TEST ON A HOT-BLAST HEATING SYSTEM.

In the

Engineering Laboratory of the

MICHIGAN STATE COLLEGE.

by

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1912.

THESIS

12-4-51
(9)

In the installation of a hot blast heating system, one of the most important factors to take into consideration is the amount of air to be delivered per unit of time, or the velocity of the air.

It is customary to take the manufacturers rating of the fan to be used, with consideration for the losses due to friction in the conductor pipes, neglecting any losses that might occur due to friction of the coils in the heater.

Our object in performing this test has been to determine to what extent these losses due to the heater coils will affect the rated output or velocity of air delivered by the system, and, incidentally, obtain other data on the performance of a system of this type.

DESCRIPTION OF SYSTEM.

The complete system consists of five sections of four row coils, the long coils being 3'6" in lenght, and the short coils 3'3" in length. The pipe used in the coils is one inch pipe. The dimensions of the coils correspond to the standard No. 412 A type sections as manufactured by the Massachusett's Fan Co. There are twelve pipes in each row, with a spacing of 2.75 inches center to center. The fan is a No. 60 steel plate made by The American Blower Co. A 10 H.P. motor was used to drive the fan. The speed was varied by changing the pulleys on the fan shaft. The discharge pipe of the fan is 25 inches in diameter.

METHOD.

Six runs were made; the first with all five sections in the heater, the second with four sections, and so on, removing a section before each run, the last being run with all sections removed. Each run consisted of four tests, each at a different fan speed. The length of tests was 1 1/2 to 2 hours each.

The velocity of the discharge air was measured in the outlet pipe with a Pitot tube connected to a differential manometer, filled with a special solution, which read directly in inches of water. The mean velocity was obtained by raking manometer with the Pitot tube inserted midway between the circumferences of imaginary concentric circles which diveded the discharge pipe into small areas in the cross-section, as shown by blue-print. The average velocity of the air passing thru each small area of the cross-section was then obtained from the application of the average manometer reading of the area in the formula for reducing the av. reading to velocity in feet per sec. The sum of all these average velocities multiplied by the area in which the velocity was measured was then divided by the whole area of the cross-section and the mean velocity of the discharge air was the quotient thus obtained. Having obtained the mean velocity the volune of air passing thru the outlet was obtained by multiplying the mean velocity be the cross sectional area of the discharge pipe. All velocities an volumes were corrected for a standard temperature and pressure of 70 degrees Fahr. and 29.92 In. of mercury. All curves plotted are based on the corrected velocities and volumes.

The pressure loss due to the coils in the heater was measured by means of a manometer attached to a series of 3/8" pipe so as to give the average drop, as shown in a blue print herewith.

The condensation from each coil was colledted in large tanks and weighed at the end of each test.

Temperatures were taken of the air, as it entered, in the duct out of doors, and in the outletpipe where the Pitot tube readings were taken. The room temperature was also taken at the same time.

Barometer readings were recorded, also R.P.M. of motor and fan, and input of motor.

The steam pressure in the heater was maintained at 5 Lbs. guage.

The thermometers and steam guages were calibrated at the beginning of the test, and all thermometer readings were corrected from calibration curves.

A steam separator was placed in the main above the heater, and the quality of the steam used measured with a separating calorimeter.

The manner of computing the velocities by both the Pitot tube method and the condensation method are shown herewith for Test A-1.

PITOT TUBE METHOD OF MEASURING VELOCITIES.

Referring to tabulated data sheet of test A-1, the Av. of manometer readings No. 12 was taken as h-1, and the Av. of readings No. 1 and No. 11, 2 and 10, 3 and 9, etc. were taken as h-2, h-3, etc. No. 6 was taken as h-7. This arrangement was necessary as the Pitot tube could not be brought closer than 3" on one side of the outlet on account of its construction. These readings reduced to velocity in ft. per sec. correspond to v-1, v-2, etc. on blue print B.

The formula for reducing the manometer readings to velocity readings is $V=V\frac{2gh}{12} \times \frac{D}{d} = 2.316\ V\frac{hD}{d}$

Where h equals Av. velocity head in inches of water.

D equals density of water at room temp. Kent-638.

d equals density of air at outlet temp. Kent-584.

TEST NO. A-1. RESULTS.

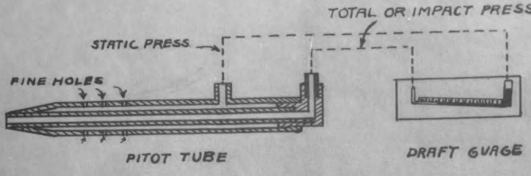
$D = 62.14 \quad d = .067119 \quad V = 2.316V\ h \times \frac{62.14}{.067119} = 70.4V\ h$

v-1 = 70.4 $\sqrt{.453}$ = 47.4 ft. per sec.		a-1 = 1.004 sq. ft.	
v-2 = 70.4 $\sqrt{.513}$ = 51.1 " " "		a-2 = 0.829 " "	
v-3 = 70.4 $\sqrt{.503}$ = 50.0 " " "		a-3 = .654 " "	
v-4 = 70.4 $\sqrt{.509}$ = 50.2 " " "		a-4 = .480 " "	
v-5 = 70.4 $\sqrt{.548}$ = 52.0 " " "		a-5 = .3054 " "	
v-6 = 70.4 $\sqrt{.556}$ = 52.5 " " "		a-6 = .131 " "	
v-7 = 70.4 $\sqrt{.550}$ = 52.2 " " "		a-7 = .0054 " "	

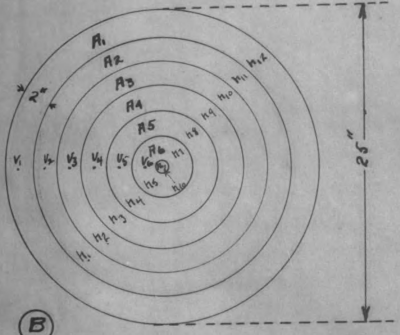
a-1 x v-1 =	47.600
a-2 x v-2 =	42.400
a-3 x v-3 =	32.700
a-4 x v-4 =	24.030
a-5 x v-5 =	15.870
a-6 x v-6 =	6.870
a-7 x v-7 =	.282
	169.752

Average velocity thru outlet = $\frac{169.752}{3.409}$ = 49.7 ft. per sec.

Cross sectional area of outlet = 3.409 sq. ft.

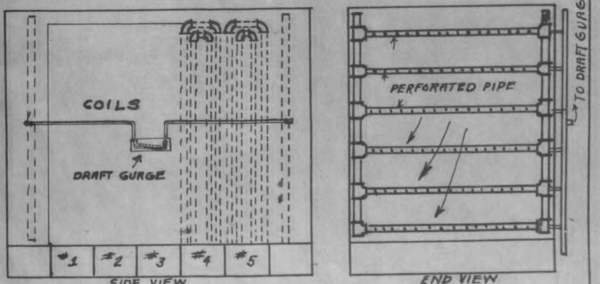


(A)



(B)

SHOWING METHOD OF DIVIDING CROSS-SECTIONAL AREA OF DISCHARGE PIPE TO DETERMINE AV. VELOCITY OF AIR Velocity head read for mid-point of concentric circles each 2" wide and also in centre of small inner circle 1" in diam.



(C)

METHOD OF MEASURING PRESSURE DROP THRU COILS

CONDENSATION METHOD.

TEST A-1.

1. Atmospheric pressure = 14.12 Lbs. per sq. in.
2. Absolute steam pressure = 19.12 Lbs. per sq. in.
3. Quality of steam (see formula) = 93.30%
4. Latent heat of steam at 19.12 Lbs. per sq. in, = 961 B.T.U.
5. Latent heat of steam as used = 896 ".5.7.
6. Temperature of steam used.
7. Heat available per Lb. of steam = 896 + (225.6 - 212) = 909.6 B.T
8. Total condensation per hr. = 592.18 Lbs.
9. Total heat given up by steam = 592.18 x 909.6 = 5383647 B.T.U. hr
10. Totalheat given up by steam = 8,977 B.T.U. per min.
11. Temperature rise of air = (108.5 - 37.3) = 71.2 degrees.
12. Pounds of air passing thru heater per min. = $\frac{8977}{71.2 \times .2375}$ =532 Lbs
13. Vol. of 1 Lb. of air at 108.5 degrees = 14.4 sq. ft.
14. Volume of air passing over heater = 532 x 14.4 = 7650 cu. ft. min
15. Area of outlet pipe = 3.409 cu. ft.
16. Free area thru heater = 5.47 sq. ft.
17. Velocity thru outlet = $\frac{7650}{3.409}$ = 2242 ft. per min.
18. Velocity thru heater = $\frac{7650}{5.47}$ = 1400 ft. per min.

Formula for quality of steam $$q = \frac{\frac{APa}{42}\sqrt{\frac{3(P - Pa)}{Pa}}}{\frac{APa}{42}\sqrt{\frac{3(P - Pa)}{Pa}} + W}$$

A = Area of orifice in sq. in.
Pa = Absolute pressure of atmosphere.
P = Absolute steam pressure.
W = Weight of separated water in Lbs. per second.

PERFORMANCE CURVES.

Curve sheet A shows the average friction loss in inches of water for different depths of sections, with fan delicering air at different velocities (in ft. per min. obtained from the condensation method). The curve was plotted from the data in Table A.

Curve sheet A-1 shows the curves from sheet A plotted logarithmically. The abscissae represent velocity in ft. per Min. stabting at 1 on the sheet, for values of 1000 , 1100. 1200 etc. with the corresponding pressure losses in inches of water as ordinates of the curves (1 representing a pressure loss of .1". 2 represents .2" etc.). Curve 1-1 is for a depth of one section, 2-2 for a depth of 2 sections etc. The points for curves 1-1 2-2 and 5-5 do not give a curve with an exact slope for which the exponent n = 2 in the equation $y = Bx^n$, but since curves 3-3 and 4-4 do, and since curves 1-1 and 2-2 give a greater slope and curve 5-5 gives a lesser slope than onf for which n = 2, this value was taken as the average for all the curves. For an explanation of logarithmic curves see Kent 8th edition pg. 85,

Curve sheet B shows the average friction loss in inchesof water for different depths of sections, for different fan speeds. These curves are plotted from data in table A.

Curve sheet C shows the average friction losses for different depths of sections for the same fan speed. This curve is plotted from values taken from curves on curve sheet B.

Curve sheet D shows the velocities in ft. per min. produced for different depths of sections, by different fan speeds. The velocity is that thru the free areain heater, as measured by Pitot tube method. The points for curve are taken from table A.

Curve sheet E shows the condensation per sq. ft. per hr. for various section depths for different velocities of air in ft. per min thru the heater, as calculated by the dondensation method.

Curve sheet F shows the different velocities produced for different consumptions of power. From table A.

Curve sheet G shows the power necessary to drive the fan at vabious speeds with five sections in the heater. The depth of sections does not alter the power required at low speeds, and only very slightly at higher speeds, so the curve shown may be assumed as that for any depth of sections for speeds shown.

These curves show, in general, that for a constant fan speed the pressure loss varies approximately as the depth of sections, and the square of the velocity, (curve A) and with the fan speed in a ratio of 3:2. (Curve B), calculations base on the condensation method of measuring velocity.

The relative velocity loss is found to vary directly both as the fan speed and as the depth of sections. (Curve sheet D).

