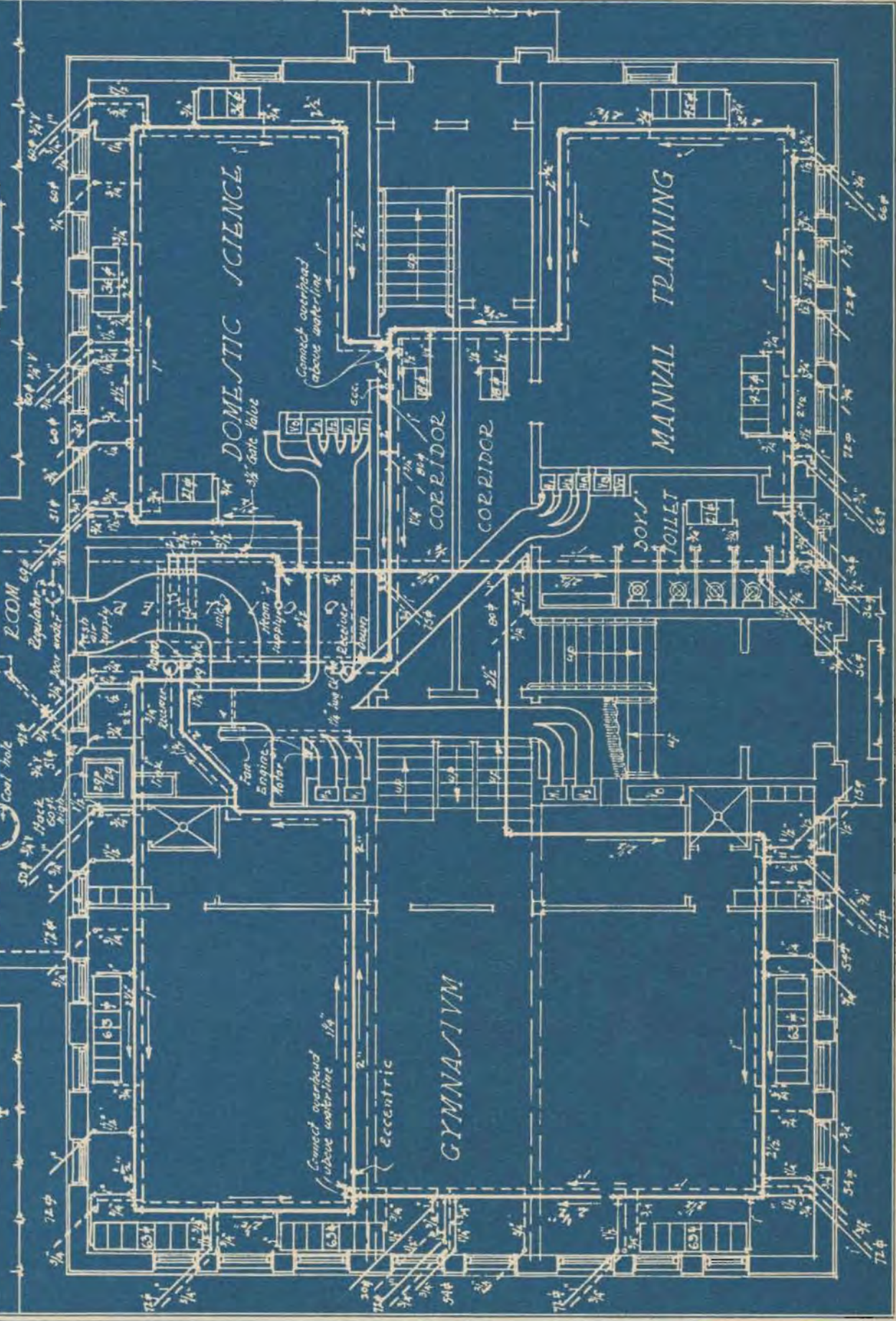
Scale for all drawings on this sheet: 1/8" = 1'-0".....

For Basement Plan see following sheet.....

