THESIS

THE EFFECT OF SUPERHEATED STEAM ON CYLINDER CONDENSATION IN A CORLISS STEAM ENGINE

JOHN F. BORDEN '04
WALTER S. FINLAY JR '04

THE EFFECT OF

SUPERHEATED STEAM

ON

CYLINDER CONDENSATION

IN A

CORLISS STEAM ENGINE

EXPERIMENTAL THESIS

PRESENTED TO THE FACULTY

OF

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FOR THE DEGREE OF

"MECHANICAL ENGINEER"

BY

WALTER STEVENSON FINLAY, JR.

AND

JOHN FRANCIS BORDEN.

INTRODUCTION.

In the following thesis and reports upon a series of tests conducted with a view to obtaining the practical working results of the use of superheated steam upon a simple condensing Harris Corliss engine, data and graphical represntations are carried out to the extent that they may fully demonstrate these practical results alone. The theoretical side of the problem has not been dealt with.

The unusually large cylinder condensation necessarily present in the type of engine employed, prevented any actual attainment of high thermodynamic efficiency; nevertheless the system of graphical relations holds true.

For purposes of comparison of the results of this test with the assumptions, and theory of present practice the statements of recoginzed authorities upon the subject will be quoted in the subsequent pages.

SUPERHEATED STEAM AS A WORKING FLUID

Dr. Robert Henry Thurston in his work, "A Manual of the Steam Engine," has given expression to the ideas of the highest authorities of the day, with regard to the working qualities of superheated steam. His introductory statements to the subject are as follows:

"Superheated Steam . . . . . can probable never be used in the ordinary steam engine, and even superheating, in its legitimate function of reducing liability to interior wastes, is employed comparatively infrequently. It is not used as a working substance for the reason that, in order that it may retain the gaseous state throughout the expansion period, it must be superheated initially to a higher temperature than is found ordinarily safe or practicable; or, otherwise, a way, as yet undiscovered, must be found to so modify the engine itself as to permit its safe use, and at the same time to prevent those wastes of heat which now so promptly convert the steam, at entrance, from the superheated to the saturated or wet condition."

The above statement is however qualified by this: "Could it be employed, its characteristics would be those of

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The above statement is however qualified by this:

"Could it be employed, its characteristics would be those of

the gases, ... it would insure a high thermodynamic efficiency, combined with the high mechanical efficiency of the steam engine."

In "a steam engine using superheated steam . . . . ., the condensation at entrance is reduced in amount; but, ordinarily, at least, the fluid is still more or less wet at the point of cut-off. Superheating is thus, as commonly practiced, simply a method of economizing by reduction of interior waste."

"It is probably never the fact, in practice," that it is possible to secure, safely and economically, so much superheating as is needed to keep the steam dry throughout the stroke."

"The superheating of the steam continually improves the working of the engine in (1), giving a better working substance and thus initially reducing interior wastes; - (2), at the same time, meeting more completely the demand for heat to bring up the temperature of the metal to that of the prime steam before the entrance of the latter into the cylinder."

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William J. M. Rankine, in his work "Steam Engine and other Prime Movers", makes the following statements in regard to the use of superheated steam:

"The objects and methods of superheating steam.

(1). To raise the temperature at which the fluid receives heat, and so as to increase the efficiency of the

the gases. . . . . It would insure a high thermodynamic efficiency, combined with the high mechanical efficiency of the steam engine."

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(2). To diminish the density of the steam employed to overcome a given resistance, and so as to lessen the back pressure.

(3). To prevent condensation of the steam during its expansion without the aid of a jacket.

The principal methods of superheating are the following:

(1) Wire-drawing, occasioning superheating when the pressure in the cylinder is much less than that in the boiler. Superheating ..... takes place more by accident than design, and does not secure the advantages ascribed to it.

(2). By the steam-jacket, taking place when the steam-jacket communicates more heat to the sylinder steam than is necessary merely to prevent any of it from condensing. This kind of superheating cannot be subject to definite calculation, - and its extent is limited.

(3) Superheating in the steam chest or upper part of the boiler by means of flues traversing or surrounding it. By this method, the steam may be raised to a temperature somewhat, but not very much exceeding the boiling point corresponding to the pressure in the boiler.

(4). Superheating in tubes or passages which the steam traverses on its way from the boiler to the cylinder. By this method, almost any required temperature can be given to steam of any pressure.

(5). Superheating by mixture, where a portion only of

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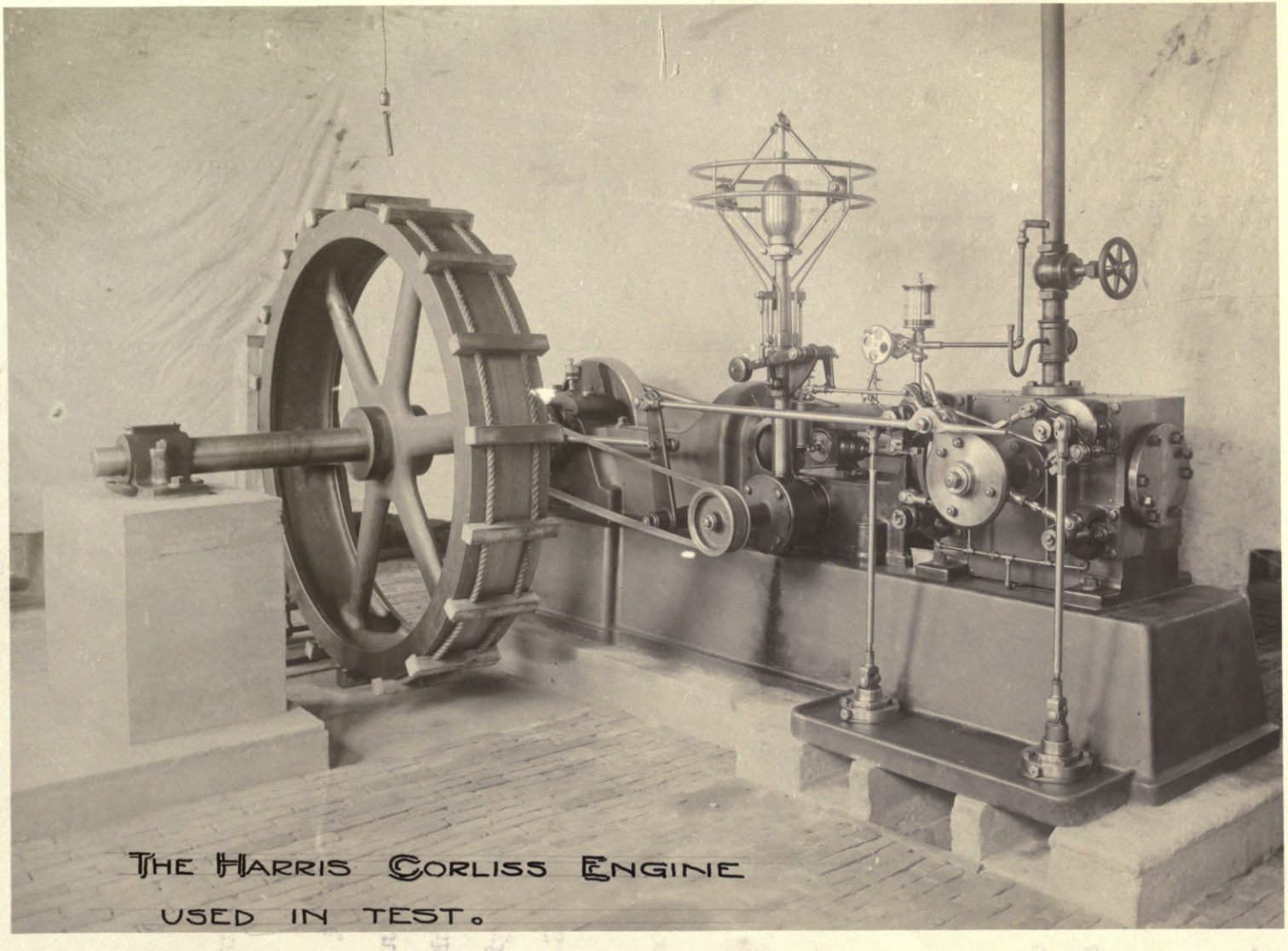
(5). Superheating by mixture, where a portion only of

the steam is passed through superheating tubes, and raised to a very high temperature, and then injected amongst the remainder of the steam at or near the cylinder ports.

(6). Superheating in the cylinder by means of a flue or furnace."



THE HARRIS CORLISS ENGINE
USED IN TEST.

THE ENGINE.

Description of the 5 x 15 Harris Corliss engine used in the test:-

The engine is of a size not adapted to commercial use, being of a special build, but modeled, however, to secure good working results. As a detailed description of the machine is unnecessary, particular attention will be given only to the points which involve any effective bearing upon the case in hand.

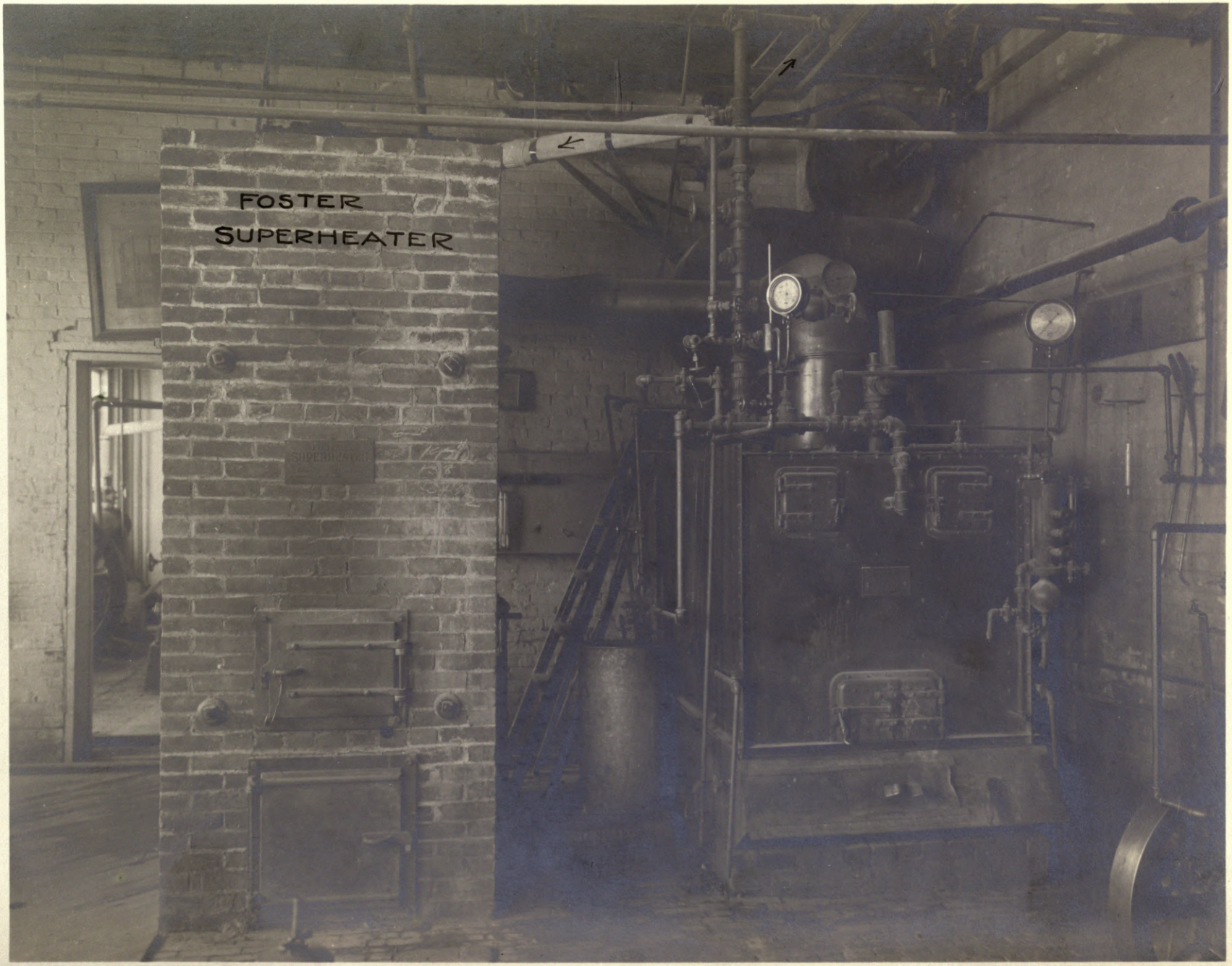
The construction of the frame work is heavy and non-conducive to shock or vibration.

The cylinder is lagged with sheet steel, the steam and exhaust valves being somewhat exposed. As is mechanically requisite in a small engine, the clearance is proportionally large.

The Valve Gear:-

The Brown releasing gear is employed. The hook engagement is positive, and is due alone to gravity action, release being effected by a locked-edge cam, operating between the arms of the steam crank. The cam causes cut-off by a sharp shoulder, a recurve causing a slow positive steam cut-off due to governor action.

The governor is of the Porter type, running at a normal


FOSTER
SUPERHEATER

THE FOSTER SUPERHEATER.

For the tests made, the Foster Superheater was employed to reheat the steam. The original supply of steam was at times, from a Roberts Water Tube Boiler, and also from the main steam supply line of Sibley College.

In this superheater steam passes through a series of two vertical steel pipes, whose heating surface is greatly enlarged by means of large iron washers fitting about the pipes. These washers give a corrugated effect to the apparatus.

The construction and general arrangement of the superheater is shown in accompanying diagrams.

The control of degree of superheat was accomplished by means of draught and firing only. A fair continuity in point of constant results was possible, although, at times, owing to the discharge of condensed steam into the superheater great irregularities occured.

It would seem advisable in the event of the use of the superheater at any distance from the supply, that either a separator be used or proper drip-cocks and drainage be placed at the base of the construction.

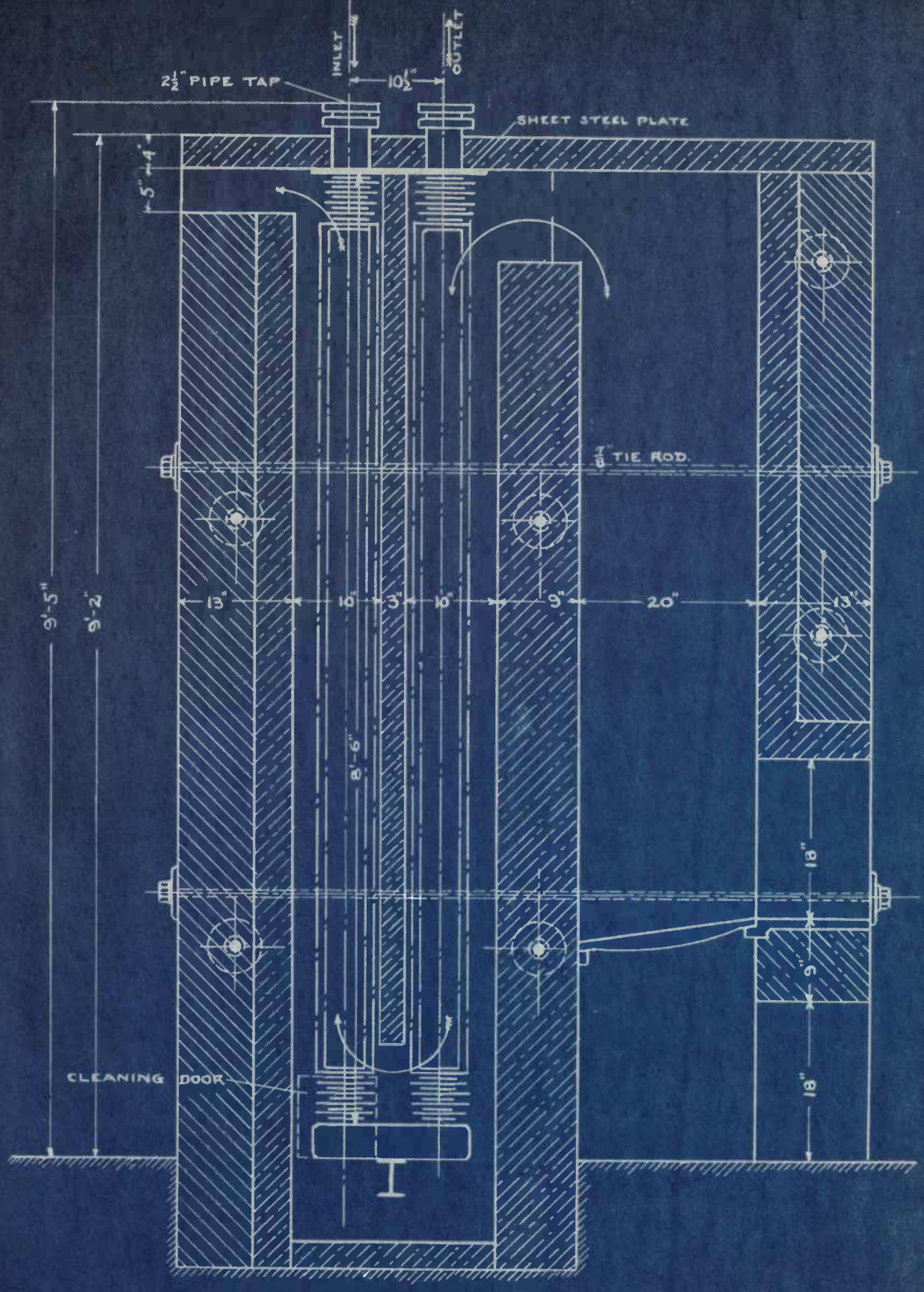
CRANES

1904

ATLANTA

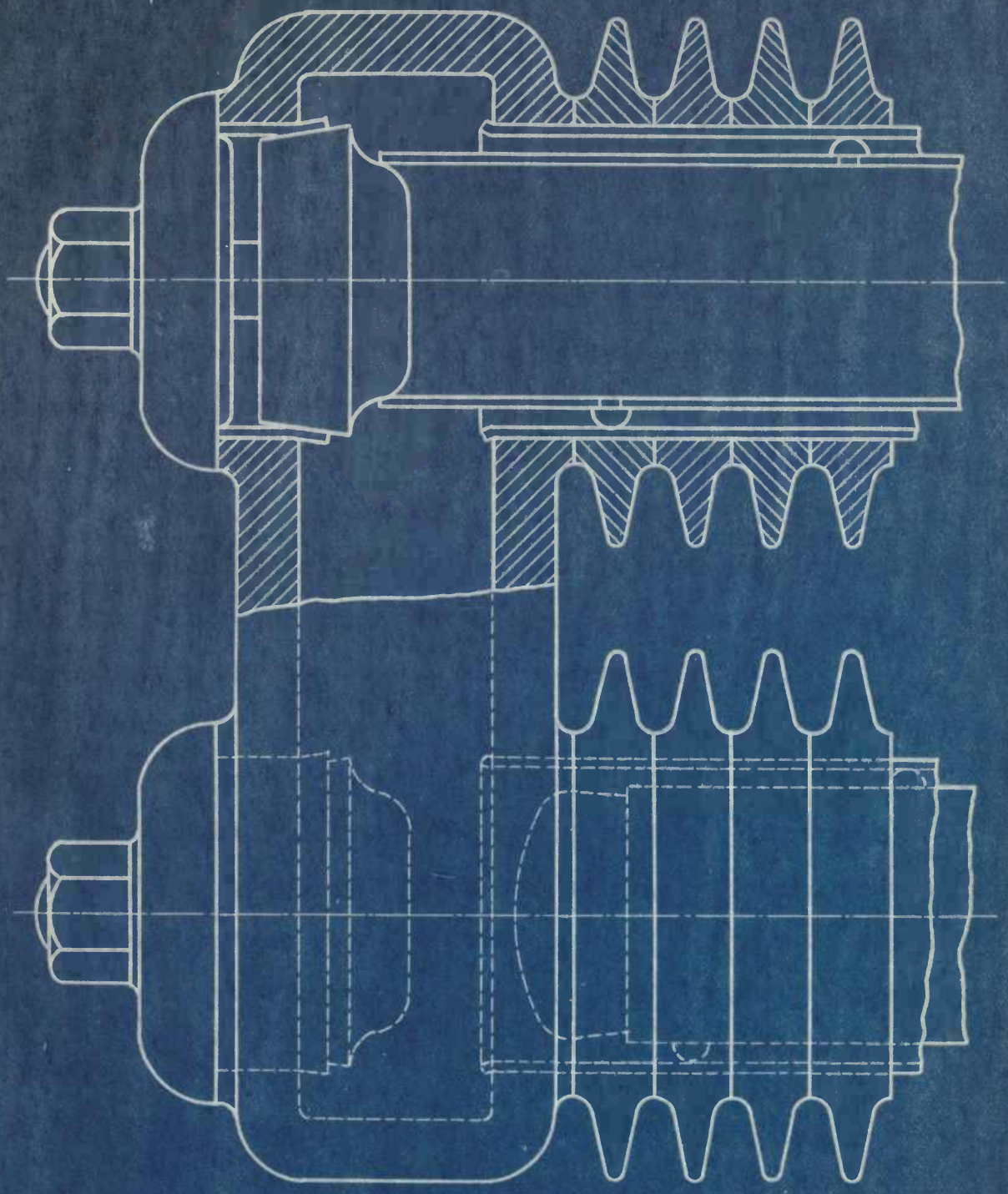
The rated capacity of the superheater is 2400 # of steam per hour, at 100° superheat. 150° superheat required at the engine necessitated a maximum degree at the superheater of 250° superheat. Under best running conditions, a drop of about 40° occurred.

Careful lagging of pipe lines between the superheater and engine gave the best possible results under running conditions.



SECTIONAL SIDE ELEVATION.

FOSTER SUPERHEATER.



DETAILS OF RETURN HEADER.

FOSTER SUPERHEATER.

THE TEST.

For the sake of comparison four runs, of an hour and a half each, under conditions of saturation and atmospheric exhaust, were made.

In the main test, sixteen actual hour and one half runs, were made, ten readings at ten minute intervals. The test was subdivided into four divisions, as to degree of superheat. The first at saturation, the second at fifty, the third at one hundred, and the fourth at one-hundred fifty.

These divisions were of four runs each, the runs averaging a developed horsepower of 2.5, 5, 7 and 9.

The governor action being poor, with a tendency to "hunting", a device of controlling springs assisted to some degree, but not so as to maintain a very constant speed. Steam pressures also varied from the desired 120 # gauge, but it was not possible for the operator to control this.

CONCLUSIONS.

As has been stated in the introductory remarks, the conclusions and results of the test are best expressed by the graphical method. The object in view of the operators has been not at all to obtain results bearing upon the economy although these results have been graphically shown.

With the increase in degree of superheat the expected results of lessened cylinder condensation occurred, and a general improvement in the operation of the engine was noticable up to 100° degree mark. At 150°, continued running emphasized a tendency upon the part of the valves to heat up and stick.

Valves, pipe-joints, and unions were affected by the high degree, and great leakage resulted.

Towards the conclusion of the test, conditions became so bad, that were a continuance to be considered, entire new gasketing and repacking would have been necessitated.

For constant use of superheated steam, decided change and improvement in these features is imperative.

DATA.

In the following pages of data the numbers designating the different runs will have the following meaning.

S - V - 2 = Saturated Steam-Vacuum-2 D.H.P.(approx.)
S - V - 5 = " " " 5 " " .
50 - V - 9 = 50° Superheat-Vacuum - 9 " " .
100 - V - 9 = 100° " " " " " .
150 - V - 9 = 150° " " " " " .
S - A - 7 = Saturated Steam-Atmoshpere-7 D.H.P.

For every sheet of data there will be found corresponding curve sheets showing graphically all the results obtained.

While the data sheets are classed by the approximate D.H.P's.of each run, the actual D.H.P's. are used in all computations and curves.

DATA.

S - V - 2

Barom. = 29.076" = 14.3 # .

No.	RPM	Gauge Reading Gau	Vac	Temperatures Eng. r'm	Con S	Inj water	Dis water	Calorimeter Gau.	Pres.	Temp	Weight Con S	Inj water
1	....	102	25.5	82	72.0	46	67.0	...	....	...	36.5	1810
2	94.5	115	23.5	..	72.0	46	65.0	104	15.1	266	33.2	1870
3	95.2	110	26.5	..	72.0	46	66.0	...	....	...	29.3	1870
4	94.5	101	27.0	..	73.5	46	66.5	110	15.2	272	32.5	1870
5	94.2	113	27.3	84	74.0	46	66.0	110	15.2	270	34.2	1870
6	93.5	101	27.3	..	74.8	45	65.0	117	15.3	270	35.8	1810
7	94.4	113	27.2	..	75.0	45	63.8	...	....	...	36.2	2000
8	94.9	110	27.3	..	75.0	44	67.5	107	15.1	266	35.7	1930
9	93.3	107	27.3	84	75.0	43	63.0	...	....	...	35.0	1870
10	94.1	107	27.5	..	75.0	43	62.0	...	....	....	35.5	1930
Av.	94	108	26.6	83	74.0	45	65.0	111.6	15.2	268	34.4	1883

I H P = 3.40

Brake Load = 62 1/2 # net. Water rate per D.H.P.=73.0

D H P = 2.8 " " " I.H.P.=60.2

Mech. eff. = 82.4 %

Quality = 99 %

Baron. = 29.078" = 14.3 #.

No.	Reading	Gauge Pressure	Temperatures			Calorimeter			Weight
			Eng. r'm	Con. S	Inj. water	Dia. water	Gas.	Pres.	Temp	Con. S	Inj. water
1	....	102	25.5	92	72.0	46	67.0	...	....	...	56.5	1810
2	94.5	118	25.5	..	72.0	46	66.0	104	15.1	268	33.3	1870
3	95.2	110	26.5	..	72.0	46	66.0	...	....	...	29.3	1870
4	94.5	102	27.0	..	73.5	46	66.5	110	15.2	272	32.5	1870
5	94.2	118	27.3	94	74.0	45	66.0	110	15.2	270	34.3	1870
6	93.5	102	27.5	..	74.8	46	66.0	117	15.5	270	36.8	1810
7	94.4	118	27.5	..	75.0	45	63.8	...	....	...	36.2	2000
8	94.2	110	27.5	..	75.0	44	67.5	107	15.1	266	35.7	1930
9	95.5	102	27.5	94	75.0	43	63.0	...	....	...	35.0	1870
10	94.1	102	27.5	..	75.0	43	62.0	...	....	....	35.5	1930
Av.	94	102	26.5	93	74.0	46	65.0	111.5	15.2	268	34.4	1883

I H P = 3.40

Brake load = 62 1/2 # net. Water rate per B.H.P.=29.0

B H P = 2.8 " " " I.H.P.=30.2

Mech. eff. = 82.4 %

Quality = 99 %

S - V - 8

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	1.10	27.8	2.06	13.6	106	20	4	2.3
2	1.13	30.6	2.12	13.6	116	20	4	2.3
3	0.96	26.0	1.80	13.6	112	20	4	1.7
4	1.04	28.2	1.95	13.6	106	20	4	2.3
5	0.96	26.0	1.80	13.6	108	20	4	1.1
6	0.94	25.5	1.77	13.6	104	18	4	2.4
7	1.00	27.1	1.87	13.6	113	18	4	1.3
8	0.90	24.4	1.69	13.6	108	19	4	1.0
9	0.94	25.5	1.76	13.6	108	20	4	1.4
10	0.97	26.3	1.82	13.6	108	20	4	2.3
Av.	0.98	26.9	1.86	13.6	109	19	4	1.8

C R A N K E N D.

1	0.82	22.2	1.54	13.6	100	18.4	4.0	0.0
2	0.82	22.2	1.54	13.6	108	18.4	4.8	0.0
3	0.71	19.2	1.33	13.6	100	14.3	4.0	0.0
4	0.75	20.4	1.41	12.0	100	12.0	4.0	0.6
5	0.85	23.0	1.59	13.6	104	16.8	4.0	0.6
6	0.78	21.1	1.46	13.6	100	16.0	4.0	1.4
7	0.75	20.3	1.41	13.6	108	18.4	4.0	1.0
8	1.00	27.1	1.87	13.6	109	20.0	4.0	1.4
9	0.84	22.8	1.58	13.6	104	18.4	4.0	1.4
10	0.90	24.4	1.70	13.6	104	18.4	4.0	1.7
Av.	0.82	24.3	1.54	13.6	104	16.1	4.1	0.8

Total I.H.P. = 3.40.

Barom. = 29.076" = 14.35 # .

No.	RPM	Gauge Reading Gau	Vac	Eng. r'm	Temperature Con S	Inj water	Dis water	Calorimeter Gau	Pres.	Temp	Weight Con S	Inj water
1		98	26.0	85	72	42.0	63.7	...	....	...	....	....
2	91.9	100	26.1	..	73	42.0	66.0	100	15.1	268	43.0	1875
3	92.0	102	26.2	..	75	41.5	66.0	...	....	...	44.0	1875
4	93.2	112	26.0	..	77	41.0	66.0	113	15.2	262	45.0	1875
5	93.2	103	26.0	85	78	41.0	65.5	...	....	...	42.7	1810
6	93.4	110	26.0	..	77	41.0	64.0	117	15.2	250	44.0	1750
7	93.9	115	26.0	..	77	41.0	65.0	...	....	...	42.5	1750
8	93.7	111	26.3	..	78	40.8	65.0	105	15.2	260	43.0	1875
9	92.0	97	26.1	86	78	40.8	66.0	...	....	...	42.3	1750
10	92.2	97	26.4	..	78	40.8	65.5	97	15.1	270	43.3	1810
Av.	92.8	104	26.0	85	77.3	41	65.2	106	15.2	262	43.0	1815

I.H.P. = 5.85

Brake load = 112 # net.

D.H.P. = 4.95

Mech. eff. = 84.5 %

Quality = 98.2 %

Water rate per D.H.P. = 51.3

" " " I.H.P. = 43.4

Barom. = 29.075" = 14.36 #.

Reading	Gauge Pressure	Temperature			Calorimeter			Weight
		F.M.	S	water-water	Gas	Pres.	Temp.	Con Inj S water
1	99	28.0	86	72	...	....	...	....
2	100	28.1	..	73	42.0	63.7	...	....
3	100	28.2	..	73	42.0	66.0	100	15.1 298 43.0 1878
4	100	28.2	..	75	41.5	36.0	...	.... 44.0 1878
5	105	28.0	..	77	41.0	66.0	115	15.2 282 43.0 1878
6	110	28.0	..	79	41.0	66.5	...	.... 42.7 1810
7	115	28.0	..	77	41.0	64.0	117	15.2 280 44.0 1750
8	111	28.1	..	77	41.0	65.0	...	.... 42.5 1780
9	107	28.1	..	78	40.8	65.0	108	15.2 280 43.0 1878
10	107	28.4	..	79	40.8	63.0	...	.... 42.3 1750
Av.	104	28.0	86	77.3	41	65.5	97	15.1 270 43.3 1810
	103	28.0	85	77.3	41	65.2	106	15.2 282 43.0 1816

I.H.P. = 5.85 Water rate per I.H.P. = 31.3

Brake load = 112 # net. " " B.H.P. = 42.4

B.H.P. = 4.95

Mech. eff. = 84.5 %

Quality = 96.2 %

S - V - 5.

H E A D E N D.

No.	Area	M.E.P.	I.H.P	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % st.
1	1.65	44.7	3.08	13.6	104	28.0	4.8	10.2
2	1.67	45.2	3.13	13.6	106	28.0	4.8	12.2
3	1.60	43.5	3.00	13.6	108	28.0	4.0	8.4
4	1.64	44.5	3.07	13.6	118	28.0	4.8	7.5
5	1.56	42.5	2.92	13.6	112	28.0	4.0	7.8
6	1.51	41.0	2.83	13.6	116	24.0	4.0	6.8
7	1.60	43.5	3.00	13.6	120	26.0	4.0	6.8
8	1.63	44.2	3.05	13.6	120	26.4	4.0	7.5
9	1.69	45.8	3.16	13.6	104	28.4	4.0	10.2
10	1.57	42.5	2.94	13.6	104	26.4	4.8	9.2
Av.	1.61	43.7	3.02	13.6	110	26.9	4.3	8.7

C R A N K E N D.

1	1.57	42.5	2.93	13.6	104	24.0	4.0	6.77
2	1.50	40.6	2.80	13.6	104	25.6	4.0	8.47
3	1.53	41.5	2.86	13.6	108	26.4	4.8	7.46
4	1.56	42.3	2.92	13.6	120	26.4	5.4	6.42
5	1.61	43.5	3.00	13.6	112	26.4	4.0	6.10
6	1.42	38.5	2.66	13.6	116	26.4	4.0	5.10
7	1.51	41.0	2.83	13.6	120	26.4	4.0	5.10
8	1.46	39.6	2.73	13.6	117	28.0	4.0	5.80
9	1.51	41.0	2.83	13.6	101	26.4	4.9	8.40
10	1.44	39.0	2.69	13.6	104	26.4	4.0	6.40
Av.	1.51	41.0	2.83	13.6	111	26.2	4.3	6.70

Total I.H.P. = 5.85.

S - V - 7

Barom. = 29.152" = 14.4 #.

No.	RPM	Gauge Reading Gau	Vac	Temperatures Eng. r'm	Con S	Inj water	Dis water	Calorimeter Gau.	Pres.	Temp	Weight Con S	Inj. water
1	....	120	26.4	81	89.0	40.5	73.5	...	....	...	....	....
2	89.8	112	26.3	..	87.5	40.5	75.7	...	....	...	54.5	1625
3	90.0	116	26.7	..	90.0	40.5	75.0	112	15.4	262	58.0	1625
4	89.8	110	26.8	..	88.0	40.5	74.5	...	....	...	59.5	1625
5	90.2	112	27.1	..	103.0	40.5	70.5	115	15.4	255	54.5	1750
6	90.2	114	27.0	83	90.7	40.2	64.0	...	....	...	57.5	1685
7	89.5	110	27.2	..	84.5	40.2	65.0	120	15.4	264	54.8	1685
8	90.7	118	27.5	..	83.0	40.2	65.0	...	....	...	53.5	2180
9	90.6	114	27.5	..	81.0	40.2	65.0	117	15.4	268	54.0	2320
10	90.7	115	27.4	80	81.0	40.2	65.0	...	....	...	54.5	1560
Av.	90.0	114	27.0	82	88.0	40.0	69.0	116	15.4	262	55.6	1785

Brake load = 155 # net.

Quality = 97.7 %

D.H.P. = 6.64

Mech. eff. = 87.1 %

I.H.P. = 7.62

Water rate per D.H.P. = 49.1

" " " I.H.P = 42.7

Barom. = 29.185" = 14.4 #.

No.	Reading Manom.	Vac.	Gau.	Temperatures Eng.	Con.	Inj.	Dis.	Calorimeter Gau.	Pres.	Temp	Weight Con Inj. S water
						r'm	S	water	water		
1	....	....	....	....	....	....	....	....	....	....	....
2	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
3	90.0	113	27.4	..	90.0	40.8	74.5	....	....	....	....
4	90.0	113	27.4	..	90.0	40.8	74.5	....	....	....	....
5	90.0	113	27.4	..	90.0	40.8	74.5	....	....	....	....
6	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
7	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
8	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
9	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
10	90.0	114	27.4	..	90.0	40.8	74.5	....	....	....	....
Av.	90.0	114	27.4	82	90.0	40.8	74.5	118	15.4	282	55.6	1780

Brake load = 156 # net. Water rate per B.H.P. = 49.1

Quality = 97.7 % " " " I.H.P = 42.7

B.H.P. = 4.64

Mech. eff. = 87.1 %

I.H.P. = 7.68

S - V - 7

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.22	60.3	4.02	20	126	36.8	4.8	15.3
2	2.16	58.6	3.90	20	116	36.0	4.8	18.6
3	2.18	59.2	3.94	20.8	123	36.0	5.6	17.0
4	2.25	61.0	4.06	20	116	37.6	5.6	17.6
5	2.21	60.2	4.01	20	124	37.6	5.6	14.6
6	2.12	57.5	3.83	16	124	36.0	5.6	13.5
7	2.13	57.8	3.85	16	116	36.0	5.6	15.2
8	2.10	57.4	3.82	16	125	36.0	5.6	13.5
9	2.13	57.8	3.85	16	123	36.0	5.6	14.2
10	2.03	55.0	3.66	16	124	36.0	5.6	13.8
Av.	2.15	58.5	3.90	18.1	122	36.4	5.4	15.3

C R A N K E N D.

1	2.06	55.8	3.72	16	126	36	4.8	13.5
2	1.98	53.7	3.58	20	117	36	4.8	15.5
3	2.05	55.6	3.70	20	124	38	5.6	13.5
4	1.97	53.4	3.56	20	117	34.4	5.6	13.5
5	2.10	57.0	3.80	16	125	36	5.6	11.9
6	2.00	54.3	3.62	16	124	36	5.6	11.9
7	1.94	52.0	3.47	16	117	36	5.6	13.5
8	2.00	54.2	3.61	16	126	36	5.6	11.9
9	2.07	56.1	3.74	16	124	36	5.6	13.2
10	1.98	53.1	3.54	16	124	36	5.6	11.8
Av.	2.00	54.5	3.63	17.2	123	36	5.44	12.9

Total I.H.P. = 7.62.

S- V - 9. Barom. = 29.152" = 14.4 #.

No.	RPM	Gauge Reading Gau	Vac.	Temperature Eng. r'm	Con S	Inj water	Dis water	Calorimeter Gau.	Press	Temp	Weight Con S	Inj water
1	85.8	120	25.0	80	89.0	40.2	69.0	120	15.4	264	68.5	....
2	90.5	125	26.0	..	89.0	40.0	69.0	...	....	...	67.5	2500
3	83.1	115	25.4	..	89.0	40.0	69.0	112	15.3	260	64.5	2310
4	84.3	106	25.0	..	89.0	40.0	70.0	...	....	...	66.3	2310
5	85.7	114	25.0	..	90.0	40.1	68.5	115	15.4	258	69.0	2380
6	85.6	114	25.1	80	90.0	40.2	75.0	...	....	...	60.0	2440
7	86.9	120	25.2	..	90.0	40.2	66.0	122	15.4	254	68.0	2310
8	85.3	120	25.2	..	88.0	40.0	67.0	...	....	...	71.0	2500
9	88.6	120	25.0	..	88.0	40.0	67.5	116	15.4	256	74.0	2560
10	83.9	120	25.4	80	89.0	40.0	68.0	...	....	...	74.5	2500
Av	86.0	117	25.2	80	89.0	40.0	69.0	117	15.4	258	68.5	2423

Brake load = 215 # net. Water rate per D.H.P. = 46.7

D.H.P. = 8.8 " " " I.H.P. = 40.3

Mech. eff. = 87%

Quality = 98 %

I.H.P. = 10.01

S - V - 9

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel.	Back	Cut-off % St.
1	2.96	80.0	5.10	16	128	54	5.6	27.1
2	3.12	84.3	5.37	16	132	50	4.8	27.1
3	3.00	81.0	5.16	16	122	52	5.6	31.2
4	2.90	78.5	5.00	16	116	52	5.6	33.9
5	3.01	81.5	5.19	16	124	52	5.6	30.5
6	3.03	82.0	5.22	16	124	52	5.6	31.2
7	3.04	82.2	5.23	16	130	52	5.6	29.5
8	2.96	80.0	5.10	16	128	50	5.6	27.2
9	2.95	80.0	5.10	16	124	52	5.6	28.8
10	2.97	80.2	5.11	16	128	49	5.6	27.1
Av.	2.99	81.0	5.16	16	126	52	5.5	29.7

Total I.H.P. = 10.01

C R A N K E N D.