Curve sheet E is probably only approximately correct, owing to trouble in collecting condensation. However it shows that the condensation per sq. ft. per hour increased at a much more rapid rate for five sections as the velocity increases, than for a lesser depth of sections, or in other words the condensation per sq. ft. increases more rapidly the greater the depth of sections.

We find that taking all friction losses into consideration the power input increases gradually in a uniform manner, up to a fan speed of about 500 R.P.M. and a delivery of about 1000 ft. of air per min. after which the input increases at a rapid rate.

A glance at the curves will give quite complete information as to the performance of the system. For instance, taking the sheets in order, if we desire to know the performance of the system, under the standard conditions calculated, for a depth of five sections and a fan speed of 500 R.P.M., we find the pressure loss is .36 inches of water, the velocity of the air thru the heater is 755 ft. per min. (Condensation Method) or 1125 ft. per min. (Pitot tube method), The condensation per hour is 1.37 Lbs. per sq. ft. of heating surface, and it takes 3.5 horse power to drive the fan.

GENERAL DISCUSSION OF RESULTS OBTAINED.

We used the condensation method results for obtaining the velocity of the air thru the heater, because this method is supposed to be more accurate than the Pitot tube method. The velocity heads in this latter method should be multiplied by a coefficient to obtain the correct velocity heads, and this coefficient is difficult, if not impossible, to obtain accurately.

The system we used was not provided with air valves on the inlet side of the coild, so the results, in all probabioity, are affected by the coils beconing air-bound towards the latter part of each test. We let the steam blow thru the coils before we began each test, until we judged all the air was expelled, but during the gest the air, coming over in the steam had no means for escape. This air settled in the bottom manifold and extended some distance up the pipes, air being heavier than steam.

In our tests we kept the coils as free from air as possible, yet we believe the small amount of condensation collected in the first two tests of runs C & D was due to air-binding. We con easily imagine the affect of this air-binding, and its consequent reduction of effective heating surface, in commercial installations where no attention is paid to the coils whatever.

The results of the condensation method must be also affected by the radiation of heat from the sheet iron casing of the heater and fan housing, and air leakage thru the casing. We could not determine nor estivate these losses, so we made no allowance for ghem.

There may, also, be some error from the evaporation of the collected condensation in the tanks during the test.

CONCLUSIONS.

We have found that the fan runs most efficiently at a speed of about 500 R.P.M. and consuming about 3.5 H.P. and delivering air at a velocity of 1000 ft. per min. These conclusions are drawn from curve sheet 6; which takes into consideration all friction losses.

From curve sheet A, we find that the pressure loss due to the coils varies directly as the number of sections, and approximately as the square of the air velocity, As the number of coils increase, the pressure drop comes to vary almost directly as the velocity. The velocity referred to is the velocity thru the heater.

Curve sheet D shows that the velocity drop caused by the friction of the coils, varies directly as the number of sections and directly as the fan speed.

Public buildings require air furnished at a velocity of about 1200 ft. per minute. Referring to table C, we find that the air supplied when the entire five sections are in the heater is 22% less than when the coils are all removed. Now, since the pressure loss varies directly as the number of sections in the heater, and approximately as the square of the air velocity thru the heater, we are able to derive a formula from the curves on curve sheet A-1.

$$p = Bnv^2$$

The general equation for the curves is $p = Bx^n$. (Kent pg. 35) or in logarithmic form; Log y = Log B + Log x, in which B represents intercept with the vertical axis, and "n" the slope. These curves are shown on curve sheet A-1, and we find that they are all straight lines from which we obtain:

$$n = 2 \qquad B = .0000000018$$

The value of B is an average value for one four row section and is found to vary as the number of sections, Substituting in the original formula we obtain:

$$p = .0000000018nv^2.$$

p = pressure loss in inches of water.
n = number of sections.
v = air velocity thru heater in ft. per min.

If it is desired to find "p" in ounces per sq. inch the formula becomes:

$$p = .0000000056nv^2.$$

Mr. E.J. Shealy, in the Heating and Ventilating Magazine for Nov. 1911, obtains the following formula for a two row section:

$$p = .0000000nv^2.$$

p = ounces per sq. in.

The system upon which his tests were run consisted of two row sections 3 ft. high and 3 ft. wide, and the fan used was 48 inches in diameter, making it rather difficult to compare results.

From the results obtained in these tests, we are led to believe, that in the installation of a heating system of this type, if the system is to give entire satisfaction, the friction loss due to the heater coils must be calculated and allowed for.

TESTS OF 5 No. 112 Hot Blast Coils. MICHIGAN STATE COLLEGE,

TEST No. A-1. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 4-18-12.

TOTAL HEATING SURFACE 277.5 sq. ft. FROM 1:25 P.M. to 3:25 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	1:25	1:55	2:25	2:55	3:25	Av.
Barometer	28.72	28.72	28.74	28.75	28.75	28.73
Steam pressure in heater						5 Lbs.
Temp. of steam in heater						226
Temp. of entering air	38.2	38.5	37	37	37	37.3
Temp, of leaving air	110	109.5	107.5	107.5	107.5	108.5
Temp. rise						71.2
Temp, test room						89.1
R.P.M. of fan	764	766	770	771		767.75
R.P.M. of motor	772	775	778	778		775.75
Friction loss thru heater	.79	.78	.79	.80	.80	.703
Calorimeter readings	.072 Lbs. in 25'		.055 in 20'.			

MANOMETER READINGS.

READINGS (In. of water.)			
1.	.455	.465	.465
2.	.455	.465	.465
3.	.465	.480	.480
4.	.505	.505	.505
5.	.540	.530	.540
6.	.550	.550	.550
7.	.575	.575	.575
8.	.590	.590	.590
9.	.610	.610	.610
10.	.625	.625	.625
11.	.560	.565	.565
12.	.450	.450	.455

	No, of section.					
Condensation in Lbs. per hr.	1.	2.	3.	4.	5.	
	149.5	129.13	115.3	103.6	94.8	5921
" per sq, ft. per hr.						2.14

Quality of steam 93.3% B.T.U. of steam used 909.6

Wt. of cu. ft. of air in blast .067119 Lbs.

Velocity of air (ft. per min.) from Man. readings	2983'	Outlet pip
Volume of air (cu. ft. per Min " "	10178'	" "
Equivalent velocity of air at 70 F. & 29.92 Hg.	2675'	Free area
" volume under above conditions	9125'	" "
Velocity thru heater from condensations	1499	" "

TESTS OF 5 No. 112 Hot Blast Coils. MICHIGAN STATE COLLEGE,

TEST No. A-2. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3" DATE 4-19-12.

TOTALHEATENG SURFACE 377.5 Sq. ft. FROM 1:40 P.M. to 3:40 P.M.

FREE AREA THRI HEATER 5.47 " "

Time	1:40	2:10	2:40	3:10	3:40	Av.
Barometer	29.13	29.12	29.12	29.12	29.12	29.12
Steam pressure in heater						5 Lbs.
Temp. of steam in heater						226
Temp. of entering air	52	51.5	51.0	51.2	50.0	50.4
Temp. of leaving air	121	118	117.5	118	117.5	118.9
Temp. rise						68.5
Temp. test room						82.8
R.P.M. of fan	554	560	552	562	560	557.6
R.P.M. of motor	804	800	800	808	805	803.4
Friction loss thru heater	.474	.482	.48	.475	.48	.475
Calorimeter readings	.092 Lbs, in 20''			.09 Lbs. in 22'		
	.091 " " 22'			.09 " " 20'		

MANOMETER READINGS.

READINGS. (In. of water)			
1.	.125	.130	.125
2.	.235	.240	.235
3.	.235	.245	.235
4.	.250	.255	.250
5.	.265	.275	.260
6.	.275	.280	.275
7.	.280	.280	.280
8.	.290	.300	.295
9.	.305	.310	.305
10.	.315	.315	.310
11.	.285	.285	.285
12.	.230	.230	.230

	No. of sections.					
Condensation in Lbs. per hr.	109.1	94.0	66.45	59.2	49.50	378.25
B per sq. ft. per hr.						1,37
Quality of steam 89.7% B.T.U. of steam used 960.7						
Wt, of cu, ft, of air in blast .06673 Lbs.						
Velocity of air (cu. ft. per min.) from Man. readings					2230'	Outlet
Volume of air (cu, ft, per min.) B B B					7600	"
Equivalent velocity of air at 70 F & 29.92 Hg.					1986	Free are
" volume under above conditions					6775	" "
Velocity thru heater from condensation					1460	" "

TESTS OF 5 No. 112 Hot Blast Heating Sections.

TEST No. A-3. MICHIGAN STATE COLLEGE,

LENGTH OF PIPES 3'6" & 3'3". East Lansing, Mich.

TOTAL HEATING SURFACE 277.5 Sq. ft. DATE 4-19-[illegible].

FREE AREA THRU HEATER 5.47 " " FROM 7:30 P.M. TO 9:30 P.M.

Time	7:30	8:00	8:30	9:00	9:30	Av.
Barometer	29.14	29.15	29.16	29.16	29.16	29.15
Steam pressure in heater						5 Lbs.
Temp.of steam in heater						226
Temp. of entering air	43	39.2	39.2	40.0	40.0	39.90
Temp, of leaving air	120	119.7	117.0	114.5	115.0	117.40
Temp. rise						74.50
Temp. test room						86.00
R.P.M. of fan	448	457	456	459	458	455.60
R.P.M. of motor	803	838	848	841	840	834.00
Friction loss thru heater	.333	.342	.344	.348	.344	.306
Calorimeter readings	.117 Lbs. in 21'		.099 Lbs. in 18'.			
	.114 Lbs. in 25'		.095 Lbs. in 20'.			

MANOMETER READINGS.

READINGS (In. of water)				
1.	.145	.150	.150	.150
2.	.145	.150	.150	.150
3.	.155	.150	.150	.150
4.	.160	.155	.160	.160
5..	.170	.170	.170	.170
6.	.180	.180	.170	.180
7.	.185	.180	.180	.180
8.	.190	.185	.185	.185
9.	.195	.190	.190	.190
10.	.200	.200	.200	.200
11.	.170	.170	.170	.170
12.	.140	.140	.140	.140

	No. of section. 1	2	3	4	5	Total
Condensation in Lbs.per sq. in. per hr.	91.1	78.9	60.5	51.5	40.5	322.5
" per sq. ft. per hr.						4.1

Quality of Steam 88.7% B.T.U. of steam used 857.5

Wt. of cu, ft, of air in blast .0873

Velocity [illegible] (ft. per min.) from Man. readings 1890 Outlet pipe

Volume of air (cu, ft. per min.) " " 5780 " "

Equivalent velocity of air at 70 F. & 30.02" Hg. 947 Free area

" volume under above conditions 5180 " "

Velocity thru heater from condensation 930 " "

TESTS OF 5 Hot Blast Heater Sections. MICHIGAN STATE COLLEGE,

TEST No. A-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 1-19-12.

TOTAL HEATING SURFACE 277.5 Sq. ft. FROM 10:00 P.M. TO 11:30 P.M.

FREE AREA THRU HEATER 5.42 " "

Time	10:00	10:30	11:00	11:30	Av.	
Barometer	29.16	29.16	29.16	29.16	29.16	
Steam pressure in heater					5.00	Lbs.
Temp. of steam in heater					226.00	
Temp. of entering air	36.50	36.80	35.50	36.00	36.10	
Temp. of leaving air	118.00	116.00	116.00	116.00	116.70	
Temp. rise					77.60	
Temp. test room					86.80	
R.P.M. of fan	353.00	352.00	353.00	353.00	353.00	
R.P.M. of motor	857.00	857.00	859.00	854.00	856.75	
Friction loss thru heater	.232	.232	.232	.232	.232	
Calorimeter readings	.115 Lbs. in 22' .965 Lbs. in 11'					
	.105 " " 36.5'.					