SHEET NUMBER TWO  
 PLAN NUMBER SEVEN  
 A SCHOOL BUILDING  
 CONTINUED FROM SHEET # 1.

Pitch all pipes down in direction of arrows. Top of receivers should be at least 20" above boiler water line.

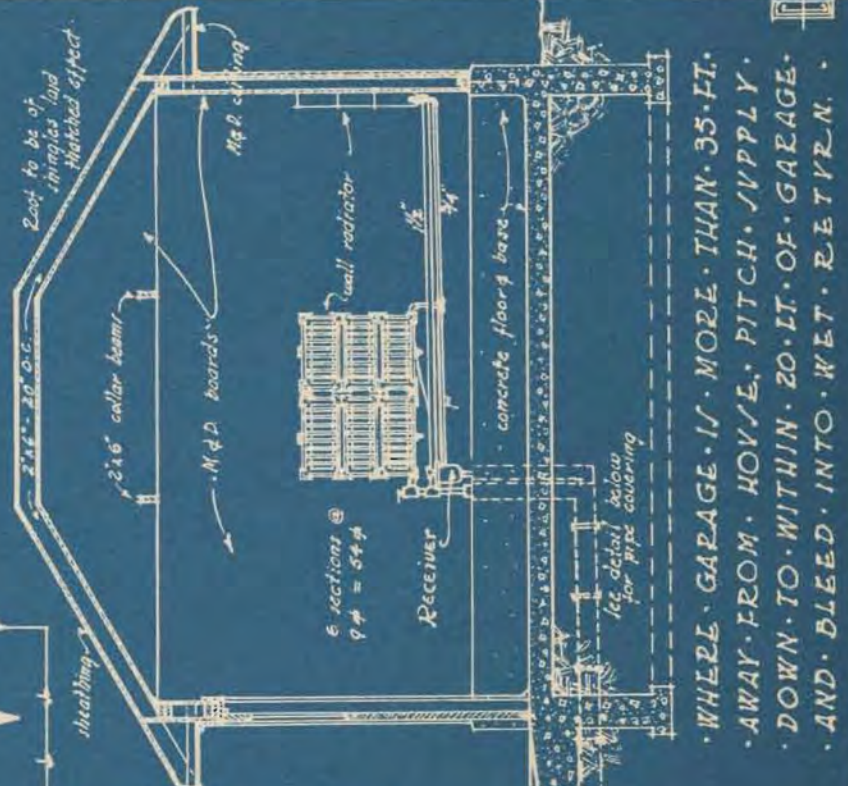
BASEMENT PLAN.  
 No scale.....



PLAN NUMBER LIGHT-  
A DISCONNECTED GARAGE-  
SEE ALSO PLAN NUMBER TWO, SHEET FOUR.

PIPE PASSING UNDER GROUND  
MUST BE AT LEAST EIGHTEEN  
INCHES ABOVE WATERLINE OF  
BOILER. SELECT LOW WATER-  
LINE BOILER. USUALLY A PIT  
IS REQUIRED UNLESS A CON-  
DENSATION PUMP IS USED AS  
SHOWN ON FOLLOWING SHEET.

ELEVATION SHOWING  
GARAGE IN CONNECTION  
WITH RESIDENCE SHOWN  
ON SHEET NUMBER FOUR.  
... Scale:  $\frac{3}{8}'' = 1'-0''$



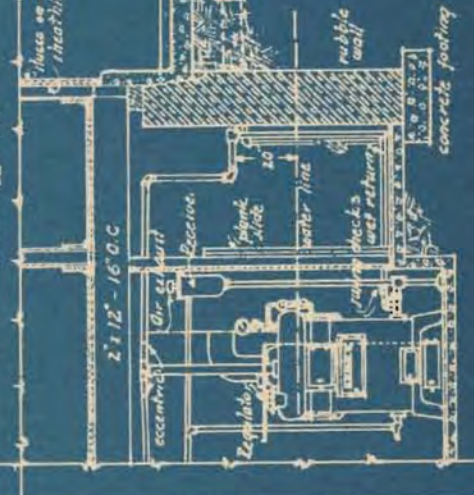
WHERE GARAGE IS MORE THAN 35 FT.  
AWAY FROM HOV/E, PITCH SUPPLY  
DOWN TO WITHIN 20 LT. OF GARAGE  
AND BLEED INTO WET RETRYN.