1	2.75	74.4	4.74	16	132	48	5.6	21.2
2	2.84	77.0	4.91	16	132	49	4.8	22.0
3	2.88	78.0	4.97	16	124	48	4.8	25.4
4	2.80	75.8	4.82	16	116	48	4.8	30.5
5	2.83	76.5	4.86	16	124	48	4.8	25.4
6	2.85	77.0	4.91	16	126	50	4.8	26.1
7	2.85	77.0	4.91	16	130	49	5.6	25.4
8	2.77	75.0	4.78	16	128	48	5.6	23.7
9	2.85	77.0	4.91	16	128	48	5.6	25.4
10	2.74	74.0	4.72	16	129	48	5.6	22.4
Av.	2.82	76.2	4.85	16	129	48	5.1	24.8

Barom. = 29.45" = 14.52 #.

No.	RPM	St. gau	Vac.	Ent S	Eng r'm	Con S	Inj water	Dis water	Exh	Super heat	Con S	Inj water
1	....	120	26.3	393	82	88	59.5	79	111	43.0	..	....
2	96.0	116	26.2	398	..	88	59.5	79	111	50.3	31	1625
3	95.7	121	26.3	402	..	87	59.5	79	110	51.4	29	1625
4	95.9	118	26.3	413	84	87	59.5	77	113	64.1	30	1750
5	95.6	125	26.3	409	..	86	59.5	77	117	56.2	29	1750
6	95.8	115	26.3	418	..	85	59.5	77	119	70.9	29	1688
7	95.1	114	26.4	407	84	85	59.5	76	120	60.5	31	1875
8	96.1	118	26.3	391	..	86	59.5	86	114	42.1	28	1815
9	95.5	115	26.2	387	..	88	70.0	93	115	39.9	33	1815
10	95.8	109	26.0	406	84	92	62.5	99	114	62.5	30	1000
Av.	95.7	117	26.3	...	..	87	61.5	82	114	54.1	30	1660

Brake load = 62.5 # net. Water rate per I.H.P. = 48.7

Mech. eff. = 77 % " " " D.H.P. = 63.2

D.H.P. = 2.84

I.H.P. = 3.69

50 - V - 2

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	.82	22.2	1.58	12.0	122	16.8	4.8	1.3
2	.80	21.6	1.54	12.0	120	16.0	4.0	1.7
3	.80	21.6	1.54	16.0	126	16.0	4.0	1.4
4	.80	21.6	1.53	12.0	121	16.0	4.0	1.7
5	.80	21.7	1.54	12.0	130	16.0	4.0	1.0
6	.85	23.0	1.64	12.8	119	16.8	4.0	1.7
7	.84	22.8	1.62	12.0	119	16.8	4.8	1.7
8	.80	21.7	1.54	12.0	114	16.0	4.0	.7
9	.83	22.2	1.58	9.6	106	17.6	4.0	.7
10	.80	21.6	1.53	12.0	104	16.0	4.0	1.3
Av.	.81	22.0	1.56	12.2	118	16.4	4.2	1.3

C R A N K E N D.

1	1.12	30.4	2.16	12.0	126	10.1	4.8	1.0
2	1.11	30.1	2.14	12.0	121	20.4	4.0	1.0
3	1.15	31.2	2.22	12.0	136	20.4	4.0	1.0
4	1.10	30.0	2.12	12.0	122	20.4	4.0	.7
5	1.07	29.0	2.06	12.0	132	21.6	4.8	..
6	1.12	30.4	2.16	8.0	119	20.0	3.2	.7
7	1.07	29.0	2.06	12.0	119	20.0	4.8	1.0
8	1.15	31.2	2.22	8.0	120	20.0	4.0	..
9	1.10	29.9	2.13	12.0	108	20.0	3.2	..
10	1.10	29.9	2.13	10.0	112	20.0	4.8	1.0
Av.	1.11	30.1	2.13	11.0	122	19.3	4.2	.6

Total I.H.P. = 3.69.

MEAN ERROR.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. Inlet	Out-off	Back	Cut-off %
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Av.							

CRANK END.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. Inlet	Out-off	Back	Cut-off %
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Av.							

Total I.H.P. = 3.89.

50 - V - 5

Barom. = 29.6"

No	RPM	St. gau	Vac.	Temperatures. Ent S	Eng r'm	Con S	Inj wtr	Dis wtr	Exh	Super heat	Weights. Con S	Inj water
1	....	118	26.5	404	84	85.0	53.1	71.0	110	55.7	....	....
2	93.0	117	26.6	426	..	85.0	53.5	72.0	110	77.8	40.0	2250
3	93.6	113	26.5	399	..	86.0	53.0	70.0	109	53.1	43.5	2500
4	93.4	114	26.6	420	85	84.5	53.0	71.0	110	73.5	38.0	2380
5	93.5	124	26.6	410	..	84.0	52.8	71.0	110	57.8	40.0	2380
6	93.1	118	26.6	414	..	84.5	52.8	71.0	122	65.2	38.5	2440
7	92.6	120	26.7	430	86	85.0	53.0	74.0	128	80.0	39.5	2120
8	93.0	109	26.6	432	..	85.7	53.0	73.6	113	88.5	42.5	2060
9	92.3	123	26.6	418	89	85.0	53.1	73.5	111	66.3	41.7	2120
10	93.2	125	26.6	434	..	87.0	53.2	74.0	113	81.2	41.5	2120
Av.	93.0	118	26.5	420	86	85.0	53.0	72.0	115	70.0	40.7	2260

Drake load = 125 # net.

D.H.P. = 5.53

Mech. eff. = 85.3 %

Water rate per D.H.P. = 44.0

" " " I.H.P. = 37.6

I.H.P. = 6.48

50 - V - 5

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of Comp	Cut off	Rel	Back	Cut-off % St.
1	1.67	45.3	3.14	12	120	28	4	8.5
2	1.73	46.9	3.24	12	116	28	4	8.1
3	1.72	46.6	3.22	11.2	112	28	4	8.8
4	1.80	48.8	3.38	8.8	116	29	4	8.5
5	1.78	48.2	3.34	12.0	128	28	4	6.8
6	1.75	47.5	3.28	16.0	125	30	4	8.5
7	1.74	47.2	3.28	12.0	128	28	4.8	7.5
8	1.75	47.5	3.28	12.0	108	30	4.0	10.3
9	1.80	48.8	3.38	12.0	126	28	4	8.1
10	1.73	47.0	3.26	12.0	126	29	4	8.1
Av.	1.74	47.3	3.28	12.0	121	28.6	4	8.3

C R A N K E N D.

1	1.70	46.1	3.20	11.2	123	28	4	7.1
2	1.64	14.5	3.08	10.4	120	28	4	7.5
3	1.65	47.7	3.30	8.0	112	28	4	8.8
4	1.74	47.2	3.28	8.0	120	28	4	6.8
5	1.65	44.7	3.10	12.0	126	28	4	6.1
6	1.67	45.2	3.13	12.0	125	28	4	6.8
7	1.65	44.7	3.09	12.0	126	29	4	6.8
8	1.78	48.2	3.34	11.2	108	28	4	8.8
9	1.67	45.3	3.14	12.0	126	29	4	6.8
10	1.75	47.5	3.28	12.0	125	28	4	6.8
Av.	1.70	46.0	3.20	10.8	121	28	4	7.1

50 - V - 7

Barom. = 29.216" = 14.4 #.

No.	RPM	St. Gau	Vac	Temperatures. Ent St.	Eng r'm	Con St.	Inj wtr	Dis wtr	Exh	Super heat	Heights. Cond St.	Inj wtr
1	....	...	..	408	86	82	54	72	113	54.1	..	..
2	94.4	127	26	408	..	83	54	72	113	53.5	45	42
3	94.9	128	26	406	..	83	54	72	113	46.6	47	44
4	94.1	137	26	397	88	83	54	72	116	47.0	46	43
5	93.8	120	26	404	..	85	54	70	112	50.6	46	45
6	92.2	126	26	408	..	85	54	72	114	60.9	44	42
7	89.8	115	26	426	89	84	54	72	118	76.0	44	41
8	89.9	120	26	390	..	86	54	78	117	41.7	44	38
9	89.4	117	26	436	..	87	54	76	114	80.4	44	33
10	90.7	130	26	426	..	85	54	75	114	76.4	41	34
Av.	91.8	123	26	411	88	84	54	73	114.5	58.7	44.5	40.2

Brake load = 155 # net. Water rate per I.H.P. = 34.9 #.

I.H.P. = 7.66 " " " D.H.P. = 39.9 #.

D.H.P. = 6.7

Mech. eff. = 87.5

50 - V - 7

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.20	59.7	4.07	12	133	36	4.0	11.0
2	2.18	59.0	4.02	12	132	36	4.0	12.0
3	2.23	60.5	4.12	12	140	26	4.0	10.0
4	2.14	58.0	3.95	8	125	36	2.4	11.0
5	2.30	62.5	4.25	12	132	40	4.0	12.0
6	2.20	55.4	4.12	12	125	36	3.2	10.0
7	2.00	54.2	3.70	12	128	36	4.0	10.0
8	2.05	55.5	3.78	8	124	36	3.2	10.0
9	2.05	55.5	3.78	8	136	36	4.0	8.5
10	2.10	57.0	3.88	8	124	36	3.2	10.0
Av.	2.14	57.7	3.96	10.4	130	36	3.6	10.4

C R A N K E N D.

1	1.95	53.0	3.61	8	134	32.0	4.0	8.5
2	2.03	55.0	3.75	8	136	33.6	4.0	8.5
3	2.00	54.2	3.70	8	140	34.4	4.0	7.0
4	1.93	52.2	3.56	12	124	36.0	4.0	8.0
5	2.05	55.5	3.78	12	132	36.0	3.2	8.5
6	1.98	55.4	4.00	11	128	36.0	4.0	8.0
7	1.90	51.5	3.51	8	128	32.0	4.0	7.0
8	2.00	54.2	3.70	8	124	36.0	4.0	12.0
9	2.05	55.5	3.78	8	136	36.0	4.0	7.0
10	2.00	54.2	3.70	8	128	36.0	4.0	8.8
Av.	1.98	54.0	3.70	9.1	131	34.8	3.9	8.3

Total I.H.P. = 7.66.

HEAD END.

No.	Area	B.E.P.	I.H.P.	Ind. of comp	Cut off	Rel	Back	Cut-off % St.
1	.20	80.7	4.07	12	135	38	4.0	11.0
2	.20	80.0	4.02	12	132	36	4.0	12.0
3	.22	90.8	4.12	12	140	29	4.0	10.0
4	.24	80.0	3.95	8	128	36	2.4	11.0
5	.20	86.8	4.25	12	130	40	4.0	12.0
6	.20	86.4	4.10	12	128	36	3.2	10.0
7	.20	84.0	3.70	10	128	36	4.0	10.0
8	.22	86.8	3.70	8	124	36	3.2	10.0
9	.25	86.0	3.70	9	128	36	4.0	8.8
10	.20	87.0	3.80	8	124	36	3.2	10.0
Av.	.14	87.7	3.98	10.4	130	35	3.6	10.4

CRANK END.

1	1.05	85.0	3.61	8	124	32.0	4.0	8.8
2	.05	86.0	3.72	8	128	33.4	4.0	8.8
3	.00	84.0	3.72	9	120	34.4	4.0	7.0
4	1.04	85.2	3.80	10	124	36.0	4.0	9.0
5	.05	86.6	3.70	12	128	36.0	3.2	8.8
6	1.00	86.4	4.30	11	128	36.0	4.0	8.0
7	1.00	81.8	3.41	8	120	32.0	4.0	7.0
8	1.00	84.8	3.70	8	124	36.0	4.0	12.0
9	1.05	86.8	3.78	8	128	36.0	4.0	7.0
10	1.00	84.0	3.70	8	128	36.0	4.0	8.8
Av.	1.00	84.0	3.80	9.1	131	34.8	3.8	8.5

Total I.H.P. = 7.88.

50 - V - 9

Barom. = 29.216" = 14.4 #.

No.	RPM	St. Gau	Vac	Temperatures Ent S	Eng r'm	Con S	Inj wtr	Dis wtr	Exh	Super heat	Weights. Con S	Inj water
1	....	117	26	416	90	89	55	78	116	67.7	..	..
2	83.3	117	26	420	..	89	55	78	118	71.7	52	42
3	83.3	115	26	414	..	90	55	77	118	67.0	52	41
4	82.9	112	26	426	..	90	55	77	118	80.7	52	41
5	81.7	110	26	417	90	90	55	78	118	73.0	52	41
6	82.5	112	26	392	..	90	56	78	118	46.7	53	42
7	82.7	115	26	414	..	91	56	77	118	67.0	53	42
8	82.7	122	26	413	..	91	56	78	121	62.0	55	41
9	83.7	120	26	415	90	90	56	76	117	65.0	53	43
10	83.0	119	26	402	..	90	56	78	118	52.5	53	43
Av.	83.5	116	26	413	90	90	55.5	77.3	118	67.3	52.8	41.8

Brake load = ?

I.H.P. = 9.48

D.H.P. = 8.56

Mech. eff. = 90.5 %.

Water rate per I.H.P. = 33.4 #.

" " " D.H.P. = 37.0 #.

50 - V - 9

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.78	75.5	4.80	12.0	124	48	4.0	25
2	2.88	78.0	4.82	12.0	124	52	4.0	26
3	2.85	77.5	4.80	12.0	124	50	4.0	26
4	2.86	77.5	4.80	12.0	120	50	3.2	29
5	2.92	79.2	4.90	12.0	117	52	4.0	32
6	2.85	77.2	4.80	16.0	118	52	3.2	28
7	2.83	76.7	4.77	12.0	122	52	3.2	27
8	2.85	77.2	4.80	12.0	128	50	2.4	24
9	2.80	76.0	4.71	12.0	126	48	4.0	24
10	2.85	77.2	4.80	9.6	126	52	4.0	25
Av.	2.84	77.2	4.80	12.0	123	50.6	3.6	25.6

C R A N K E N D.

1	2.69	73.0	4.52	8.0	126	48	4.0	24
2	2.80	76.0	4.72	8.0	124	50	2.4	25
3	2.75	74.5	4.62	8.0	124	48	4.0	25
4	2.82	76.5	4.75	9.6	120	50	4.0	29
5	2.86	77.5	4.80	12.0	120	52	4.0	29
6	2.75	74.5	4.62	12.0	120	50	4.0	27
7	2.83	76.7	4.77	9.6	122	48	4.0	27
8	2.80	76.0	4.71	12.0	128	48	3.6	24
9	2.75	74.5	4.62	8.0	126	48	4.0	24
10	2.83	76.7	4.75	9.6	126	52	4.0	25
Av.	2.78	75.5	4.68	9.7	123	49.4	3.8	26

Total I.H.P. = 9.48.

B E A R E R B.

No.	Area	M.E.P.	I.H.P.	Ind. of comp	Absolute pressure. Cut off	Rel.	Back	Out-off % st.
1	2.72	73.5	4.80	12.0	124	44	4.0	28
2	2.78	73.3	4.78	12.0	124	58	4.0	28
3	2.82	73.5	4.80	12.0	124	50	4.0	28
4	2.78	73.5	4.80	12.0	120	80	5.2	29
5	2.76	73.3	4.80	12.0	117	82	4.0	30
6	2.78	73.3	4.80	12.0	119	82	5.3	28
7	2.74	73.3	4.77	12.0	122	82	5.3	27
8	2.80	73.3	4.80	12.0	124	80	2.4	24
9	2.80	73.3	4.77	12.0	122	46	4.0	24
10	2.84	73.3	4.80	9.6	124	82	4.0	28
Av.	2.78	73.3	4.80	12.0	122	68.6	4.0	28.6

C R I E R B.

1	2.86	73.3	4.82	9.6	126	46	4.0	24
2	2.82	73.3	4.77	9.6	124	80	6.4	26
3	2.76	73.3	4.78	9.6	124	46	4.0	23
4	2.82	73.3	4.77	9.6	120	80	4.0	29
5	2.84	73.3	4.80	12.0	120	82	4.0	29
6	2.72	73.3	4.82	12.0	120	80	4.0	27
7	2.74	73.3	4.77	9.6	120	46	4.0	27
8	2.80	73.3	4.71	12.0	126	46	3.3	24
9	2.76	73.3	4.82	9.6	126	46	4.0	24
10	2.84	73.3	4.80	9.6	126	82	4.0	28
Av.	2.78	73.3	4.80	9.7	123	49.4	3.8	26

Total I.H.P. = 9.48.

100 - V - 2

Barom. = 29.6" = 14.6 #.

No.	RPM	St. gua	Vac	Temperatures Ent S	Eng r'm	Con S	Inj water	Dis water	Exh	Super heat	Weights. Con S	Inj water
1	98.0	120	26.8	421	93	83.5	53.7	63.5	130	71.0	....	....
2	98.0	115	26.8	425	..	82.0	53.6	66.0	133	76.0	25.5	2500
3	98.0	120	26.9	430	..	79.5	53.8	67.5	134	80.0	24.5	2380
4	98.1	120	27.0	438	95	78.5	54.4	65.5	133	88.0	29.0	2500
5	97.8	112	27.1	445	..	77.5	54.0	66.0	134	99.7	27.0	2620
6	97.7	108	27.0	452	..	77.0	54.0	65.0	134	109.0	26.5	2440
7	97.7	118	27.1	448	96	76.5	54.0	65.0	134	99.0	27.5	2750
8	97.9	112	27.0	441	..	76.5	54.0	65.0	134	95.7	26.0	2560
9	97.9	118	27.0	458	..	76.0	54.0	66.0	133	109	24.5	2560
10	97.9	115	27.0	461	96	76.0	54.0	64.0	134	114	24.5	2620
Av.	97.9	116	27.0	442	95	78.5	53.9		133	94.1	26.0	2549

Brake load = 62.5 # net.

D.H.P. = 2.91

Mech. Eff. = 78.7 %

Water rate per D.H.P. = 53.6

" " " I.H.P. = 42.2

I.H.P = 3.7

100 - V - 2

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	.90	24.4	1.77	12	109	16.8	3.2	0.0
2	1.00	27.1	1.97	12	108	24.0	1.6	0
3	.88	23.8	1.74	13.6	116	16.8	4.0	0
4	.86	23.3	1.69	12.0	112	17.6	4.0	0
5	.85	23.0	1.67	12.0	106	17.6	4.0	0
6	.82	22.2	1.62	12.0	104	17.3	4.0	0
7	.90	24.4	1.77	12.0	114	17.6	3.2	0
8	.91	24.6	1.79	12.0	112	18.4	4.0	0
9	.96	26.0	1.89	12.0	112	18.4	4.0	0
10	.97	26.3	1.92	9.6	114	19.2	3.2	0
Av.	.90	24.5	1.78	12.0	111	18.4	3.5	0

C R A N K E N D.

1	1.00	27.1	1.97	5.6	109	20.0	2.4	0
2	.85	23.0	1.67	12.0	112	18.4	4.0	0
3	1.00	27.1	1.97	8.0	116	20.4	4.0	0
4	1.40	38.0	2.78	8.0	116	20.0	3.2	0
5	1.00	27.1	1.90	8.0	108	20.0	3.2	0
6	1.00	27.5	1.78	8.0	106	14.4	3.2	0
7	.91	24.6	1.78	8.0	114	20.0	3.2	0
8	.90	24.4	1.77	8.0	112	19.2	3.2	0
9	.92	24.9	1.81	8.6	112	19.2	3.2	0
10	.93	25.2	1.83	8.00	112	18.4	3.2	0
Av.	1.00	25.8	1.92	8.3	112	19.0	3.3	0

Total I.H.P. = 3.70.

100 - V - 5

Barom. = 29.6" = 14.65 #.

No.	RPM	St. gau	Vac	Temperatures Ent S	Eng r'm	Con $	Inj water	Dis water	Exh	Super heat	Weights Con S	Inj water
1	....	122	26.5	448	89	84.0	53.5	72.8	120	96.9	31.5	2000
2	93.0	128	26.6	446	..	85.0	53.5	72.5	110	91.5	37.5	2300
3	94.3	122	26.6	432	..	84.5	53.6	72.2	130	80.9	35.5	2250
4	93.4	105	26.7	432	..	84.0	54.0	73.0	137	91.0	38.5	2310
5	93.2	120	26.7	432	89	84.5	54.0	70.0	131	82.0	37.0	2380
6	93.5	119	26.7	427	..	86.2	53.5	70.0	108	77.6	....	....
7	93.3	116	26.7	443	..	85.0	54.0	72.0	110	95.4	....	....
8	93.0	112	26.6	446	94	84.5	54.0	71.0	121	100	39.5	2380
9	93.6	115	26.6	447	..	84.0	54.0	70.5	129	100	37.0	2440
10	94.3	127	26.7	434	..	84.5	53.6	70.5	132	80.0	....	....
Av.	93.5	1186	26.5	438	90	85.0	54.0	72.0	123	90.0	26.6	2306

Brake load = 125 # net.

D.H.P. = 5.56

Mech. eff. = 86.5 %

I.H.P. = 6.43

Water rate per D.H.P. = 39.5

" " " I.H.P. = 34.3

100 - V - 5

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	1.75	47.5	3.30	12.0	125	28.6	3.2	7.4
2	1.72	46.6	3.23	12.0	130	28.0	4.0	6.8
3	1.72	46.6	3.22	12.0	128	28.0	4.8	6.8
4	1.72	46.6	3.22	12.0	112	28.0	4.0	10.3
5	1.75	47.5	3.30	8.8	122	28.8	3.2	8.1
6	1.75	47.5	3.30	9⅛	124	28.0	2.4	7.1
7	1.65	44.7	3.10	12.0	120	28.0	4.8	7.5
8	1.65	44.7	3.10	12.0	116	28.0	4.0	8.5
9	1.65	44.7	3.10	12.0	120	28.0	4.0	8.5
10	1.62	44.0	3.05	12.0	130	28.0	4.0	6.1
Av.	1.70	46.0	3.20	11.6	122	28.0	3.8	7.7

C R A N K E N D.

1	1.73	47.0	3.26	9.6	124	28.0	3.2	6.8
2	1.75	47.4	3.30	11.2	132	28.0	4.0	5.8
3	1.70	46.1	3.20	10.4	128	28.0	4.8	5.4
4	1.65	44.7	3.10	8.0	116	28.0	4.8	6.8
5	1.73	47.0	3.26	9.6	122	28.8	4.0	6.1
6	1.68	45.5	3.16	12.0	124	28.0	3.2	6.8
7	1.70	46.0	3.19	8.0	120	28.0	3.2	8.5
8	1.73	47.0	3.26	8.0	114	28.0	1.6	8.5
9	1.78	48.2	3.34	8.0	120	28.8	4.0	8.5
10	1.73	47.0	3.26	7.2	128	28.0	4.8	6.8
Av.	1.71	46.7	3.23	9.6	122	28.0	3.7	7.0

Total I.H.P. = 6.43.

100 - V - 7

No.	RPM	St. Gau	Vac	Temperatures. Ent St.	Eng r'm	Cond St.	Inj wtr	Dis wtr	Exh	Super heat	Weights. Cond St.	Inj wtr
1	....	127	25.8	455	84	84	54	70	116	101	..	....
2	93.6	120	25.8	432	..	82	54	70	115	82	43	2940
3	95.8	114	25.8	429	..	82	54	71	115	82.5	42	2820
4	91.6	119	25.8	453	..	82	54	72	115	104	41	2560
5	92.1	120	25.8	450	86	82	54	72	116	100	39	2440
6	94.5	117	25.8	448	..	82	55	72	115	99.7	41	2460
7	94.0	120	25.8	463	..	82	55	71	114	113	41	2560
8	93.5	120	26.0	454	..	84	56	75	115	104	..	....
9	93.5	124	26.0	464	87	84	56	72	128	111	40	2500
10	93.5	119	26.0	456	..	83	56	73	135	107	39	2400
Av.	93.6	120	26.0	450	86	82.7	55	72	118	100	40.7	2585

Brake load = 155 # net. Water rate per I.H.P. = 32.3 #.

I.H.P. = 7.56 " " " D.H.P. = 35.4 #.

D.H.P. = 6.9

Mech. eff. = 91.2 %

100 - V - 7

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.03	55.0	3.82	8	134	32	3.2	8.0
2	2.04	55.5	3.86	8	128	36	4.0	10.0
3	2.00	54.2	3.78	8	120	36	4.0	11.0
4	2.00	54.2	3.78	8	124	36	4.0	10.0
5	2.00	54.2	3.78	8	128	36	4.0	9.0
6	2.02	55.0	3.82	8	124	36	2.4	10.0
7	2.00	54.2	3.78	8	126	36	4.0	10.0
8	1.95	53.0	3.68	8	128	36	4.0	8.5
9	2.00	54.2	3.78	8	130	32	4.0	9.0
10	1.96	53.2	3.68	8	124	36	2.4	9.0
Av.	2.00	54.2	3.77	8	127	35	3.6	9.5

C R A N K E N D.

1	2.05	55.7	3.87	8	134	36	3.2	10.0
2	2.05	55.5	3.86	8	130	36	4.0	10.0
3	2.00	54.2	3.78	8	118	36	4.0	11.0
4	2.01	54.6	3.80	8	124	36	4.0	10.0
5	2.00	54.2	3.78	8	128	36	4.0	8.5
6	2.02	55.0	3.82	8	124	36	3.2	10.0
7	2.00	54.2	3.78	8	126	36	4.0	9.0
8	1.95	53.0	3.68	8	128	36	4.0	8.5
9	1.96	53.2	3.68	8	132	36	4.0	8.5
10	2.05	55.7	3.87	8	124	32	3.2	10.0
Av.	2.00	54.5	3.79	8	127	35	3.7	9.5

Total I.H.P. = 7.56.

Barom. = 29.486" = 14.55#.

No.	RPM	Gauge Readings. Temp	Steam Gauge	Super heat	Vac	Temperatures. Eng r'm	Cons St.	Inj. Water	Dis. water	Exh.	Weights. Con. St.	Inj. water
1	....	440	120	90.0	26	89	95	59	81	118	..	....
2	87.6	447	113	93.2	26	..	95	59	82	120	51	2330
3	87.9	455	125	102.2	26	..	95	59	81	132	50	2380
4	88.7	447	125	94.2	26	88	94	59	80	132	49	2440
5	89.0	478	130	122.4	26	..	94	59	78	138	49	2500
6	88.6	464	125	111.2	26	..	93	59	79	142	49	2500
7	87.4	454	115	106.8	26	88	93	59	83	143	47	2250
8	86.6	474	116	125.2	26	..	95	58	83	146	47	2060
9	87.5	454	117	105.7	26	..	95	58	83	142	49	2060
10	88.6	432	134	74.3	26	89	94	61	84	139	50	2310
Av.	87.9	455	123	103.0	26	89	94	59	83	136	49	2320

Brake load = 215 # net. Water rate per D.H.P. = 32.6#

D.H.P. = 9. "" " " I.H.P. = 30.2#

I.H.P. = 9.73.

Mech. eff. = 92.5 %.

100 - V - 9

H E A D E N D .

No.	Area	M.E.P.	I.H.P.	End of comp	Cut off	Rel	Back	Out-off % St.
1	2.70	73.2	4.78	12.0	124	45.0	4	24
2	2.76	75.0	4.89	12.0	124	46.0	4	24
3	2.66	72.2	4.72	9.6	132	45.6	4	21
4	2.80	76.0	4.95	12.0	130	48.0	4	22
5	2.70	73.2	4.77	9.6	133	44.0	4	20
6	2.65	72.0	4.19	9.6	128	44.0	4	21
7	2.70	73.2	4.78	9.6	120	45.6	4	26
8	2.70	73.2	4.78	9.6	123	44.0	4	25
9	2.73	74.0	4.82	9.6	124	48.0	4.8	25
10	2.63	71.4	4.65	9.6	136	44.0	4.	18
Av.	2.70	73.3	4.73	10.0	127	45.4	4	22.6

C R A N K E N D .

1	2.83	76.8	5.00	9.6	126	46.0	3.2	25
2	2.87	78.0	5.09	9.6	126	48.0	4.0	26
3	2.85	77.4	5.04	9.6	134	48.0	4	22
4	2.95	80.0	5.21	12.0	133	48.0	4	24
5	2.80	76.0	4.95	9.6	137	45.0	4	21
6	2.85	77.4	5.04	9.6	132	48.0	4	22
7	2.85	77.4	5.04	9.6	121	48.0	4	28
8	2.80	76.0	4.46	9.6	127	48.0	4	27
9	2.85	77.4	5.04	12.0	126	51.0	4.8	27
10	2.85	77.4	5.04	12.0	140	48.0	4	20
Av.	2.85	77.3	5.00	10.0	130	47.8	4.0	24.2

Total I.H.P. = 9.73.

No.	Speed	I.H.P.	Mid of comp	Out off	Sel	Back	Out-off % Et.
1	77.3	4.78	12.0	124	46.0	4	24
2	75.0	4.95	12.0	124	46.0	4	24
3	73.2	4.72	9.6	132	46.0	4	21
4	70.0	4.95	12.0	130	46.0	4	22
5	73.2	4.77	9.6	133	44.0	4	20
6	70.0	4.19	9.6	132	44.0	4	21
7	73.2	4.70	9.6	130	46.0	4	23
8	72.4	4.72	9.6	133	44.0	4	25
9	74.0	4.82	9.6	134	42.0	4.8	25
10	71.4	4.85	9.6	132	44.0	4.	19
Av.	73.0	4.79	10.0	127	45.4	4	22.6

C L A S S E B .

No.	Speed	I.H.P.	Mid of comp	Out off	Sel	Back	Out-off % Et.
1	73.5	5.00	9.6	129	46.0	5.2	25
2	75.0	5.02	9.6	129	42.0	4.0	26
3	77.4	5.04	9.6	134	46.0	4	23
4	80.0	5.21	12.0	138	46.0	4	24
5	76.0	4.95	9.6	127	46.0	4	21
6	77.4	5.04	9.6	132	46.0	4	22
7	77.4	5.04	9.6	131	46.0	4	28
8	76.0	4.46	9.6	127	46.0	4	27
9	77.4	5.04	12.0	126	81.0	4.8	27
10	77.4	5.04	12.0	140	42.0	4	20
Av.	77.3	5.00	10.0	130	47.6	4.0	24.2

Total I.H.P. = 9.79.

150 - V - 2

Barom. = 29.62".

No.	RPM	St. gua	Vac	Temperatures. Ent S	Eng r'm	Con S	Inj water	Dis water	Exh	Super heat	Weights. Con S	Inj water
1	97.0	118	28.2	478	92.0	83.5	50.0	68.0		129	26.0	1930
2	96.8	110	28.2	510	..	84.1	51.0	68.0		166	23.5	1870
3	97.1	120	28.1	532	..	82.0	54.6	65.0		182	21.5	1930
4	97.7	109	28.1	540	..	79.8	49.5	60.5		198	22.5	1930
5	97.5	120	28.1	528	92	77.5	48.7	60.0		178	21.0	1930
6	97.8	120	28.6	500	..	75.5	49.0	60.0		150	21.0	2180
7	96.0	115	28.5	470	..	74.0	49.0	60.5		123	22.0	2120
8	96.0	111	28.6	458	..	73.0	49.0	61.3		114	22.5	2180
9	97.2	118	28.4	464	92	73.0	49.0	61.6		115	24.1	2060
10	97.2	102	28.5	470	..	72.5	49.0	61.0		132	25.0	2180
Av.	97.0	114	28.3	495	92	77.4	50.0	62.6		148.7	23	2030

Brake load = 67.5 # net.

D.H.P. = 2.79

Mech. eff. = 78 %

I.H.P. = 3.57

Water rate per D.H.P. = 49.4

Water rate per I.H.P. = 38.7

150 - V - 2

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Out off	Rel	Back	Cut-off % St.
1	1.00	21.7	1.96	8	109	17.6	4.00	0
2	.91	24.6	1.78	8	104	16.0	4.00	0
3	.90	24.4	1.76	8	108	16.8	4.00	0
4	.90	24.4	1.77	8	102	16.8	4.00	0
5	.90	24.4	1.77	8	110	16.0	4.00	0
6	.90	24.4	1.77	8	108	16.0	4.00	0
7	.91	24.6	1.78	8	104	17.6	4.00	0
8	.97	26.3	1.91	8	104	18.4	4.00	0
9	.90	24.4	1.77	12	109	18.4	4.00	0
10	.87	23.6	1.71	8	100	16.0	4.00	0
Av.	.93	24.8	1.80	8.4	105	17.0	4.00	0

C R A N K E N D.

1	.91	24.6	1.78	8	109	19.2	4.00	0
2	.87	23.6	1.72	8	104	17.6	4.00	0
3	.95	25.7	1.86	8	109	16.0	4.00	0
4	.90	24.4	1.77	8	100	15.2	4.00	0
5	.90	24.4	1.77	8	108	17.6	4.00	0
6	.90	24.4	1.77	8	104	16.0	4.00	0
7	.91	24.6	1.78	8	102	16.8	4.00	0
8	.95	25.7	1.86	8	100	17.6	4.00	0
9	.86	23.3	1.69	8	104	17.6	4.00	0
10	.85	23.0	1.67	8	96	16.0	3.20	0
Av.	.90	24.4	1.77	8	104	17.0	4.00	0

Total I.H.P. = 3.57.

Barom. = 29.62".

No.	RPM	St. gau	Vac	Temperatures. Ent S	Eng r'm	Con S	Inj water	Dis water	Super heat	Weights Con S	Inj water
1	....	129	28.0	465	88	76.8	46.1	62.8	110	....	....
2	93.6	130	28.0	484	..	76.2	46.2	65.5	129	35.1	2310
3	92.4	122	27.9	494	..	76.5	46.2	63.1	143	35.0	2060
4	93.4	130	28.0	491	..	75.5	46.5	64.0	135	34.5	2250
5	93.5	120	28.0	490	893	75.5	46.5	64.0	140	34.5	2180
6	93.5	127	28.2	493	..	75.1	46.6	65.0	139	33.5	2120
7	93.0	118	28.4	498	..	75.5	46.7	63.0	149	35.0	2120
8	93.6	105	28.1	486	887	75.0	46.9	62.0	145	33.7	2310
9	93.6	130	28.1	470	..	77.0	46.7	65.0	114	36.0	2310
10	93.0	118	28.1	498	..	76.5	46.7	64.0	149	34.5	2250
Av.	93.2	123	28.0	487	88.6	76.0	46.4	63.8	135	34.5	2212

Brake load = 125 # net. Water rate per D.H.P. = 37.4

D.H.P. = 5.54 " " " I.H.P. = 32.1

Mech. eff. = 86 %

I.H.P. = 6.45

150 - V - 5

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	1.64	44.5	3.09	8	128	26	4	5.1
2	1.75	47.5	3.30	12	132	29	4	6.8
3	1.80	48.8	3.39	12	124	28	4	8.5
4	1.75	47.5	3.30	12	128	29	4	6.8
5	1.75	47.5	3.30	8	131	28	4	5.7
6	1.73	47.0	3.26	8	128	28.0	4	6.8
7	1.75	47.5	3.30	12	120	28	4	8.5
8	1.76	47.7	3.32	8	112	28	4	10.2
9	1.70	46.0	3.20	12	132	28	4	5.1
10	1.69	45.8	3.18	12	116	28	4	7.4
Av.	1.73	47.0	3.26	10	125	28	4	7.1

C R A N K E N D.

1	1.73	47.0	3.26	12	129	28	4	6.8
2	1.65	44.7	3.10	8	132	28	4	5.1
3	1.73	47.0	3.26	8	124	28	4	6.8
4	1.73	47.0	3.26	8	128	28	4	5.1
5	1.70	46.0	3.20	8	132	28	4	5.1
6	1.63	44.2	3.07	8	128	28	4	5.1
7	1.73	47.0	3.26	8	120	28	4	6.8
8	1.67	45.3	3.15	8	112	26	3	6.8
9	1.65	44.7	3.10	8	131	28	4	5.1
10	1.70	46.0	3.19	8	116	28	2	6.8
Av.	1.71	45.9	3.19	8.4	125	28	4	5.9

Total I.H.P. = 6.45.

150 - V - 7

Barom. = 29.486" = 14.55 #.

No.	RPM	Gauge Readings. Temp	Steam Gauge	Super heat	Vac	Temperatures. Eng r'm	Cond St.	Inj. water	Dis. water	Exh.	Weights. Con. St.	Inj. water
1	....	504	110	159.9	26.0	77	87	58	76	149	..	....
2	89.5	482	110	137.9	26.1	..	87	58	77	123	33	2060
3	90.2	476	120	126.0	26.1	..	87	58	76	130	38	2130
4	90.0	494	107	151.7	26.1	..	88	58	76	135	38	2190
5	88.9	494	122	142.9	26.1	79	86	58	76	138	36	2500
6	90.3	500	119	150.6	26.2	..	86	58	75	140	36	2190
7	90.1	502	119	152.6	26.2	..	86	58	75	140	36	2190
8	90.1	501	115	153.9	26.2	82	86	58	75	140	35	2250
9	89.0	500	114	153.5	26.3	..	86	58	77	138	35	2130
10	90.4	501	109	157.5	26.3	83	86	58	76	132	35	2190
Av.	89.8	495	115	148.6	26.2	80	87	58	76	137	36	2203

Brake load = 155 # net. Water rate per D.H.P. = 32.6 #.

D.H.P. = 6.64. " " " I.H.P. = 29.8 #.

I.H.P. = 7.25

Mech. eff. = 91.5 %

150 - V - 7

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.00	54.2	3.54	8.0	116	32.0	3.2	13
2	2.00	54.2	3.54	8.0	114	32.8	4.0	14
3	1.97	55.5	3.50	12.0	128	32.8	4.0	11
4	1.96	53.0	3.46	12.0	112	32.0	4.0	15
5	1.92	52.0	3.40	9.6	130	32.0	4.0	11
6	1.97	53.5	3.50	8.0	126	32.0	4.0	12
7	1.95	53.0	3.46	8.0	121	32.0	3.2	12
8	1.90	51.5	3.36	9.6	124	32.0	4.0	10
9	1.95	53.0	3.46	8.0	120	32.0	4.0	12
10	2.08	54.2	3.54	9.6	116	33.0	3.2	14
Av.	1.96	53.2	3.47	9.3	121	32.0	3.7	12.5

C R A N K E N D.

1	2.14	58.0	3.78	8.0	120	36.0	4.0	15
2	2.10	57.0	3.72	8.0	116	36.0	4.0	15
3	2.17	59.0	3.85	8.0	129	36.0	4.0	11
4	2.05	50.5	3.30	8.0	113	33.6	4.0	15
5	2.00	54.2	3.54	9.6	134	36.0	4.0	11
6	2.12	57.5	3.75	12.0	128	36.0	3.2	12
7	2.10	57.0	3.72	8.0	124	34.2	3.2	12
8	2.10	57.0	3.72	8.0	125	33.0	4.0	10
9	2.10	57.0	3.72	9.6	122	36.0	4.0	12
10	2.11	57.0	3.72	8.0	118	36.0	4.0	14
Av.	2.10	56.4	3.78	8.7	123	35.2	3.8	12

Total I.H.P. = 7.25.

Barom. = 29.486 " = 14.55 #.