MANOMETER READINGS.

READINGS (In. of water)

1.	.07	.07	.07
2.	.07	.07	.07
3.	.07	.07	.07
4.	.08	.08	.08
5.	.08	.085	.085
6.	.085	.085	.085
7.	.085	.09	.09
8.	.09	.095	.095
9.	.095	.100	.100
10.	.100	.100	.100
11.	.095	.095	.095
12.	.075	.085	.085

	No, of section.					
	1.	2.	3.	4.	5.	Total
Condensation in Lbs. per hr.	73.27	71.80	59.15	48.90	40.40	293.52
" per sq. ft. per hr.						1.06

Quality of steam 88.6% ".3.7. of steam used 852

Wt, of air in blast per cu. ft. .0873

Velocity of air (cu. ft. per min.) from Man readings 1150 outlet

Volume of air(cu. ft. per min.) " " " 4025 "

Equivalent velocity of air at 70 F. & 29.92" Hg. 661 free area

" volume under above conditions 3819 " "

Velocity threu heater from condensation. 547 " "

TESTS OF 4 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST No. B-1. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 4-25-12.

TOTAL HEATING SURFACE 222 Sq. ft. FROM 9:15 A.M. TO 11:15 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	9:15	9:45	10:15	10:45	11:15	Av.
Barometer	29.47	29.42	29.42	29.42	29.42	29.42
Steam pressure in heater						5 Lbs.
Temp. of steam in heater						228.00
Temp, of entering air	57.00	58.20	60.00	60.00	60.00	57.90
Temp, of leaving air	105.00	105.00	106.20	105.00	105.00	102.60
Temp. rise						44.70
Temp. test room						77.00
R.P.M. of fan	738.00	763.00	765.00	761.00	760.00	753.00
R.P.M. of motor	752.00	773.00	771.00	772.00	773.00	768.00
Friction loss thri heater	.6	.63	.63	.62	.61	.574
Calorimeter readings,	.14 Lbs. in 16'		.13 Lbs. in 20'			
	.16 " " 20'		.065 " " 16'			

Manometer readings.

Readings (In. of water)		
1.	.485	.485
2.	.485	.485
3.	.505	.505
4.	.530	.530
5.	.580	.580
6.	.600	.600
7.	.625	.625
8.	.650	.650
9.	.670	.670
10.	.615	.615
11.	.505	.505
12.	.505	.505

	No. of section. 1.	2.	3.	4.	Total	
Condensation in Lbs. per hr.	149.75	129.00	110.25	108.00	497.00	
B per sq. ft. per hr.					2.24	
Quality of steam 85.0% B.T.U. of steam used 813						
Wt. of cu. ft. of air in blast .06937						
Velocity of air (ft. per min.) from Man. readings					3100	Outlet
Volume of air (cu. ft. per min.) " "					1056	"
Equivalent velocity of air at 70 F. & 29.92" Hg.					1786	Free a
" volume under above conditions					919	"
Velocity thru heater from condensation					1515	"

TESTS OF 4 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

Test No. B-2. EAST LANSING, MICH.

LENGTH OF PIPES. 3'6" & 3'3". DATE 4-25-12.

TOTAL HEATING SURFACE 222 sq. ft. FROM 12:45 OP.M. TO 2:45 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	12:45	1:15	1:45	2:15	Av.	
Barometer	29.40	29.40	29.37	29.36	29.38	
Steam pressure in heater					5.00	Lbs.
Temp. of steam in heater					226.50	
Temp.of entering air	65.20	63.00	65.00	64.60	63.50	
Temp. of leaving air	116.00	115.60	116.00		115.80	
Temp. of rise					49.70	
Temp. test room					81.70	
R.P.M. of fan	570.00	573.00	570.00	571.00	571.00	
R.P.M. of motor	822.00	827.00	822.00	822.00	823.00	
Friction loss thru heater	.42	.374	.42	.40	.359	
Calorimeter readings	.16 Lbs. in 28'			.11 Lbs. in 20'		
	.092 " " 17'					

MANOMETER READINGS.

READINGS (In. of water)		
1.	.260	.260
2.	.260	.260
3.	270	.270
4.	.280	.280
5.	.300	.300
6.	.315	.315
7.	.325	.325
8.	.335	.335
9.	.345	.345
10.	.355	.355
11.	.325	.310
12.	.255	.255

	No, of section 1.	2.	3	4.	Total	
Condensation in Lbs. per hr.	130.2	108.5	86.3	79.7	404.7	
" per sq. ft. per hr.					1.83	
Quality of steam 87.6% B.T.U. of steam used 842						
Wt. of cu. ft. of air in blast .0671						
Velocity of air (ft. per min.) from Man readings				2300	Outlet Pipe	
Volume of air (cu. ft. per min.) " " "				7850	" "	
Equivalent velocity of air at 70 F. & 29.92" Hg.				2090	Free Area	
" volume under above conditions				7125	5" "	
Velocity thru heater from condensation				2132	" "	

Tests of 4 Hot Blast Heating Sections. Michigan State College,

Test No. B-3. East Lansing, Mich.

Length of Pipes 3'6" & 3'3". Date 4-25-42.

Total Heating Surface 222 Sq. ft. From 2:32 P.M. To 4:02 P.M.

Free Area Thru Heater 5.47 " "

Time	2:32	3:02	3:32	4:02	Av. Cor.
Barometer	29.35	29.34	29.34	29.34	29.34
Steam pressure in heater					5.00 Lbs,
Temp. of steam in heater					226.5
Temp. of entering air	64	65	64	63	63.#
Temp. of leaving air	120.5	120	118	117.5	116.2
Temp. rise					53.1
Temp. of test room					85.5
R.P.M. of fan	443	453	457	454	452
R.P.M. of motor	383	840	859	851	846
Friction loss thru heater	.276	.280	.278	.282	.252
Calorimeter readings	.12 Lbs. in 24'.			.13 Lbs. in 24'.	

Manometer readings.

Readings (In. of water)

1.	.150	.155	.155
2.	.150	.155	.155
3.	.155	.160	.160
4.	.165	.170	.170
5.	.175	.180	.180
6.	.180	.185	.185
7.	.190	.195	.195
8.	.195	.200	.200
9.	.200	.205	.205
10.	.205	.210	.210
11.	.180	.185	.185
12.	.150	.155	.155

	No. of section.				
	1.	2.	3.	4.	5. Total
Condensation in Lbs. per hr.	115.3	88.5	72.4	61.3	337.5
B per Sq.ft per hr.					1.52

Quality of steam 88.4% B.T.U. of steam used 849

Wt. of cu. ft. of air in blast .03747

Velocity of air (ft. per Min.) from Man. readings	1740	Outlet Pipes.
Volume of air cu. ft. per Min " " "	5940	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.	1570	Free area.
" volume under above conditions	5360	" "
Velocity thru heater from condensation	931	" "

TESTS OF 4 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST NO. B-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3" DATE 4-26-12.

TOTAL HEATING SURFACE 232 sq. ft. FROM 2:00 P.M. TO 3:30 P.M.

FREE AREA THRU HEATER 5.47 sq. ft.

Time	2:00	2:30	3:00	3:30	Av. Cor.
Barometer	28.8	28.79	28.79	28.79	28.79
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					225.6
Temp. of entering air	73	72	71.6	70.2	70.8
Temp. of leaving air	127.5	126.2	126.5	126	123.6
Temp. rise					52.8
Temp. of testroom.					81.8
R.P.M. of fan	336	338	342	330	338
R.P.M. of motor	818	828	831	798	819
Friction loss thru heater	.138	.134	.138	.130	.112
Calorimeter readings	.045 Lbs. in 30'		.075 Lbs. in 31'.		

MANOMETER READINGS.

READINGS. (IN. of water)			
1.	.08	.07	.07
2.	.08	.07	.07
3.	.08	.07	.07
4.	.085	.075	.075
5.	.090	.085	.080
6.	.100	.090	.085
7.	.105	.095	.085
8.	.115	.105	.095
9.	.110	.100	.100
10.	.115	.100	.095
11.	.085	.100	.090
12.	.085	.075	.070

	No. of sections. 1.	2.	3.	4.	Total	
Condensation in Lbs. per hr.	102.3	73.6	55.3	44.3	275.4	
" per aq. ft per hr.					1.24	
Quality of steam 93.1% B.T.U. of steam used 895						
Wt. of cu. ft. of air in blast .0834						
Velocity of air (ft. per min.) from Man. readings					1222	Outlet Pipe.
Volume of air (cu. ft. per min.) " " "					4170	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.					1570	Free area
" volume under above conditions					3662	" "
Velocity thru heater from condensation					890	" "

TESTS OF 3 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST NO. C-1. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 4-29-12.

TOTAL HEATING SURFACE 166.5 Sq. ft. FROM 3:43 P.M. TO 5:13 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	3:43	4:13	4:43	5:13	Av, Cor.
Barometer	28.87	28.88	28.88	28.88	28.88
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	49.3	48.3	48	48	47.7
Temp. of leaving air	88	85	85	85	84.6
Temp. rise					36.9
Temp. of test room					79
R.P.M. of fan	756	780	781	780	774
R.P.M. of motor	766	787	790	789	783
Friction loss thru heater	.45	.46	.48	.47	.438
Calorimeter readings	.152 Lbs. in 29' .943 Lbs. in 8'. .085 Lbs. in 20'.				

MANOMETER READINGS.

READINGS (IN. of water)

1.	.435	.455	.435
2.	.435	.455	.435
3.	.460	.465	.445
4.	.480	.500	.480
5.	.525	.525	.520
6.	.550	.555	.545
7.	.575	.590	.575
8.	.600	.620	.600
9.	.635	.645	.630
10.	.650	.660	.665
11.	.610	.615	.605
12.	.510	.515	.500

	Np. of section. 1.	2.	3.	Total
Condensation in Lbs. per hr.	99.7	130.3	124.8	354.8
" per sq. ft. per hr.				2.14

Quality of steam 88.75% B.T.U. of steam used 852

Wt. of cu. ft. of air in blast .0705

Velocity of air (ft. per min.) from Man. readings	3055	Outlet Pipe
Volume of air (cu. ft. per Min.) " "	10410	"
Equivalent velocity of air at 70 F & 29.92 Bar.	1793	Free Area
" volume under above conditions	6820	" "
Velocity thru heater from condensation	1468	" "

TESTS OF 3 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST NO. C-2. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 4-30-12.