SECTION  
... Scale:  $\frac{3}{8}'' = 1'-0''$



DETAIL OF PIPE COVERING  
... Scale:  $\frac{3}{8}'' = 1'-0''$

PLAN  
... Scale:  $\frac{3}{8}'' = 1'-0''$

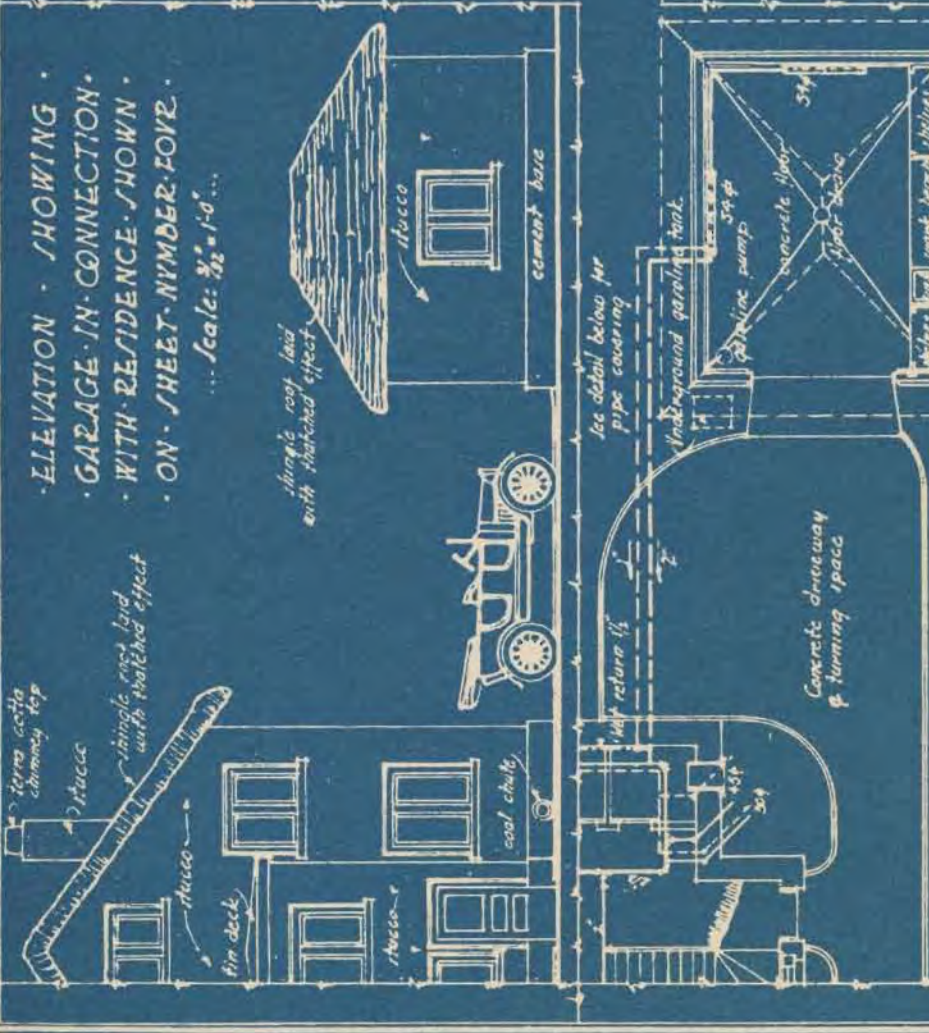




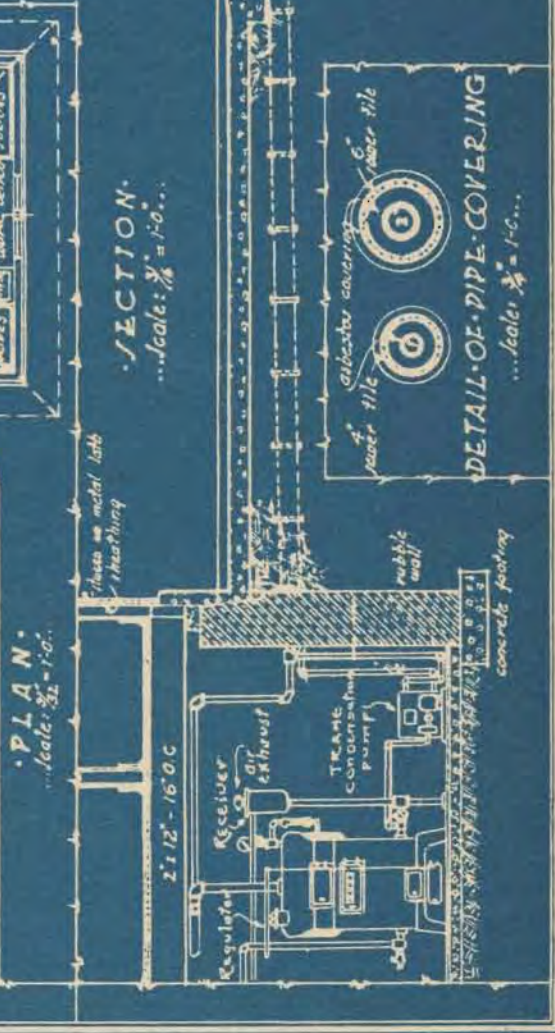
**PLAN NUMBER NINE  
A DISCONNECTED GARAGE**  
SEE ALSO PLAN NUMBER TWO SHEET FOUR