No.	R.P.M.	Gauge Readings Temp	Steam Gauge	Super heat	Vac	Temperatures. Eng r'm	Cond St.	Inj. water	Dis water	Exh	Weights Con St	Inj water
1	....	510	117	161.7	26.1	83	89	58	79	117	..	....
2	86.9	502	129	147.0	26.1	..	90	58	79	132	45	2250
3	86.0	504	106	162.3	26.2	..	90	58	78	141	43	2380
4	87.1	502	140	131.3	26.2	..	90	58	79	147	44	2310
5	86.6	496	115	148.9	26.0	..	90	58	78	152	47	2500
6	86.0	504	115	156.9	26.3	85	90	58	78	153	41	2380
7	85.6	504	105	163.0	26.1	..	90	58	79	155	43	2440
8	87.5	514	120	164.0	26.1	..	92	58	78	158	44	2180
9	87.4	500	102	160.8	26.0	...	90	58	77	156	43	2380
10	96.5	480	120	130.0	26.2	86	90	58	78	155	45	2500
Av.	86.6	502	117	152.3	26.1	85	90	58	78	147	44	2370

Brake load = 215 # net. Water rate per D.H.P. = 29.7 #.

D.H.P. = 8.88 " " " I.H.P. = 27.3 #.

I.H.P. = 9.67

Mech. eff. = 92 %

150 - V - 9

H E A D E N D .

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.85	77.4	4.98	12.0	123	48	4	27
2	2.75	74.5	4.80	12.0	134	44	4	19
3	2.85	77.4	4.98	9.6	113	48	4	34
4	2.73	74.0	4.77	9.6	144	43	4	18
5	2.75	74.5	4.80	12.0	123	49	4	26
6	2.78	75.2	4.85	12.0	120	44	3.2	27
7	2.85	77.4	4.98	8.0	116	48	3.2	34
8	2.85	77.4	4.98	9.6	125	48	4.0	27
9	2.75	74.5	4.80	8.0	112	48	4.0	34
10	2.70	73.1	4.72	9.6	140	44	4.0	18
Av.	2.79	75.5	4.86	10.2	125	46	3.8	28

C R A N K E N D .

1	2.86	77.5	4.99	9.6	124	45.6	3.2	27
2	2.82	76.4	4.43	12.0	137	44.8	4.0	21
3	2.83	76.5	4.43	8.0	116	48.0	3.2	32
4	2.75	74.5	4.80	8.0	146	48.0	3.2	18
5	2.76	74.7	4.82	8.0	124	45.6	3.2	25
6	2.75	74.5	4.80	9.6	124	46.4	4.0	27
7	2.80	75.8	4.88	9.6	118	48.0	4.0	30
8	2.88	78.0	5.03	9.6	127	45.5	3.2	27
9	2.74	74.2	4.78	9.6	112	48.0	4.0	34
10	3.03	79.2	5.11	9.6	144	48.0	4.0	19
Av.	2.81	76.1	4.81	9.4	127	46.8	3.6	26

Total I.H.P. = 9.67.

S - A - 2

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of Comp	Cut off	Rel	Back	Cut-off % st.
1	0.98	26.6	1.62	36	114	28	14.4	3.4
2	1.00	27.1	1.65	36	114	26	14.4	3.4
3	0.96	26.0	1.58	36	114	26	14.4	3.4
4	0.96	26.0	1.58	36	116	28	14.4	3.4
5	1.02	27.6	1.68	36	107	28	14.4	5.1
6	0.95	25.7	1.56	40	113	26	14.4	3.7
7	0.98	26.6	1.62	32	116	28	14.4	3.7
8	0.88	23.8	1.45	40	117	24	14.4	2.4
9	0.94	25.5	1.55	36	106	24	14.4	3.4
10	0.96	26.0	1.58	36	120	24	14.4	2.4
Av.	0.96	26.1	1.59	36	114	26	14.4	3.4

C R A N K E N D.

1	1.00	27.1	1.65	22	116	28	14.4	1.7
2	1.10	29.8	1.81	24	116	28	14.4	3.4
3	1.10	29.8	1.81	28	123	28	14.4	3.4
4	1.09	29.5	1.80	24	118	28	14.4	4.8
5	1.10	29.8	1.80	24	111	28	14.4	5.4
6	1.05	28.4	1.73	27	116	28	14.4	4.1
7	1.04	28.2	1.73	24	116	28	14.4	3.4
8	1.20	32.5	1.98	24	127	28	14.4	3.7
9	1.16	31.5	1.92	24	108	29	14.4	6.8
10	1.16	31.5	1.92	24	122	28	14.4	3.7
Av.	1.10	29.8	1.82	25	117	28	14.4	4.0

Total I.H.P. = 3.41.

No.	Area	M.E.P.	I.M.P.	Rpm	Absolute Pressures. Cut off	Rel. Comp	Cut-off % et.
1	0.89	25.6	1.62	36	134	28	14.4	8.4
2	1.00	27.1	1.85	36	134	28	14.4	8.4
3	0.86	24.0	1.32	36	114	28	14.4	8.4
4	0.95	26.0	1.80	36	116	28	14.4	8.4
5	1.00	27.8	1.89	36	107	28	14.4	8.1
6	0.94	24.7	1.38	40	115	28	14.4	8.7
7	0.87	24.4	1.32	40	116	28	14.4	8.7
8	0.85	23.7	1.42	40	117	28	14.4	8.4
9	0.94	26.3	1.75	36	106	28	14.4	8.4
10	0.86	24.0	1.67	36	120	28	14.4	8.4
Av.	0.92	25.1	1.69	36	114	28	14.4	8.4

C Y L . H . E N D.

1	1.00	27.1	1.75	36	110	28	14.4	1.7
2	1.10	29.8	1.71	36	113	28	14.4	8.4
3	1.10	29.8	1.91	28	128	28	14.4	8.4
4	1.05	25.6	1.70	36	118	28	14.4	6.8
5	1.10	29.8	1.90	36	111	28	14.4	8.4
6	1.08	29.4	1.74	36	118	28	14.4	6.1
7	1.14	30.9	1.94	36	118	28	14.4	8.4
8	1.10	30.8	1.68	36	127	28	14.4	8.7
9	1.14	31.0	1.93	36	109	28	14.4	8.8
10	1.10	31.8	1.92	36	120	28	14.4	8.7
Av.	1.10	30.8	1.82	36	117	28	14.4	8.8

Total I.H.P. = 3.41.

S - A - 2

Barom. = 29.116" = 14.35 #.

No.	RPM	Steam gauge	Temperatures. Eng. r'm	Con. S	Inj. water	Dis. water	Calorimeter Gau.	Press	Temp	Weights. Con S	Inj. water
1	82.2	111	84	72.0	39.0	58.0	111	15.3	276	27.3	1620
2	82.2	109	84	71.4	39.0	57.0	...	....	...	39.8	1560
3	82.4	116	84	70.0	39.0	57.0	116	15.4	272	31.5	1620
4	82.2	111	84	69.8	39.0	57.0	....	....	...	31.0	1560
5	82.7	102	84	69.0	38.5	57.0	105	15.2	264	30.0	1560
6	81.1	108	84	69.0	38.5	56.8	...	....	...	32.0	1560
7	82.6	112	84	68.0	38.5	56.5	113	15.3	268	33.0	1620
8	81.5	111	84	68.0	38.5	56.0	...	....	...	33.0	1560
9	81.5	101	84	69.3	38.0	56.2	105	15.2	259	27.8	1560
10	81.5	115	84	68.5	38.0	55.8	...	....	...	32.3	1620
Av.	81.9	110	84	69.4	38.6		110	15.3	267	30.8	15740 (Total)

I.H.P. = 3.41

D.H.P. = 2.63

Quality = 98.8 %

Mech. eff. = 77.1 %

Brake load = 67.5 # net.

Water rate per D.H.P. = 69.2

" " " I.H.P. = 53.5

S - A - 5

Barom. = 29.156" = 14.4 #.

No.	RPM	Steam gauge	Temperatures Eng. r'm	Con. S	Inj. water	Dis. water	Calorimeter Gau.	Press	Temp	Weight Con. S	Wt.
1	....	114	82	76	38.5	62.0	110	15.2	246	49.0	1690
2	79.4	105	..	74	38.5	60.8	...	....	...	46.0	1750
3	79.6	114	..	73	38.0	60.0	...	....	...	43.5	1690
4	79.3	115	82	72	37.5	60.8	110	15.2	258	42.0	1620
5	80.7	111	..	72	37.0	63.0	...	....	...	44.5	1560
6	79.3	114	..	71	37.0	63.0	...	....	...	43.5	1560
7	80.6	104	81	70	37.0	63.0	104	15.2	256	41.0	1690
8	80.2	113	..	71	37.0	60.0	...	....	...	41.5	1690
9	80.8	114	..	70	37.0	62.5	...	....	...	42.0	1560
10	80.1	111	80	70	37.0	63.0	113	15.3	262	42.0	1560
Av.	80.0	111.5	81	72	37.4	62.0	109	15.2	256	43.5	1637

I.H.P. = 5.67

Brake Load = 125 # net.

D.H.P. = 4.75.

Mech. eff. = 84 %

Quality = 97.7 %

Water rate per D.H.P. = 53.6

" " " I.H.P. = 45.0

Barom. = 29.128" = 14.4 #.

No.	Temperatures				Calorimeter	Weight
	Gauge	T'a	Cor. Inj. Dis. Water	Cor. Inj. Dis. Water	Corr.	Wt.
1	....	114	80	78	36.8	02.0	110	15.2	264	49.0	1890
2	76.4	108	..	74	36.5	00.8	...	....	...	46.0	1780
3	76.3	114	..	73	36.0	80.0	...	....	...	43.5	1880
4	76.7	115	80	72	37.6	80.8	110	15.2	256	42.0	1820
5	80.7	111	..	72	37.0	85.0	...	....	...	44.5	1860
6	76.3	114	..	71	37.0	86.0	...	....	...	43.5	1880
7	80.3	104	81	70	37.0	88.0	104	15.2	256	41.0	1890
8	80.3	113	..	71	37.0	80.0	...	....	...	41.5	1880
9	80.7	114	..	70	37.0	82.5	...	....	...	42.0	1860
10	80.1	111	80	70	37.0	83.0	113	15.3	262	42.0	1860
Av.	80.0	111.8	81	72	37.4	82.0	109	15.2	256	43.5	1857

I.H.P. = 8.87

Brake horse = 128 # mec. " " I.H.P. = 45.0

D.H.P. = 4.76.

Mech. eff. = 84 %

Quality = 87.7 %

Water rate per D.H.P. = 55.6

S - A - 5

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure End of comp	Cut off	Rel	Back	Cut-off % St.
1	1.93	52.3	3.12	36	120	40.0	14.3	13.5
2	1.90	51.5	3.07	36	112	40.0	14.3	16.9
3	1.82	49.3	2.94	36	120	36.0	14.3	13.5
4	1.80	48.8	2.91	36	120	36.8	14.3	11.8
5	1.55	42.0	2.50	36	116	36.0	14.3	10.2
6	1.76	47.6	2.83	36	120	36.0	14.3	11.8
7	1.81	49.0	2.92	36	112	40.0	14.3	15.2
8	1.80	48.9	2.91	36	120	36.4	14.3	11.8
9	1.80	48.8	2.91	36	123	36.4	14.3	11.8
10	1.93	52.3	3.12	36	116	41.6	14.3	16.9
Av.	1.81	49.1	2.95	36	118	36.5	14.3	13.5

C R A N K E N D.

1	1.72	46.6	2.77	28	120	36.0	14.3	11.2
2	1.56	42.3	2.53	24	112	36.0	14.3	11.8
3	1.70	46.1	2.74	24	122	36.0	14.3	11.8
4	1.68	45.5	2.71	24	124	36.0	14.3	10.2
5	1.52	41.2	2.46	24	116	36.0	14.3	8.5
6	1.75	47.5	2.83	24	122	40.0	14.3	10.2
7	1.83	49.3	2.94	24	112	40.0	14.3	15.2
8	1.84	50.1	3.02	24	120	40.0	14.3	11.8
9	1.80	48.8	2.91	24	120	40.0	14.3	11.8
10	1.60	43.3	2.58	24	120	40.0	14.3	8.8
Av.	1.70	46.1	2.75	24	119	38.0	14.3	11.1

Total I.H.P. = 5.67.

S - A - 6

Barom. = 29.123" = 14.3 #.

No.	RPM	Steam gauge	Eng. r'm	Con. Inj. S water	Dis. water	Gau.	Press	Temp.	Con. Inj. S	water
1	....	105	72	80.0	39.5	67.0	...	....	...	....	....
2	79.5	106	..	77.5	39.5	66.5	1045	15.1	229	48.2	1690
3	79.8	108	..	76.0	39.5	67.0	...	....	...	49.7	1620
4	79.5	110	..	75.5	39.5	67.0	108	15.2	231	46.0	1870
5	79.8	112	78	75.5	39.5	68.0	...	....	...	42.7	1500
6	80.2	108	..	75.5	39.5	68.0	105	15.2	240	49.7	1620
7	79.9	107	..	76.0	39.5	68.5	...	....	...	50.5	1690
8	79.3	112	..	76.0	39.5	67.5	109	15.2	241	49.0	1690
9	77.7	109	80	76.0	39.5	63.0	...	....	...	48.0	1690
10	79.0	108	..	76.0	39.5	68.0	...	....	...	44.0	1690
Av.	79.5	108	77	76.0	39.5	67.0	106	15.2	253	47.5	1673

I.H.P = 6.63

Brake load = 156 # net.

Quality = 96.5 %

D.H.P. = 5.91

Mech. eff. = 89.1 %

Water rate per D.H.P. = 46.5

" " " I.H.P. = 41.5

Baton. = 29.125" = 14.3 #.

No.	R.P.M	Steam Pressure	Temp.	Cond. Vacuum	Inj. Water	Dis. Water	Gauge Press.	Cond. Temp.	Inj. Water	
1	....	105	72	29.0	29.5	87.0	...	....	....	....
2	79.3	103	..	77.8	29.5	84.5	104.0	15.1	229	46.3 1830
3	79.8	103	..	75.0	29.5	87.0	...	....	....	46.7 1830
4	79.5	110	..	75.5	29.5	87.0	108	15.2	231	46.0 1870
5	79.0	112	70	75.8	29.5	86.0	...	....	...	46.7 1800
6	80.3	109	..	75.8	29.5	86.0	108	15.3	240	46.7 1830
7	79.8	107	..	73.0	29.5	86.5	...	....	...	50.8 1390
8	79.1	112	..	76.0	29.5	87.5	109	15.2	241	46.0 1890
9	77.7	109	80	75.0	29.4	85.0	..	....	...	46.0 1890
10	79.0	108	..	76.0	29.5	86.0	...	....	...	44.0 1890
Av.	79.5	109	77	76.0	29.5	87.0	106	15.2	235	47.8 1878

I.H.P = 9.88 Water rate per D.H.P. = 46.5

Brake load = 158 # net. " " I.H.P. = 41.5

Quality = 98.5 %

D.H.P. = 5.01

Mech. eff. = 39.1 %

S - A - 6.

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
1	2.00	54.3	3.19	24	112	40	14.3	21.4
2	2.03	55.2	3.24	40	112	40	14.3	21.0
3	2.00	54.5	3.20	40	120	38	14.3	17.3
4	1.90	51.3	3.02	36	116	40	14.3	16.3
5	2.18	59.2	3.48	40	120	44	14.3	18.6
6	2.33	63.2	3.71	36	116	48	14.3	25.4
7	2.13	57.5	3.38	36	116	43	14.3	20.4
8	2.12	57.2	3.36	36	120	44	14.3	18.7
9	2.16	58.4	3.43	36	116	44	14.3	20.4
10	2.10	56.7	3.33	40	116	44	14.3	20.4
Av.	2.10	56.8	3.33	36	116	43	14.3	20.0

C R A N K E N D.

1	2.06	56.0	3.28	32	112	40	14.3	22.4
2	2.05	55.7	3.27	26	116	40	14.3	19.3
3	2.04	55.5	3.26	24	120	40	14.3	17.0
4	2.15	58.5	3.44	24	116	42	14.3	20.4
5	1.94	52.2	3.07	24	117	40	14.3	15.3
6	1.95	53.0	3.11	24	116	43	14.3	17.0
7	2.13	57.8	3.40	24	114	46	14.3	18.7
8	2.10	56.7	3.33	24	120	44	14.3	17.0
9	2.15	58.0	3.40	24	116	44	14.3	19.3
10	2.15	58.0	3.40	24	116	44	14.3	20.4
Av.	2.07	56.1	3.30	25	116	40	14.3	18.7

Total I.H.P. = 6.63.

B - A - 6. R U N D S.

No.	Area	M.E.P.	I.H.P.	Pad of comp	Absolute Pressure. Out Bet	Back off	Cut-off % St.
1	2.00	54.8	3.10	34	112	40	14.3	21.4
2	2.03	55.3	3.24	40	112	40	14.3	21.0
3	2.00	54.8	3.20	40	120	38	14.3	17.3
4	1.97	51.3	3.02	36	116	40	14.3	18.3
5	2.18	59.2	3.48	40	120	44	14.3	18.6
6	2.36	64.2	3.71	36	116	48	14.3	25.4
7	2.12	57.8	3.35	36	118	43	14.3	20.4
8	2.18	59.2	3.56	36	120	44	14.3	18.7
9	2.14	58.4	3.45	36	118	44	14.3	20.4
10	2.10	57.2	3.33	40	118	44	14.3	20.4
Av.	2.10	56.8	3.35	36	118	43	14.3	20.0

O R A N G E S.

1	2.03	56.0	3.32	32	112	40	14.3	22.4
2	2.06	56.7	3.27	28	118	40	14.3	18.3
3	2.04	56.3	3.26	24	120	40	14.3	17.0
4	2.15	59.3	3.44	24	118	42	14.3	20.4
5	1.94	53.2	3.07	24	117	40	14.3	16.3
6	1.95	53.0	3.11	24	118	43	14.3	17.0
7	2.13	57.8	3.40	24	114	46	14.3	18.7
8	2.10	56.7	3.35	24	120	44	14.3	17.0
9	2.15	58.0	3.40	24	118	44	14.3	18.3
10	2.15	58.0	3.40	24	118	44	14.3	20.4
Av.	2.07	56.1	3.30	25	118	40	14.3	18.7

Total I.H.P. = 6.85.

S - A - 8

Barom. = 29.123" = 14.4 #.

No.	RPM	Steam gauge	Temperatures Eng. r'm	Con Sur.	Inj water	Dis water	Calorimeter Gau.	Press	Temp	Weight Con S	Inj water
1	....	105	81	80.0	40.0	68.0		....	...	62.0	2060
2	86.1	114	..	81.0	40.0	68.0	114	15.3	257	62.0	2000
3	86.0	113	..	81.0	40.0	69.0	...	....	...	62.0	2060
4	87.2	111	..	81.0	40.0	68.0	111	15.2	258	62.0	2000
5	85.9	101	82	81.0	39.5	69.0	...	....	...	60.0	2000
6	85.9	113	..	81.0	40.0	69.0	113	15.2	261	61.0	1690
7	86.6	116	..	81.0	40.0	74.0	...	....	...	62.0	1940
8	87.4	117	..	81.0	40.0	68.0	117	15.3	265	60.0	1880
9	86.2	110	83	81.0	39.5	73.0	...	....	...	59.0	1810
10	86.8	114	..	81.0	39.5	68.0	113.5	15.3	265	63.0	1800
Av.	86.4	112	82	81.0	40.0	69.0	113.6	15.3	261	61.3	1924

Brake load = 200 # net.

D.H.P. = 8.22

Mech. eff. = 92 %

Quality = 98 %

I.H.P. = 8.95

Water rate per D.H.P. = 43.8

" " " I.H.P. = 40.3

S - A - 8

H E A D E N D.

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut off % St.
1	2.57	72.5	4.65	40	114	48.0	14.3	33.9
2	2.55	69.2	4.45	36	120	48.0	14.3	27.1
3	2.55	69.2	4.45	28	120	48.0	14.3	27.1
4	2.55	69.2	4.45	24	117	48.0	14.3	28.8
5	2.53	68.8	4.42	28	108	52.0	14.3	35.9
6	2.64	71.6	4.60	36	120	49.6	14.3	28.8
7	2.54	69.0	4.44	32	124	49.6	14.3	26.1
8	2.55	69.3	4.45	29	124	50.3	14.3	25.4
9	2.55	69.3	4.45	36	116	52.0	14.3	31.2
10	2.45	65.5	4.20	28	120	48.0	14.3	25.4
Av.	2.55	71.4	4.46	32	118	49.4	14.3	29.0

C R A N K E N D.

1	2.54	69.2	4.45	26	112	52.0	14.3	33.9
2	2.64	71.7	4.60	24	120	48.0	14.3	28.8
3	2.55	69.2	4.45	24	120	50.0	14.3	27.8
4	2.53	68.8	4.42	24	120	48.0	14.3	28.8
5	2.46	66.8	4.28	36	112	48.0	14.3	32.2
6	2.62	71.2	4.56	24	120	52.0	14.3	29.5
7	2.61	71.0	4.55	24	124	52.0	14.3	28.8
8	2.63	71.5	4.58	24	124	52.0	14.3	27.4
9	2.65	72.0	4.62	24	116	52.0	14.3	32.2
10	2.50	68.0	4.35	24	120	48.0	14.3	25.4
Av.	2.57	69.9	4.49	25	119	50.0	14.3	29.5

Total I.H.P. = 8.95.

GENERAL AVERAGES

No.	RPM	Steam gauge	Super heat	IHP	Water rate IHP	DHP	Water rate DHP	Qual at C.O.	B.T.U. Supplied per IHP per Hr.
S-A-2	81.9	110.0	.....	3.41	53.5	2.63	69.2	....	.....
-5	80.0	111.5	.....	5.67	45.0	4.75	53.6	....	.....
-6	79.5	108.0	.....	6.63	41.5	5.91	46.5	....	.....
-8	86.4	113.0	.....	8.95	40.3	8.22	43.8	....	.....
S-V-2	94.0	108.0	.....	3.40	60.2	2.80	73.0	25.6	70200
-5	92.8	104.0	.....	5.85	43.4	4.95	51.3	34.8	50600
-7	90.0	114.0	.....	7.62	42.7	6.64	49.1	37.2	50000
-9	86.0	117.0	.....	10.01	40.3	8.80	46.7	47.0	47200
50-V-2	59.7	117.0	54.1	3.69	48.7	2.84	63.2	32.6	59100
-5	93.0	118.0	70.0	6.48	37.6	5.53	44.0	39.3	46000
-7	91.8	123.0	88.7	7.66	34.9	6.70	39.9	38.0	42500
-9	83.6	116.0	67.3	9.48	33.4	8.56	37.0	53.7	40800
100-V -2	97.9	116.0	94.1	3.70	42.2	3.91	53.6	28.2	52100
-5	93.5	118.6	90.0	6.43	34.2	5.56	39.5	40.0	42100
-7	95.5	120.0	100.0	7.56	32.3	6.90	35.4	40.1	40000
-9	87.9	123.0	103.0	9.73	30.2	9.00	32.6	50.8	37400
150V-2	97.0	114.0	148.7	3.57	38.7	2.79	49.4	34.3	48600
-5	93.2	123.0	135.0	6.45	32.1	5.54	37.4	41.8	40200
-7	89.8	115.0	148.6	7.25	29.8	6.64	32.6	50.0	37580
-9	86.6	117.0	152.3	9.67	27.3	8.88	29.7	62.7	34400

AVERAGES OF CARDS.

CRANK END

No.	Area	M.E.P.	I.H.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
S-A-2	0.96	26.1	1.59	36.0	114	26.0	14.4	3.4
S-A-5	1.81	49.1	2.92	36.0	118	38.3	14.3	13.3
S-A-6	2.10	56.8	3.33	36.0	116	43.0	14.3	20.0
S-A-8	2.55	71.4	4.46	32.0	118	49.4	14.3	29.0
S-V-2	0.98	26.9	1.86	13.6	109	19.0	4.0	1.8
S-V-5	1.61	[illegible]	3.02	13.6	110	27.0	4.3	8.7
S-V-7	2.15	58.5	3.99	18.1	122	36.4	5.4	15.3
S-V-9	2.99	81.0	5.16	16.0	126	5.2	5.5	29.4
50-V-2	0.81	22.0	1.56	12.2	118	16.4	4.2	1.3
50-V-5	1.74	47.3	3.28	12.0	121	28.6	4.0	8.3
50-V-7	2.14	57.7	3.96	10.4	130	36.0	3.6	10.4
50-V-9	2.84	77.2	4.80	12.0	123	50.6	3.6	25.6
100-V-2	0.90	24.5	1.78	12.0	111	18.4	3.5	0.0
100-V-5	1.70	[illegible]	3.20	11.6	122	28.0	3.8	7.7
100-V-7	2.00	54.2	3.77	8.0	127	35.0	3.6	9.5
100-V-9	2.70	73.3	4.73	10.0	127	45.4	4.0	22.6
150-V-2	0.92	24.8	1.80	8.4	105	17.0	4.0	0.0
150-V-5	1.73	47.0	3.26	10.0	125	28.0	4.0	7.1
150-V-7	1.96	53.2	3.47	9.3	121	32.0	3.7	12.5
150-V-9	2.79	75.5	4.86	10.2	125	46.0	3.8	26.0

AVERAGES OF CARDS.

CRANK END

No.	Area	I.H.P.	Mid of comp	Absolute Pressure. Cut off	Rel.	Back	Cut-off % St.
S-A-2	0.09	1.59	36.0	114	26.0	14.4	8.4
S-A-5	1.81	2.95	56.0	119	28.5	14.5	13.5
S-A-6	2.10	3.53	56.0	116	43.0	14.5	20.0
S-A-7	2.55	4.46	52.0	119	40.4	14.3	29.0
S-V-2	0.08	1.86	15.6	109	10.0	4.0	1.8
S-V-5	1.51	8.02	15.3	110	27.0	4.3	6.7
S-V-7	2.15	8.59	15.1	102	86.4	5.4	15.3
S-V-9	2.99	5.15	16.0	125	5.2	5.5	29.4
50-V-2	0.21	1.56	12.2	116	16.4	4.2	1.3
50-V-5	1.74	8.28	12.0	121	26.6	4.0	8.3
50-V-7	2.14	5.06	10.4	120	36.0	3.6	10.4
50-V-9	2.64	4.80	12.0	123	50.8	3.8	26.3
100-V-2	0.00	1.78	12.3	111	16.4	3.5	0.0
100-V-5	1.70	3.20	11.8	122	28.0	3.8	7.7
100-V-7	2.00	8.77	8.0	127	35.0	3.5	9.5
100-V-9	2.70	4.75	10.0	127	45.4	4.0	22.6
150-V-2	0.08	1.80	9.4	105	17.0	4.0	0.0
150-V-5	1.77	3.36	10.0	125	28.0	4.0	7.1
150-V-7	2.00	5.47	9.3	121	32.0	3.7	12.5
150-V-9	2.70	4.86	10.3	125	46.0	3.8	26.0

AVERAGES OF CARDS.

HEAD END

No.	Area	M.E.P.	I.M.P.	Absolute Pressure. End of comp	Cut off	Rel	Back	Cut-off % St.
S-A-2	0.96	26.1	1.59	36.0	114	26.0	14.4	3.4
S-A-5	1.81	49.1	2.92	36.0	118	38.3	14.3	15.3
S-A-6	2.10	56.8	3.33	36.0	116	43.0	14.3	20.0
S-A-8	2.55	71.4	4.46	32.0	118	49.4	14.3	29.0
S-V-2	0.98	26.9	1.86	13.6	109	19.0	4.0	1.8
S-V-5	1.61	43.7	3.02	13.6	110	27.0	4.3	8.7
S-V-7	2.15	58.5	3.99	18.1	122	36.4	5.4	15.3
S-V-9	2.99	81.0	5.16	16.0	126	5.2	5.5	29.4
50-V-2	0.81	22.0	1.56	12.2	118	16.4	4.2	1.3
50-V-5	1.74	47.3	3.28	12.0	121	28.6	4.0	8.3
50-V-7	2.14	57.7	3.96	10.4	130	36.0	3.6	10.4
50-V-9	2.84	77.2	4.80	12.0	123	50.6	3.6	25.6
100-V-2	0.90	24.5	1.70	12.0	111	16.4	3.5	0.0
100-V-5	1.70	46.0	3.20	11.6	122	28.0	3.8	7.7
100-V-7	2.00	54.2	3.77	8.0	127	35.0	3.6	9.5
100-V-9	2.70	73.3	4.73	10.0	127	45.4	4.0	22.6
150-V-2	0.92	24.8	1.80	8.4	105	17.0	4.0	0.0
150-V-5	1.73	47.0	3.26	10.0	125	28.0	4.0	7.1
150-V-7	1.96	53.2	3.47	9.3	121	32.0	3.7	12.5
150-V-9	2.79	75.5	4.86	10.2	125	46.0	3.8	26.0

ACTUAL INDICATOR

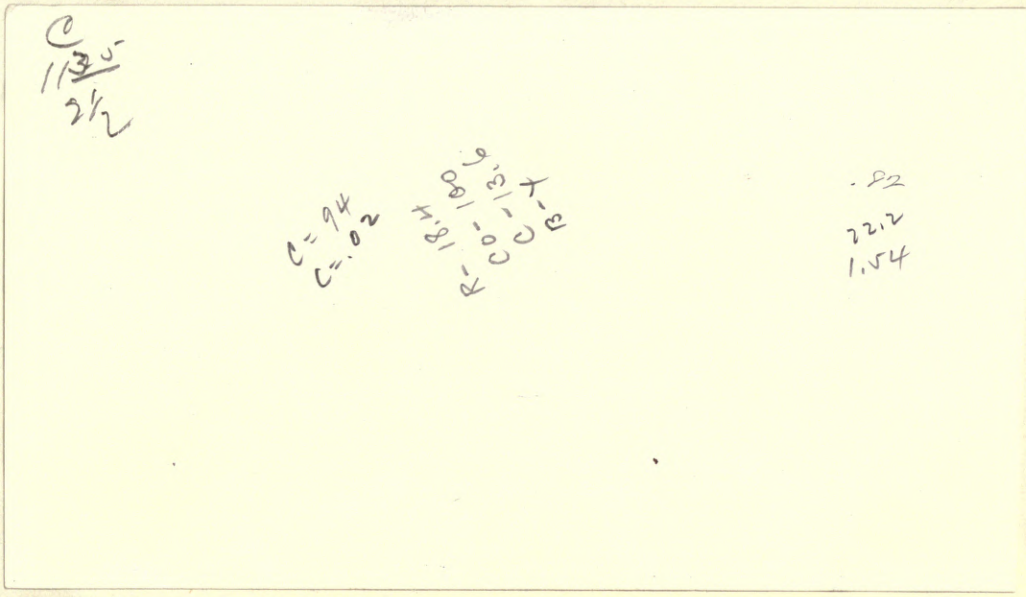
CARDS.

ACTUAL INDICATOR

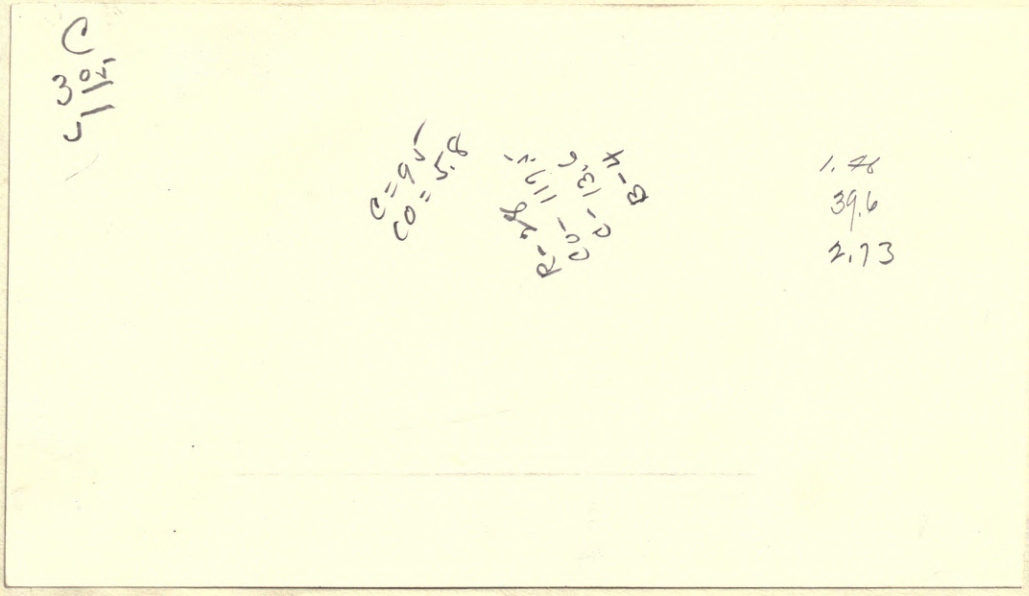
CARDS.

ACTUAL INDICATOR CARDS.

SATURATED -VACUUM- 2 D.H.P.

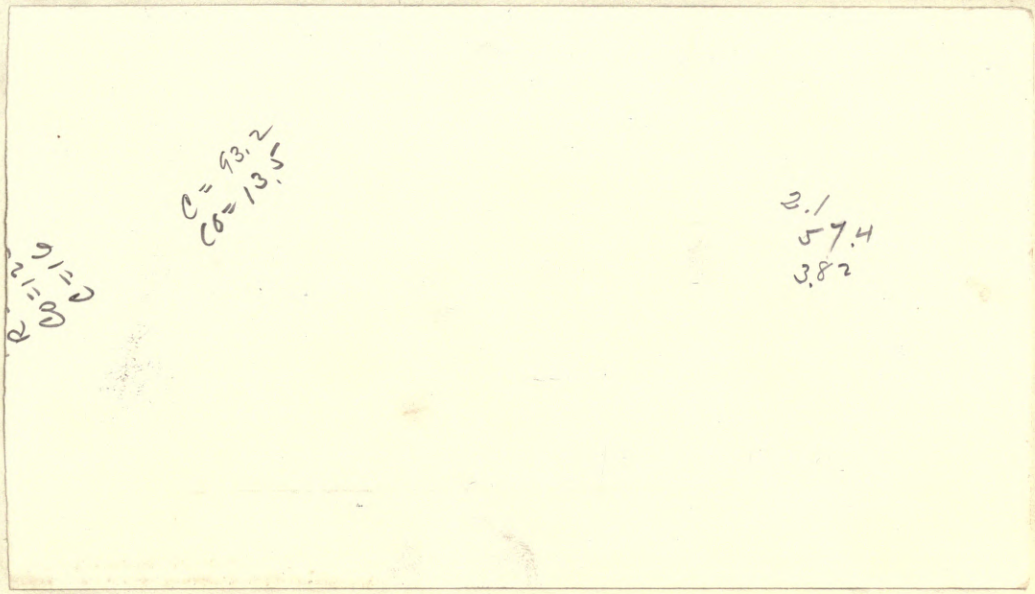


SATURATED- VACUUM- 5 D.H.P.

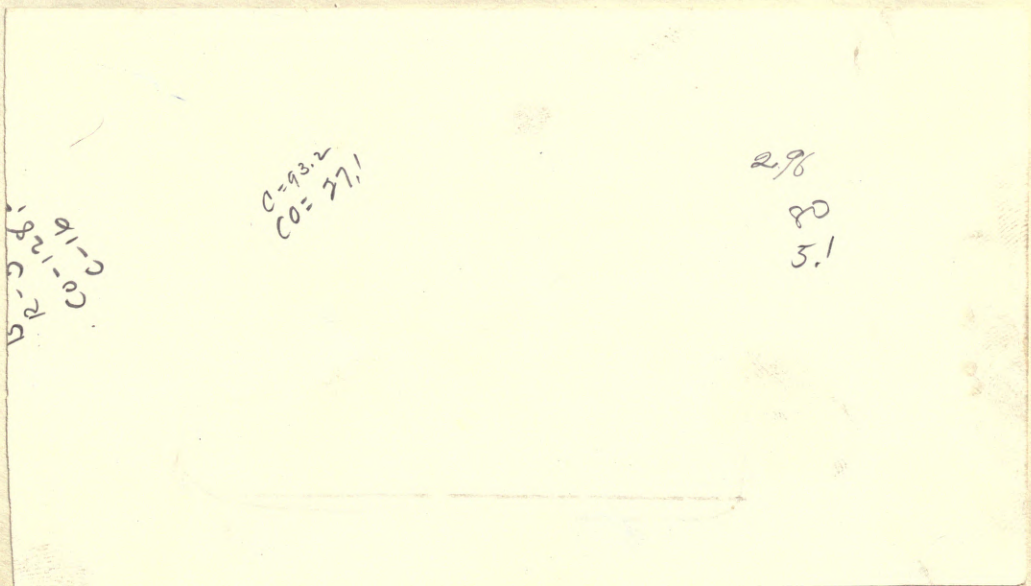


ACTUAL INDICATOR CARDS.

SATURATED- VACUUM- 7 D.H.P.

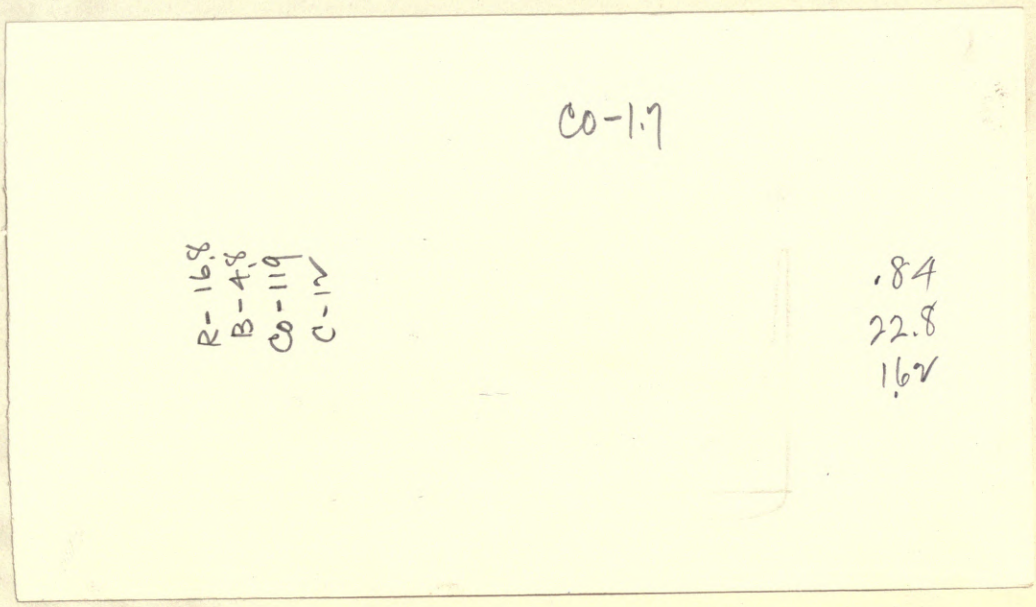


SATURATED- VACUUM- 9 D.H.P.