TOTAL HEATING SURFACE 166.5 Sq. ft. FROM 1:00 P.M. TO 2:30 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	1:00	1:30	2:00	2:30	Av. Cor.
Barometer	29.14	29.14	29.14	29.14	29.14
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	62	61	63	63	61.1
Temp. of leaving air	97	95	97	95	94
Temp. rise					32.9
Temp. of test room					84.1
R.P.M. of fan	510	558	570	572	537
R.P.M. of motor	813	802	816	821	813
Friction loss thru heater	.315	.298	.305	.31	.286
Calorimeter readings	.145 Lbs. in 24' .105 Lbs. in 33' .06 Lbs. in 33'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.230	.225	.230
2.	.230	.225	.230
3.	.230	.235	.230
4.	.250	.240	.250
5.	.265	.255	.265
6.	.275	.265	.270
7.	.300	.290	.290
8.	.310	.300	.300
9.	.325	.310	.320
10.	.300	.290	.300
11.	.330	.320	.325
12.	.250	.250	.250

	No, of section. 1.	2.	3.	Total
Condensation in Lbs. per hr.	100.8	109.1	81.5	291.4
" per Sq. ft. per hr.				1.75

Quality of steam 91.4% B.T.U. of steam used 878

Wt, of cu. ft. of air in blast .0698

Velocity of air (ft. per Min.) from Man. readings	2150	Outlet Pipe.
Volume of air (cu. ft. per Min.) " "	7330	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.	2000	Free Area
" volume under above conditions	6820	" "
Velocity thru heater from condensation	1411	" "

TESTS OF 3 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST NO. C-3. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 4-30-12.

TOTAL HEATING SURFACE 166.5 Sq. ft. FROM 8:55 A.M. TO 10:25 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	8:55	9:25	9:55	10:25	Av. Cor.
Barometer	29.12	29.14	29.14	29.14	29.14
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	51	52	55	55.5	52.6
Temp. of leaving air	99	92.5	101	101	97.5
Temp. rise					44.9
Temp. of test room					79.1
R.P.M. of fan	439	446	444	441	442
R.P.M. of motor	814	829	806	816	816
Friction loss thru heater	.178	.178	.177	.172	.165
Calorimeter readings	.155 Lbs. in 22'			.21 Lbs. in 28'	
	.065 " " 17'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.130	.130	.125
2.	.130	.130	.125
3.	.130	.130	.125
4.	.140	.140	.135
5.	.155	.150	.145
6.	.160	.160	.155
7.	.170	.170	.165
8.	.180	.175	.170
9.	.185	.185	.180
10.	.190	.190	.185
11.	.175	.175	.170
12.	.140	.140	.135

	No. of section 1.	2.	3.	Total
Condensation in Lbs. per hr.	121	97.7	83.7	302.4
" per sq. ft. per hr.				1.81

Quality of steam 83.5% B.T.U. of steam used 802

Wt. of cu. ft. of air in blast .0693

Velocity of air (ft. per min.) from Man. readings	1615	Outlet pipe
Volume of air (cu. ft. per min.) " " "	5510	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	930	Free area
" volume under above dondetions	5090	" "
Velocity thru heater from condensation	1010	" "

TESTS OF 3 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

TEST NO& C-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3" DATE 4-30-12.

TOTAL HEATING SURFACE 166.5 sq. ft. FROM 2:45 TO 4:15 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	2:45	3:15	3:45	4:15	Av. Cor.
Barometer	29.14	29.14	29.14	29.15	29.14
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					228
Temp. of entering air	61	62.5	61	60	60.1
Temp. of leaving air	110	108.5	107.5	106	105.5
Temp. rise					45.4
Temp. of test room					90.3
R.P.M. of fan	339	343	348	345	344
R.P.M. of motor	837	863	838	860	849
Friction loss thru heater	.115	.118	.118	.125	.1208
Calorimeter readings	.045 Lbs. in 27'		.04 Lbs. in 28'.		

MANOMETER READINGS.

READINGS (In. of water)

1.	.077	.08
2.	.077	.08
3.	.079	.08
4.	.08	.09
5.	.088	.095
6.	.095	.095
7.	.100	.102
8.	.105	.107
9.	..110	.112
10.	.113	.115
11.	.100	.105
12.	.080	.080

	No. of section. 1.	2.	3.	Total
Condensation in Lbs. per hr.	105.5	76.7	56.3	238.5
" per sq. ft per hr.				1.43

Quality of steam 95.7% B.T.U. of steam used 920

Wt. of cu. ft. of air in blast .0684

Velocity of air (ft. per min.) from Man. readings	1285	Outlet Pipe
Volume of air (cu,ft, per min,) " " "	4480	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.	1200	Free area
" volume under above conditions	4090	" "
Velocity thru heater from condensation	896	" "

TESTS OF 2 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE, EAST LANSING, MICH.

TESTNO. D-1. DATE 5-1-12.

FROM 12:25 TO 1:55 P.M.

LENGTH OF PIPES 3'6" & 3'3".

TOTAL HEATING SURFACE 111 sq. ft.

FREE AREA THRU HEATER 5.47 sq. ft.

Time	12:25	12:55	1:25	1:55	Av, Cor.
Barometer	29.09	29.085	29.08	20.08	19.08
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp, of entering air	51	51.5	51;5	51.5	50.8
Temp. of leaving air	71	71.5	71.8	71.8	70.6
Temp. rise					19.7
Temp. of test room					71.5
R.P.M. of fan	769	765	769	769	767
R.P.M. of motor	772	771	777	777	775
Friction loss thru heater	.373	.373	.38		.366
Calcrimeter readings	.065 Lbs. in 25'		.05 Lbs. in 22'		

MANOMETER READINGS.

READINGS (8n. of water)

1.	.060	.430	.430
2.	.460	.430	.430
3.	.470	.450	.455
4.	.505	.475	.485
5.	.550	.530	.525
6.	.580	.550	.555
7.	.600	.585	.600
8.	.650	.630	.640
9.	.690	.665	.655
10.	.705	.670	.675
11.	.660	.630	.630
12.	.550	.540	.540

	No. of section. 1.	2.	Total	
Condensation in Lbs. per hr.	104.2	112.2	216.4	
" per sq. ft per hr.			1.95	
Quality of steam 94% B.T.U. of steam used 904				
Wt, of cu. ft, of air in blast .0728				
Velocity of air (ft. per min.) from Man. readings			3015	Outlet pipe
Volime of air (cu. ft. per min.) " " "			10280	" "
Equivalent velocity of air at 70 F & 29.92" Hg.			1825	Free area
" volume under above conditions			9990	" "
Velocity thru heater from condensation			1730	" "

TESTS OF 2 Hot Blast Heater Sections. MICHIGAN STATE COLLEGE,

TEST NO. D-2. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-1-12.

TOTAL HEATING SURFACE 111 sq. ft. FROM 2:05 P.M. TO 3:35 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	2:05	2:35	3:05	3:35	Av. Cor.
Barometer	29.08	19.075	19.07	19.07	29.075
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	52	54	53.5	54	52.4
Temp. of leaving air	72.5	75	75	75.5	73.9
Temp. rise					21.5
Temp. of test room					74.7
R.P.M. of fan	568	568	587	574	574
R.P.M. of motor	812	820	825	826	816
Friction loss thru heater	.217	.22	.23	.23	.224
Calorimeter readings	.0575 Lbs. in 33'		;0425 Lbs. in 19'.		

MANOMETER READINGS.

READINGS (In. of water)

1.	.238	.238	.285	.270
2.	.238	.238	.285	.270
3.	.240	.250	.285	.270
4.	.255	.165	.308	.300
5.	.282	.290	.325	.315
6.	.300	.305	.350	.325
7.	.318	.325	.365	.350
8.	.335	.340	.380	.365
9.	.345	.350	.390	.390
10.	.350	.365	.405	.395
11.	.335	.335	.385	.370
12.	.285	.288	.325	.315
		No, of section.		

Condensation in Lbs. per hr.	85.3	98.7	184	
" per sq. ft. per hr.			1.63	
Wt, of cu, ft, of air in blast	.0723			
Velocity of air (ft. per min.) from Man. readings			2390	Outlet Pipe
Volume of air (cu. ft. per min.) " "			8160	" "
Equivalent velocity of air at 70 F & 29.92" Hg.			1440	Free area
" volume under above conditions			7860	" "
Velocity thru heater from condensation			1178	" "

TESTS OF 2 Hot Vlast Heating Coils. MICHIGAN STATE COLLEGE,

TEST NO. D-3. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-2-12.

TOTAL HEATING SURFACE 111 sq. ft. FROM 8:38 A.M. TO 10;08 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	8;38	9;08	9;38	10;08	Av. Cor.
Barometer	29.145	29.16	19.18	19.18	19.18
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	64	64	64	65	63.2
Temp. of leaving air	94.2	94.5	94	94.5	92.5
Temp. rise					29.3
Temp. of test room					78.4
R.P.M. of fan	438	441	442	442	441
R.P.M. of motor	818	813	824	823	819
Friction loss thru heater	.13	.123	.128	.128	.119
Calorimeter readings	.08 Lbs. in 32'		.085 Lbs, in 16'.		

MANOMETER READINGS.

READINGS (In. of water)

1.	.155	.1555	.155
2.	.155	.155	.155
3.	.160	.160	.160
4.	.172	.170	.170
5.	.185	.185	.185
6.	.192	.195	.195
7.	.205	.205	.207
8.	.208	.213	.215
9.	.220	.222	.225
10.	.225	.227	.228
11.	.295	.210	.210
12.	.170	.178	.180

	No. of section. 1.	2.	Total
Condensation in Lbs. per hr.	117.7	104	22.7
" per sq, ft. per hr.			1.99

Quality of steam 95% B.T.U. of steam used 914

Wt. of cu, ft. of air in blast .08903

Velacity of air (ft. per min.) from Man. readings	1790	Outlet Pipe
Volume of air (cu. ft. per min.) " " "	4700	" "
Equivalent velocity of air at 70F-& 29.92" Hg	1045	Free Area
" volume under above conditions	5720	" "
Velocity thru heater from condensation	1257	" "

TESTS OF 2 Hot Blast Heating Coils. MICHIGAN STATE COLLEGE,

TEST NO. D-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-2-12.

FREE AREA THRU HEATER 5;47 Sq. Ft. FROM 10:16 A.M. TO 11:31 A.M.

TOTAL HEATING SURFACE 111 " "

Time	10:16	10:46	11:16	11:31	Av. Cor.
Barometer	29.18	29.18	29.18	29.18	29.18
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					228
Temp. of entering air	65	66	67	67	66
Temp. of leaving air	99.5	100	100.8	100.6	99
Temp. rise					33
Temp. of test room					84.5
R.P.M. of fan	340	342	342	343	342
R.P.M. of motor	832	834	834	836	834
Friction loss thru heater	.09	.092	.088	.09	.0835
Calorimeter readings	.015 Lbs. in 22'		.035 Lbs. in 31'		
	.035 " " 15'				

MANOMETER READINGS.

READINGS (In. of water)			
1.	.090	.090	.090
2.	.092	.092	.092
3.	.095	.095	.095
4.	.100	.100	.100
5.	.110	.110	.105
6.	.115	.115	.112
7.	.120	.120	.118
8.	.130	.128	.25
9.	.132	.132	.130
10.	.135	.135	.130
11.	.125	.125	.125
12.	.105	.105	.105

	No. of section. 1.	2.	Total
Condensation in lbs. per hr.	83	62	115
" per sq. ft per hr.			1.31

Quality of steam 98.4% B.T.U. of steam used 930
Wt. of cu, ft,of air in blast .0894

Velocity of air (ft. per min.) from Man. readings	1378	Outlet pipe
Volume of air (cu. ft. per min.) " " "	4700	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.	797	Free Area
" volume under above conditions	4360	" "
Velocity thru heater from condensation	748	" "

TESTS OF 2 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

Test No. E-1. EAST LANSING, Mich.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-[illegible]-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 3:00 P.M. TO 4:30 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	3:00	3:30	4:00	4:30	Av. Cor.
Barometer	29.16	29.14	29.14	29.13	29.14
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	73	73	72	72	71
Temp. of leaving air	85	84	83.2	82.5	82.4
Temp. of test room					11.4
R.P.M. of fan					82.4
R.P.M. of motor	773	779	775	774	775
Friction loss thru heater	778	784	785	788	784
Calorimeter readings		.235	.238	.235	.233 .224
		.055 Lbs. in 22'		.015 Lbs. in 15'.	