BY INSTALLING A TRANE  
AUTOMATIC ELECTRIC CONDENSATION PUMP UNDER  
GROUND PIPING CAN BE  
RUN EVEN BELOW WATER  
LINE THUS DOING AWAY  
WITH PITTING OF BOILERS.

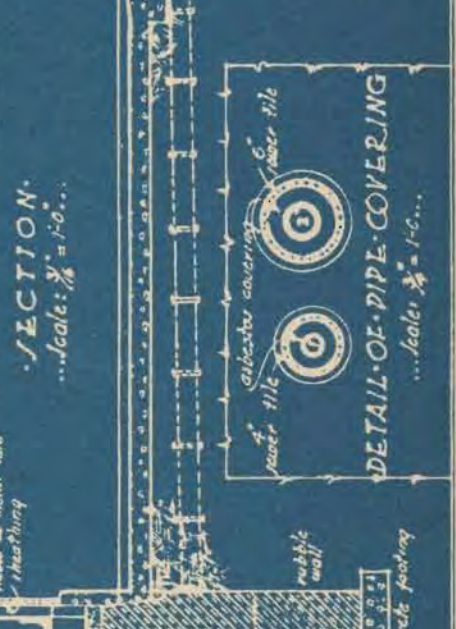
**ELEVATION SHOWING  
GARAGE IN CONNECTION  
WITH RESIDENCE SHOWN  
ON SHEET NUMBER FOUR**  
Scale:  $\frac{1}{32} = 1'-0"$