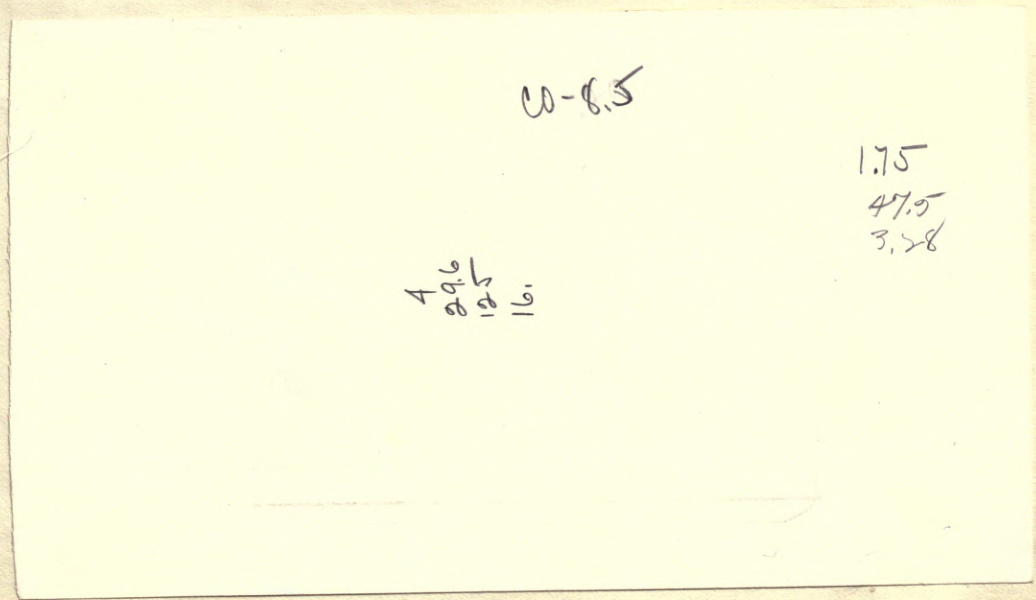


ACTUAL INDICATOR CARDS.

50° SUPERHEAT- VACUUM- 2 D.HP.

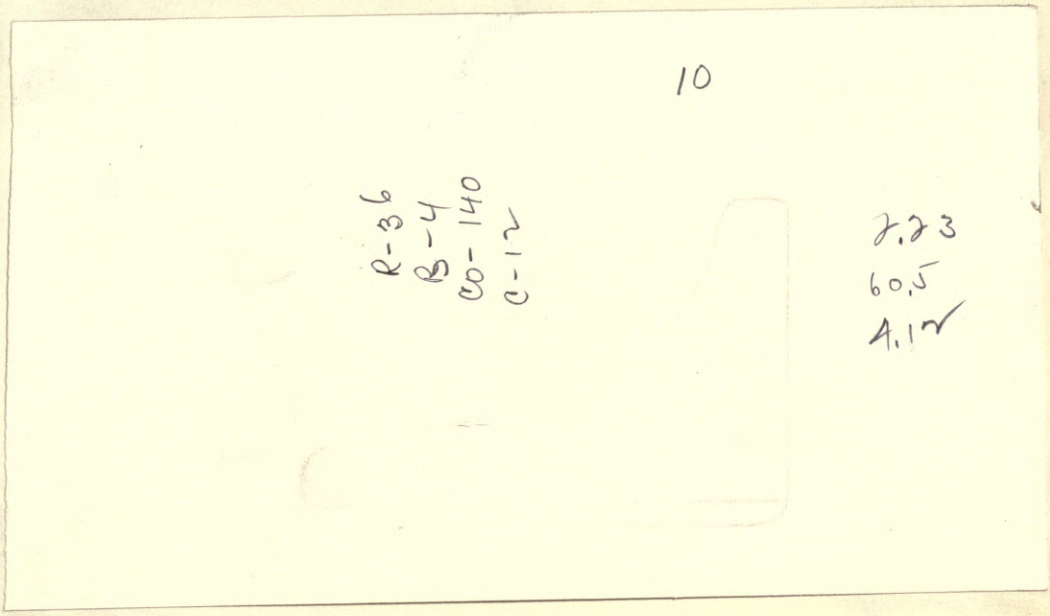


50° SUPERHEAT- VACUUM- 5 D.H.P.

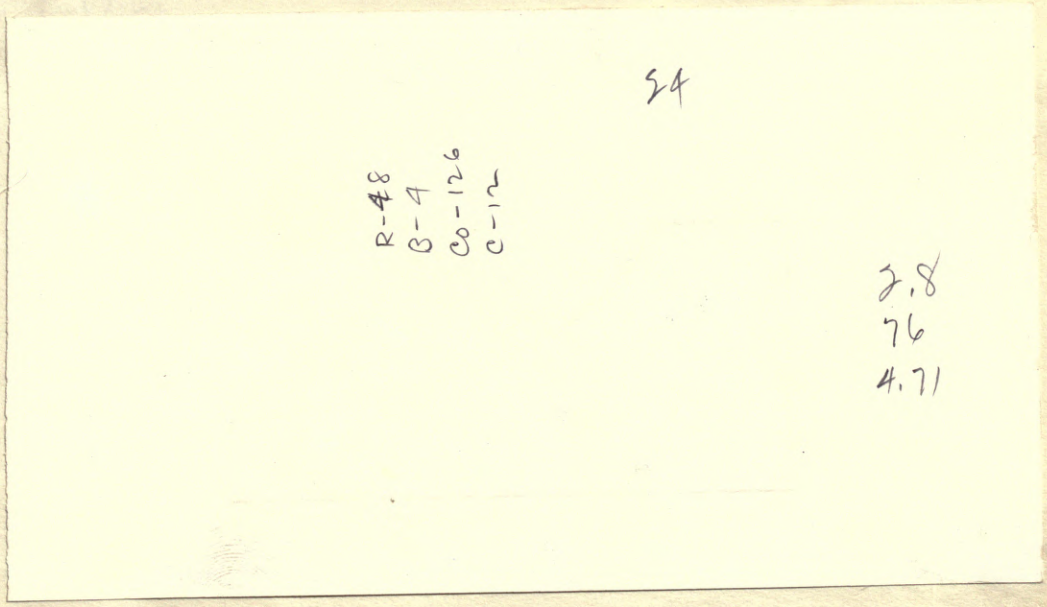


ACTUAL INDICATOR CARDS.

50° SUPERHEAT- VACUUM- 7 D.H.P.

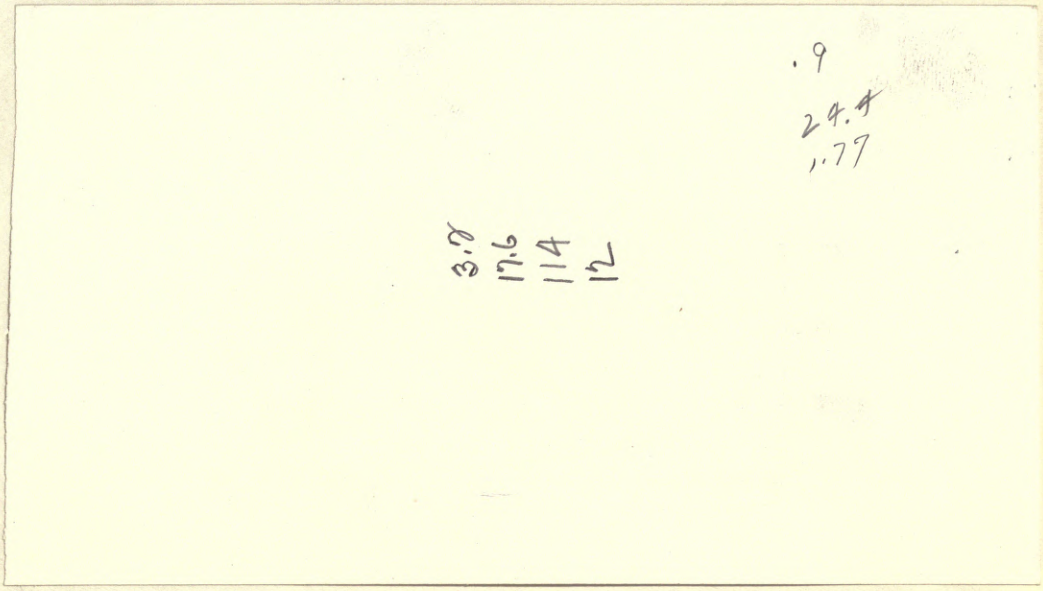


50° SUPERHEAT-VACUUM- 9 D.H.P.

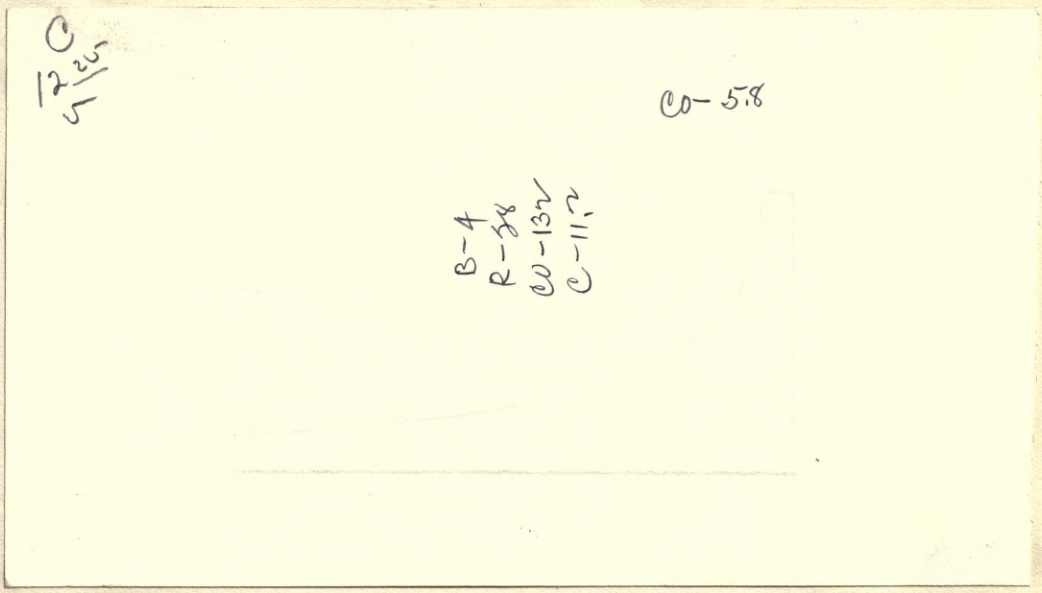


ACTUAL INDICATOR CARDS.

100° SUPERHEAT-VACUUM- 2 D.HP.

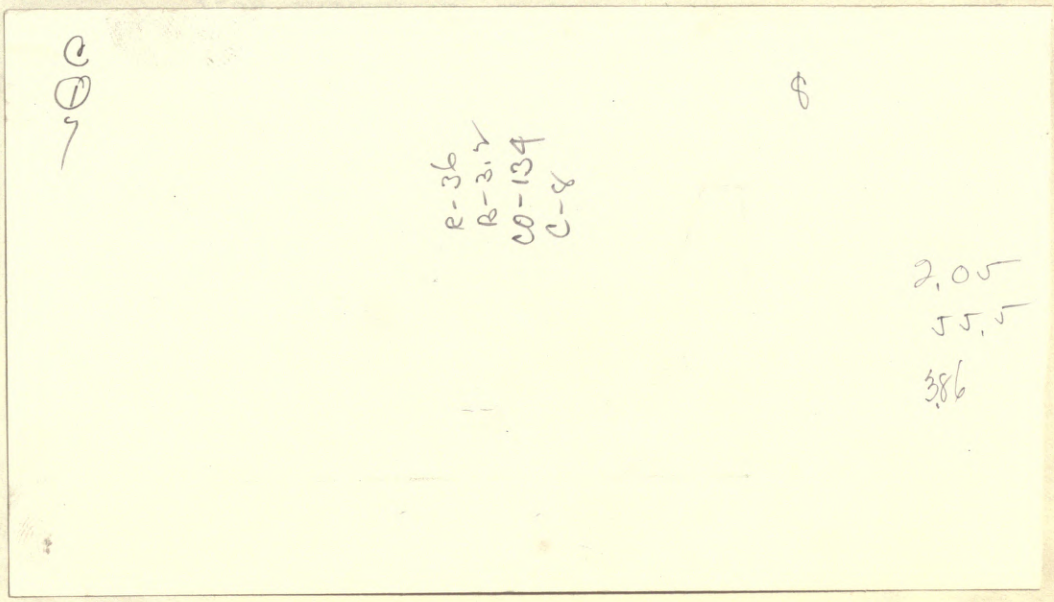


100° SUPERHEAT- VACUUM- 5 D.H.P.

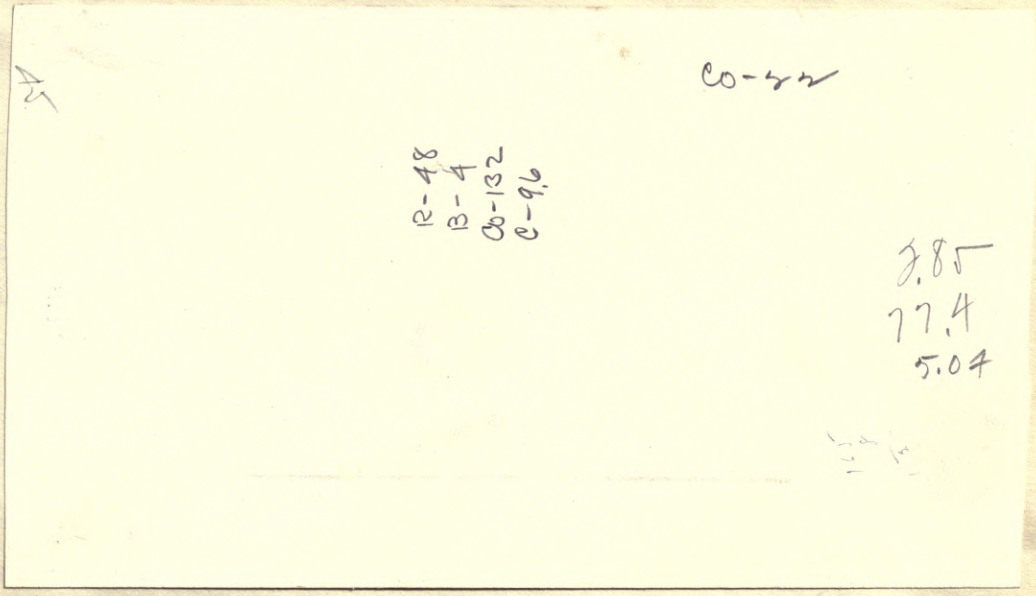


ACTUAL INDICATOR CARDS.

100° SUPERHEAT- VACUUM- 7 D.HP.

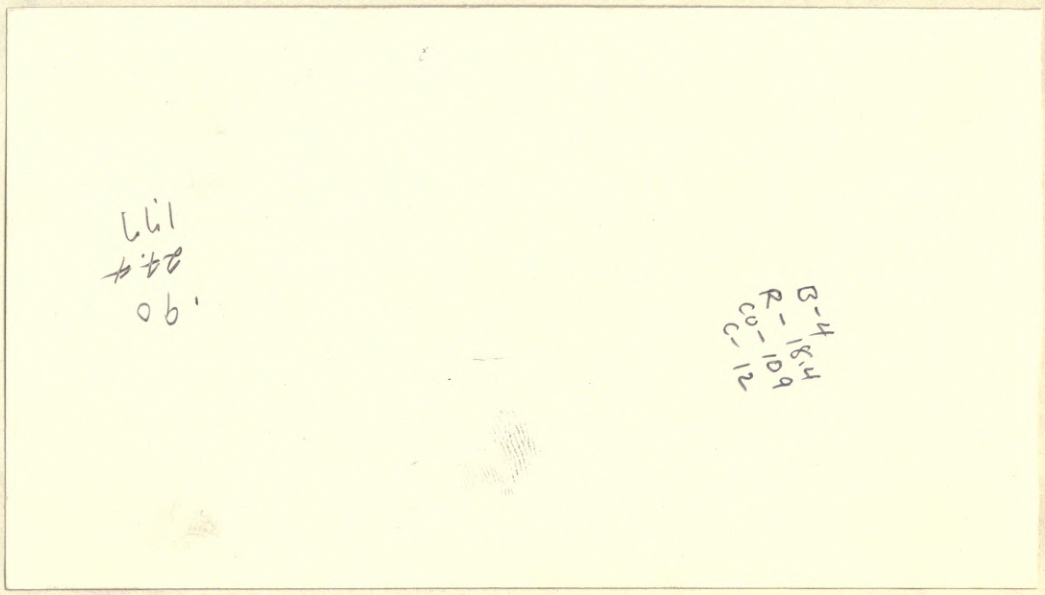


100° SUPERHEAT- VACUUM- 9 D.H.P.

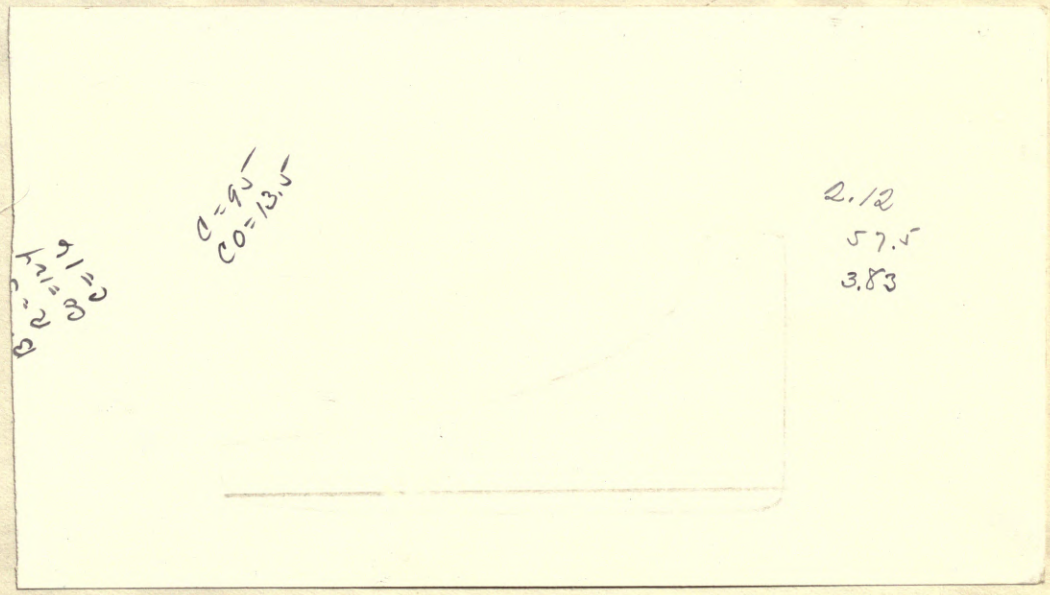


ACTUAL INDICATOR CARDS.

150° SUPERHEAT- VACUUM- 2 D.H.P.

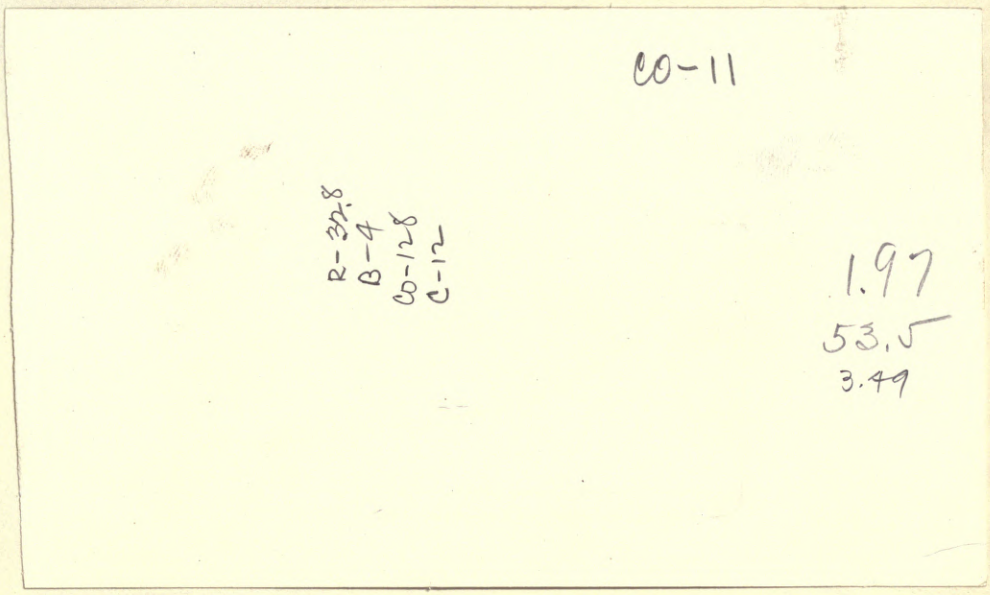


150° SUPERHEAT - VACUUM- 5 D.HP.

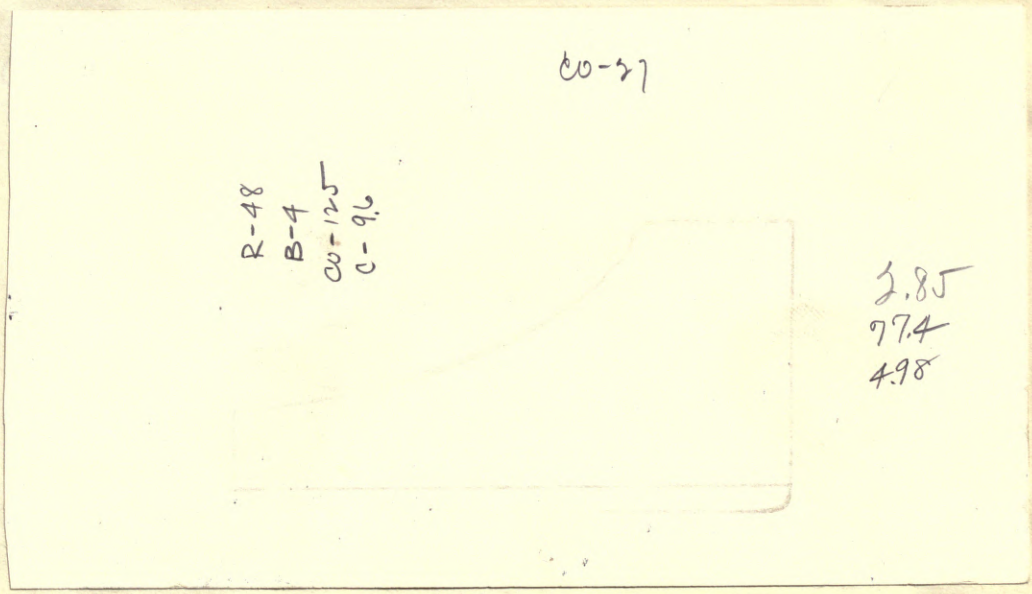


ACTUAL INDICATOR CARDS.

150° SUPERHEAT- VACUUM- 7 D.H.P.

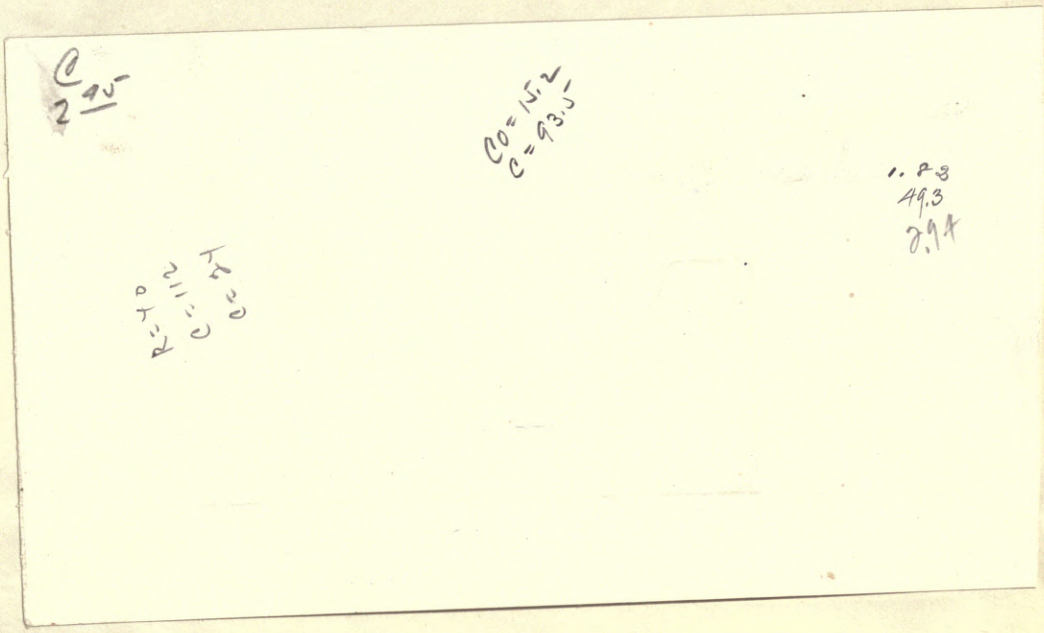


150° SUPERHEAT- VACUUM- 9 D.H.P.

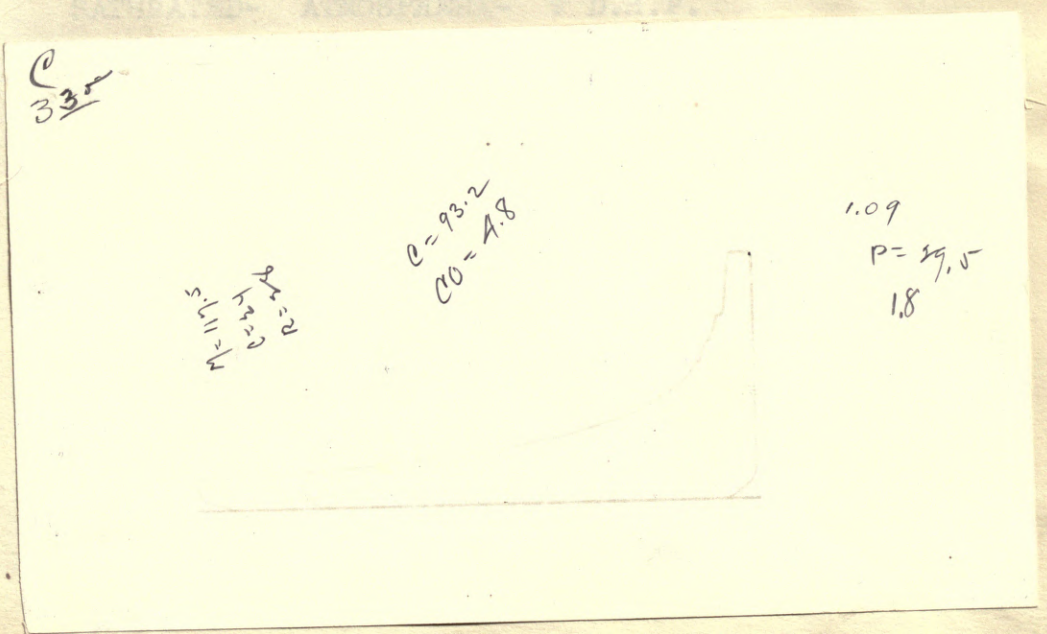


ACTUAL INDICATOR CARDS.

SATURATED-ATMOSPHERE- 5 D.H.P.

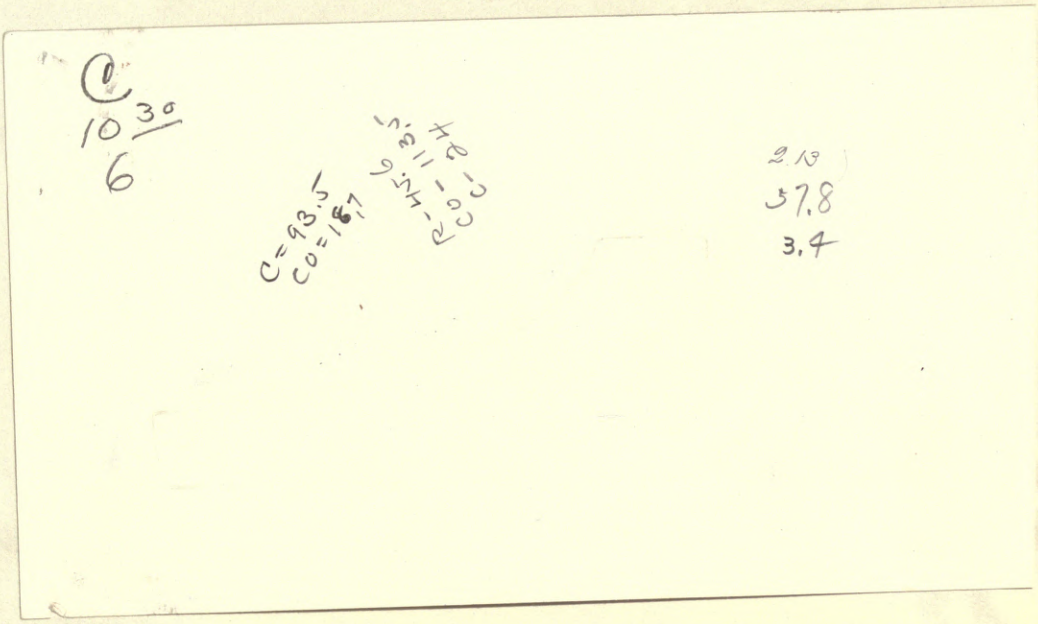


SATURATED-ATMOSPHERE- 2 D.H.P.

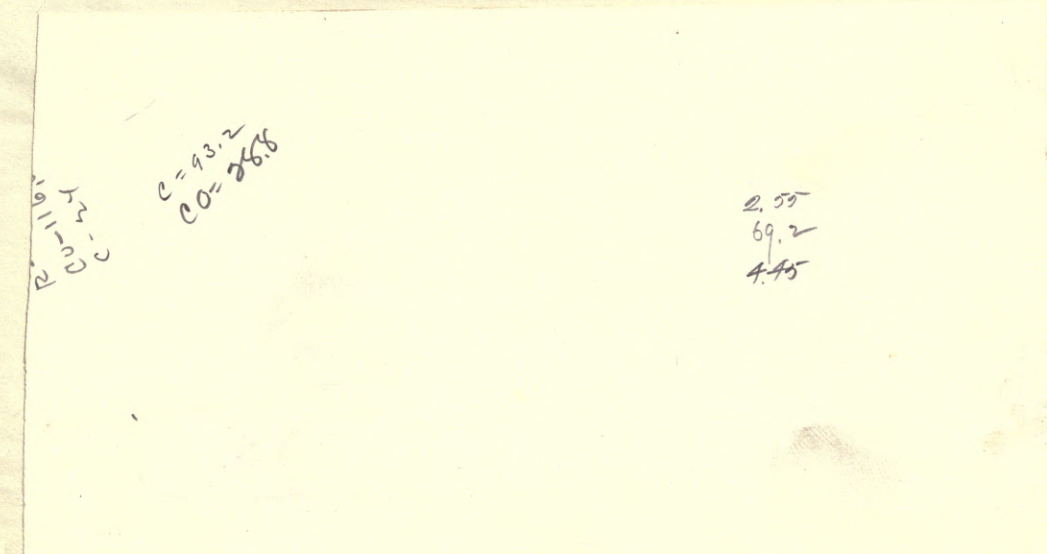


ACTUAL INDICATOR CARDS.

SATURATED- ATMOSPHERE- 7 D.H.P.

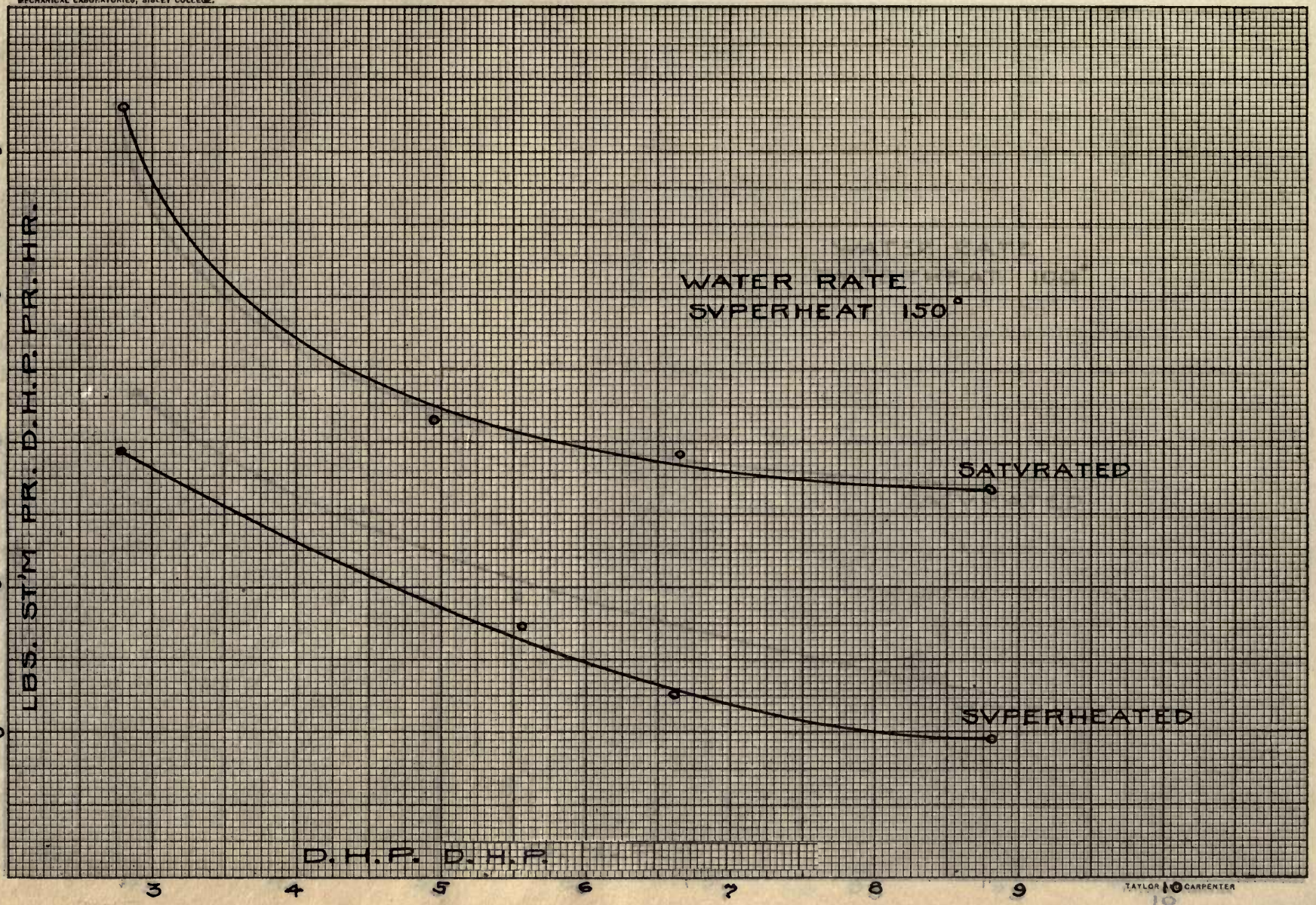


SATURATED- ATMOSPHERE- 9 D.H.P.



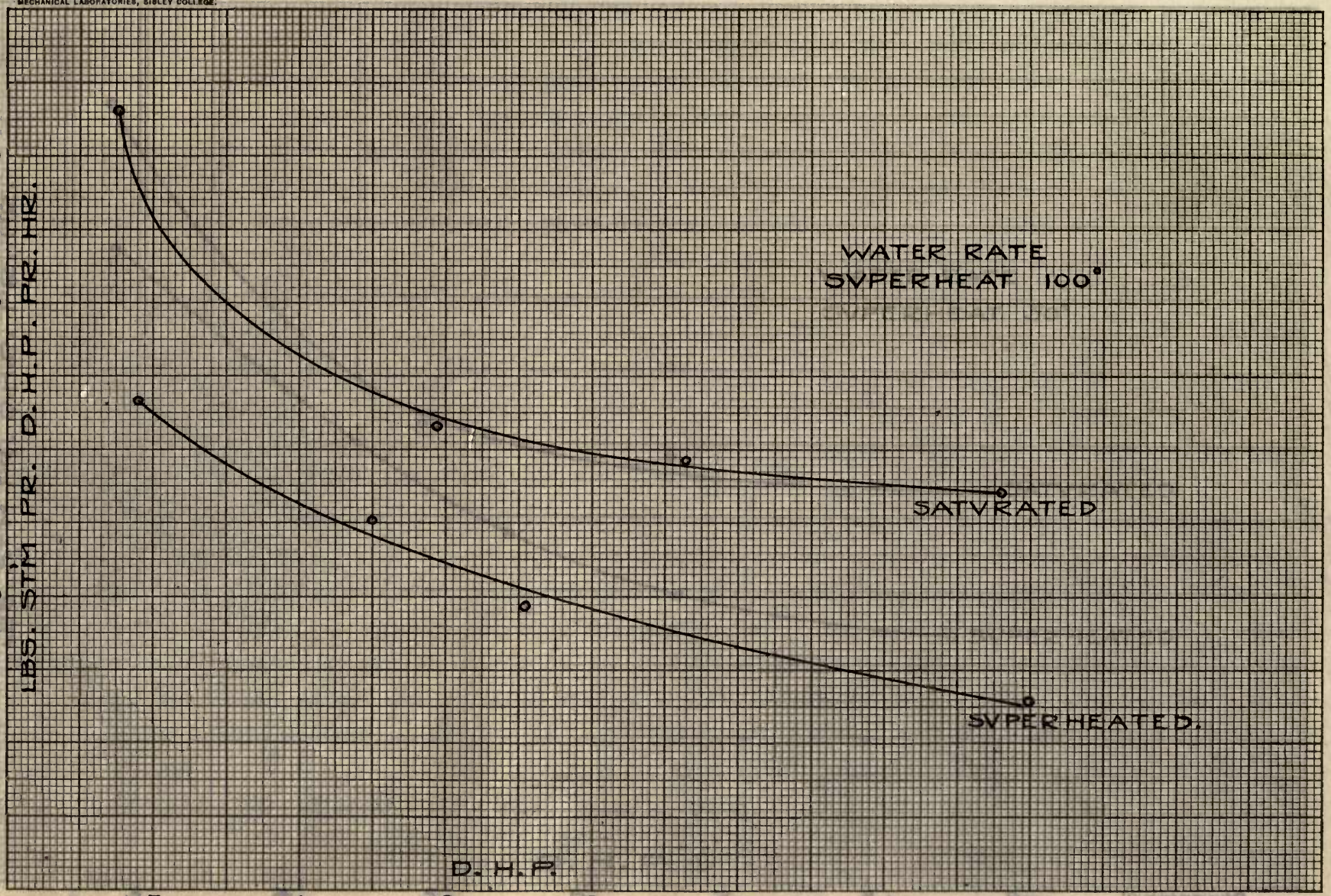
WATER RATE

CURVES.