Manometer Readings.

Readings. (In. of water)

1.	.480	.505	.480
2.	.480	.505	.480
3.	.510	.505	.480
4.	=535	.550	.510
5.	.585	.600	.560
6.	.620	.620	.595
7.	.670	.670	.625
8.	.700	.705	.685
9.	.735	.745	.710
10.	.780	.770	.745
11.	.745	.730	.705
12.	.615	.620	.610

	No. of section, 1.	Total	
Condensation in Lbs. per hr.	107.8	107.8	
" per sq. ft. per hr.		1.94	
Quality of steam 95.3% B.T.U. of steam used 920			
Wt. of cu. ft. of air in blast .0713			
Velocity of air (ft. per min.) from Man readings		3204	Outlet pipe
Volume of air (cu. ft. per min.) " " "		10920	" "
Equivalent velocity of air at 70 F & 29.92" Hg.		1893	Free Area
" volume under above conditions		1293	" "
Velocity thru heater from condensation		1547	" "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-2. EAST LANSING , MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 8:16 TO 9:46 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	8:16	8:46	9:16	9:46	Av. Cor.
Batometer	29.25	29.25	29.24	29.22	29.24
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	57.5	59	60	62	59.3
Temp. of leaving air	71.5	73	73.8	76	73.2
Temp. rise					13.9
Temp. of test room					73.8
R.P.M. of fan	544	555	561	560	555
R.P.M. of motor	795	800	802	808	801
Friction loss thru heater	.126	.125	.128	.127	.115
Colorimeter readings	Calorimeter showed no reading,				

MANOMETER READINGS.

READINGS (In. of water)

1.	.238	.260	.255
2.	.238	.262	.250
3.	.245	.262	.255
4.	.255	.285	.275
5.	.290	.305	.298
6.	.300	.325	.320
7.	.320	.345	.335
8.	.350	.385	.360
9.	.365	.395	.380
10.	380	.400	.390
11.	.360	.385	.360
12.	.395	.325	.310

Condensation in #bs. per hr. 109

" per sq.ft. per hr. 1.97

Quality of steam 96.8% B.T.U. of steam used 930

Wt. of cu. ft. of air in blast .0728

Velocity of air (ft.per min.) from Man readings 2251 Outlet Pipes.

Volume of air (cu. ft. per min.) " " " 7670 " "

Equivalent velocity of air at 70 F & 29.22" Hg. 1470 Free Area

" volume under above conditions 2610 " "

Velocity thru heater from condensation 1275 " "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-3. EAST LANSING, MICH.

LENGTH OF PIPES 5'6" & 5'0". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 9:52 A.M. TO 11:33 A.M.

Time	9:52	10:22	10:52	11:33	Av. Cor.
Barometer	29.21	29.205	29.195	29.18	29.19
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					228
Temp. of entering air	63.5	57	58	59	59.3
Temp. of leaving air	80	80	81	81	79
Temp. rise					19.8
Temp. of test room					60.1
R.P.M. of fan	410	413	432	433	417
R.P.M. of motor	318	321	329	331	325
Friction loss thru heater	.085	.083	.083	.085	.0805
Calorimeter readings	.04 Lbs. in 19'			.04 Lbs. in 30'	
	.04 " " 30'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.155	.165	.160
2.	.155	.165	.158
3.	.165	.165	.162
4.	.175	.178	.178
5.	.185	.195	.192
6.	.195	.200	.200
7.	.213	.215	.210
8.	.220	.230	.225
9.	.235	.245	.230
10.	.240	.245	.245
11.	.230	.248	.240
12.	.195	.210	.205

Condensation in lbs. per hr. 81.4
" per sq. ft. per hr. 1.47
Quality of steam 96.6% B.T.U. of steam used 928
Wt. of cu. ft. of air in blast .07175
Velocity of air (ft. per min.) from Man readings 1345 Outlet Pipes.
Volume of air (cu. ft. per min.) " " " 6290 " "
Equivalent velocity of air at 70 F & 29.92" Hg. 1100 Free Area
" volume under above conditions 6020 " "
Velocity thru heater from condensation 1042 " "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'6". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 12:20 P.M. TO 1:50 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	12:20	12:50	1:20	1:50	Av. Cor.
Barometer	29.18	29.17	29.165	29.16	29.17
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	70	71	72	72	70
Temp. of leaving air	83.5	83.2	84	84.8	82.5
Temp. rise					12.5
Temp. of test room					84.1
R.P.M. of fan	342	345	345	345	345
R.P.M. of motor	835	838	836	837	834
Fricrion loss thru heater	.052	.052	.052	.052	.0385
Calorimeter readings	.045 Lbs. in 20'			.045 Lbs. in 34'	
	.05 Lbs. in 16'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.100	.090	.090
2.	.100	.090	.090
3.	.100	.093	.095
4.	.105	.098	.100
5.	.115	.107	.108
6.	.118	.115	.118
7.	.128	.122	.122
8.	.138	.130	.130
9.	.145	.140	.138
10.	.145	.150	.140
11.	.132	.125	.135
12.	.122	.117	.115

Condensation in Lbs. per hr. 72.6
" per sq.ft. per hr. 1.31
Quality of steam 94.5% B.T.U. of steam used 908
Wt. of cu. ft. of air in blast .07125
Velocity of air (ft. per min.) from Man readings 1413 Outlet Pipes.
Volume of air (cu. ft. per min.) " " " 4823 " "
Equivalent velocity of air at 70 F & 29.92" Hg. 883 Free area
" volume under above conditions 4390 " "
Velocity thru heater from condensation 940 " "

TESTS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-1. EAST LANSING, MICH.

LENGTH OF PIPES DATE 5-3-12.

Time	[illegible] Sec.
Barometer	[illegible]

Temp. of entering air	[illegible].5
Temp. of leaving air	73.[illegible]
Temp. rise	[illegible].7
Temp. of test room	75.1
R.P.M. of fan	341
R.P.M. of motor	837

Manometer readings.

Readings (In. of water)

1.	.7[illegible]0
2.	.500
3.	.500
4.	.520
5.	.560
6.	.600
7.	.650
8.	.725
9.	.780
10.	.840
11.	.820
12.	.705

Wt. of cu, ft, of air in blast .0725		
Velocity of air (ft, per min,) from Man readings	3324	Outlet pipes
Volume of air (cu. ft. per min.) " " "	11360	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	2013	Free area
" volume under above conditions	11000	" "

TESIS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-2. EAST LANSING, MICH.

DATE 5-3-12.

Time	Av,Cor.
Barometer	29.14
Temp. of entering air	70.5
Temp. of leaving air	72.5
Temp. rise	2.6
Temp. of test room	75.1
R.P.M. of fan	447
R.P.M. of motor	834

MANOMETER READINGS.

READINGS (In. of water)

1.	.285
2.	.285
3.	.285
4.	.290
5.	.315
6.	.330
7.	.360
8.	.390
9.	.420
10.	.445
11.	.435
12.	.380

Wt. of cu. ft. of air in blast	.07275	
Velocity of air (ft. per min.) from Man. readings	8508	Outlet Pipes
Volume of air (cu. ft. per min.) " " "	8550	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	1514	Free area
" volume under above conditions	3280	" "

TESTS OF 2 Hot Vlast Heating Coils. MICHIGAN STATE COLLEGE,

TEST NO. D-3. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-2-12.

TOTAL HEATING SURFACE 111 sq. ft. FROM 8:38 A.M. TO 10;08 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	8;38	9;08	9;38	10;08	Av. Cor.
Barometer	29.145	29.16	19.18	19.18	19.18
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	64	64	64	65	63.2
Temp. of leaving air	94.2	94.5	94	94.5	92.5
Temp. rise					29.3
Temp. of test room					78.4
R.P.M. of fan	438	441	442	442	441
R.P.M. of motor	818	813	824	823	819
Friction loss thru heater	.13	.123	.128	.128	.119
Calorimeter readings	.08 Lbs. in 32'		.025 Lbs, in 16'.		

MANOMETER READINGS.

READINGS (In. of water)

1.	.155	.1555	.155
2.	.155	.155	.155
3.	.160	.160	.160
4.	.172	.170	.170
5.	.185	.185	.185
6.	.192	.195	.195
7.	.205	.205	.207
8.	.208	.213	.215
9.	.220	.222	.225
10.	.225	.227	.228
11.	.295	.210	.210
12.	.170	.178	.180

	No. of section. 1.	2.	Total
Condensation in Lbs. per hr.	117.7	104	22.7
" per sq, ft. per hr.			1.99

Quality of steam 95% B.T.U. of steam used 914

Wt. of cu, ft. of air in blast .03993

Velacity of air (ft. per min.) from Man. readings 1790 Outlet Pipe

Volume of air (cu. ft. per min.) " " " 4730 " "

Equivalent velocity of air at 70F-& 29.92" Hg 1045 Free Area

" volume under above conditions 5721 " "

Velocity thru heater from condensation 1257 " "

TESTS OF 2 Hot Blast Heating Coils. MICHIGAN STATE COLLEGE,

TEST NO. D-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-2-12.

FREE AREA THRU HEATER 5;47 Sq. Ft. FROM 10:16 A.M. TO 11:31 A.M.

TOTAL HEATING SURFACE 111 " "

Time	10:16	10:46	11:16	11:31	Av. Cor.
Barometer	29.18	29.18	19.18	19.18	29.18
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					223
Temp. of entering air	65	66	67	67	66
Temp. of leaving air	99.5	100	100.8	100.6	99
Temp. rise					33
Temp. of test room					84.5
R.P.M. of fan	340	342	342	343	342
R.P.M. of motor	832	834	834	836	834
Friction loss thru heater	.09	.092	.088	.09	.0835
Calorimeter readings	.015 Lbs. in 22'		.035 Lbs. in 31'		
	.035 " " 15'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.090	.090	.090
2.	.092	.092	.092
3.	.095	.095	.095
4.	.100	.100	.100
5.	.110	.110	.105
6.	.115	.115	.112
7.	.125	.120	.118
8.	.130	.128	.25
9.	.132	.132	.130
10.	.135	.135	.130
11.	.125	.125	.125
12.	.105	.105	.105

	No. of section. 1.	2.	Total
Condensation in lbs. per hr.	83	62	115
" per sq. ft per hr.			1.31

Quality of steam 96.4% B.T.U. of steam used 930

Wt. of cu, ft, of air in blast .0894

Velocity of air (ft. per min.) from Man. readings	1378	Outlet pipe
Volume of air (cu. ft. per min.) " " "	4700	" "
Equivalent velocity of air at 70 F. & 29.92" Hg.	797	Free Area
" volume under above conditions	4380	" "
Velocity thru heater from condensation	748	" "

TESTS OF 2 Hot Blast Heating Sections. MICHIGAN STATE COLLEGE,

Test No. E-1. EAST LANSING, Mich.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-[illegible]-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 3:00 P.M. TO 4:30 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	3:00	3:30	4:00	4:30	Av. Cor.
Barometer	29.16	29.14	29.14	29.13	29.14
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	73	73	73	72	71
Temp. of leaving air	85	84	83.2	82.5	82.4
Temp. of test room					11.4
R.P.M. of fan					82.4
R.P.M. of motor	773	779	775	774	775
Friction loss thru heater	778	784	785	788	784
Calorimeter readings		.235	.238	.235	.233 .224
		.055 Lbs. in 22'			.015 Lbs. in 15'.