**PLAN**  
Scale:  $\frac{1}{32} = 1'-0"$

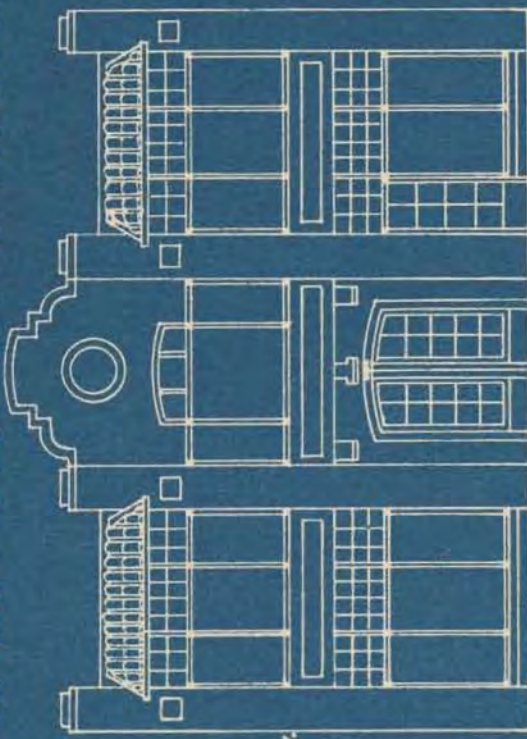


**SECTION**  
Scale:  $\frac{1}{8} = 1'-0"$

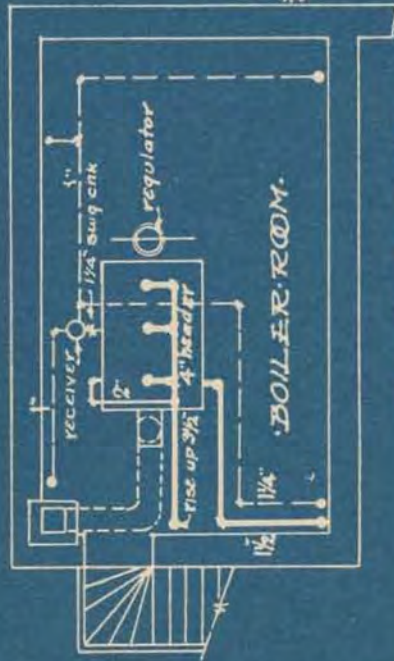


WHERE GARAGE IS MORE THAN 35 FT.  
AWAY FROM HOUSE, PITCH SUPPLY  
DOWN TO WITHIN 20 FT. OF GARAGE  
AND BLEED INTO WET-BEYRN.