WATER RATE
SUPERHEAT 150°
SATURATED
SUPERHEATED
LBS. ST'M PR. D.H.P. PR. HR.
70
60
50
40
30
D.H.P.
3
4
5
6
7
8
9
TAYLOR & CARPENTER

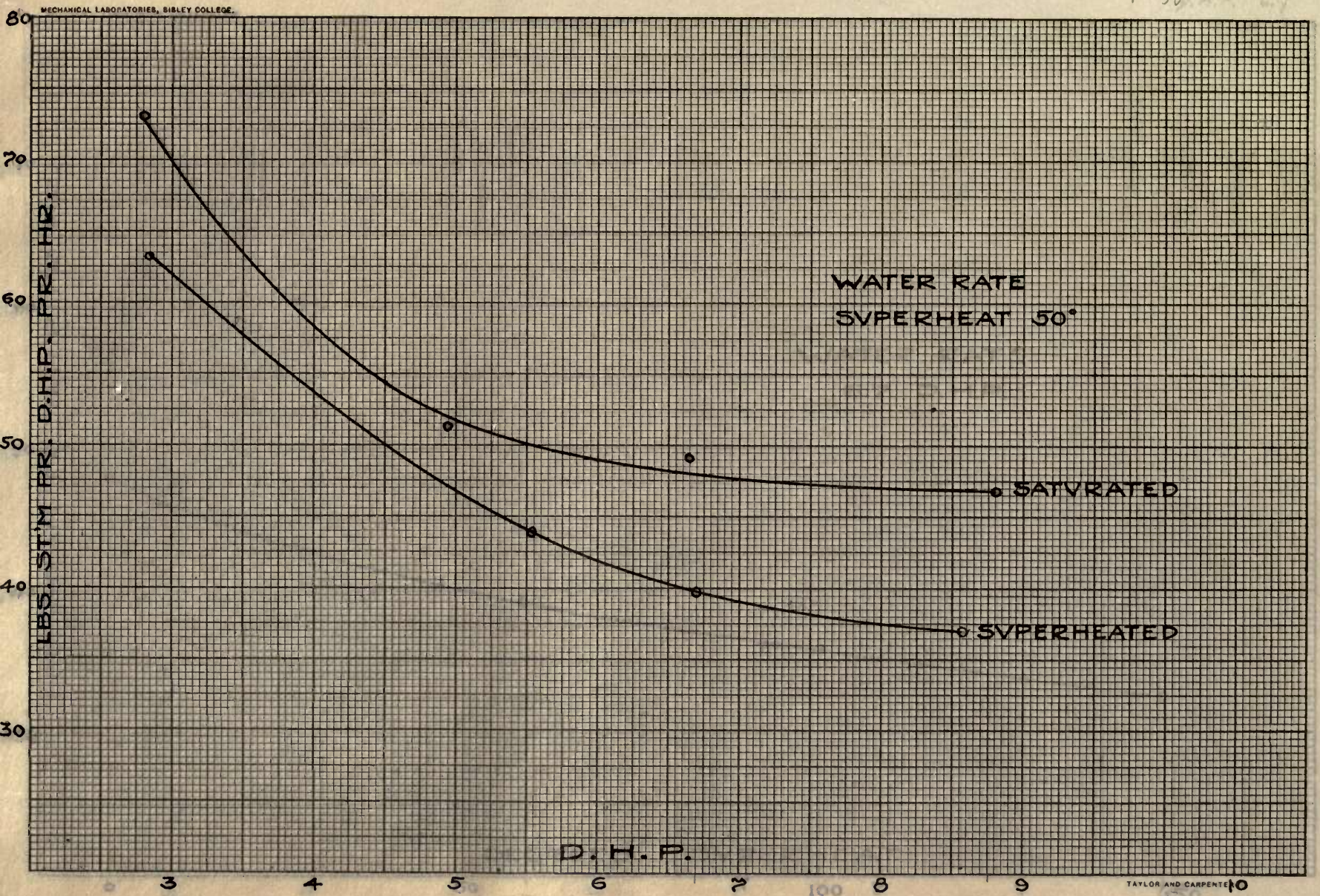
LBS. STM PR. DROP PER MIL
20
40
60
80
D.H.P.
2
4
6
8
UNTREATED
DETARRATED
MULTI-STAGE CENTRIFUGAL
STAGE REDUCTION IN D.H.P.

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

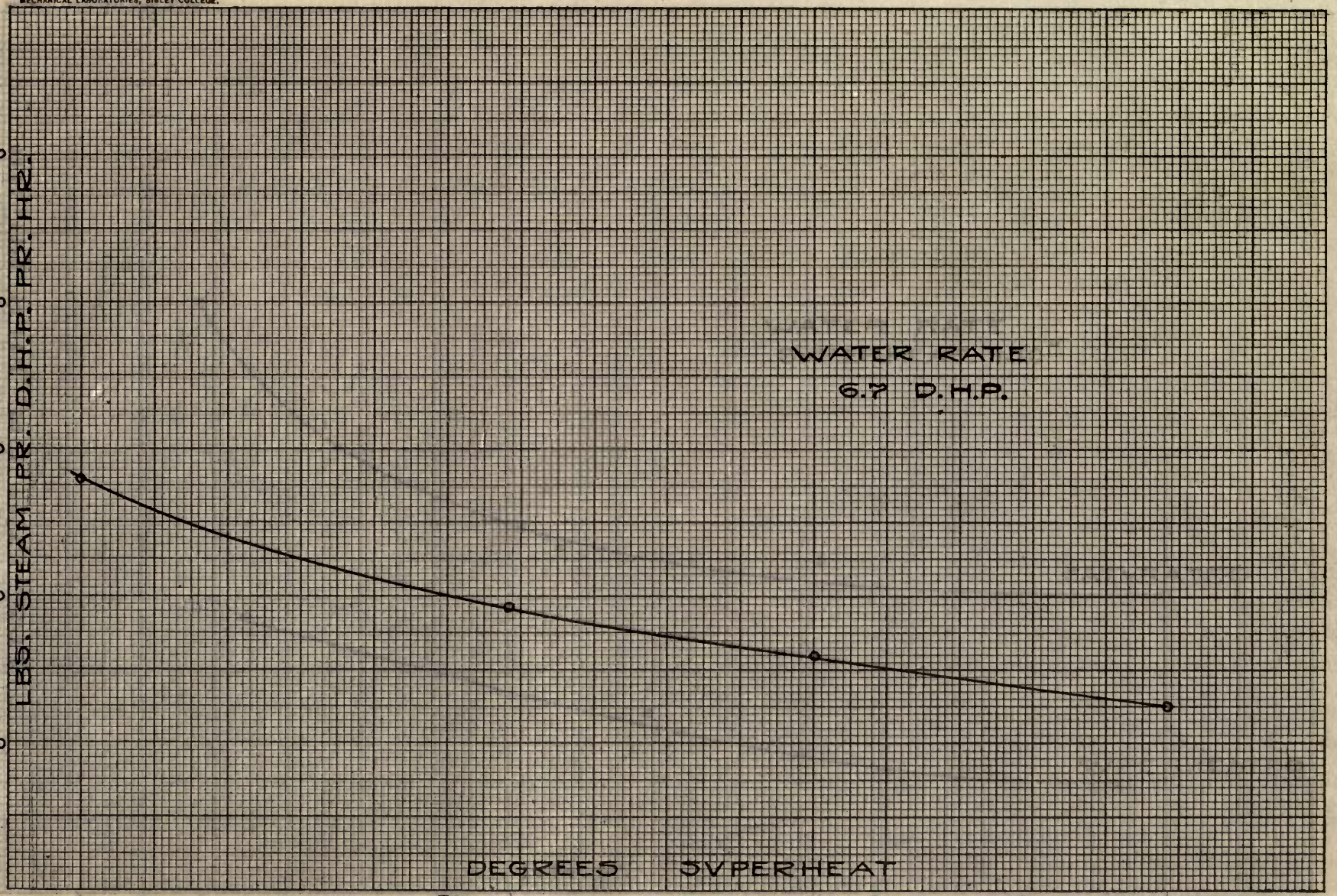
GATE VALVE
RETANGULAR GATE
GATE VALVE
RETANGULAR GATE


MECHANICAL LABORATORIES, SIBLEY COLLEGE.
LBS. ST'M PR. D.H.P. PR. HR.
80
70
60
50
40
30
WATER RATE
SUPERHEAT 50°
SATURATED
SUPERHEATED
D. H. P.
3
4
5
6
7
8
9
10
TAYLOR AND CARPENTER

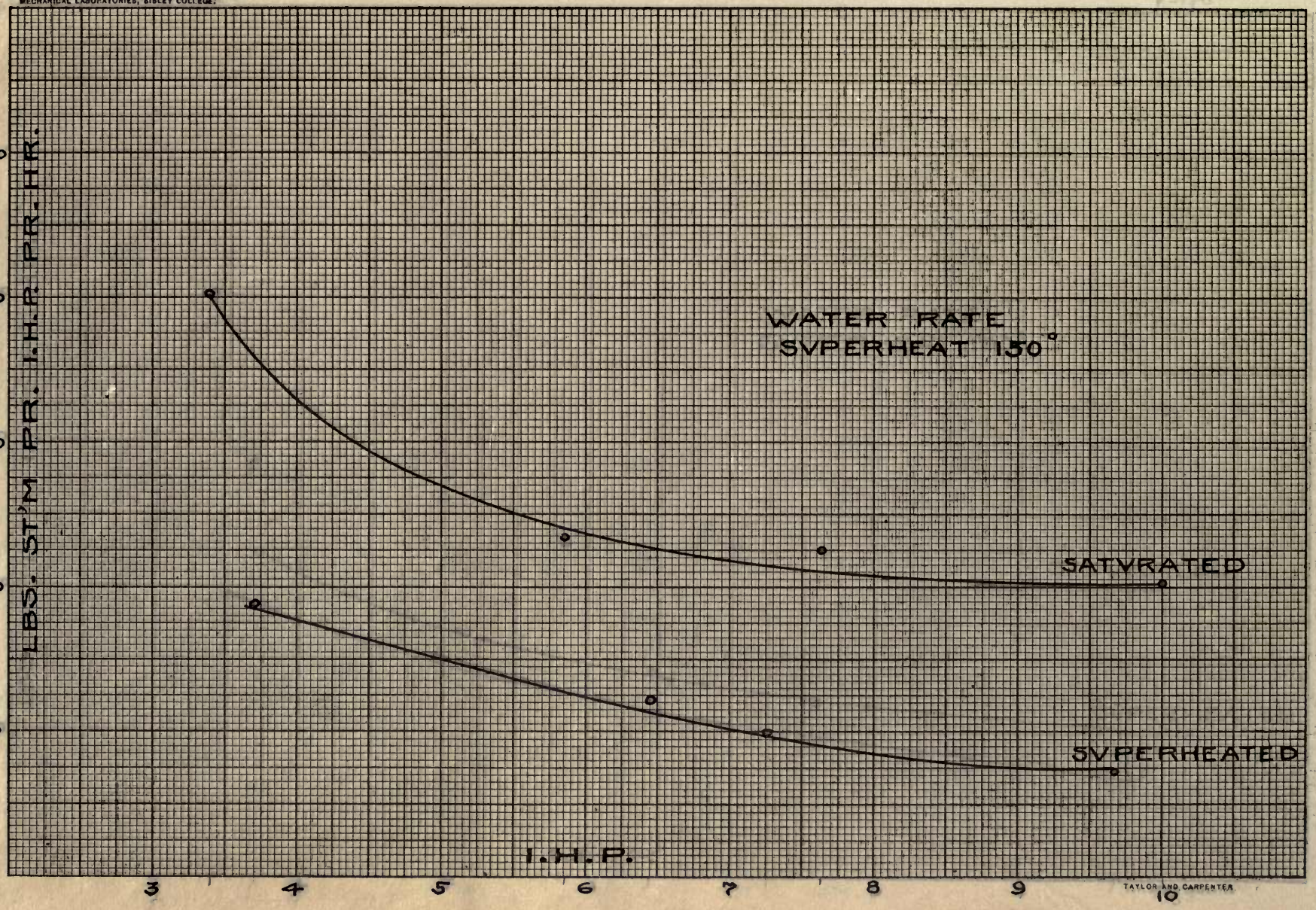
CALCULATED
OBSERVED
CALCULATED
OBSERVED

MECHANICAL LABORATORIES, SIBLEY COLLEGE.

D.H.P. 6.7

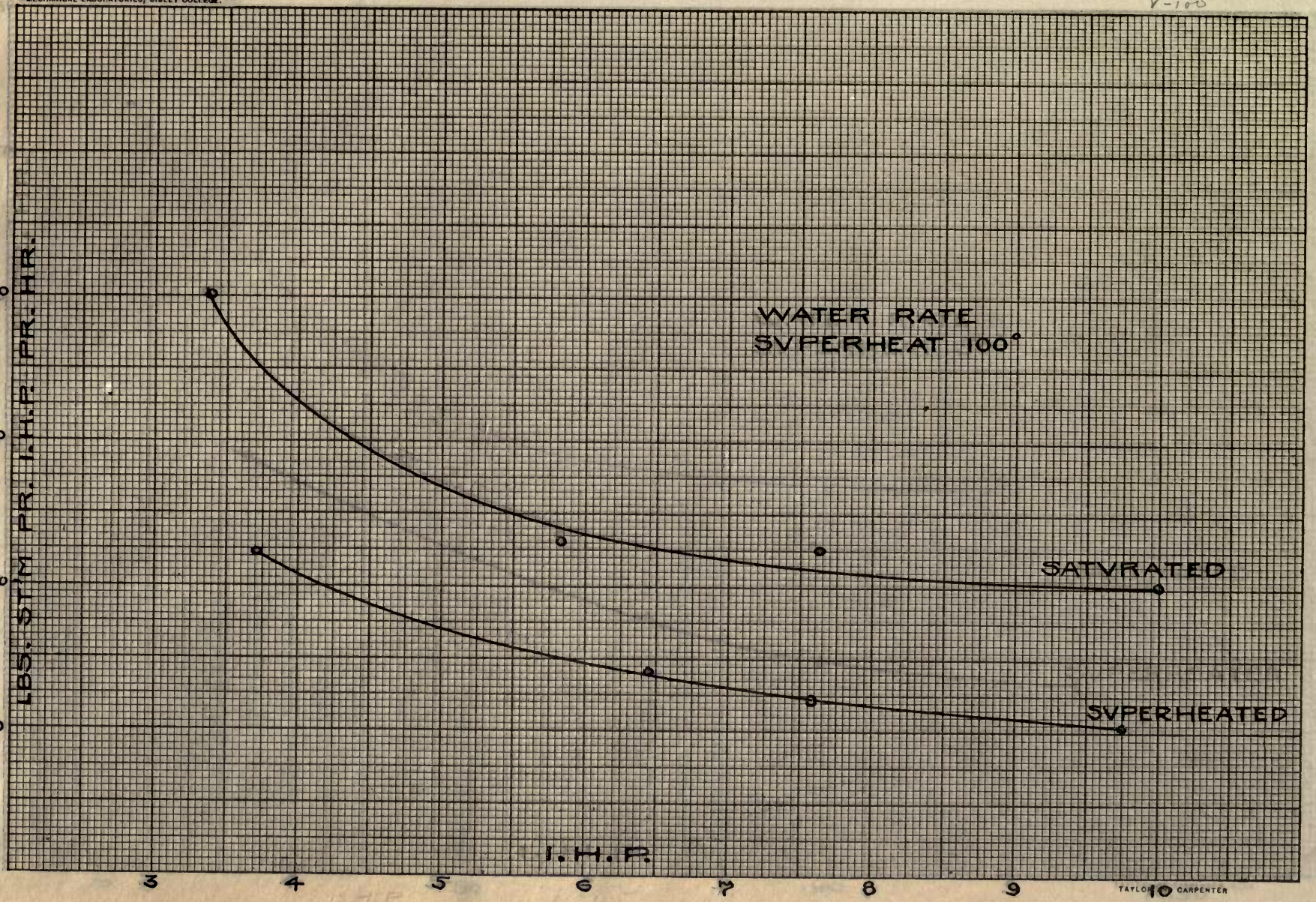


DEGREES SUPERHEAT
0
20
100
120
FEED STEAM AT DIFFERENT PRESS
WATER REMOVED

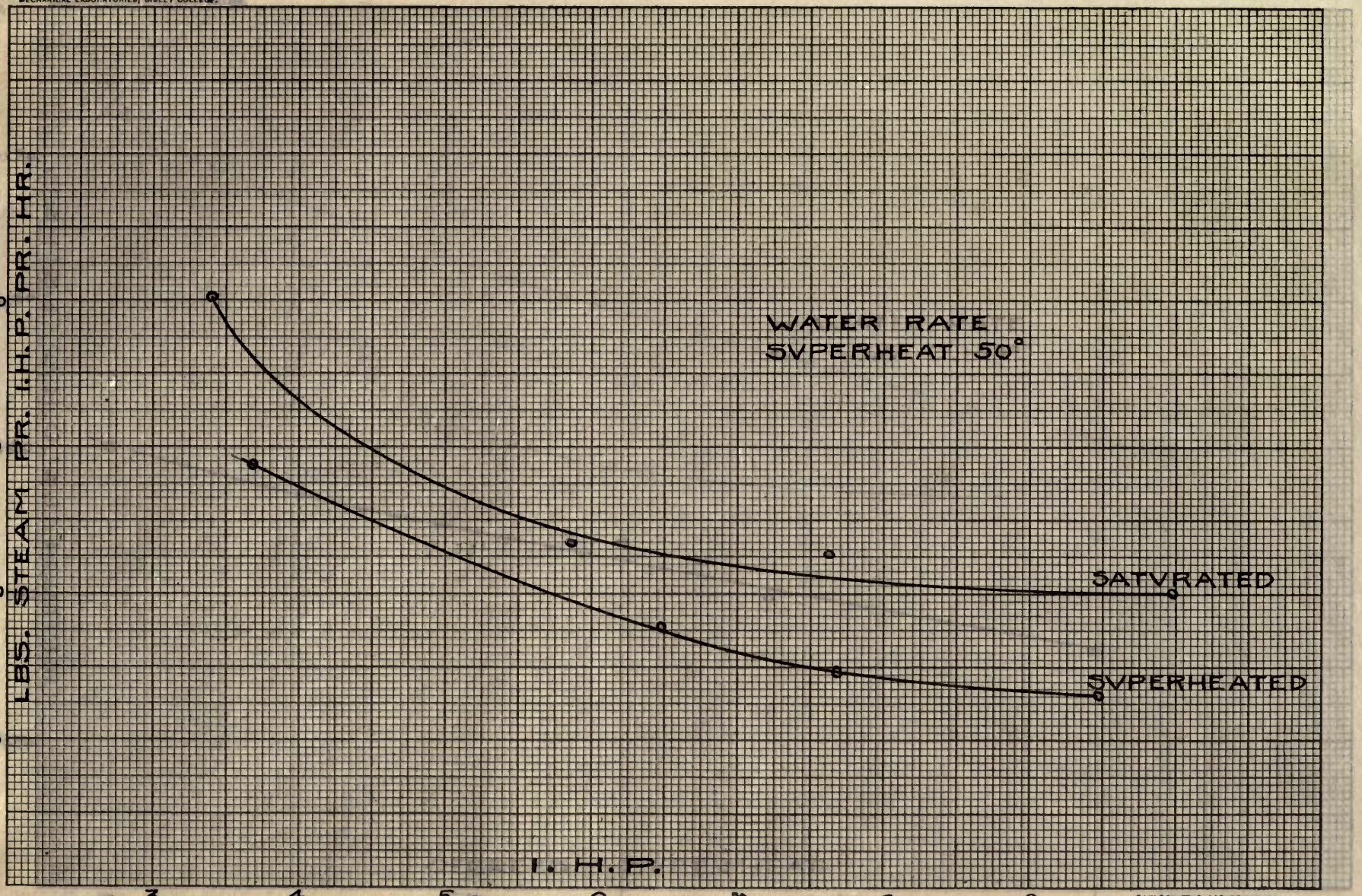


EVAPORATION RATE
EVAPORATED
ABSORBED

V-100

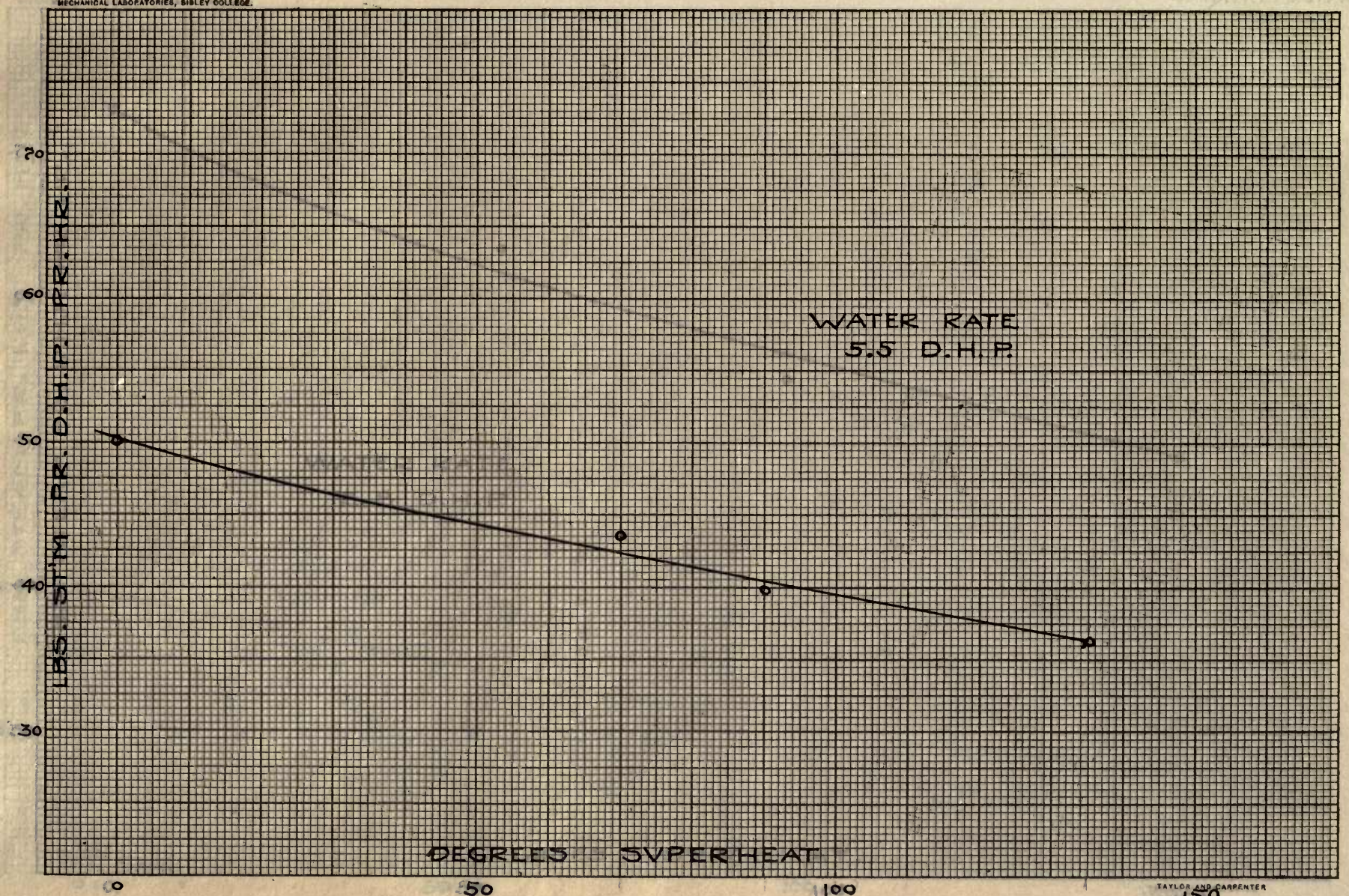

LBS. STM. PR. I.H.P. PR. HR.
60
50
40
30
WATER RATE
SUPERHEAT 100°
SATURATED
SUPERHEATED
I.H.P.
3
4
5
6
7
8
9
10
TAYLOR & CARPENTER

GAUGHEVARD
CALIBRATED
GAUGHEVARD LATE
GAUGHEVARD LATE



WATER RETAINED BY SOIL AT TENSION OF
CENTIMETERS

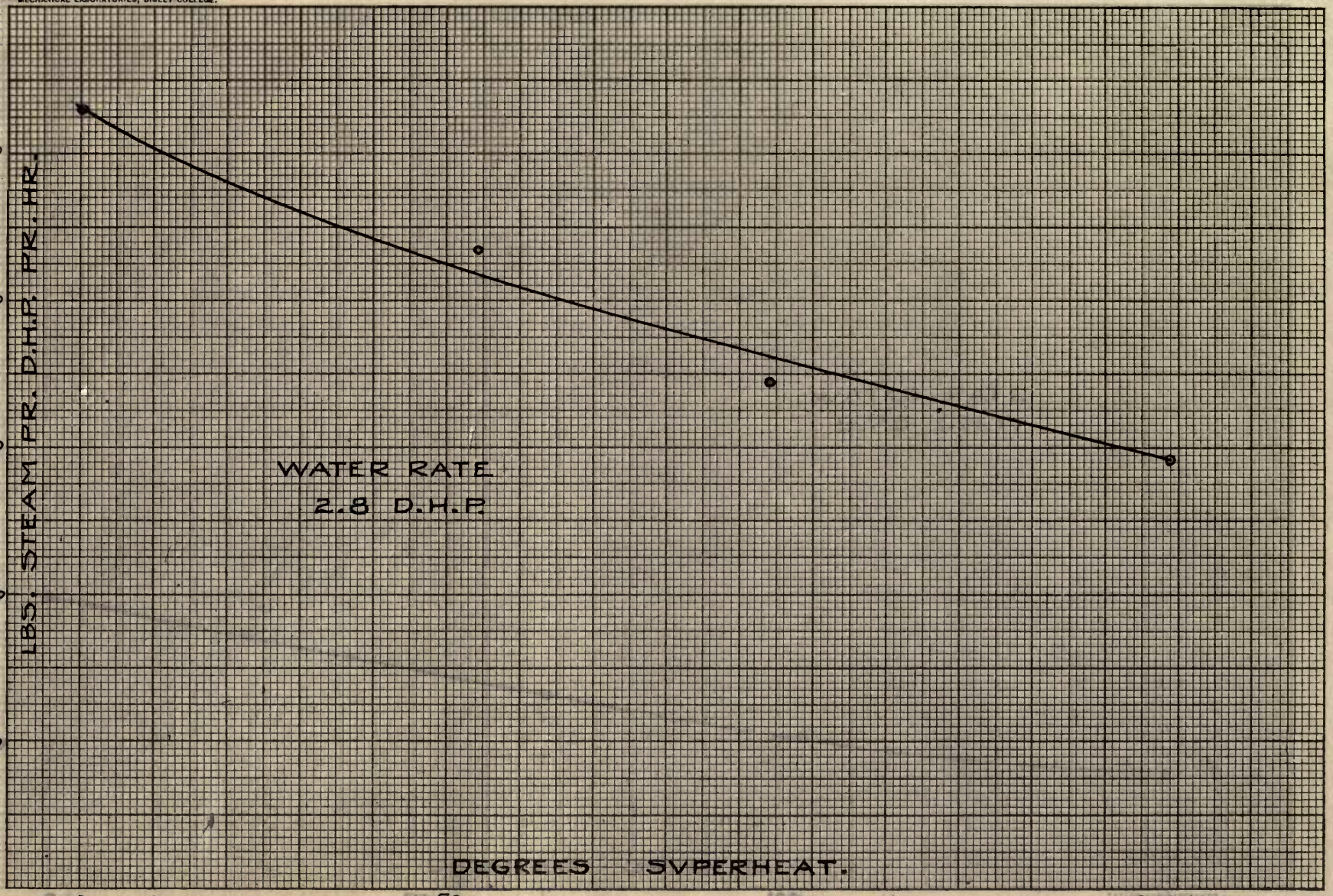
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



TAYLOR AND CARPENTER

DIESEL CYCLE EFFICIENCY
FUEL FLOW PER UNIT TIME
0
20
100
120

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

DEGREES FAHRENHEIT
0
20
100
120
MATERIAL
STATE
TEST CONDITIONS

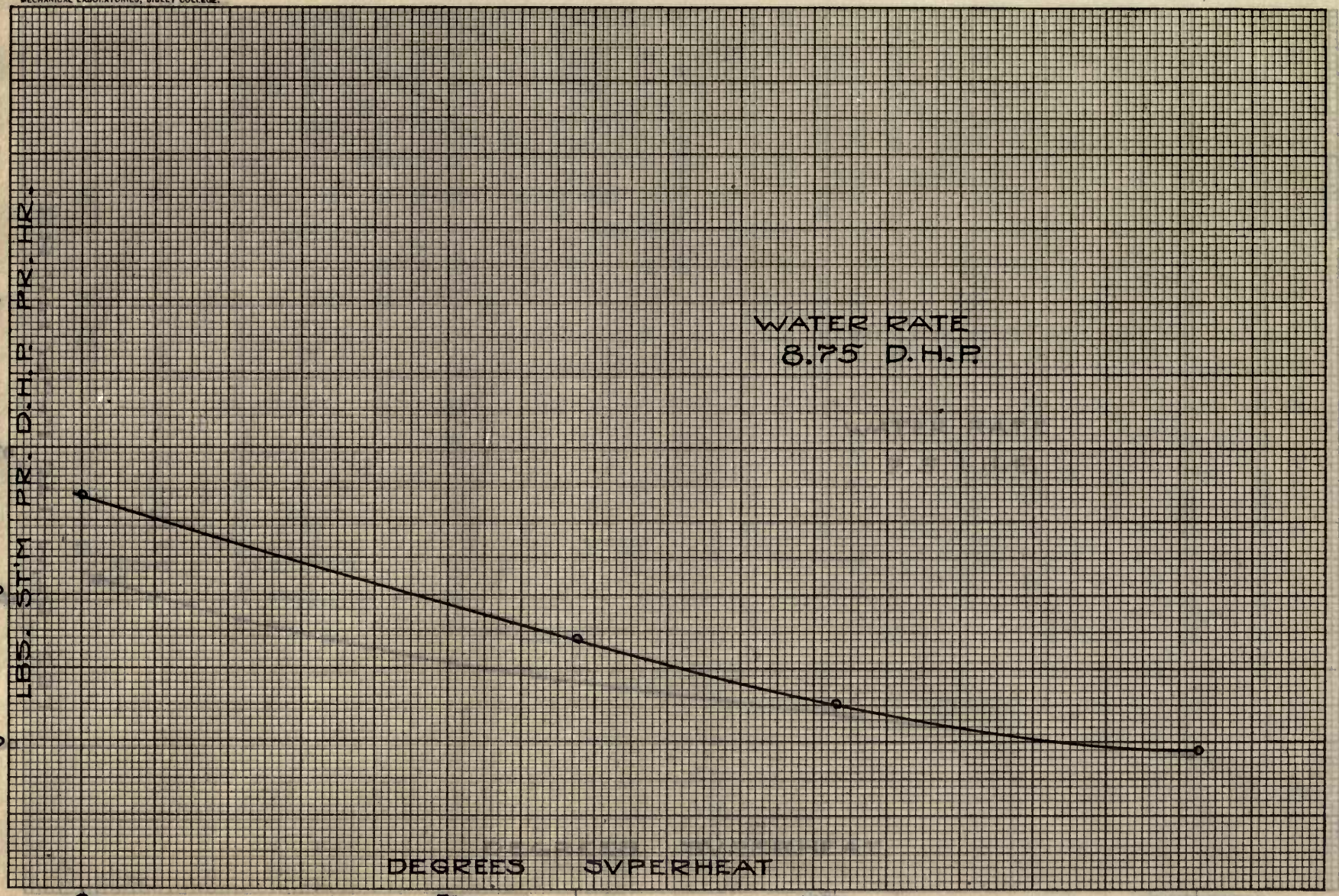
MECHANICAL LABORATORIES, SIBLEY COLLEGE.

TAYLOR AND CARPENTER

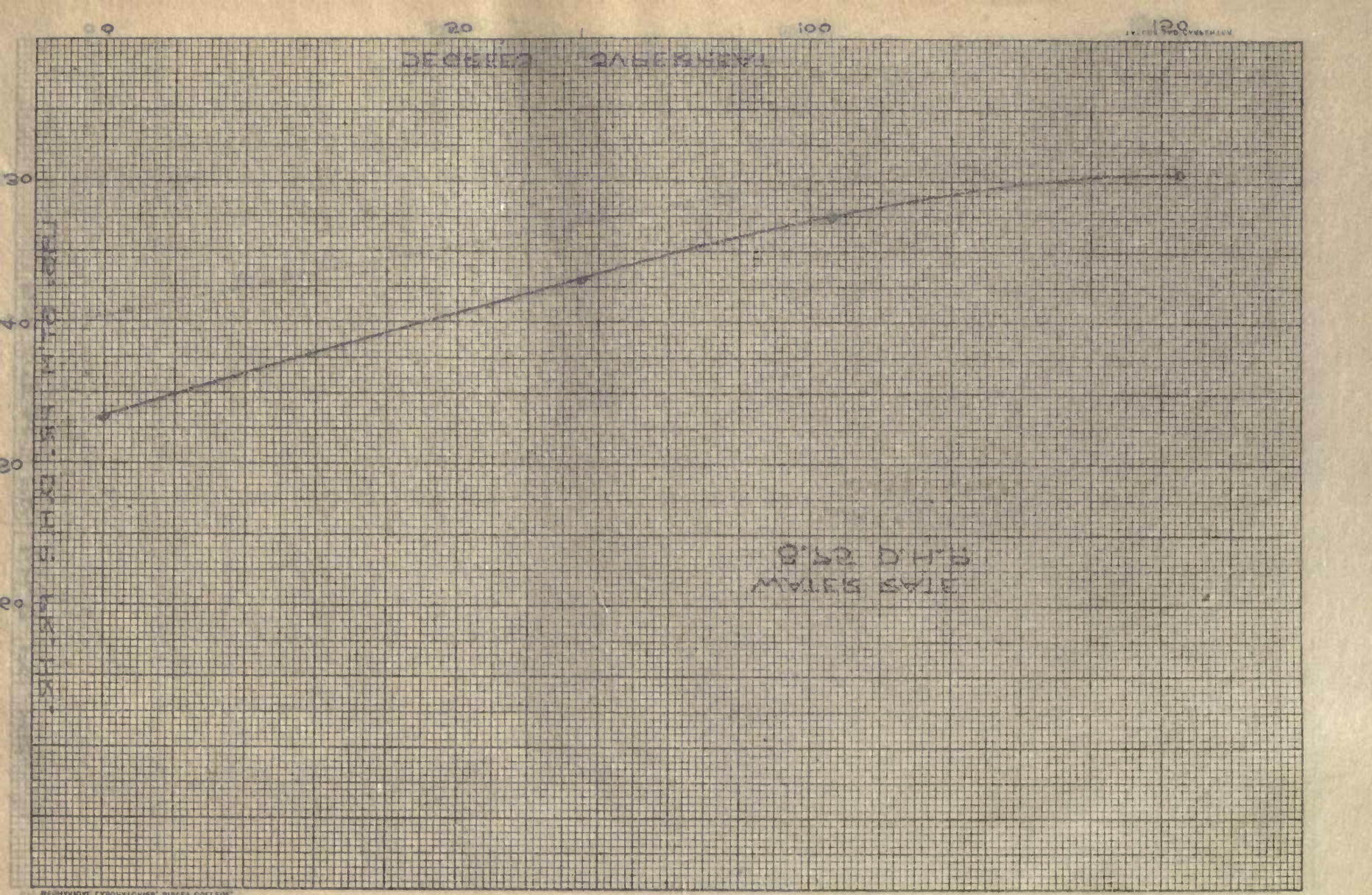
ORDERED BY THE STATE
WATER BOARD
0
20
100
120

MECHANICAL LABORATORIES, SIBLEY COLLEGE.

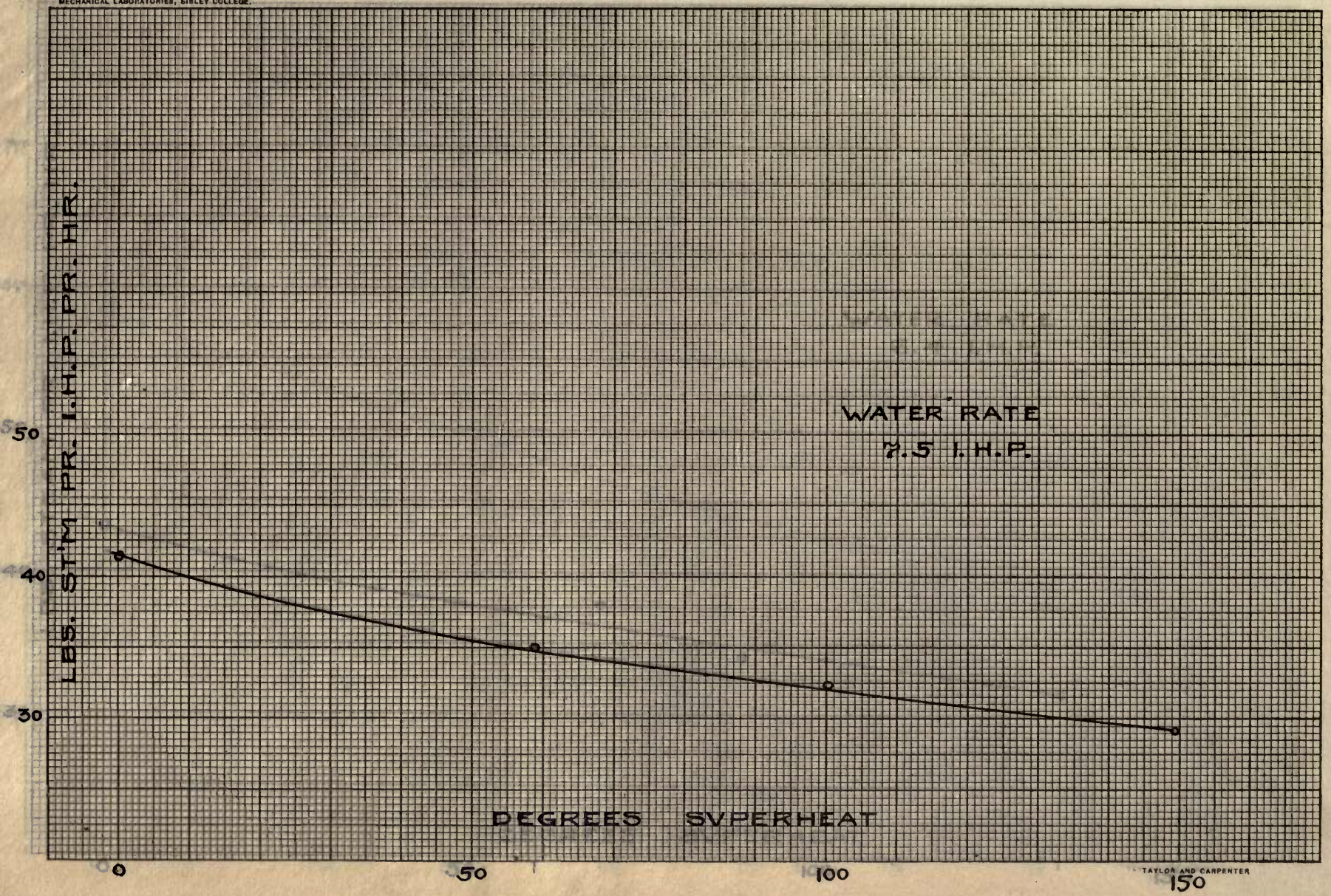
D.H.P. - 8.75 H.P.