Manometer Readings.

Readings. (In. of water)

1.	.480	.505	.480
2.	.480	.505	.480
3.	.510	.505	.480
4.	.535	.550	.510
5.	.585	.600	.560
6.	.620	.620	.595
7.	.670	.670	.625
8.	.700	.705	.685
9.	.735	.745	.710
10.	.780	.770	.745
11.	.745	.730	.705
12.	.615	.620	.610

	No. of section, 1.	Total	
Condensation in Lbs. per hr.	107.8	107.8	
" per sq. ft. per hr.		1.94	
Quality of steam 95.3% B.T.U. of steam used 920			
Wt. of cu. ft. of air in blast .0713			
Velocity of air (ft. per min.) from Man readings		3204	Outlet pipe
Volume of air (cu. ft. per min.) " " "		10920	" "
Equivalent velocity of air at 70 F & 29.92" Hg.		1893	Free Area
" volume under above conditions		1293	" "
Velocity thru heater from condensation		1547	" "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-2. EAST LANSING , MICH.

LENGTH OF PIPES 3'6" & 3'3". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 8:16 TO 9:46 A.M.

FREE AREA THRU HEATER 5.47 " "

Time	8:16	8:46	9:16	9:46	Av. Cor.
Batometer	29.25	29.25	29.24	29.22	29.24
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	57.5	59	60	65	59.3
Temp. of leaving air	71.5	73	73.8	76	73.2
Temp. rise					13.9
Temp. of test room					73.8
R.P.M. of fan	544	555	561	560	555
R.P.M. of motor	795	800	802	808	801
Friction loss thru heater	.126	.125	.128	.127	.115
Colorimeter readings	Calorimeter showed no reading,				

MANOMETER READINGS.

READINGS (In. of water)

1.	.238	.260	.255
2.	.238	.262	.250
3.	.245	.262	.255
4.	.255	.285	.275
5.	.290	.305	.298
6.	.300	.325	.320
7.	.320	.345	.335
8.	.350	.385	.360
9.	.365	.395	.380
10.	380	.400	.390
11.	.360	.385	.360
12.	.395	.325	.310

Condensation in #bs. per hr. 109

" per sq.ft. per hr. 1.97

Quality of steam 96.8% B.T.U. of steam used 930

Wt. of cu. ft. of air in blast .0728

Velocity of air (ft.per min.) from Man readings 2251 Outlet Pipes.

Volume of air (cu. ft. per min.) " " " 7670 " "

Equivalent velocity of air at 70 F & 29.22" Hg. 1270 Free Area

" volume under above conditions 9610 " "

Velocity thru heater from condensation 1275 " "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-3. EAST LANSING, MICH.

LENGTH OF PIPES 5'6" & 5'5". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 9:52 A.M. TO 11:23 A.M.

Time	9:52	10:22	10:52	11:23	Av. Cor.
Barometer	29.21	29.205	29.195	29.18	10.19
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					228
Temp. of entering air	63.5	67	68	68	66.3
Temp. of leaving air	80	80	81	81	79
Temp. rise					12.8
Temp. of test room					66.1
R.P.M. of fan	410	413	432	433	447
R.P.M. of motor	318	321	329	331	335
Friction loss thru heater	.085	.083	.083	.085	.0805
Calorimeter readings	.04 Lbs. in 19'			.04 Lbs. in 30'	
	.04 " " 30'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.155	.165	.160
2.	.155	.165	.158
3.	.165	.165	.162
4.	.175	.178	.178
5.	.185	.195	.192
6.	.195	.200	.200
7.	.213	.215	.210
8.	.220	.230	.225
9.	.235	.245	.230
10.	.240	.245	.245
11.	.230	.248	.240
12.	.195	.210	.205

Condensation in lbs. per hr. 81.4

" per sq. ft. per hr. 1.47

Quality of steam 96.6% B.T.U. of steam used 928

Wt. of cu. ft. of air in blast .07175

Velocity of air (ft. per min.) from Man readings	1345	Outlet Pipes.
Volume of air (cu. ft. per min.) " "	6290	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	1100	Free Area
" volume under above conditions	6020	" "
Velocity thru heater from condensation	1042	" "

TESTS OF 1 Hot Blast Heating Section. MICHIGAN STATE COLLEGE,

TEST NO. E-4. EAST LANSING, MICH.

LENGTH OF PIPES 3'6" & 3'6". DATE 5-3-12.

TOTAL HEATING SURFACE 55.5 Sq. ft. FROM 12:20 P.M. TO 1:50 P.M.

FREE AREA THRU HEATER 5.47 " "

Time	12:20	12:50	1:20	1:50	Av. Cor.
Barometer	29.18	29.17	29.165	29.16	29.17
Steam pressure in heater					5 Lbs.
Temp. of steam in heater					226
Temp. of entering air	70	71	72	72	70
Temp. of leaving air	83.5	83.2	84	84.8	82.5
Temp. rise					12.5
Temp. of test room					84.1
R.P.M. of fan	342	345	345	345	345
R.P.M. of motor	835	838	836	837	834
Friction loss thru heater	.052	.052	.052	.052	.0385
Calorimeter readings	.045 Lbs. in 20'			.045 Lbs. in 34'	
	.05 Lbs. in 16'				

MANOMETER READINGS.

READINGS (In. of water)

1.	.100	.090	.090
2.	.100	.090	.090
3.	.100	.093	.095
4.	.105	.098	.100
5.	.115	.107	.108
6.	.118	.115	.118
7.	.128	.122	.120
8.	.138	.130	.130
9.	.145	.140	.138
10.	.145	.150	.140
11.	.132	.125	.135
12.	.122	.117	.115

Condensation in Lbs. per hr. 72.6
" per sq.ft. per hr. 1.31
Quality of steam 94.5% B.T.U. of steam used 908
Wt. of cu. ft. of air in blast .07125
Velocity of air (ft. per min.) from Man readings 1413 Outlet Pipes.
Volume of air (cu. ft. per min.) " " " 4023 " "
Equivalent velocity of air at 70 F & 29.92" Hg. 853 Free area
" volume under above conditions 4200 " "
Velocity thru heater from condensation 940 " "

TESTS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-1. EAST LANSING, MICH.

LENGTH OF PIPES DATE 5-3-12.

Time	[illegible]
Barometer	[illegible]
Temp. of entering air	36.5
Temp. of leaving air	73.8
Temp. rise	3.7
Temp. of wet bulb	75.1
R.P.M. of fan	341
R.P.M. of motor	837

	Barometer readings. Readings (In. of water)
1.	.700
2.	.500
3.	.500
4.	.520
5.	.500
6.	.600
7.	.650
8.	.725
9.	.780
10.	.840
11.	.820
12.	.705

Wt. of cu, ft, of air in blast .0725

Velocity of air (ft, per min,) from Man readings	3324	Outlet pipes
Volume of air (cu. ft. per min.) " " "	11362	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	2013	Free area
" volume under above conditions	11000	" "

TESIS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-2. EAST LANSING, MICH.

DATE 5-3-12.

	Av,Cor.
Time	
Barometer	29.14
Temp. of entering air	70.5
Temp. of leaving air	72.5
Temp. rise	2.0
Temp. of test room	75.1
R.P.M. of fan	447
R.P.M. of motor	834

MANOMETER READINGS.

READINGS (In. of water)

1.	.285
2.	.285
3.	.285
4.	.290
5.	.315
6.	.330
7.	.360
8.	.390
9.	.420
10.	.445
11.	.435
12.	.380

Wt. of cu. ft. of air in blast	.07275	
Velocity of air (ft. per min.) from Man. readings	8508	Outlet Pipes
Volume of air (xu. ft. per min.) B " "	8550	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	1514	Free area
" volume under above conditions	3280	" "

TESTS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-3. EAST LANSING, MICH.

DATE 5-3-12.

	Av. Cor.
Barometer	29.14
Temp, of entering air	69
Temp. of leaving air	72.3
Temp. rise	3.3
Temp. of test room	75.1
R.P.M. of fan	571
R.P.M. of motor.	821

MANOMETER READINGS.

READINGS (In. of water)

1.	.180
2.	.180
3.	.180
4.	.180
5.	.195
6.	.200
7.	.223
8.	.245
9.	.270
10.	.275
11.	.270
12.	.238

Wt. of cu. ft. of air in blast .0725

Velocity of air (ft. per min.) from Man readings	1955	Outlet pipes
Volume of air (cu. ft. per min.) " " "	6660	" "
Equivalent velocity of air at 70 F & 29.92" Hg	1180	Free area
" volume under above conditions	6450	" "

TESTS WITH HEATING SECTIONS REMOVED. MICHIGAN STATE COLLEGE,

TEST NO. F-4. EAST LANSING, MICH.

DATE 5-3-12.

	Av,Cor.
Barometer	29.14
Temp. of entering air	68
Temp. of leaving air	71.5
Temp. rise	3,5
Temp. of test room	75.1
R.P.M. of fan	736
R.P.M. of motor	785

MANOMETER READINGS.

READINGS (In. of water)

1.	.105
2.	.105
3.	.105
4.	.105
5.	.110
6.	.118
7.	.130
8.	.142
9.	.150
10.	.162
11.	.162
12.	.135

Wt. of cu. ft. of air in blast .0725

Velocity of air (ft. per min.) from Man readings	1955	Outlet pipes
Volume of air (cu. ft. per min.) " "	5350	" "
Equivalent velocity of air at 70 F & 29.92" Hg.	948	Free area
" volume under above conditions	5180	" "

TABLE B.

VELOCITY OF AIR IN FT. PER MIN. FROM CONDENSATION METHOD.	FRICTION LOSS IN IN. OF WATER				
	NUMBER OF COILS IN HEATER.				
SRR	1.	2.	3.	4.	5.
800	.03	.055	.105	.153	.387
900	.048	.084	.147	.100	.450
1000	.072	.115	.185	.145	.516
1100	.100	.147	.225	.295	.590
1200	.125	.185	.27	.350	.675
1200	.16	.22	.315	.41	.74
1400	.2	.167	.37	.480	.805
1500	.24	.315	.55	.57	.87

TABLE C.