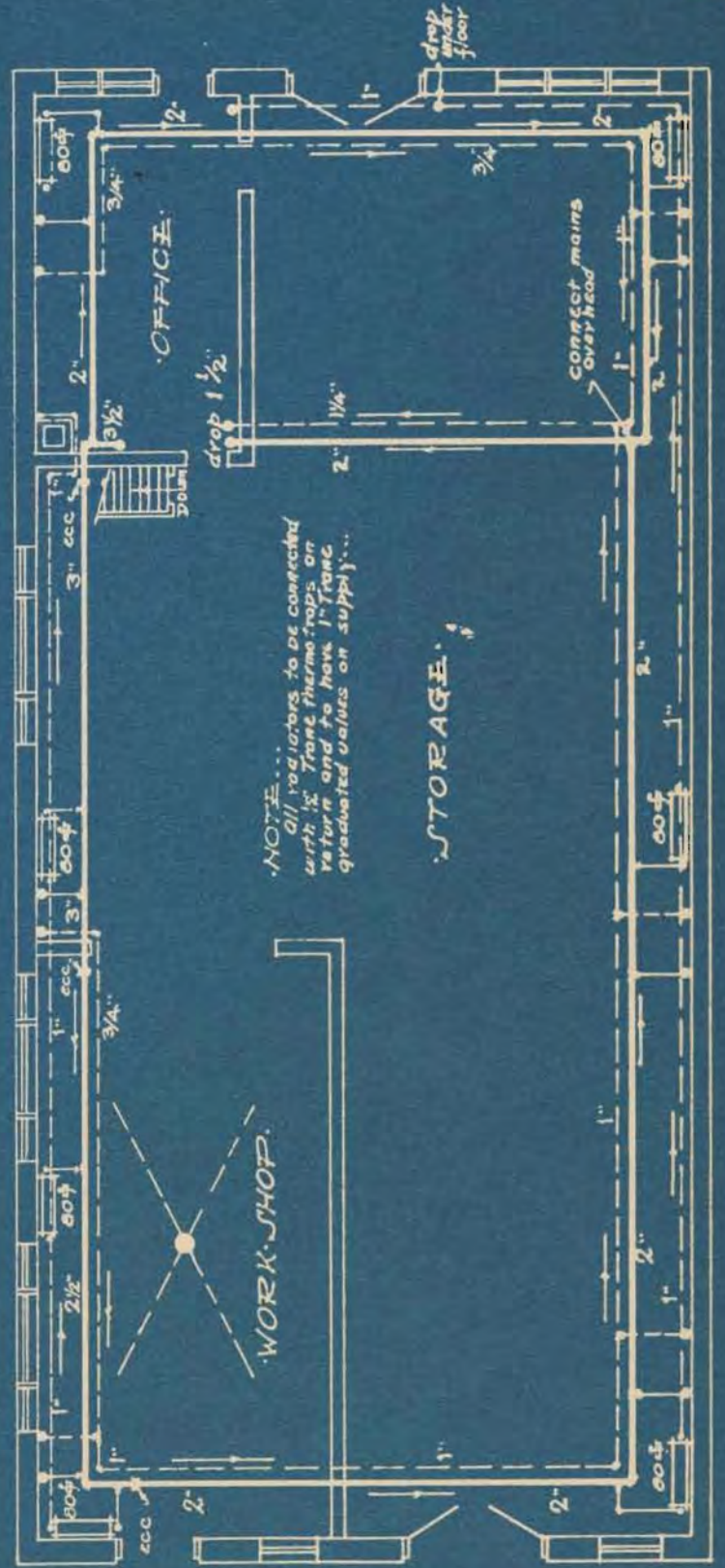
# PLAN NUMBER TEN - A GARAGE BUILDING



- BASEMENT IN.
- ONE CORNER.
- OVERHEAD.
- PIPING SYSTEM.



· BASEMENT PLAN.  
... Scale: 1/8" = 10" ...

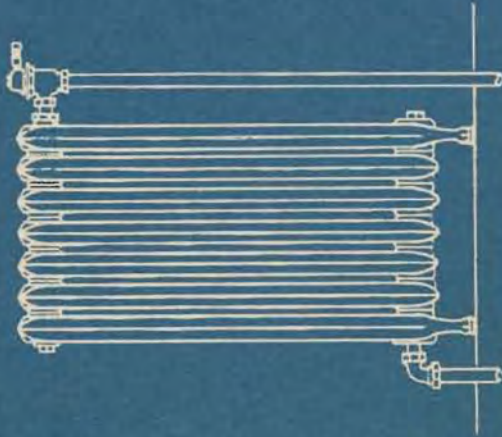


· NOTE: ...  
All radiators to be connected  
with 1/2" Trawl thermo traps on  
return and to have 1" Trawl  
graduated valves on supply...

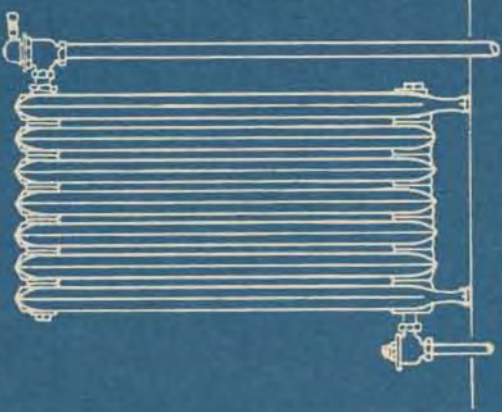
· STORAGE.



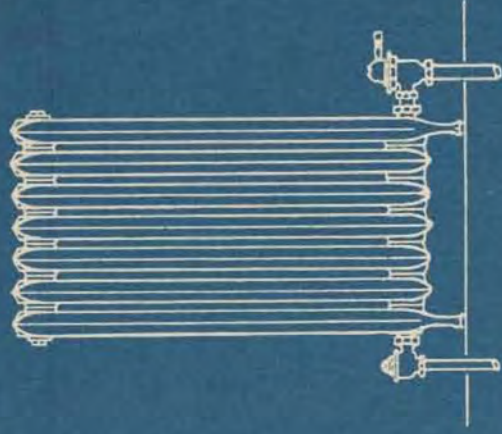
# TYPICAL RADIATOR CONNECTIONS.