TAYLOR AND CARPENTER


0
20
100
120
30
40
20
80

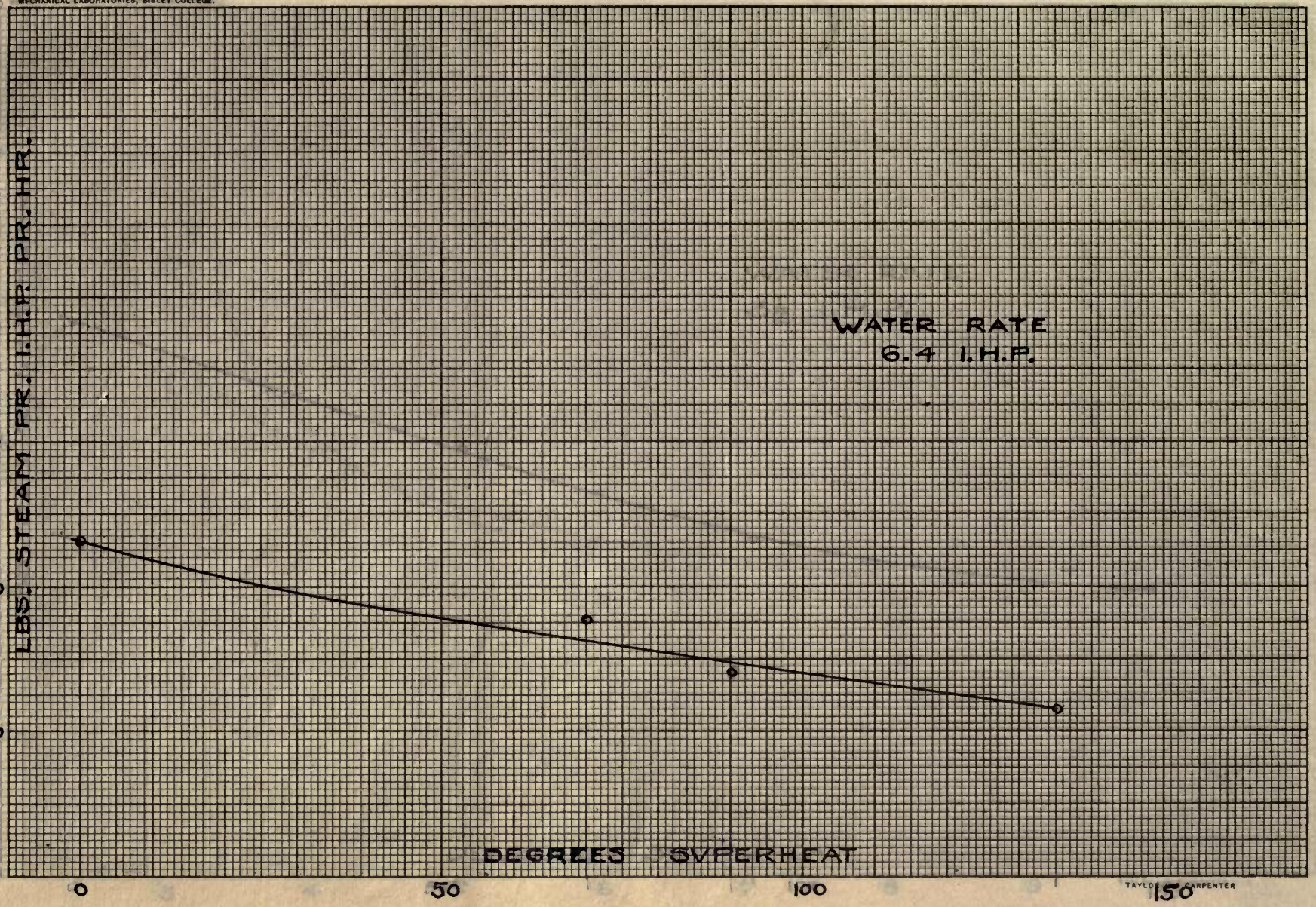
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

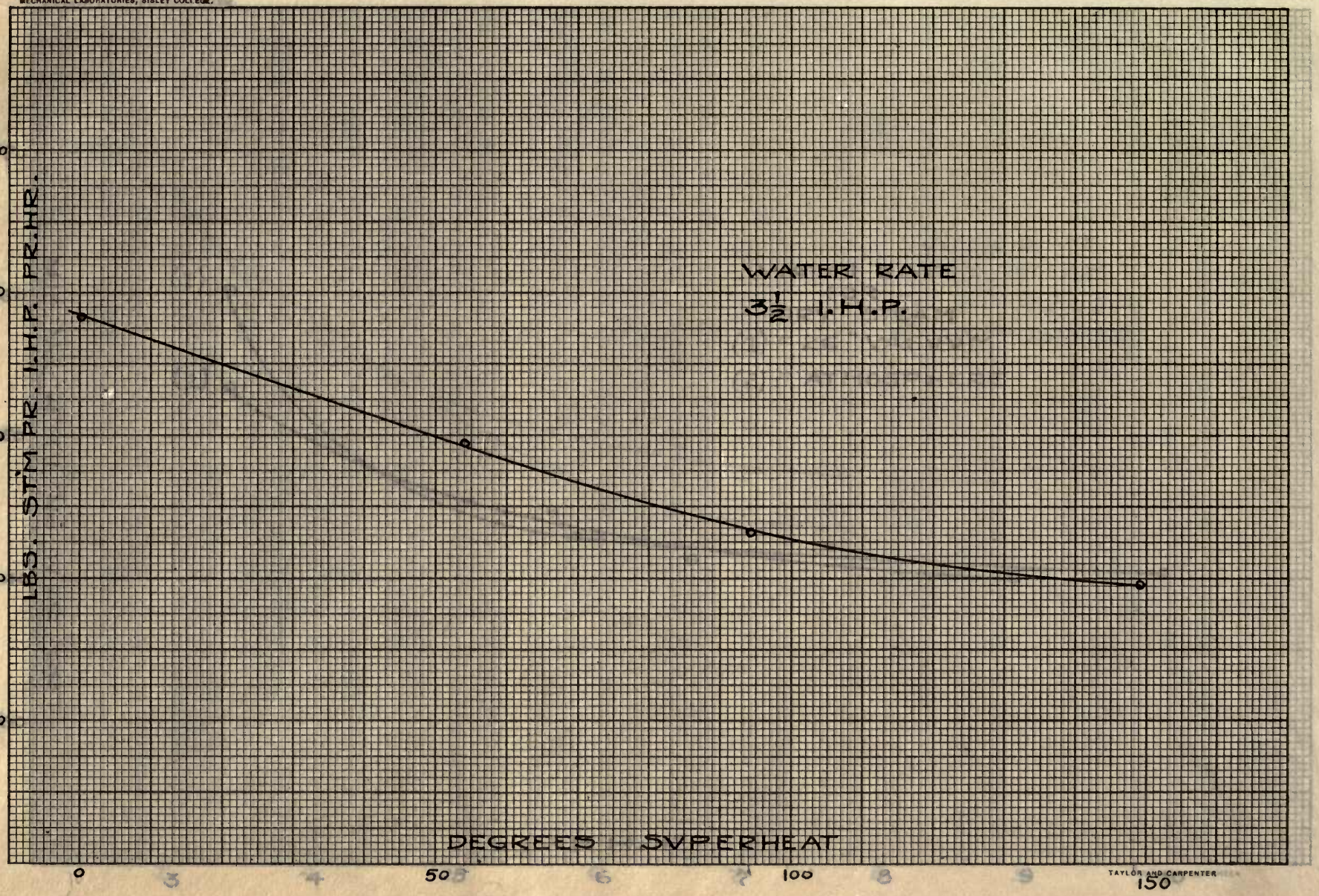
PRESSURE SYSTEM AT
WATER RATE
0
20
100
120
20
40

MECHANICAL LABORATORIES, BIBLEY COLLEGE.



0
20
100
120
THERMAL EFFICIENCY
WATER RATE
LBS STEAM PER I.H.P. PER HR.

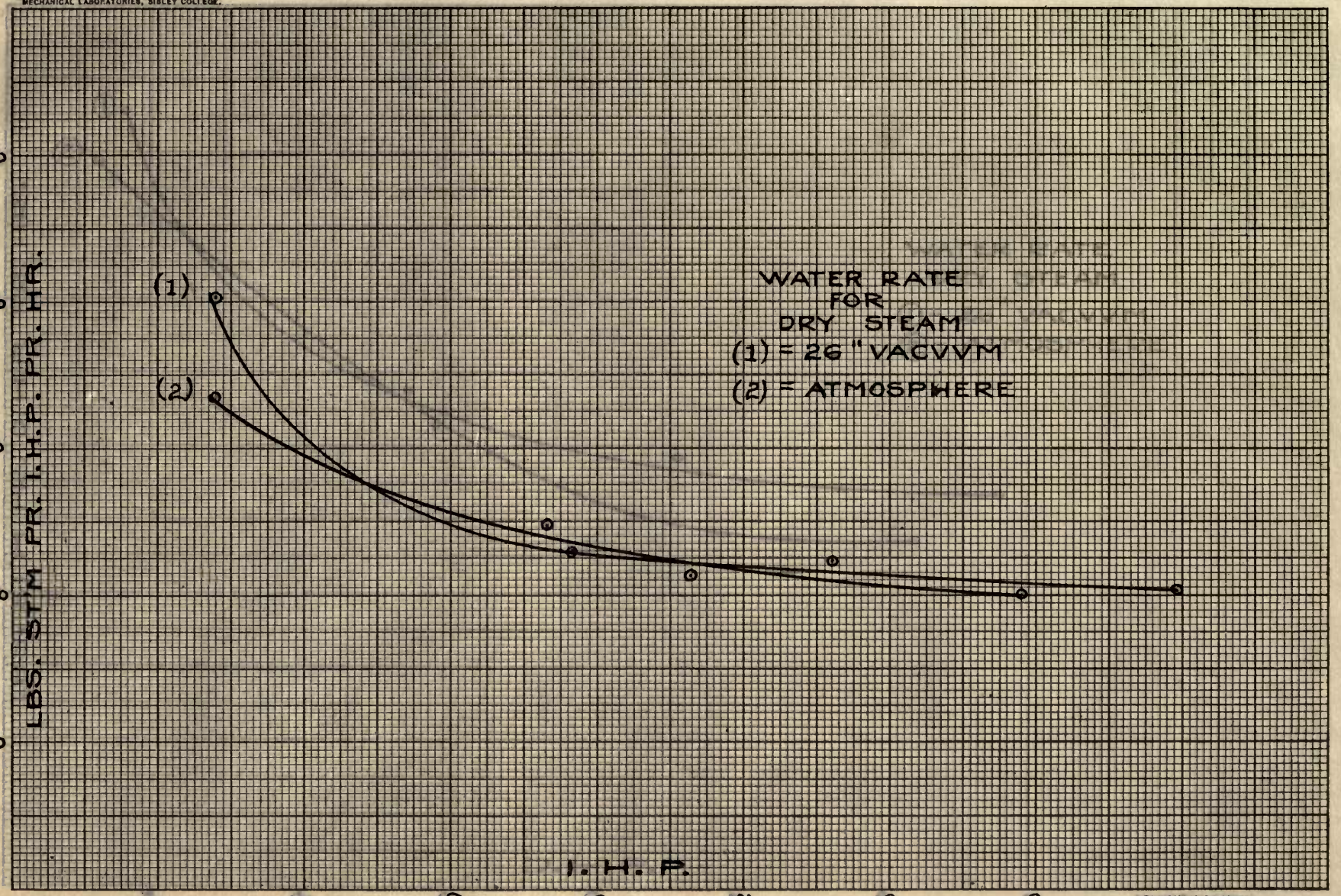
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

DEGREES RANKINE
0
20
100
120
MAXIMUM STAGE RATIO

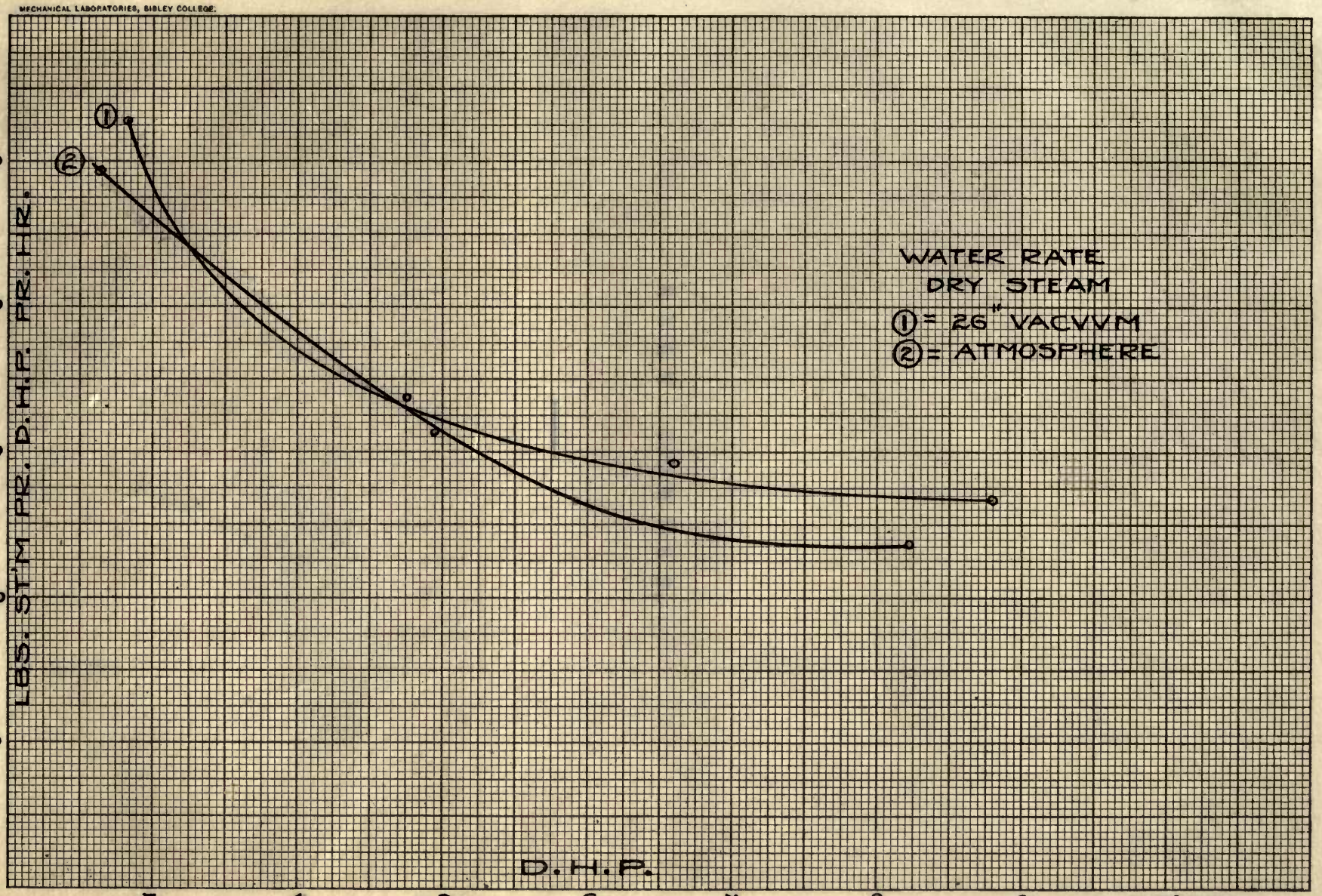
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR & CARPENTER

WATER RETAINED
FOR 1 DAY
MASTER CURVE
PAVADAY "25" E (t)
EXPERIMENTAL DATA = (E)
(E)
(t)

MECHANICAL LABORATORIES, BIBLEY COLLEGE.



TAYLOR & CARPENTER

10

FOR STATIC AND DYNAMIC STRESS
DRY STEAM
WATER RELAY
① = 25 MAY
② = 27 NOVEMBER
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

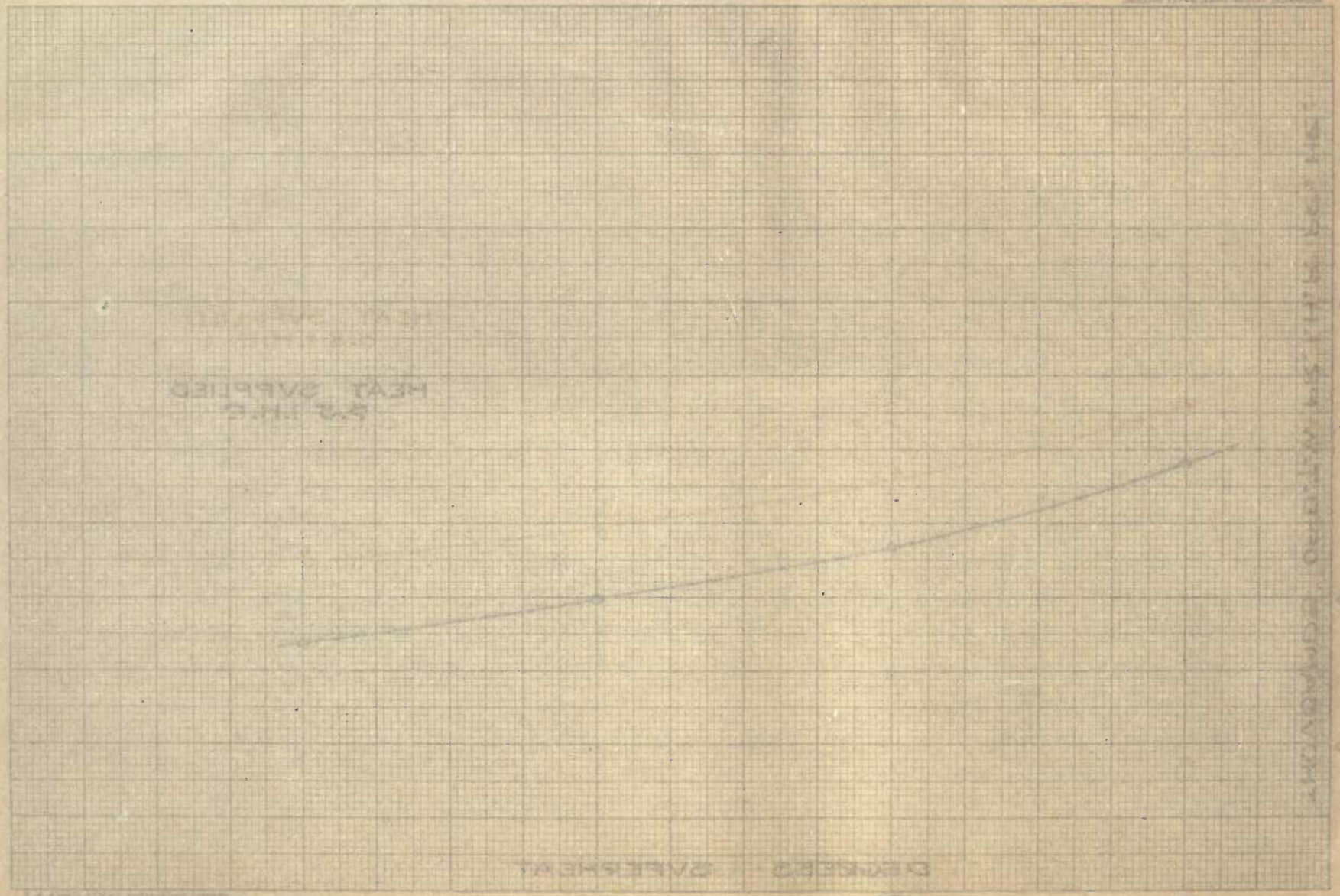
HEAT CURVES.

CRANES

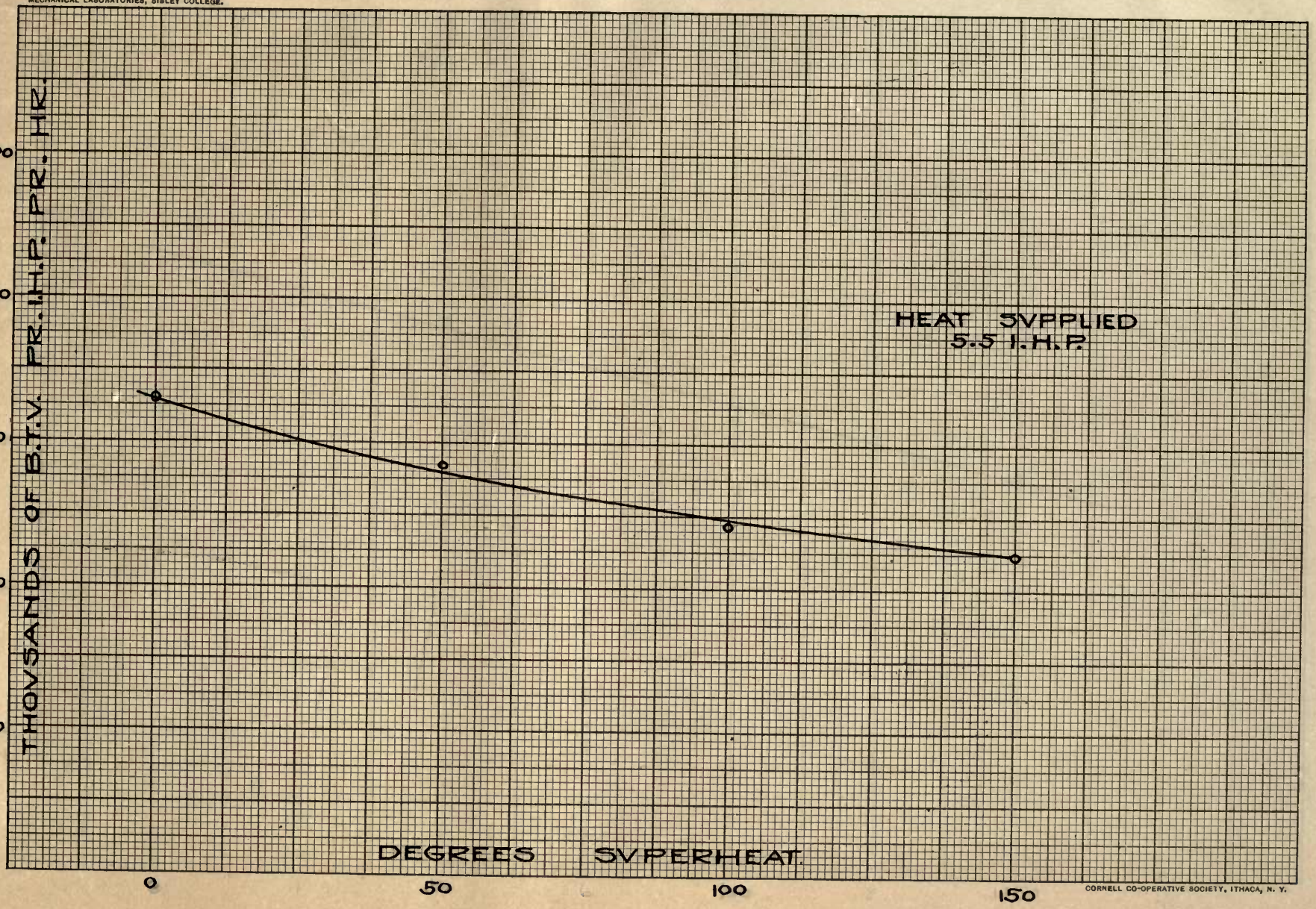
MECHANICAL LABORATORIES, SIBLEY COLLEGE.

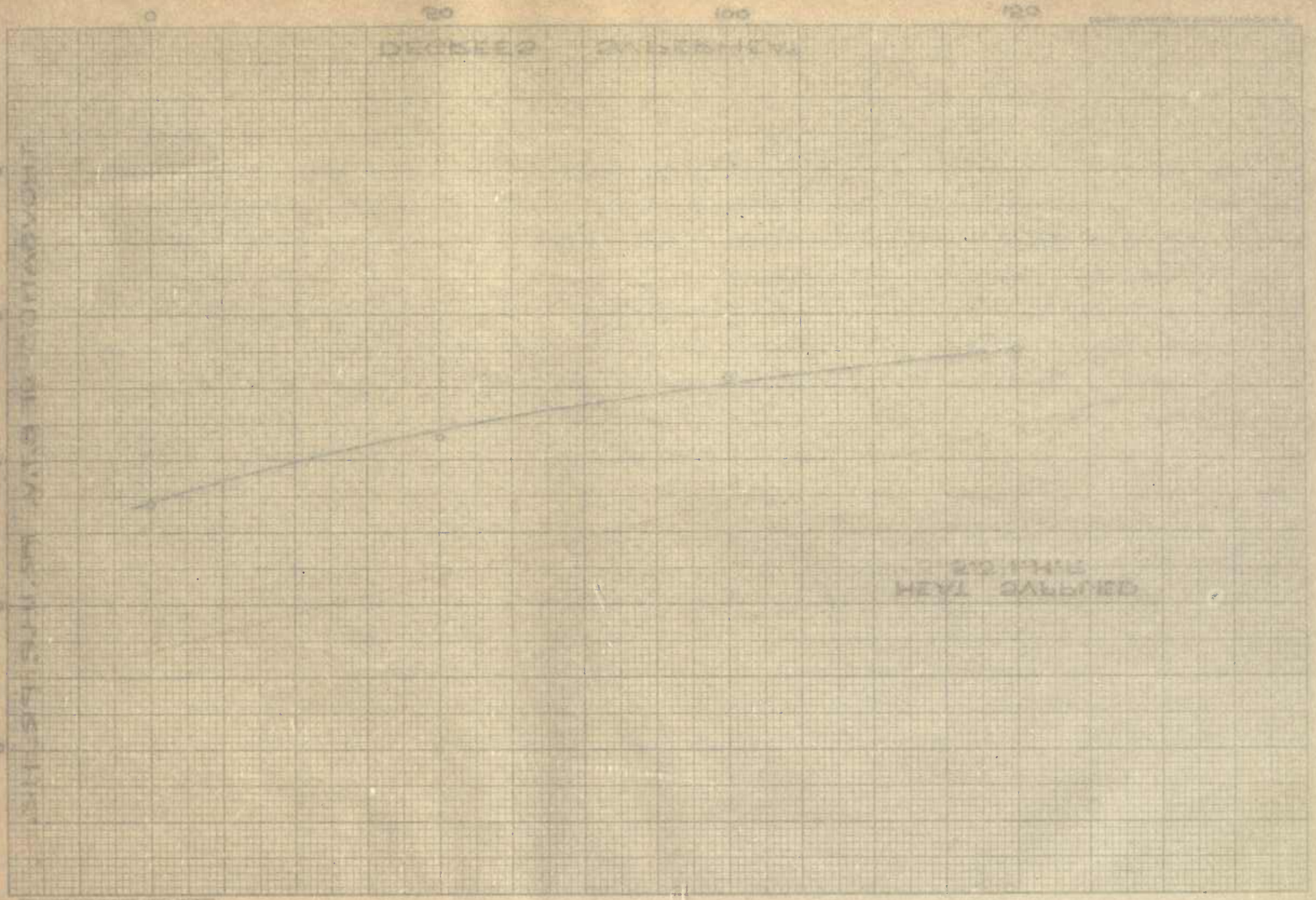
DRIED FEED
HEAT-TREATED

MECHANICAL LABORATORIES, BIBLEY COLLEGE.

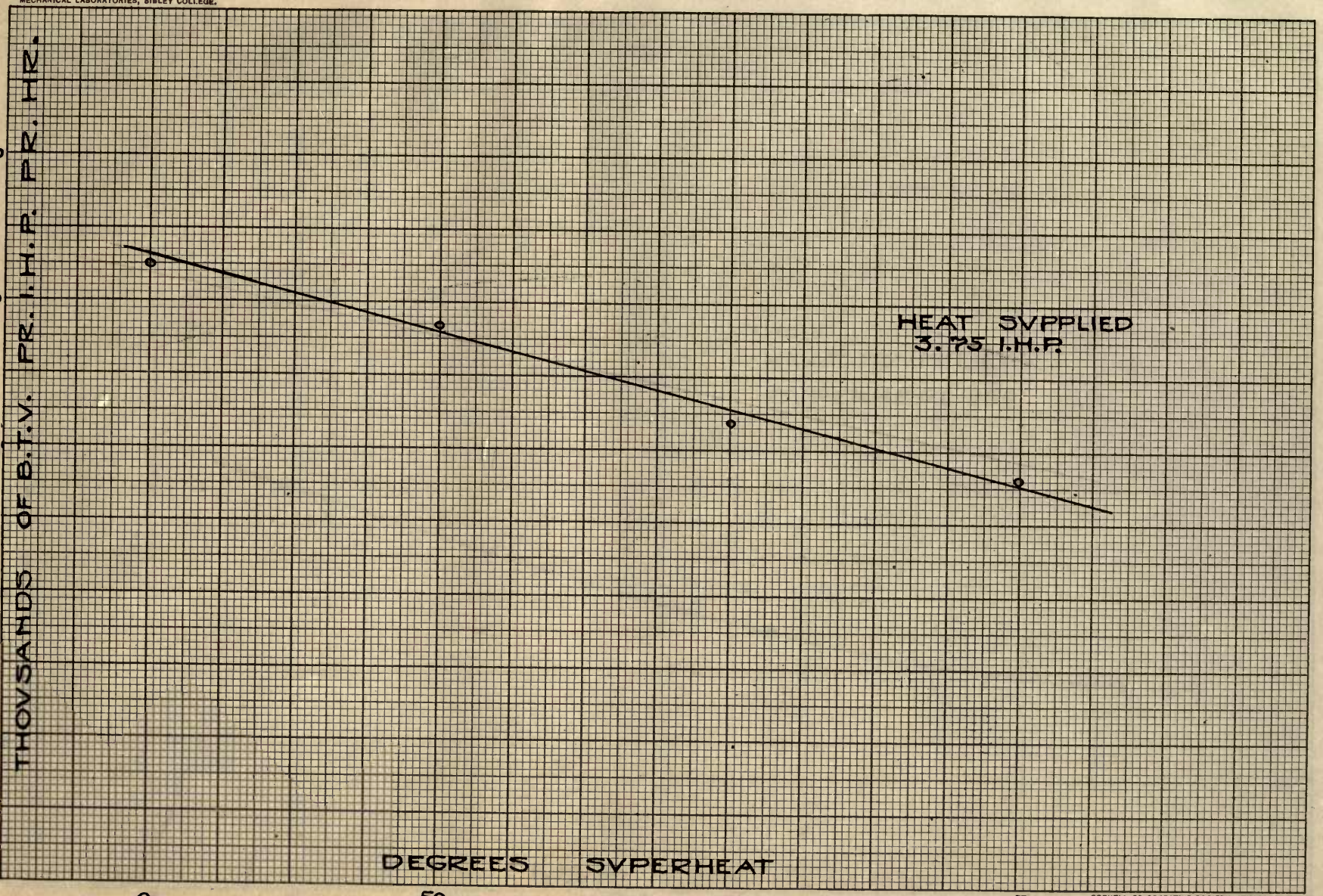


MECHANICAL LABORATORIES, BIBLEY COLLEGE.

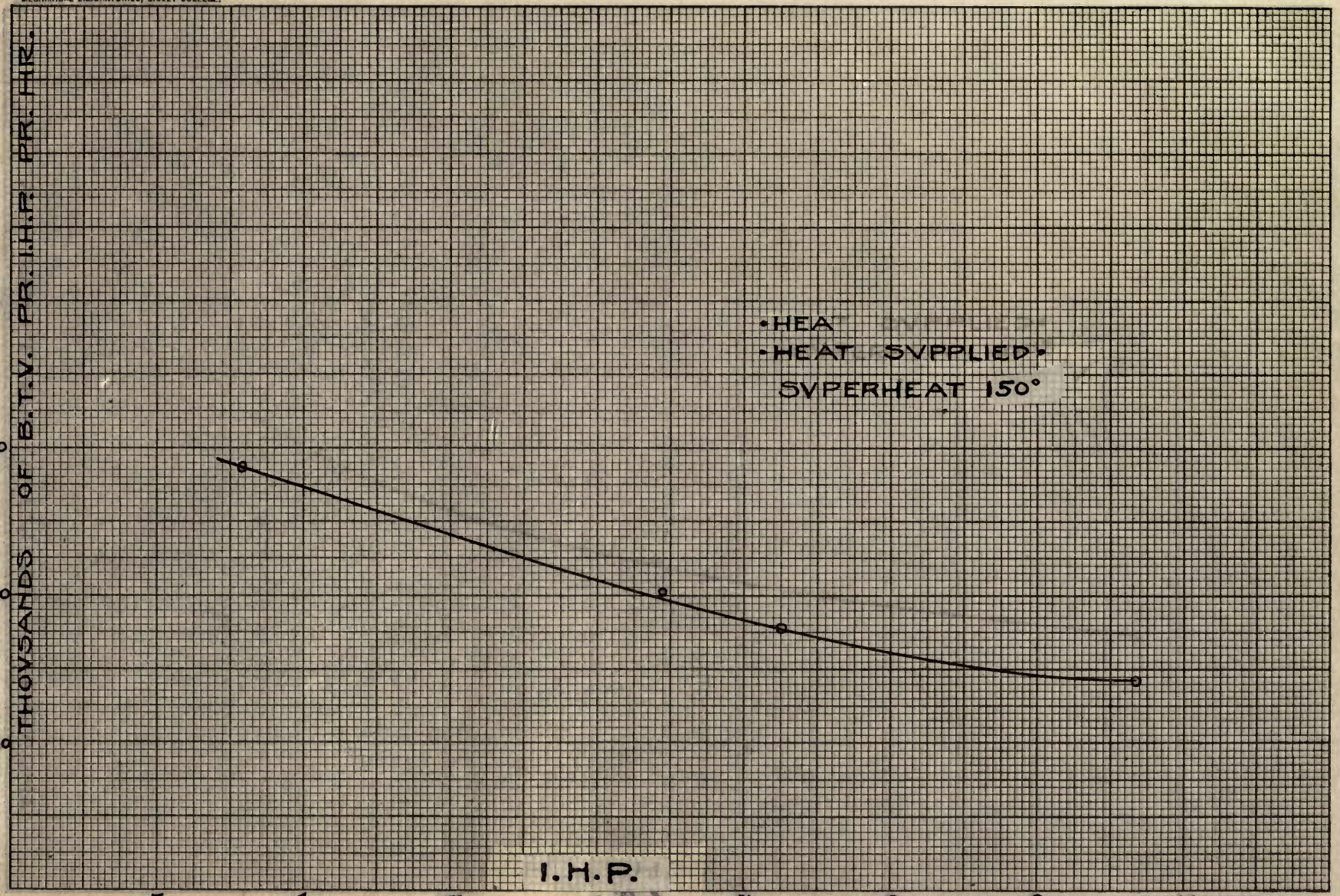




MECHANICAL LABORATORIES, SIBLEY COLLEGE.



MECHANICAL LABORATORIES, SIBLEY COLLEGE.