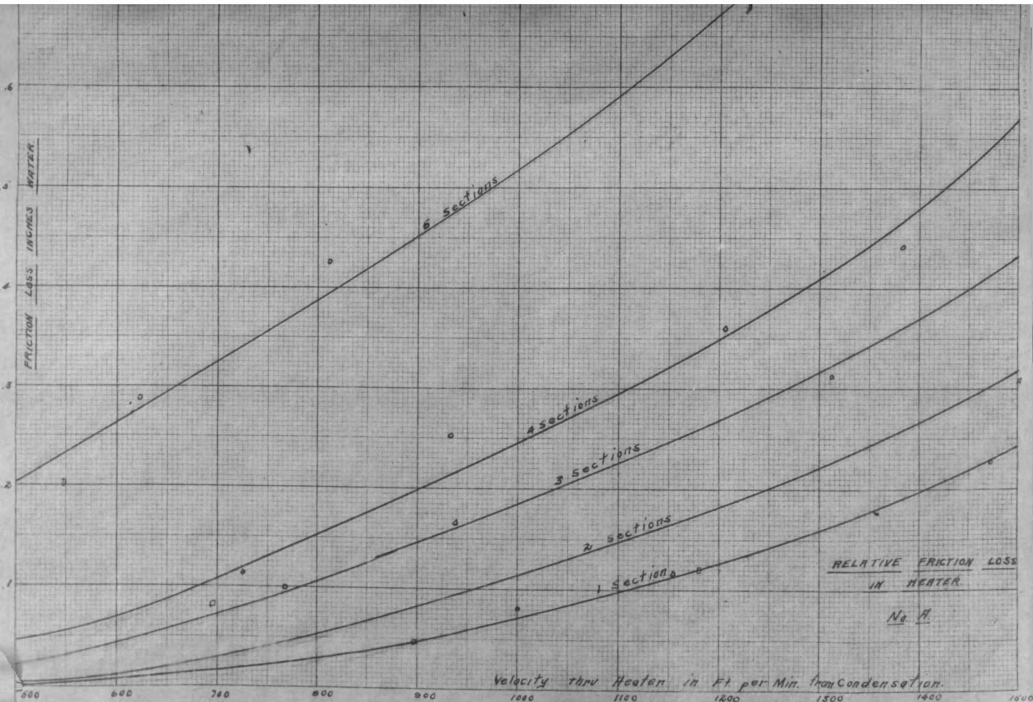
RELATION OF R.P.M. TO AIR VELOCITY THRU HEATER.

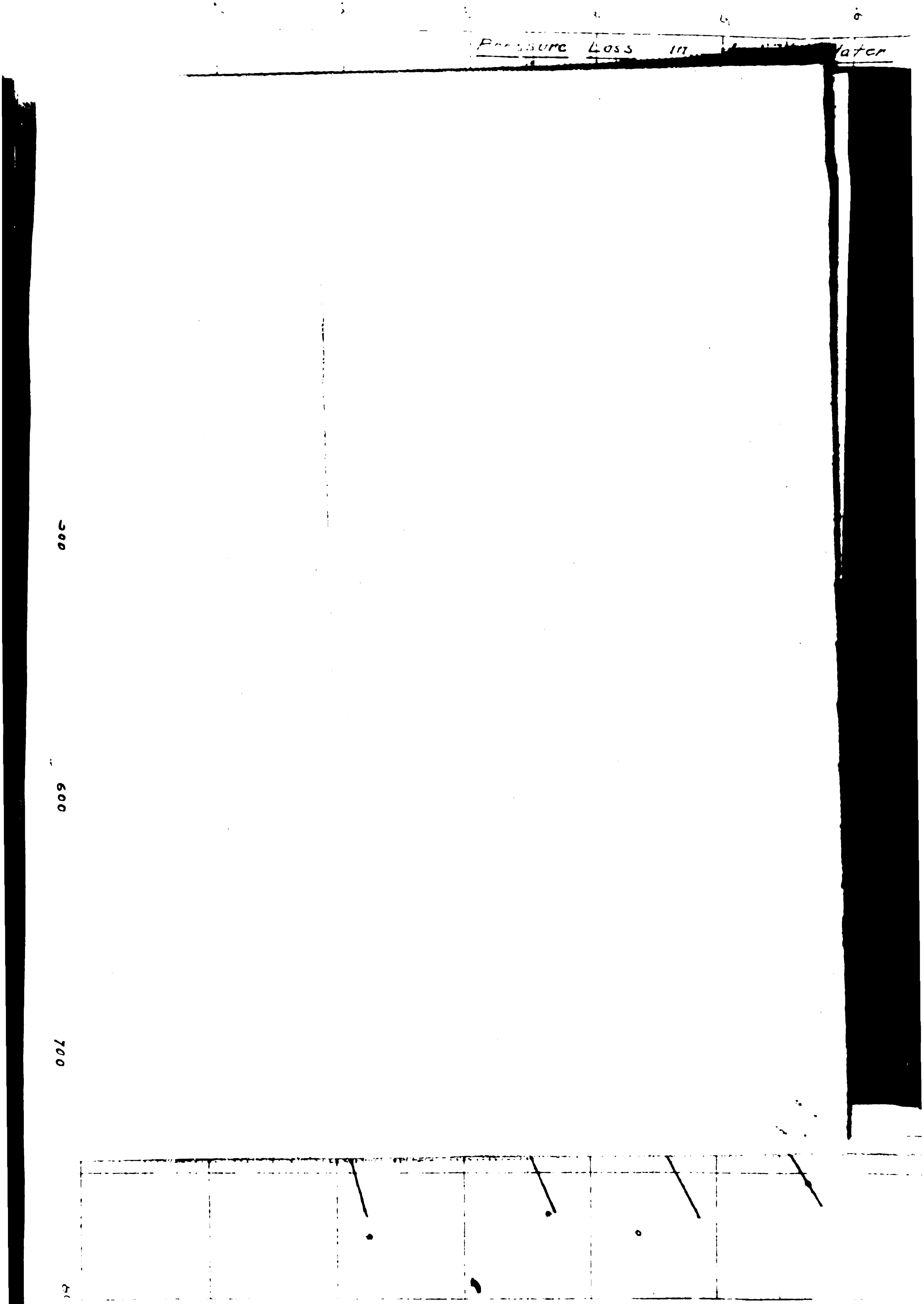
R.P.M.	NO. COILS	1 COIL	2 COILS	3 COILS	4 COILS	5 COILS
300	800	730	680	620	580	570
400	1080	1010	950	890	830	805
500	1350	1290	1230	1170	1100	1050
600	1630	1570	1505	1435	1360	1290
700	1900	1840	1780	1710	1630	1540

TABLE D.

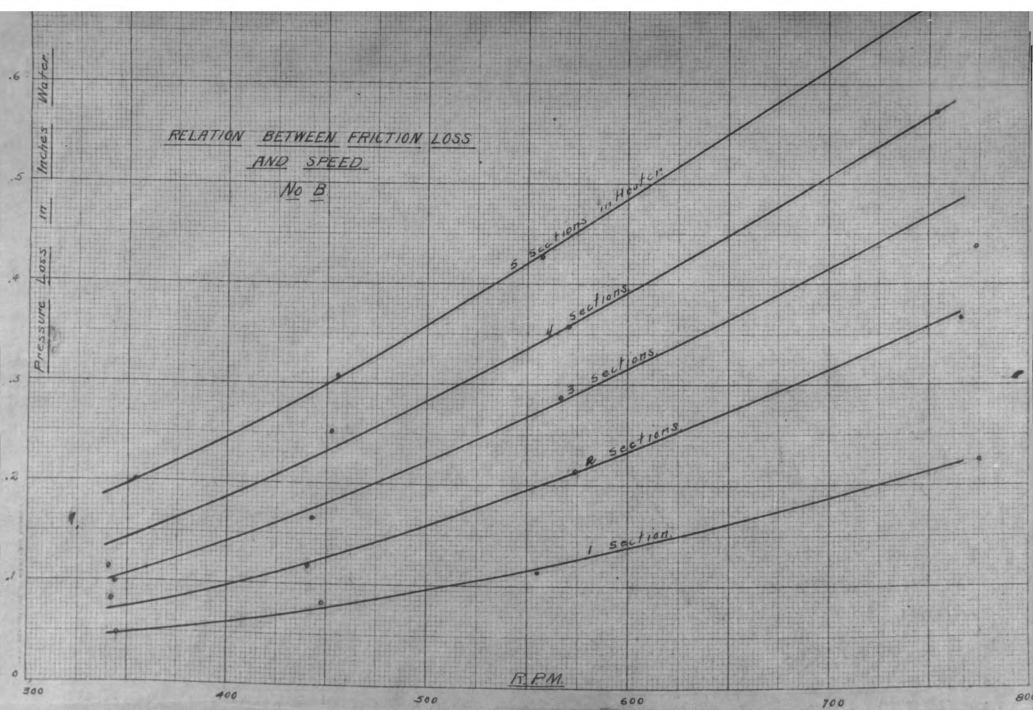
DROP IN AIR VELOCITY THRU HEATER IN PER CENT CAUSED BY THE COILS FOR DIFFERNET R.P.M. OF FAN.

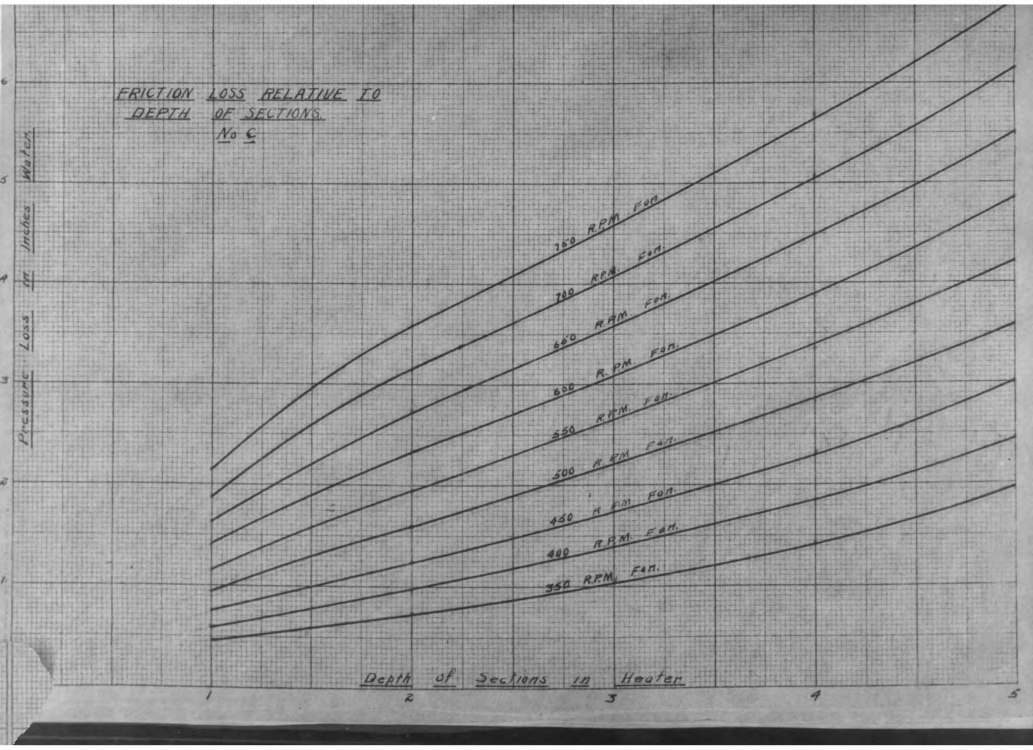
R.P.M.	1 COIL	2 COILS	3 COILS	4 COILS	5 COILS
300	8.75%	15.00%	22.50%	17.50%	18.80%
400	6.50%	12.00%	17.60%	23.00%	25.50%
500	5.50%	8.90%	13.00%	18.50%	22.20%
600	3.68%	7.67%	11.93%	16.60%	20.80%
700	3.16%	6.33%	10.00%	14.30%	18.95%