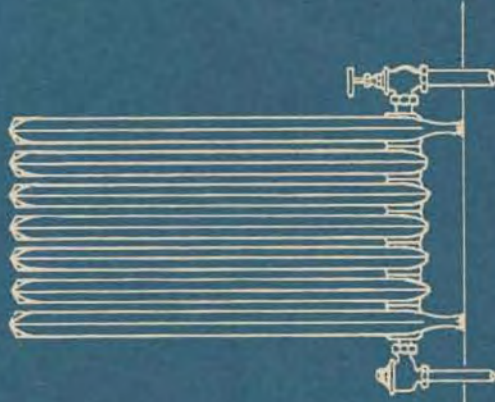
STANDARD VALVE AND RETURN FITTING CONNECTION.



STANDARD VALVE AND THERMO TRAP CONNECTION.



BOTTOM CONNECTION, USED IN CHURCHES AND SCHOOLS FOR WARM-HEAT-INTERMITTENT.



CONNECTIONS USED FOR REMODELLING STRAIGHT STEAM INSTALLATIONS.



TWO METHODS OF CONNECTING RADIATORS FOR SUPPLY AND RETURN ON SAME END.



TWO METHODS OF CONNECTING RADIATORS FOR SUPPLY AND RETURN ON SAME END.

# DETAIL OF TYPICAL BOILER CONNECTIONS. I.

Steam Inlet  
Vent opening