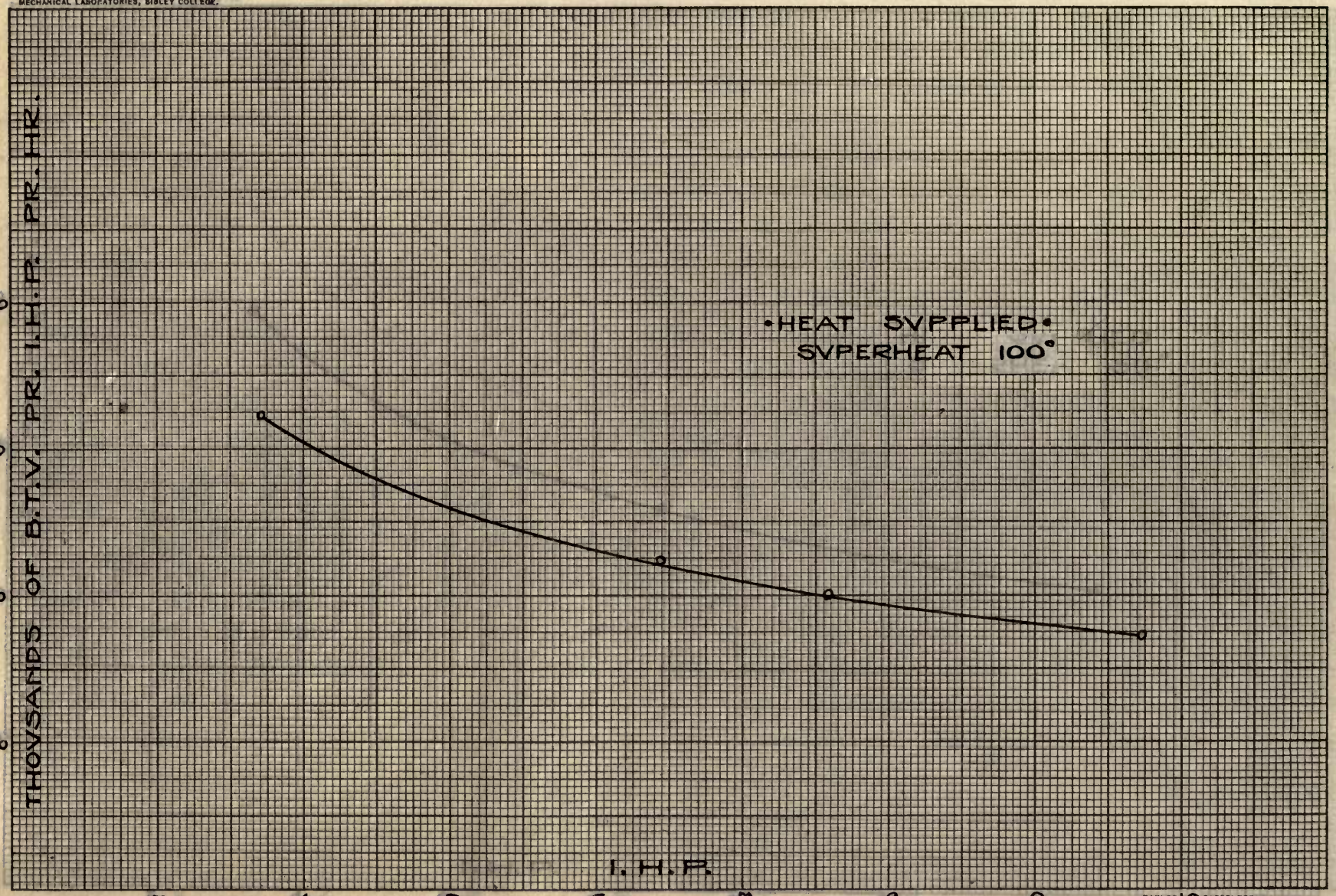


TAYLOR & CARPENTER

SATURATED SOLUTION AT 20°
HEAT EVOLVED
1 H.P.
2
3
4
8
9
20
40
60

100

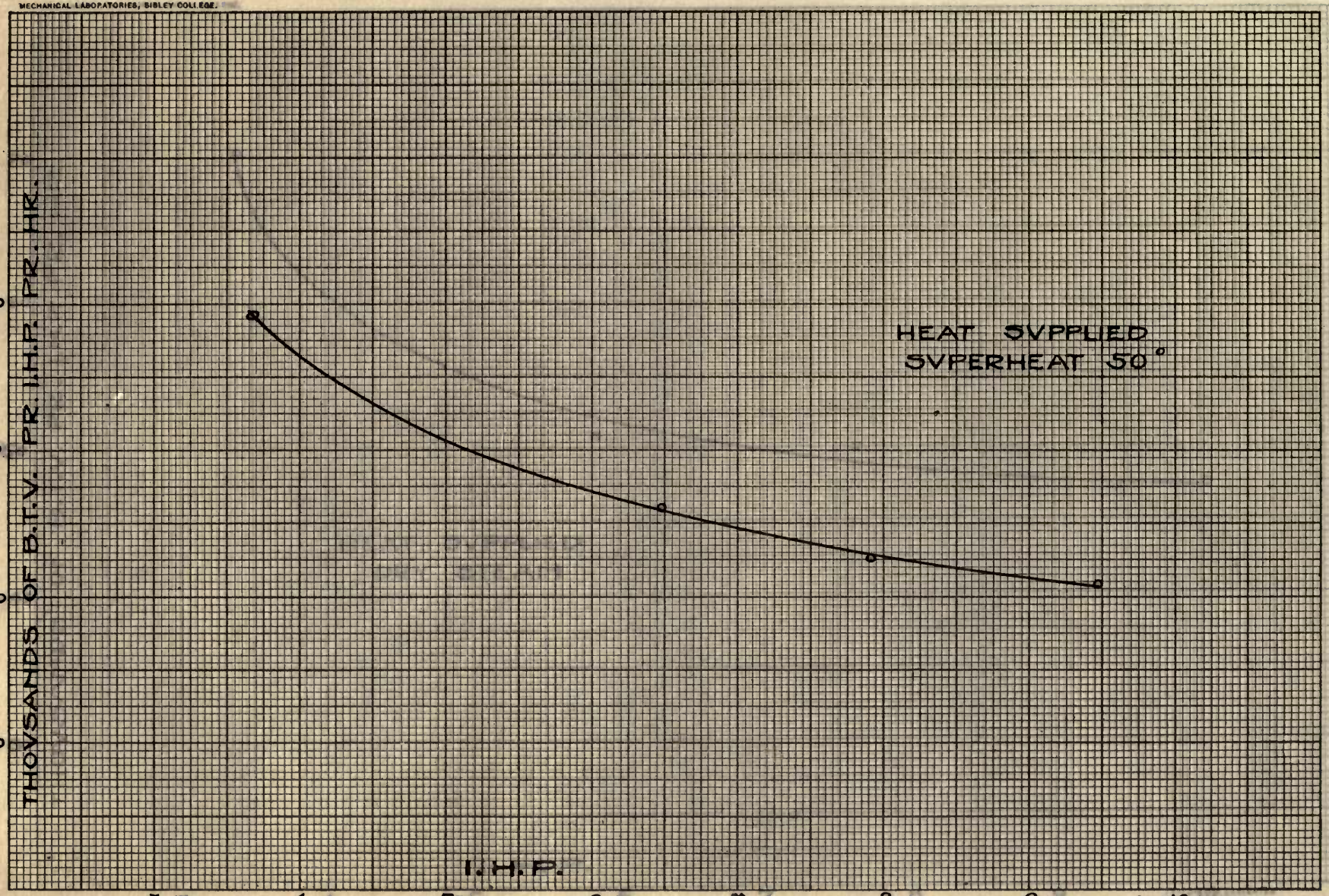
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



GABRIEL "HEAT CALCULATOR" 100
MEDIUM FINE GRAIN SUPER QUALITY

50°

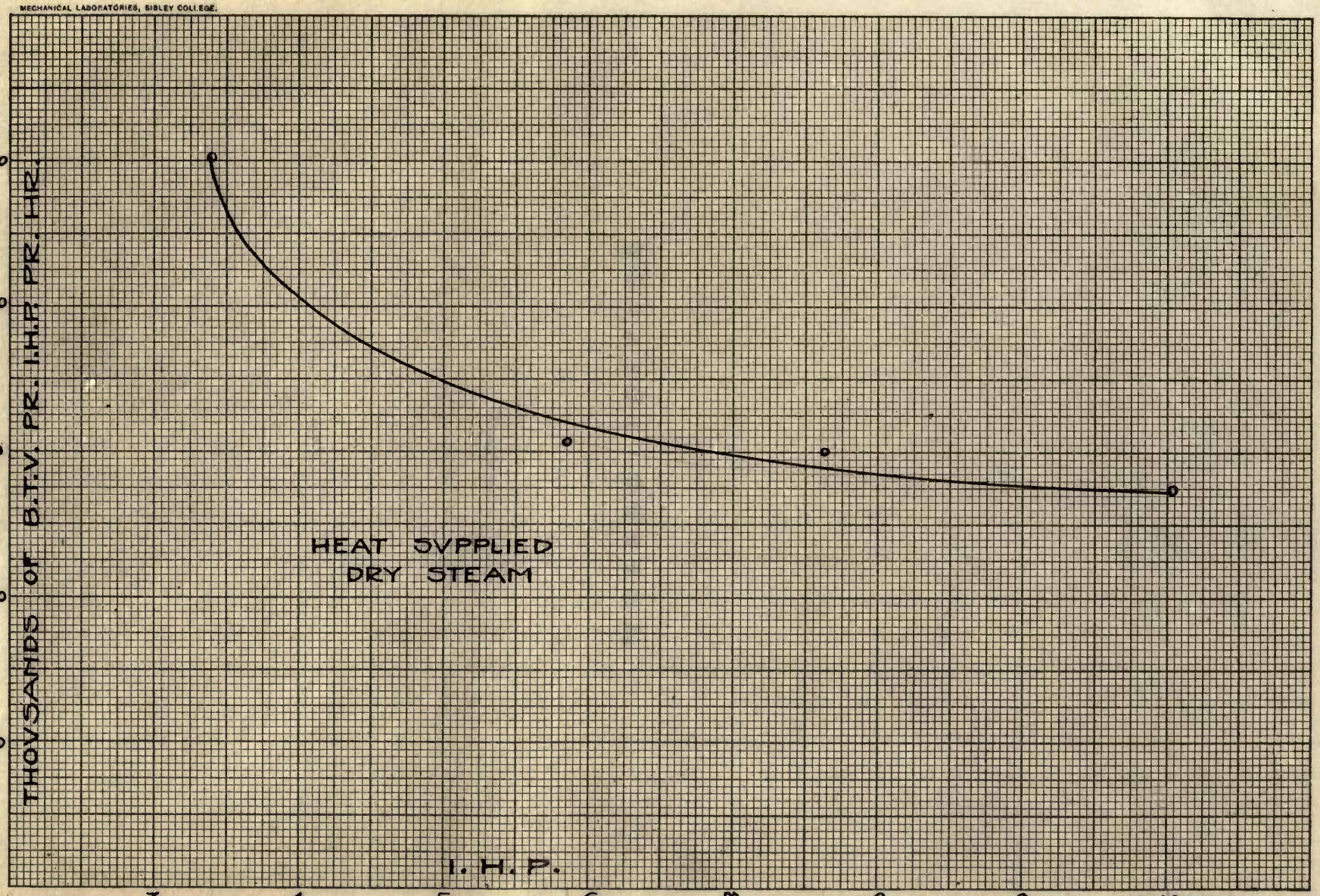
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



TAYLOR & CARPENTER

HEAT TRANSFER COEFFICIENT
TEMPERATURE DIFFERENCE
OBSERVED RATE OF HEAT FLOW PER UNIT TIME PER UNIT

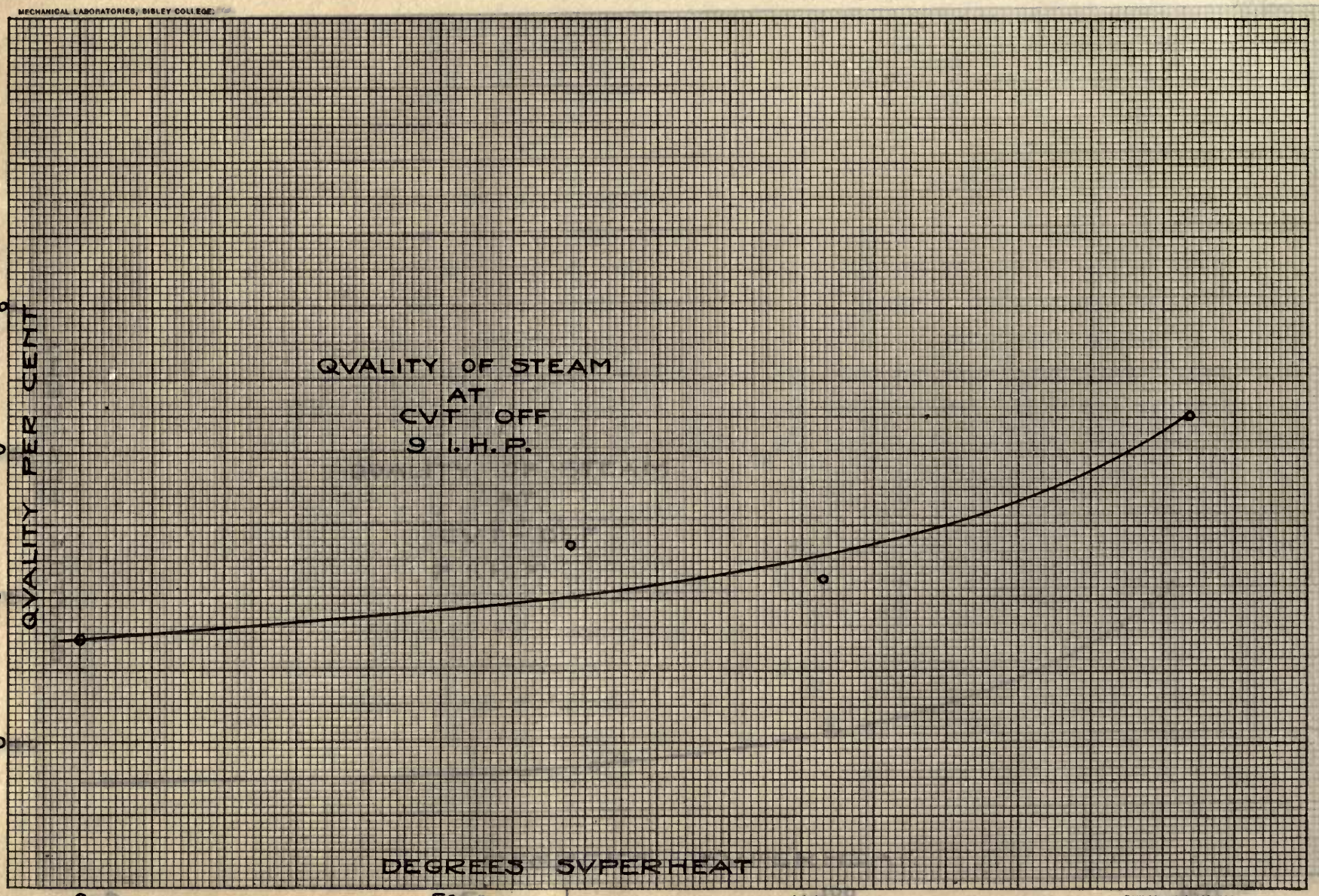
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

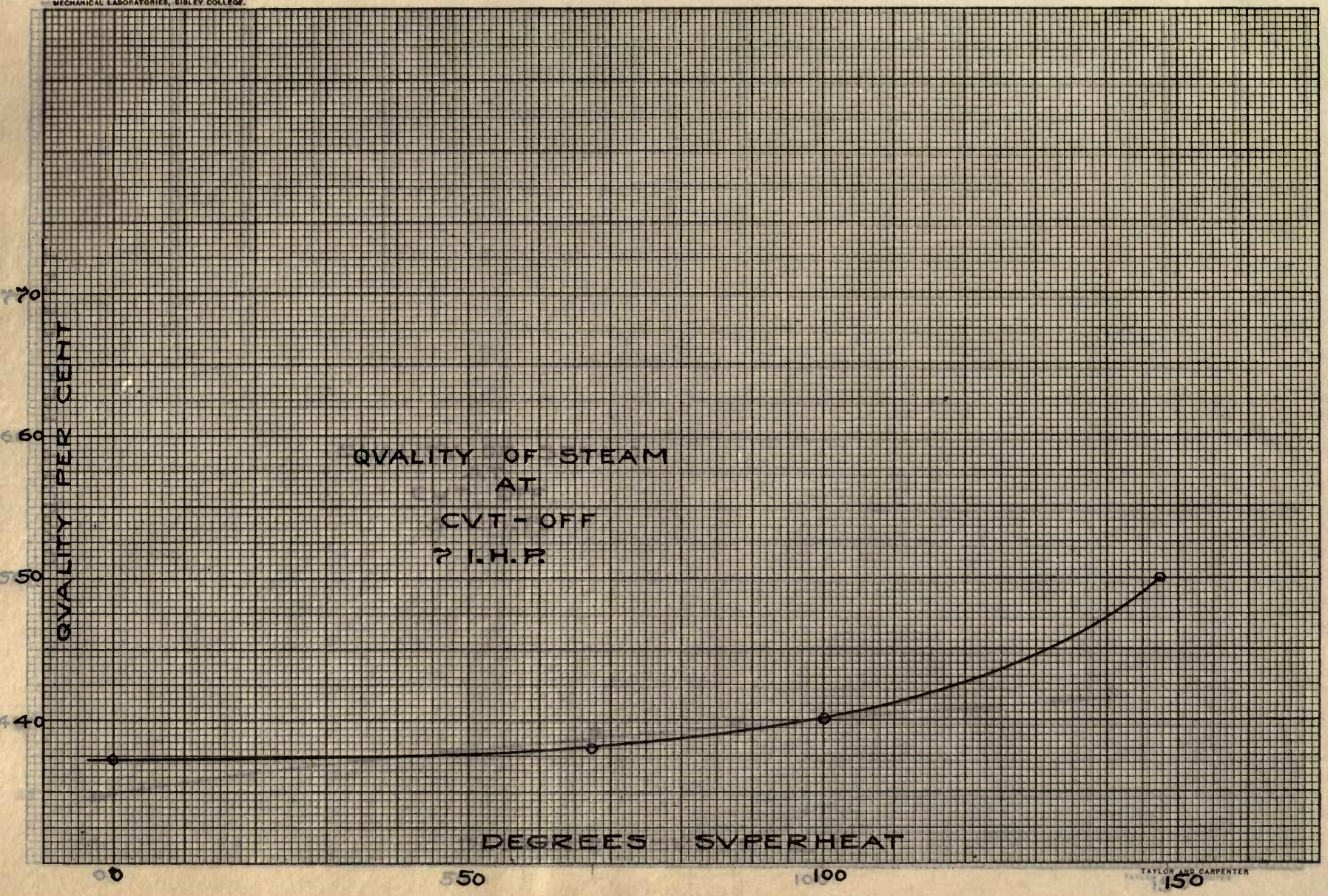
PLATE CURRENT IN MILLIAMPS
PLATE VOLTS
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
1950

QUALITY CURVES.



DEGREES OVERHEAT
GRAVITY PER CENT
GRAVITY OF WASTE STEAM
THOUSANDS B.T.U.
0
20
100
40
20
60

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



DEGREES PATHEMENT

100

50

0

GRAVITY LESS CENT

40

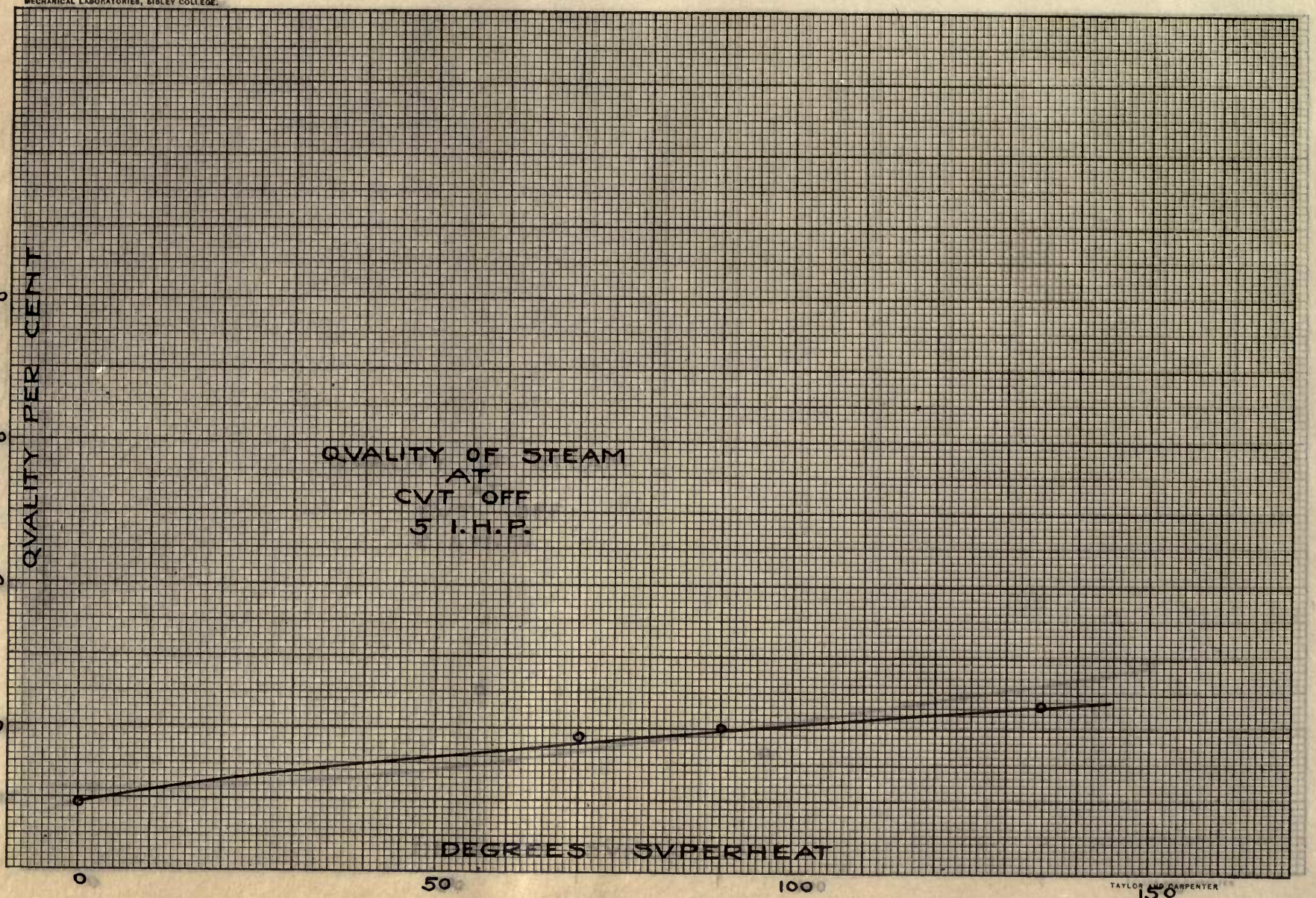
20

0

STRIP CAT-TAIL

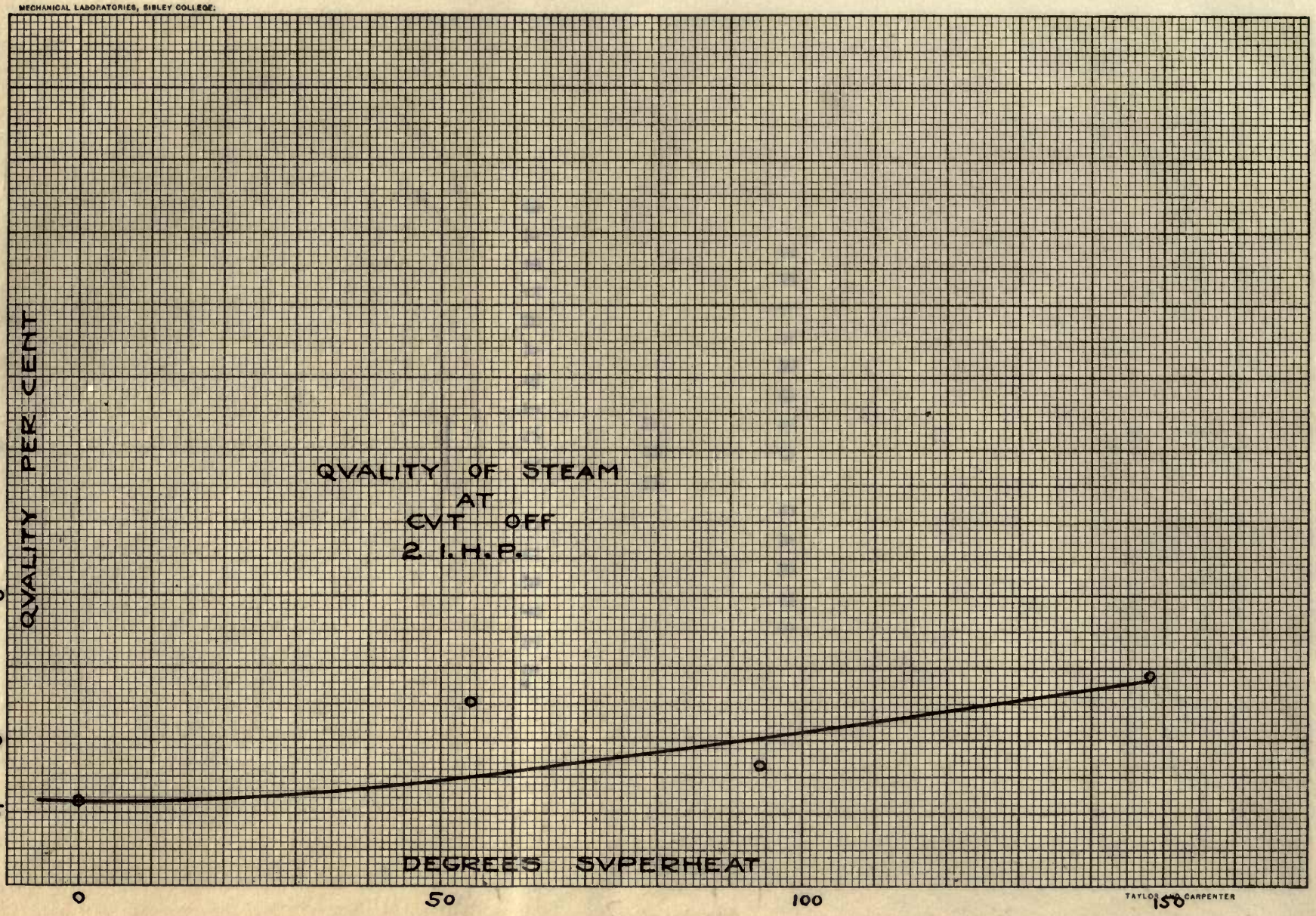
AT

MAYFIELD OF STRAW


MECHANICAL LABORATORIES, SIBLEY COLLEGE.
QVALITY PER CENT
70
60
50
40
QVALITY OF STEAM
AT
CVT OFF
5 I.H.P.
DEGREES SVPERHEAT
0
50
100
150
TAYLOR AND CARPENTER

GRAPH TO FIND THE VOLUME OF WATER DISPLACED BY GRANITE
GRANITE PER CENT
0
20
40
60
80
100
120
DISPLACED QUANTITY IN C.C.

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



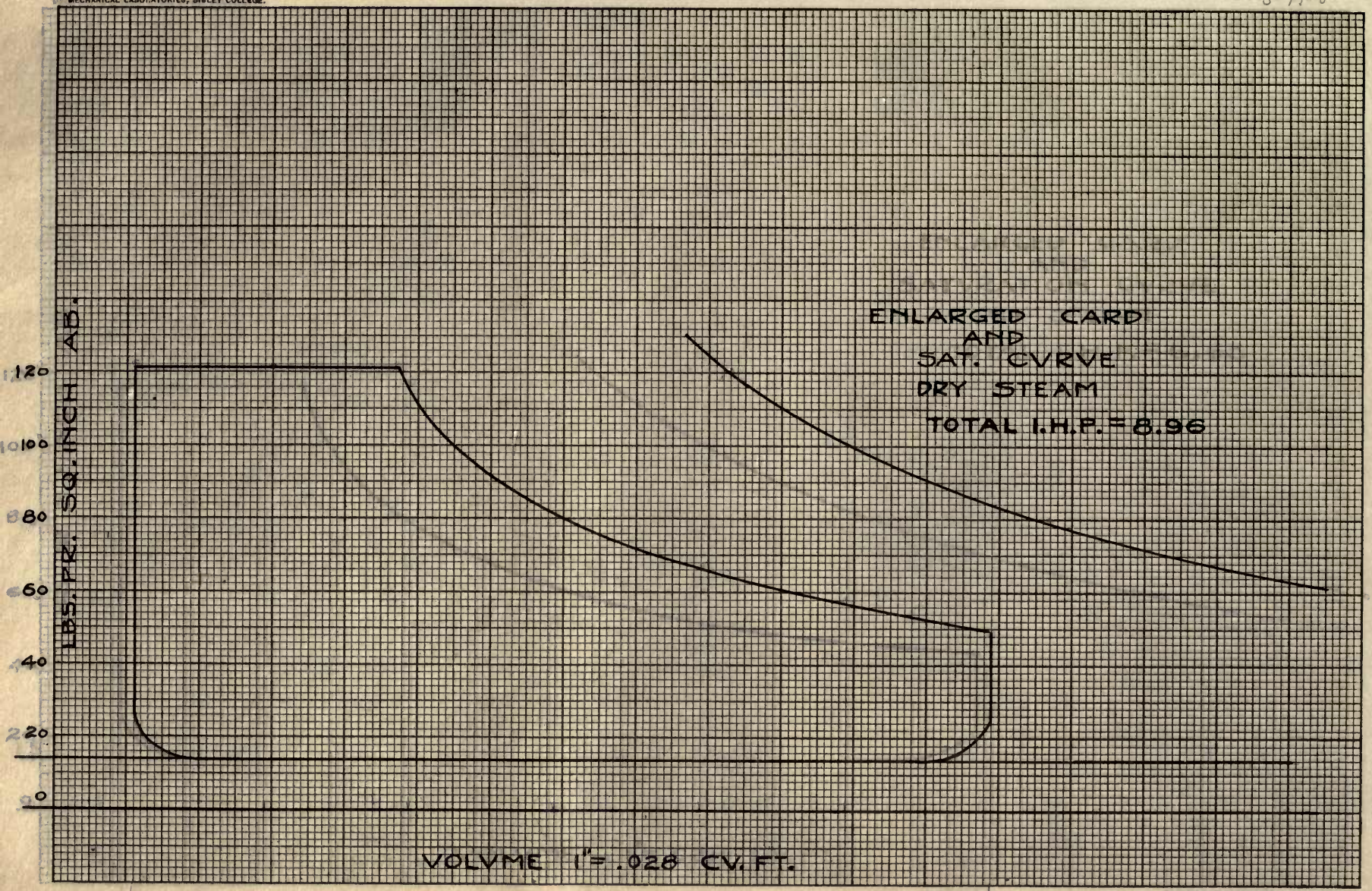
EFFICIENCY %
100
50
0
CAPILLARY LEAD CELL

ENLARGED CARDS

AND

SATURATION CURVES.

S-A-8

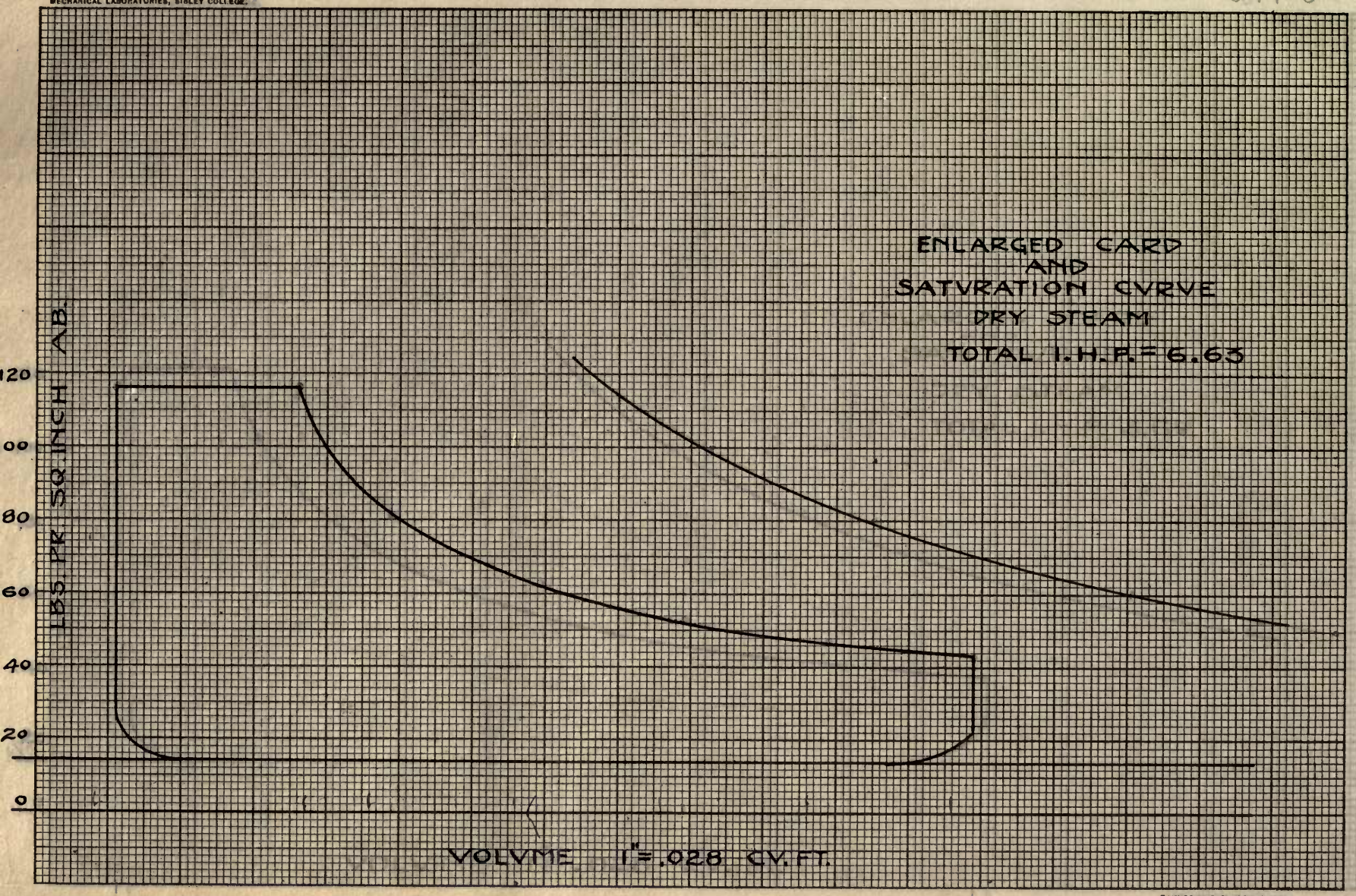


TAYLOR AND CARPENTER

ENHANCED CAVG
DSA FILTER
SAT. CURVE
AND
TOTAL FILTER = 0.2 S
FREQUENCY SELECTIVE
VOLTAGE TE 055 CAVITY
0
20
40
60
80
100
120

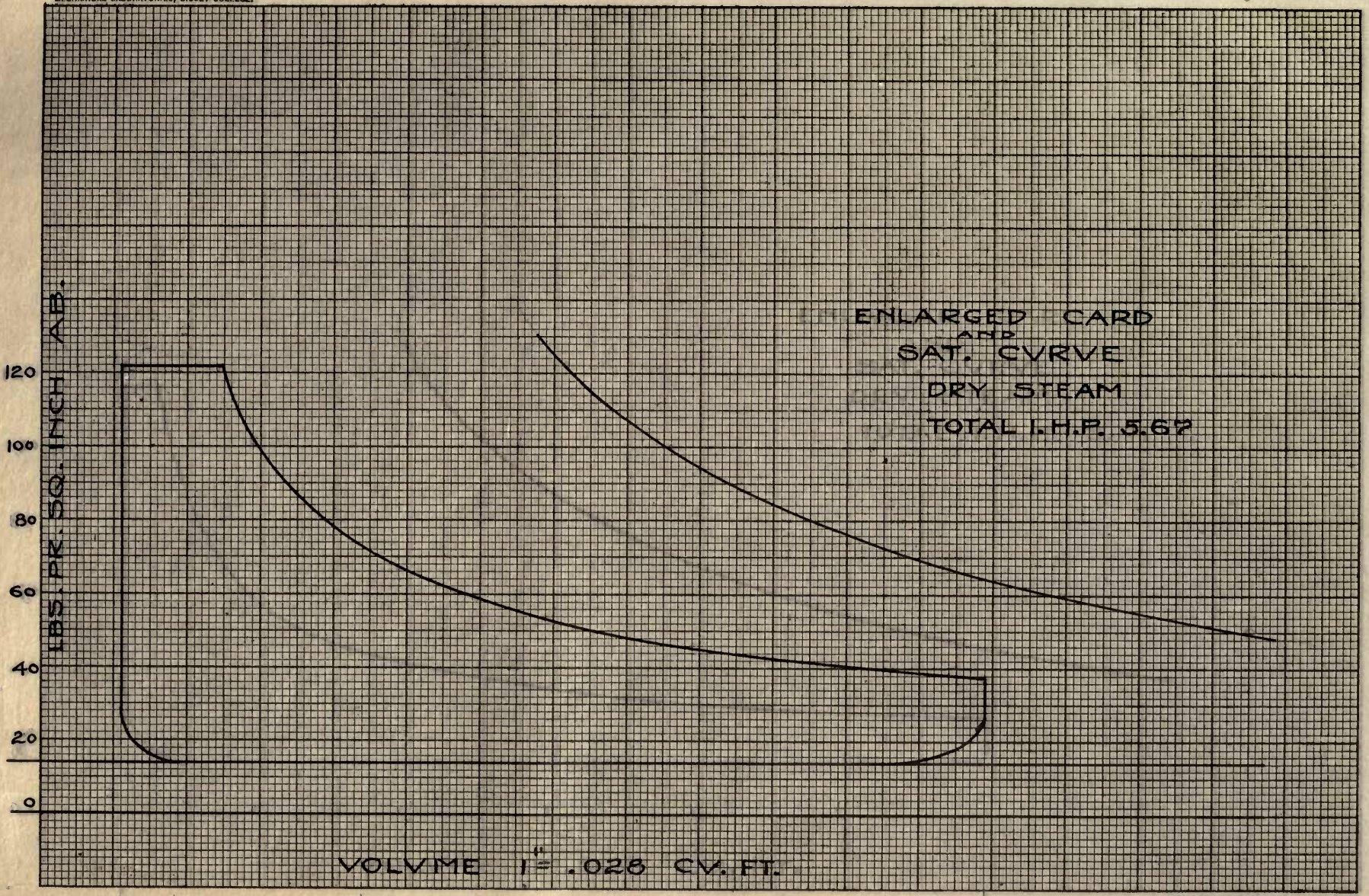
2-H-2

S-7-6

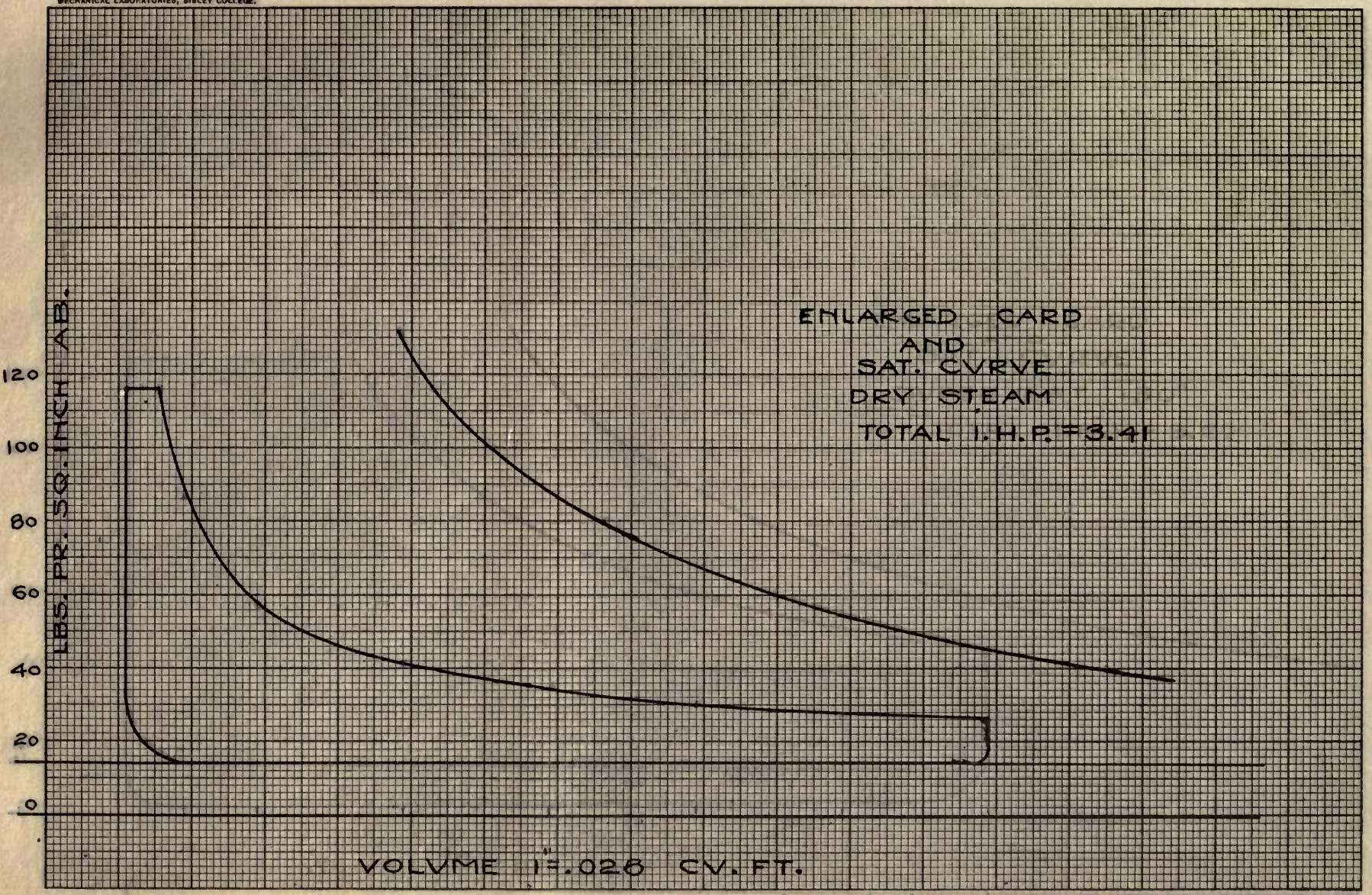


VOLTAGE
CURRENT

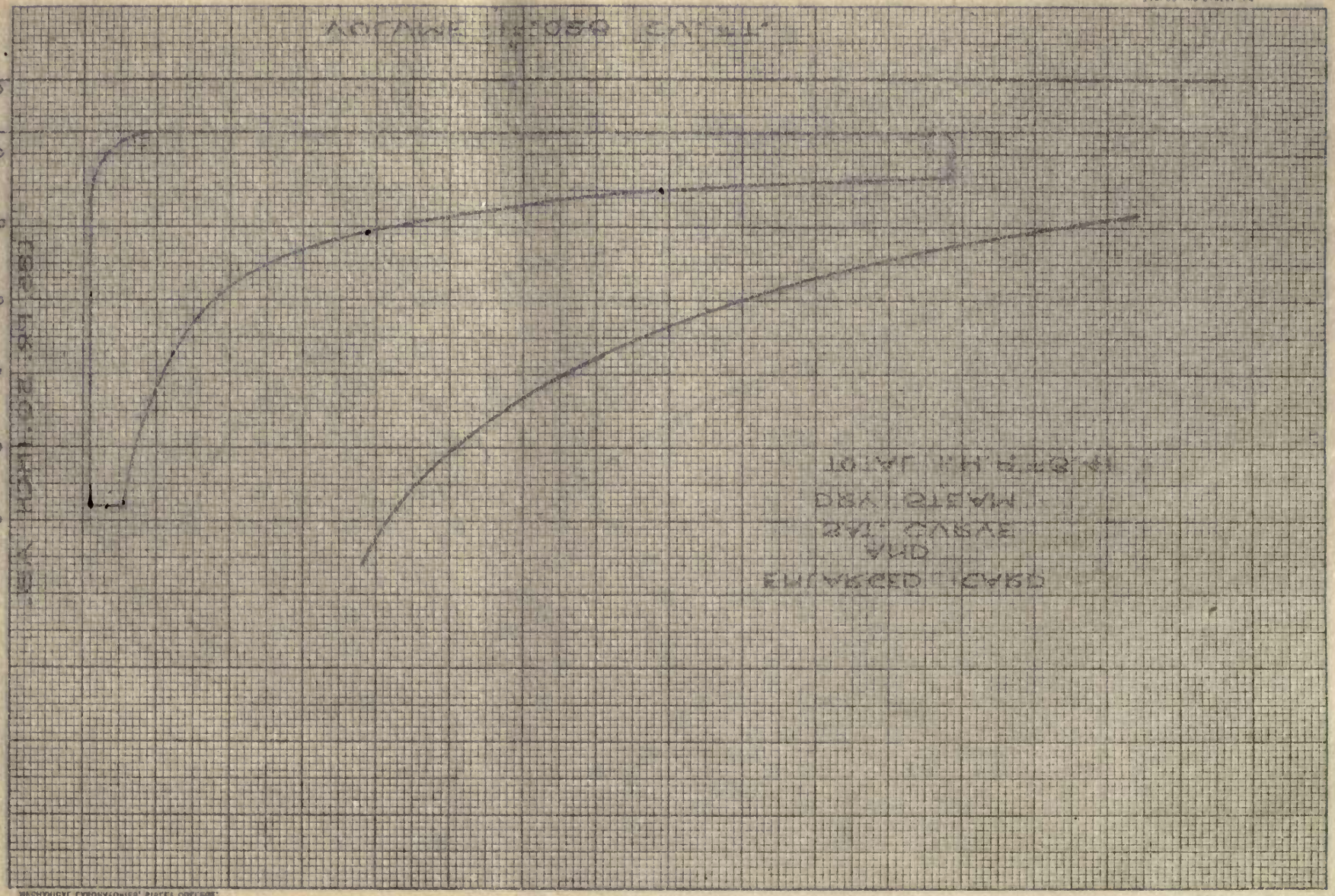
S-A-5


LBS. PR. SQ. INCH A.P.
120
100
80
60
40
20
0
ENLARGED CARD
AND
SAT. CVRVE
DRY STEAM
TOTAL I.H.P. 5.67
VOLVME 1" = .026 CV. FT.