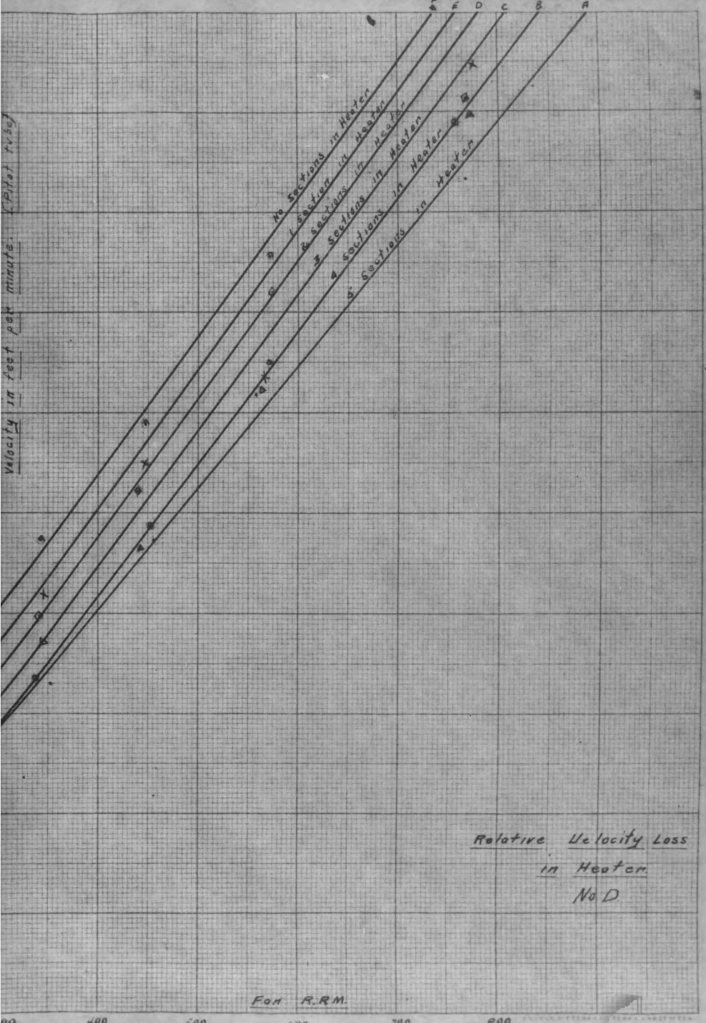

FRICTION LOSS INCHES WATER.
6 Sections
4 Sections
3 Sections
2 Sections
1 Section
RELATIVE FRICTION LOSS IN HEATER.
No. 11.
Velocity thru Heater in Ft per Min. from Condensation.
600
700
800
900
1000
1100
1200
1300
1400

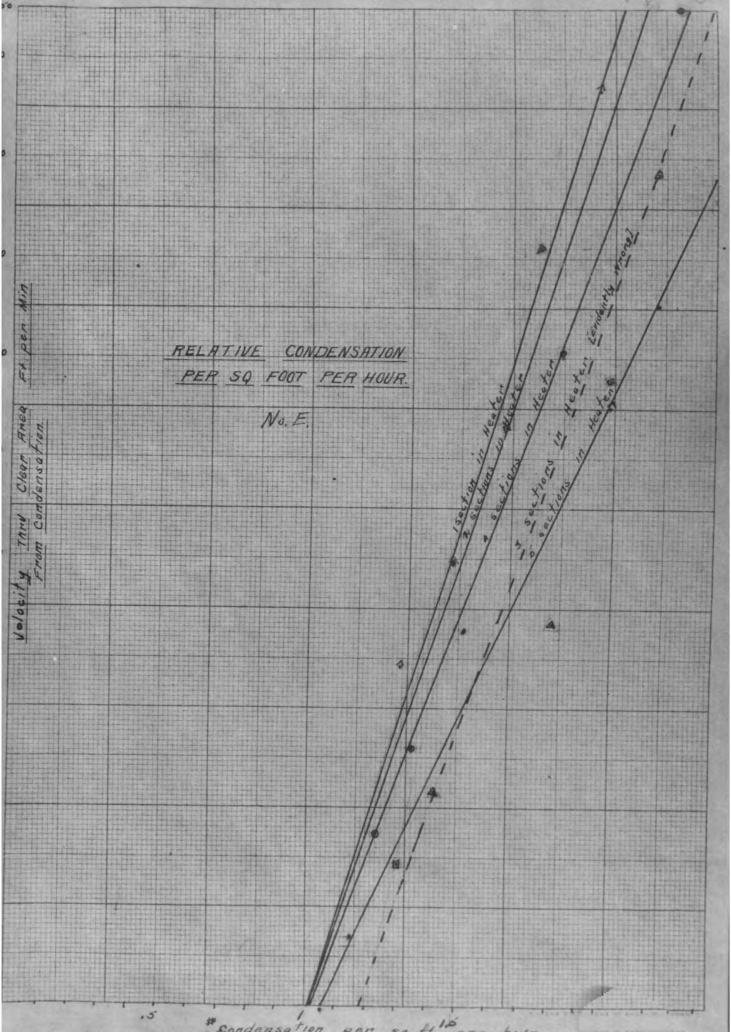


Pressure Loss in
Water
500
600
700

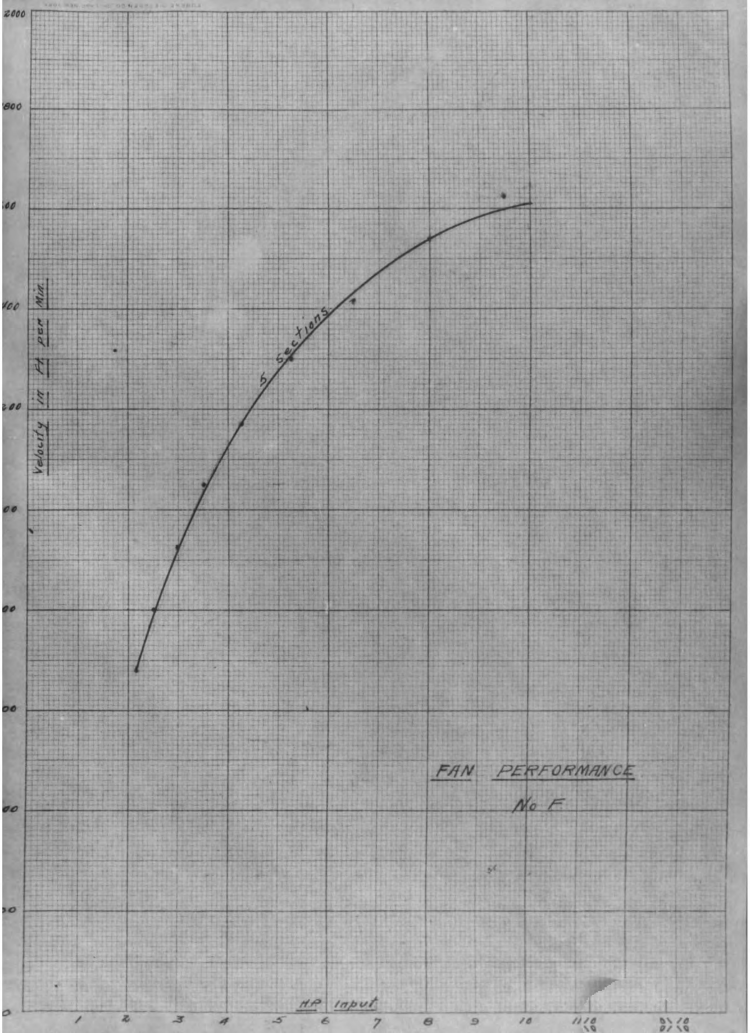

RELATION BETWEEN FRICTION LOSS
AND SPEED
No B
Pressure Loss in Inches Water
.6
.5
.4
.3
.2
.1
0
5 Sections in Heater
4 Sections
3 Sections
2 Sections
1 Section
300
400
500
600
700
R.P.M.

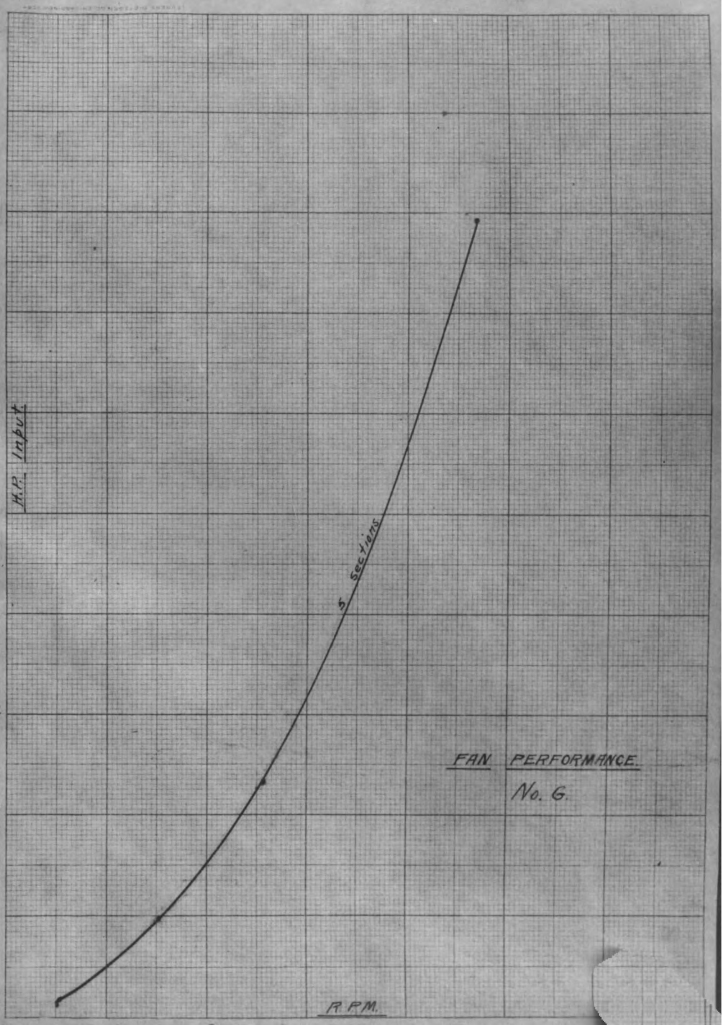

FRICTION LOSS RELATIVE TO DEPTH OF SECTIONS. No 6
Pressure Loss in Inches Water.
750 R.P.M. Fan
700 R.P.M. Fan
650 R.P.M. Fan
600 R.P.M. Fan
550 R.P.M. Fan.
500 R.P.M. Fan.
450 R.P.M. Fan.
400 R.P.M. Fan.
350 R.P.M. Fan.
Depth of Sections in Heater.
1
2
3
4
5


E
D
C
B
A
Velocity in feet per minute (Pitot tube)
No Sections in Heater
1 Section in Heater
2 Sections in Heater
3 Sections in Heater
4 Sections in Heater
5 Sections in Heater
Relative Velocity Loss
in Heater
No D
For R.R.M.
400
500
600
700
800



RELATIVE CONDENSATION
PER SQ FOOT PER HOUR.
No. E.
Velocity Thru Clear Area Ft. per Min
From Condensation.
1 section in Heater
2 sections in Heater
4 sections in Heater
3 sections in Heater (evidently wrong)
6 sections in Heater
.5
1
1.5


Velocity in Ft per Min.
5 sections
FAN PERFORMANCE
No F
HP Input


H.P. Input
11
10
9
8
7
6
5
4
3
2
3 Sections
FAN PERFORMANCE.
No. G.
R.P.M.