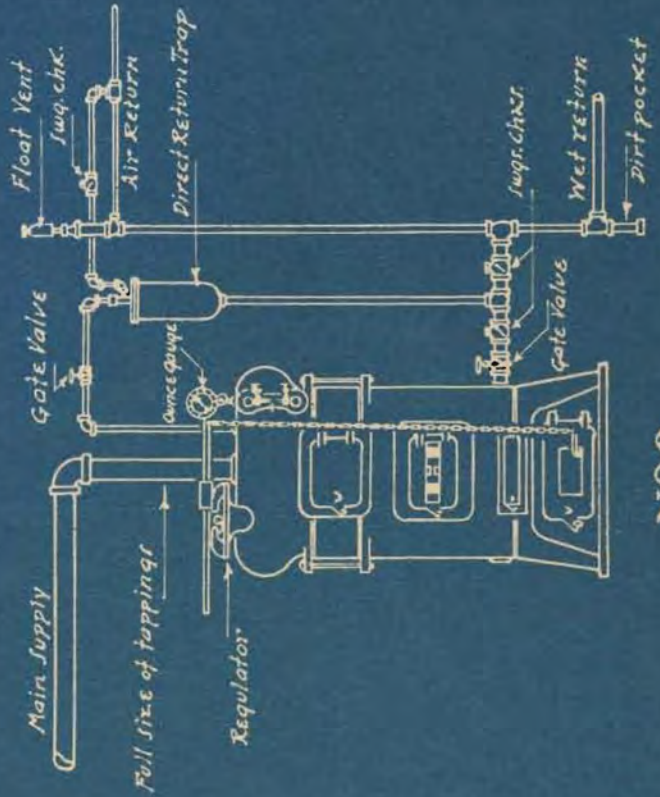


## RETURN TRAP

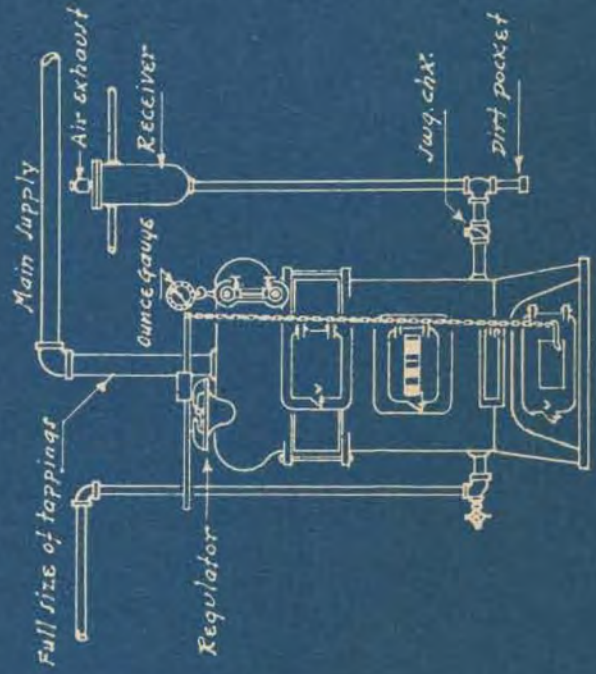


### CONNECTIONS FOR ROUND BOILERS USED WITH A TRANE SYSTEM

No. 2 Used with Return Trap and Thermetal Traps.  
No. 3 Used with Receiver and Return Fittings.

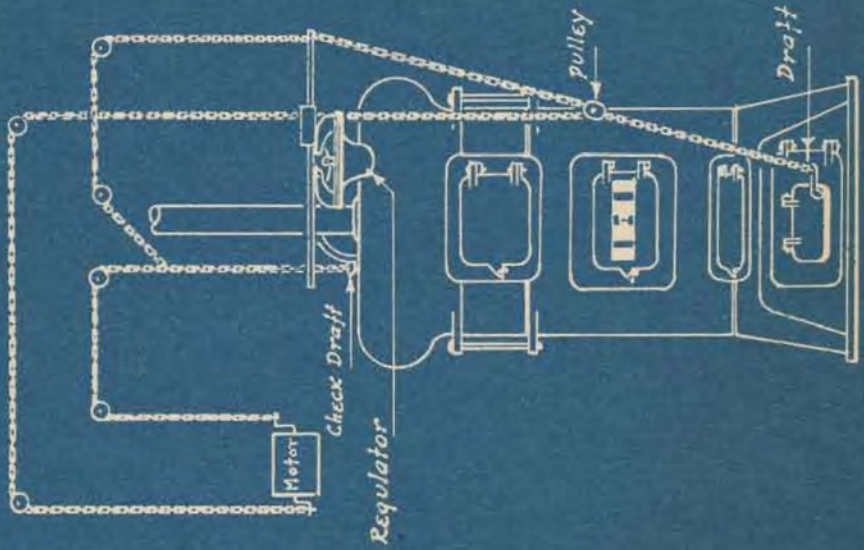


NO. 2



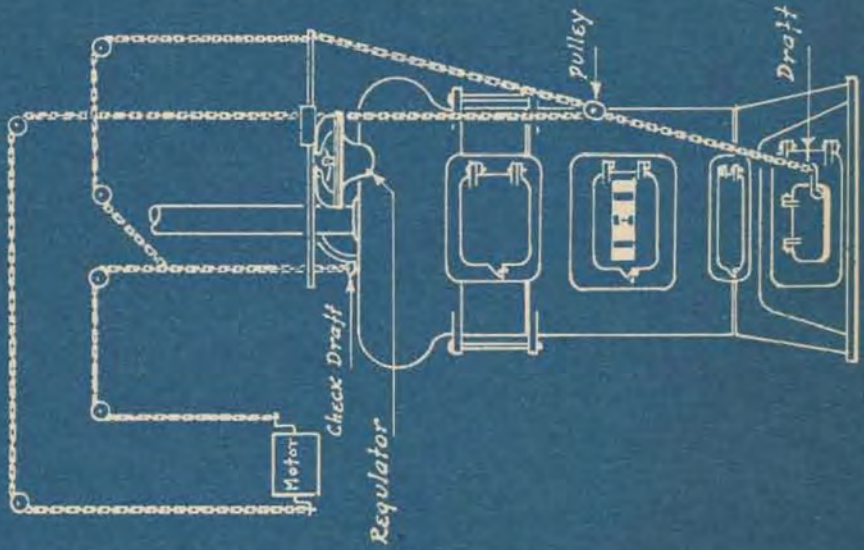
NO. 3

· DETAIL OF TYPICAL ·  
· BOILER · CONNECTIONS · II ·



NO 4

· TYPICAL CONNECTIONS · FOR ·  
· SQUARE · BOILER ·



NO 5

· THERMOSTAT · CONNECTIONS ·