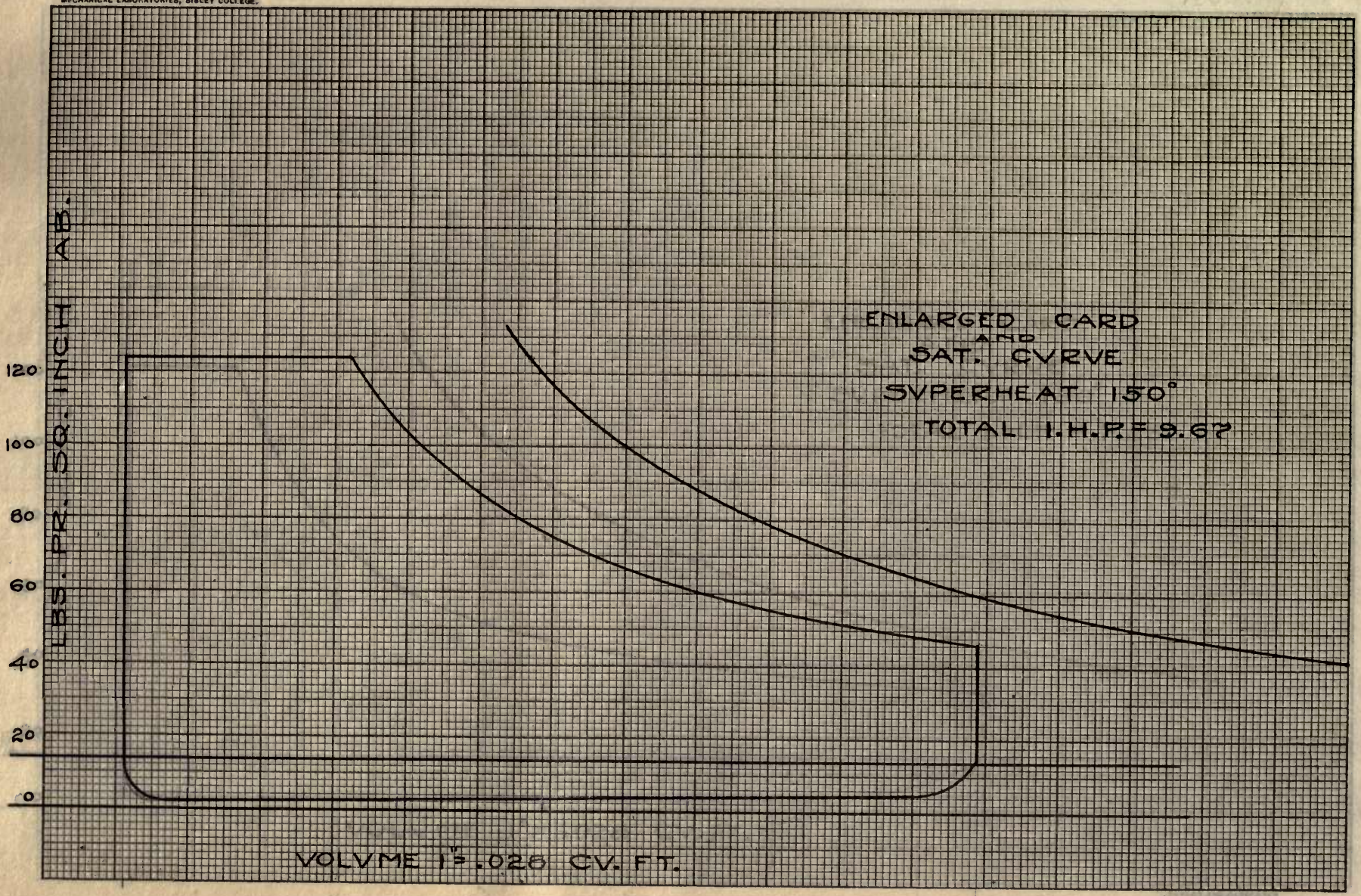
ACTUAL USE CURVE
EQUIVALENT
MATERIAL
STEEL
IDEAL
STEEL
LIMIT
COPPER
EQUIVALENT
MATERIAL
STEEL
IDEAL
STEEL
LIMIT
0
20
40
60
80
100
150



TAYLOR AND CARPENTER


0
50
40
60
100
150

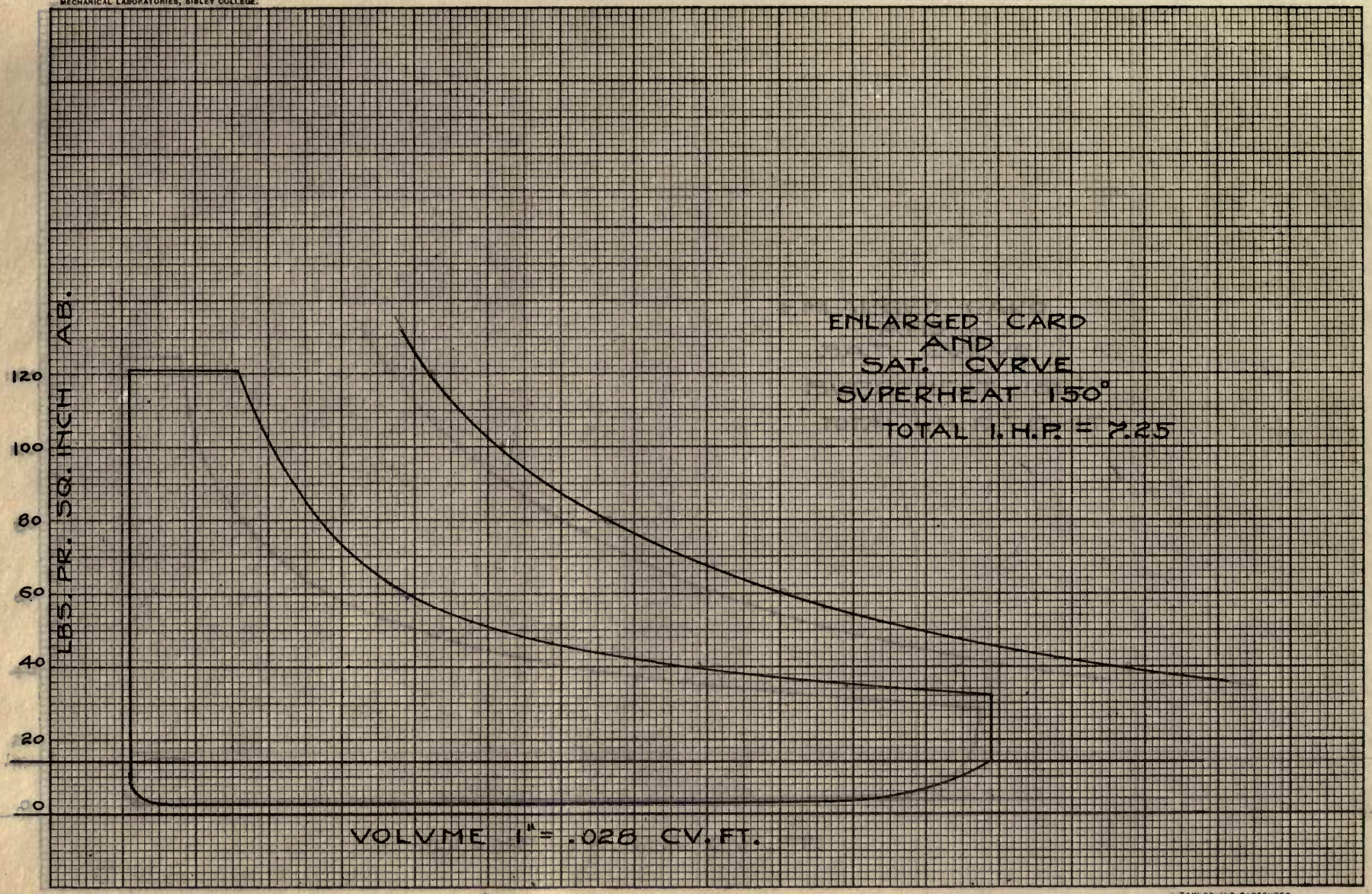
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

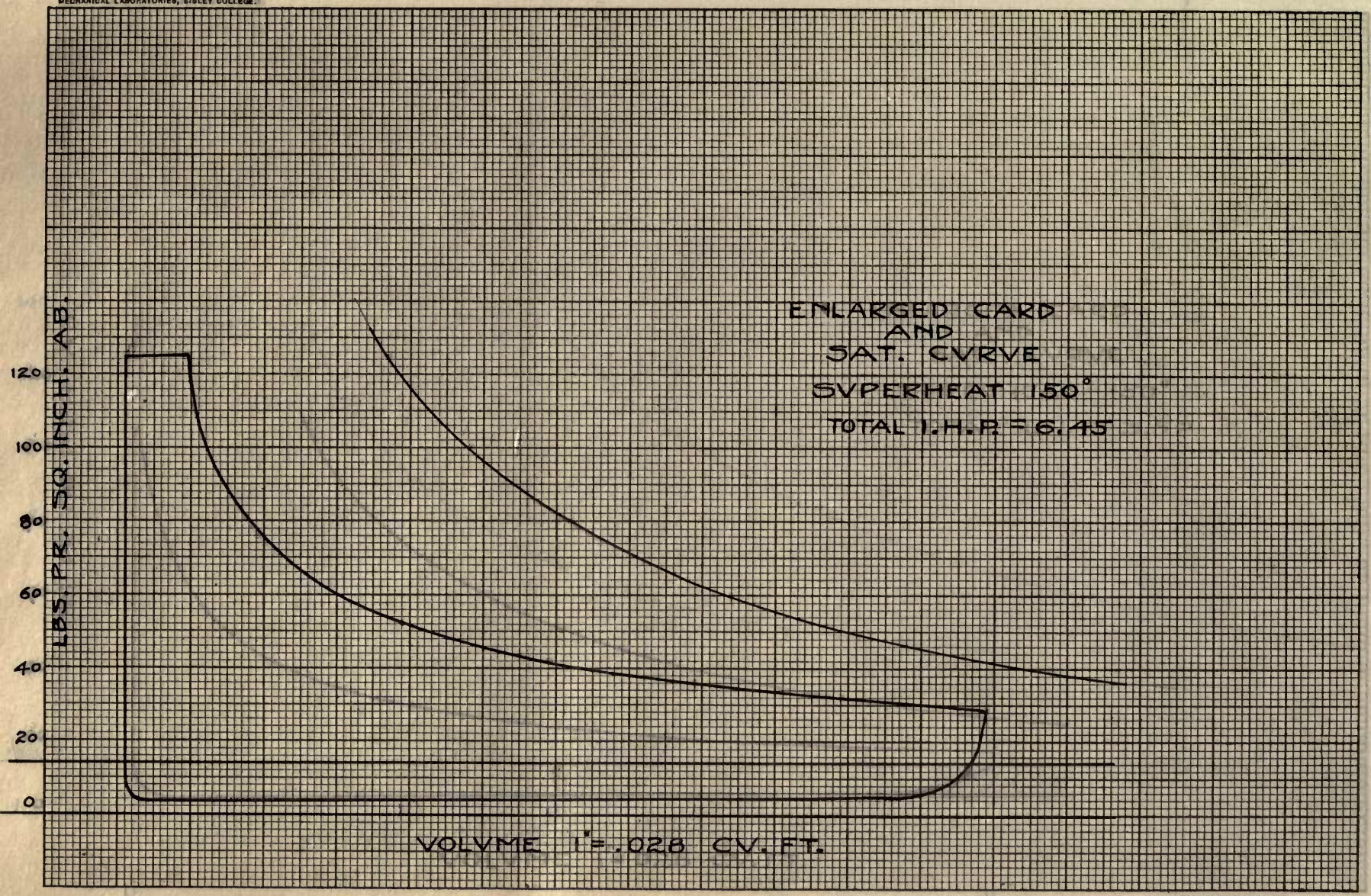
VOLTAGE IN DEGREES
PERCENT OF FULL LOAD AMPERES
0
25
4
8
10
50
DEAD SHORT CIRCUIT
AVERAGE TAP
EXCITATION AT 120°
PRESENT PRACTICE

MECHANICAL LABORATORIES, BIBLEY COLLEGE.



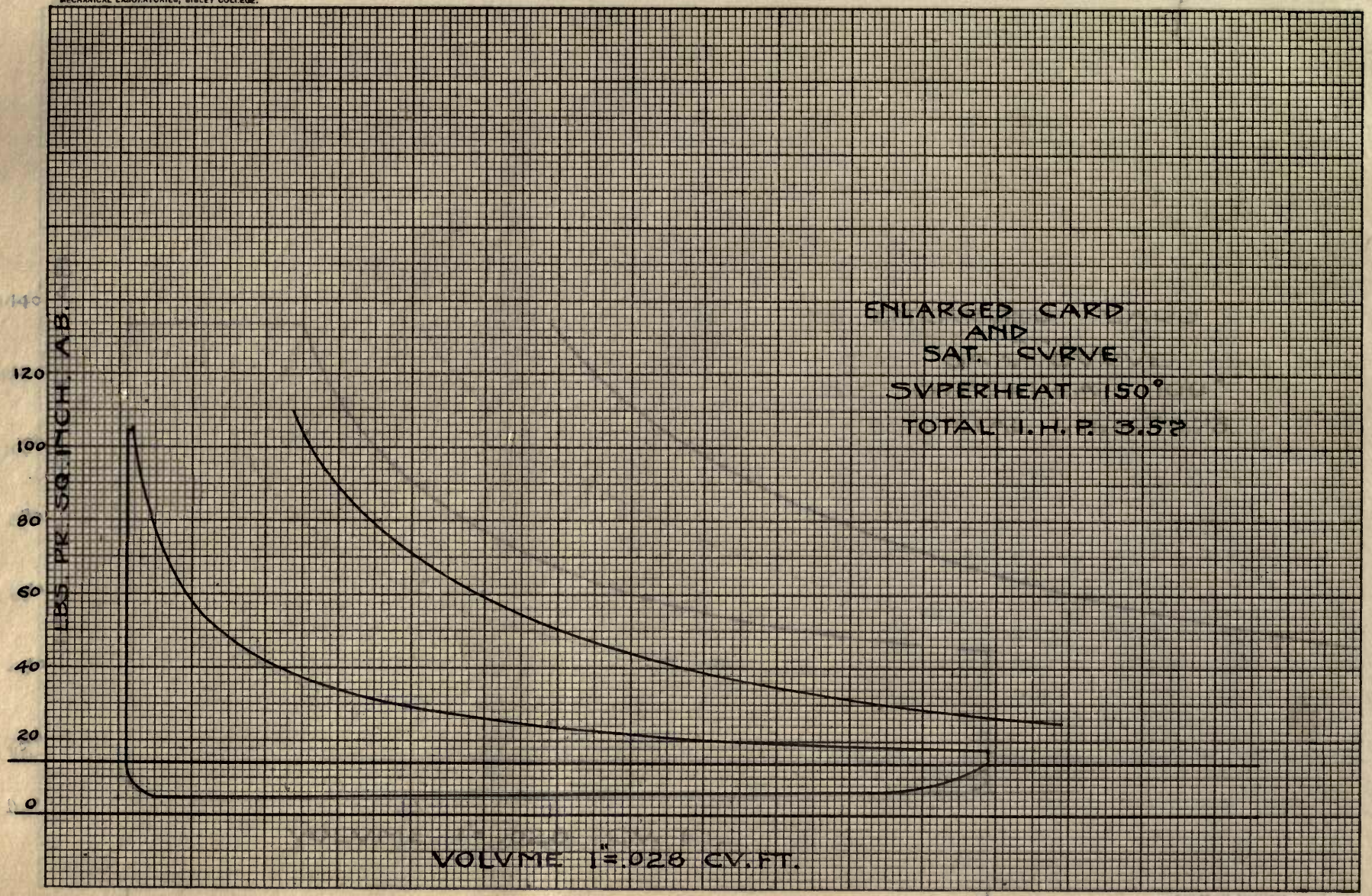
TAYLOR AND CARPENTER

ORAS DESALTE
ENERGY LEVEL
FOR THE HYDROGEN ATOM
ORBITAL
MOMENTUM QUANTUM NO.
ENERGY LEVEL


ENLARGED CARD
AND
SAT. CVRVE
SVPERHEAT 150°
TOTAL I.H.P. = 6.45
LBS. PR. SQ. INCH. AB.
120
100
80
60
40
20
0
VOLVME 1" = .028 CV. FT.

ΑΠΟΛΥΤΗΣ ΕΝΤΑΣΗ ΦΩΤΟΣ
ΕΝΕΡΓΕΙΑΚΟΣ ΧΑΡΑΚΤΗΡΙΣΤΙΚΟΣ ΦΩΤΟΣ
ΣΧΕΔΙΑΣΜΑ ΠΕΙΡΑΜΑΤΟΣ

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

ΔΟΡΥΦΟΡΙΑ ΙΣΟΣΤΑΣΙΟΥ ΕΛΑΤΗΡΙΟΥ

ΕΥΘΕΙΑ ΑΠΟΚΡΙΣΗΣ ΕΛΑΤΗΡΙΟΥ

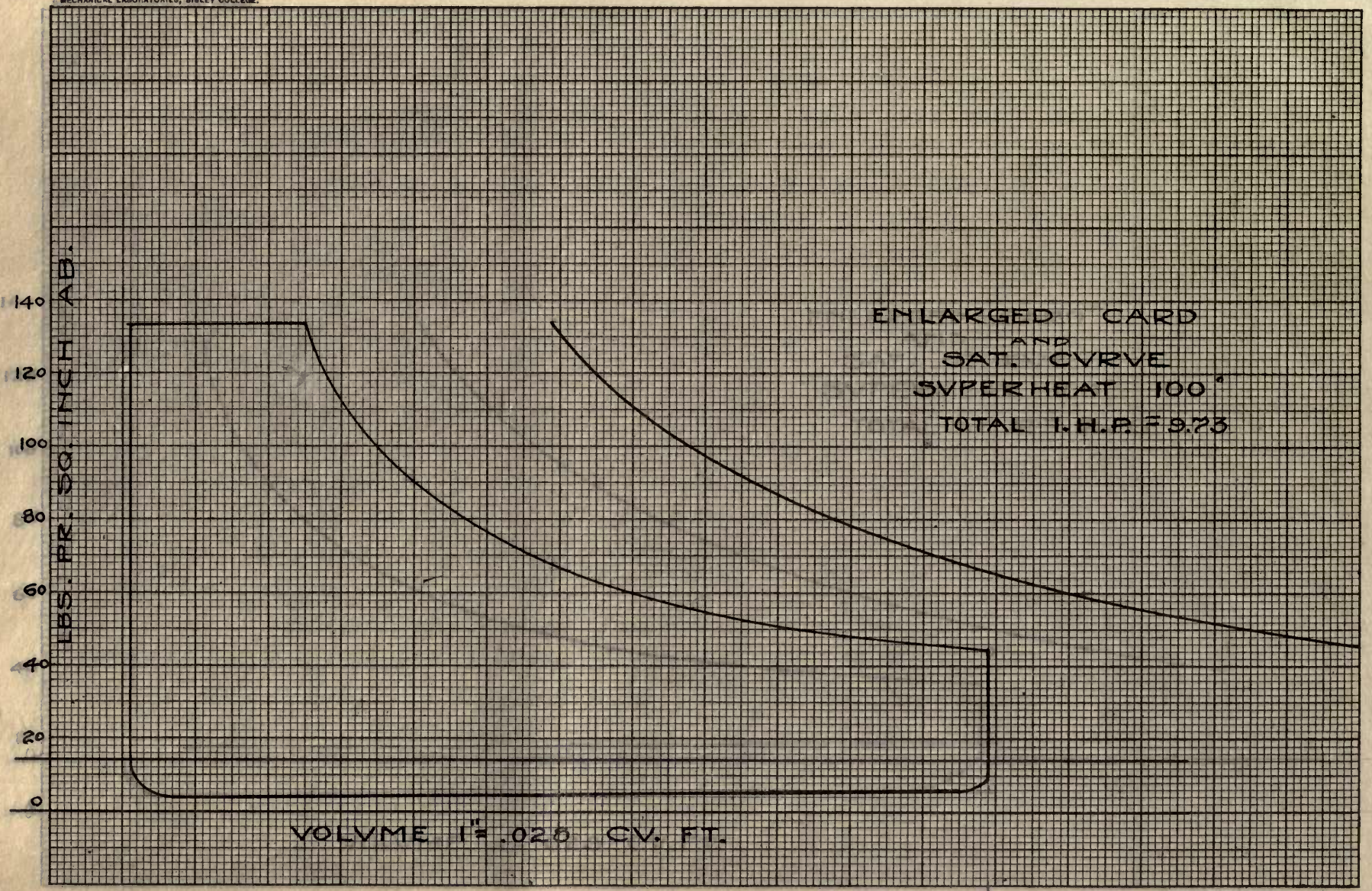
ΕΥΘΕΙΑ ΑΠΟΚΡΙΣΗΣ ΑΕΡΙΟΥ

ΜΕΣΟ ΒΑΡΟΣ ΕΛΑΤΗΡΙΟΥ (gr)

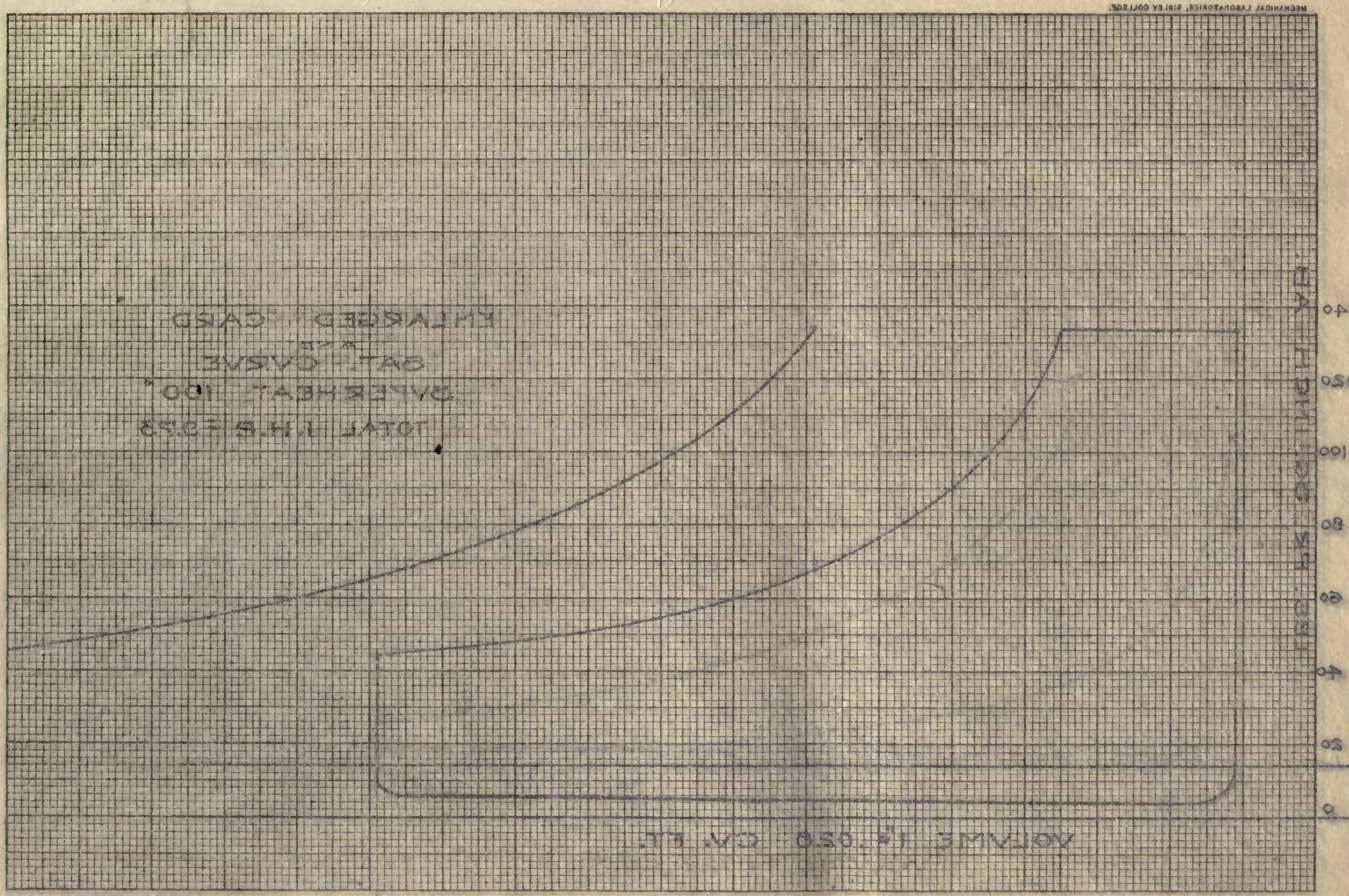
ΕΠΙΜΗΚΥΝΣΗ ΕΛΑΤΗΡΙΟΥ

0 0,5 1 1,5 2 2,5 3 3,5 4 4,5 5 5,5 6 6,5 7 7,5 8 8,5 9 9,5 10 10,5 11 11,5 12 12,5 13 13,5 14 14,5 15 15,5 16 16,5 17 17,5 18 18,5 19 19,5

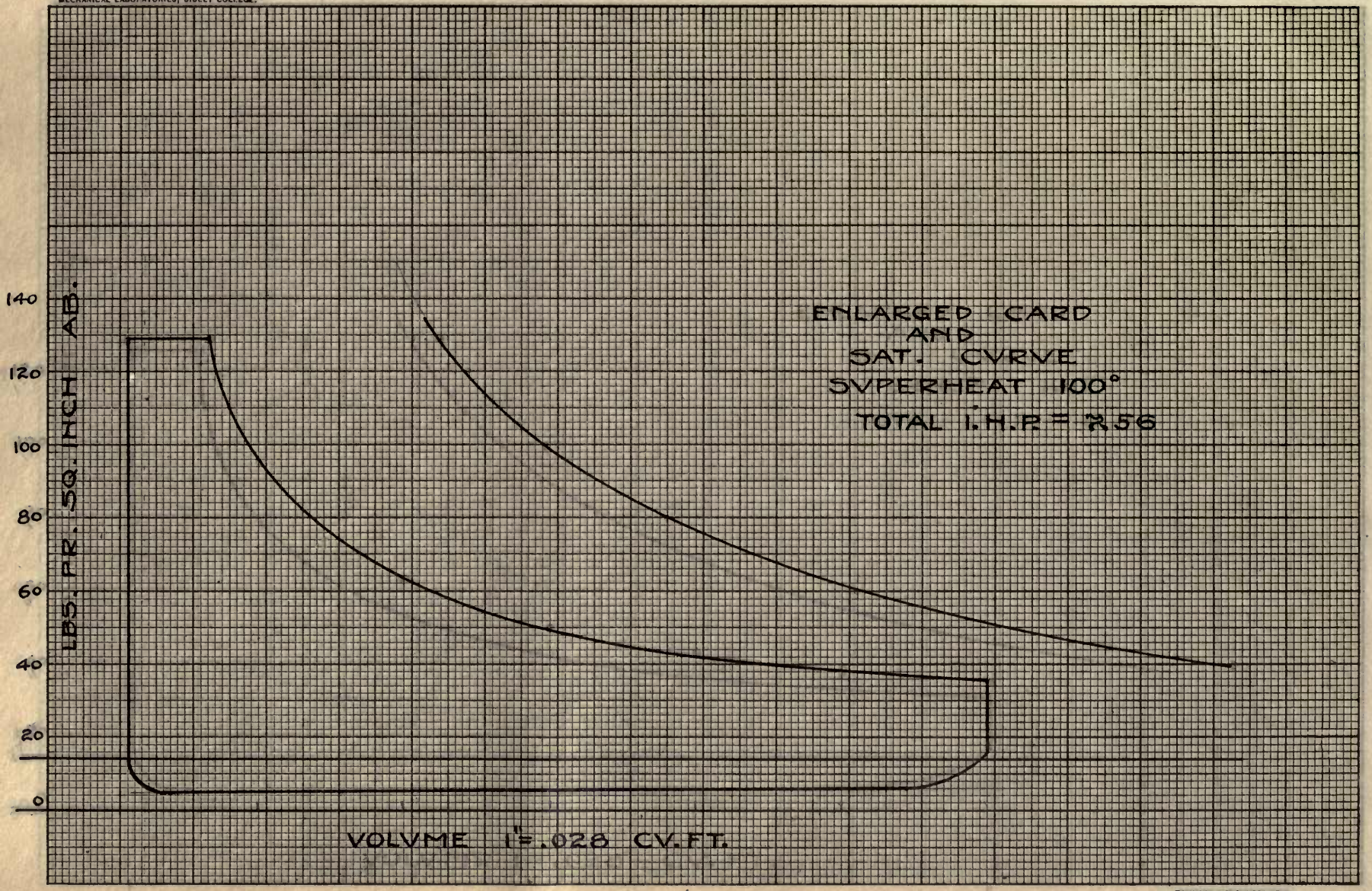
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



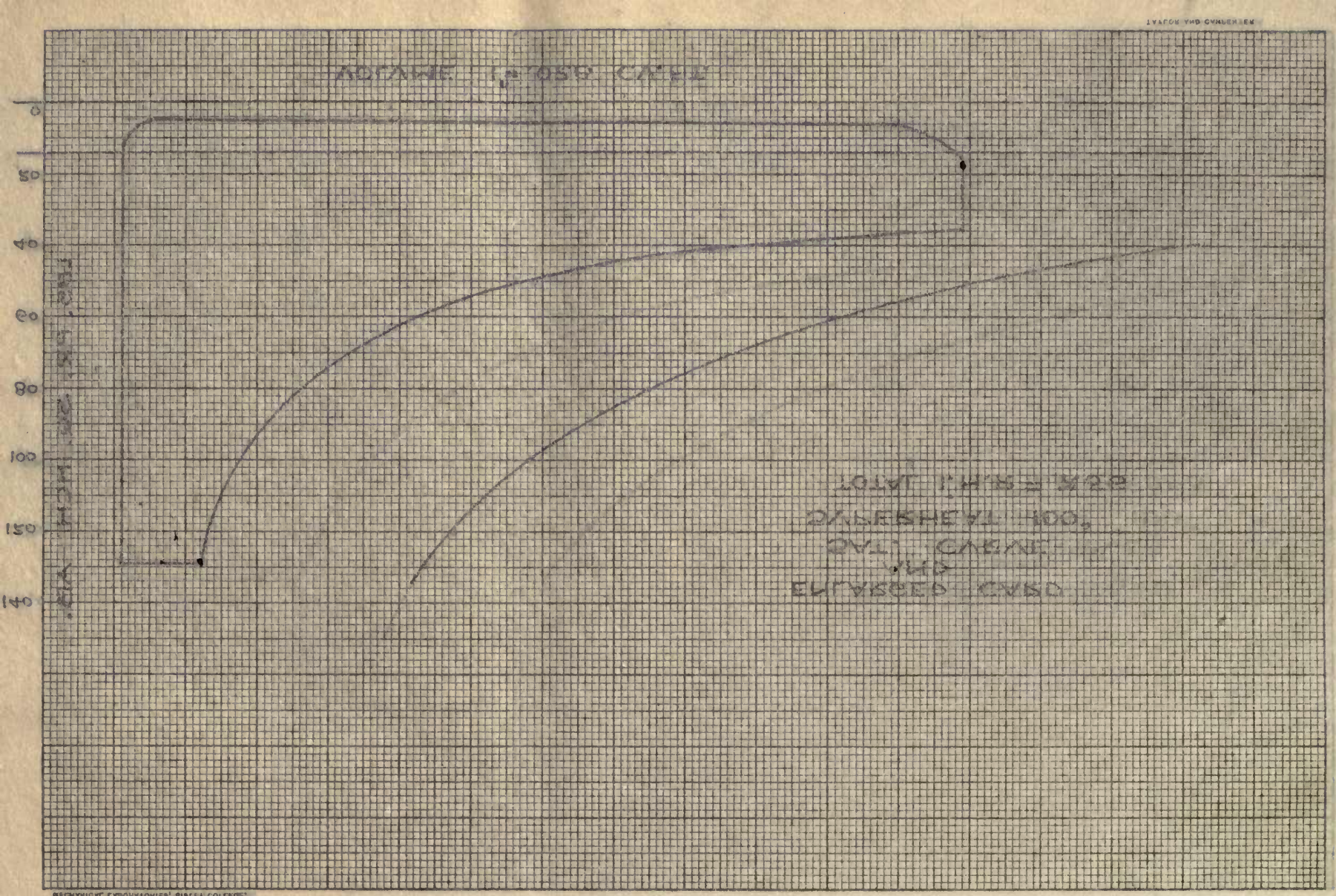
TAYLOR AND CARPENTER



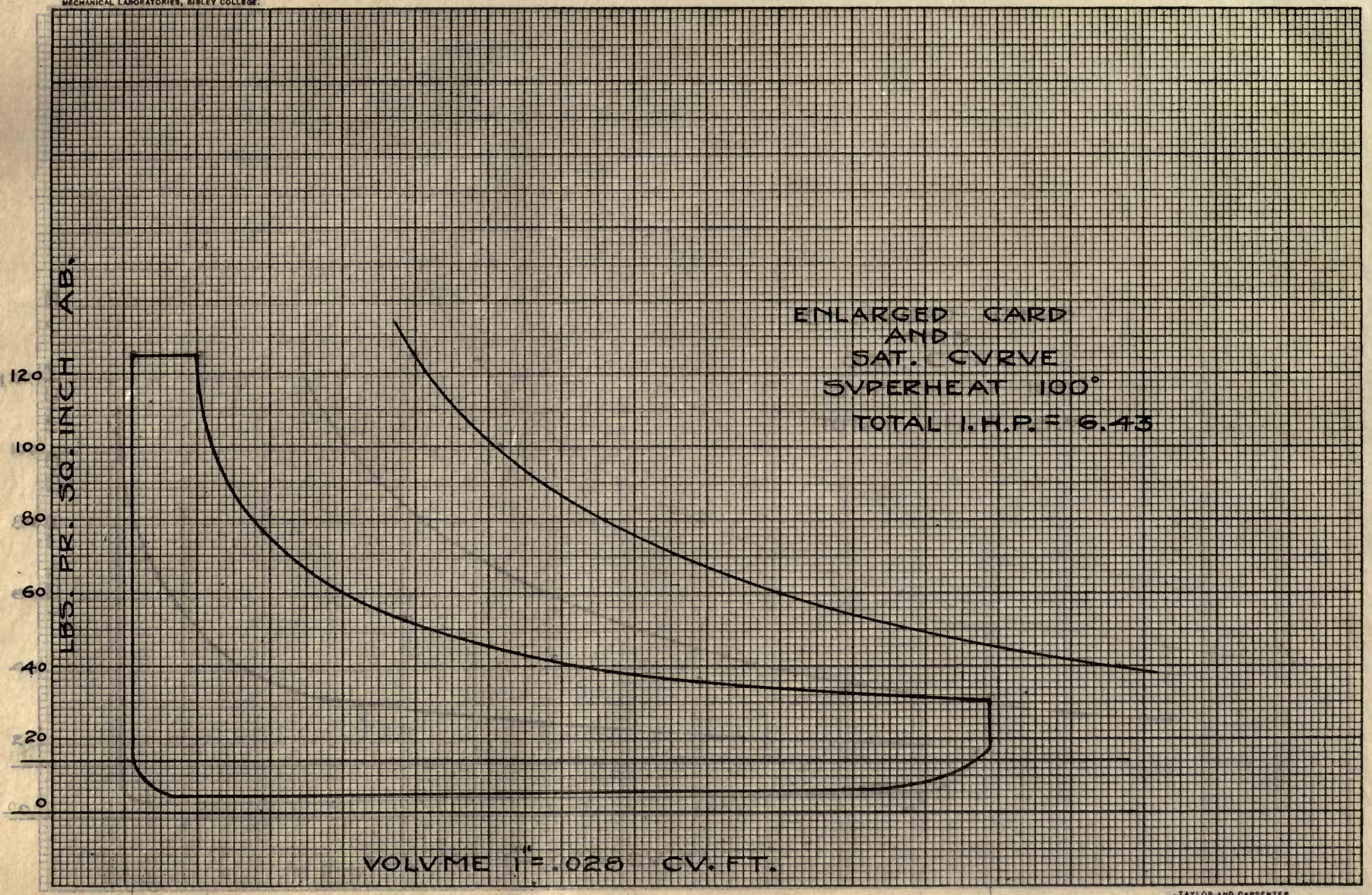
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



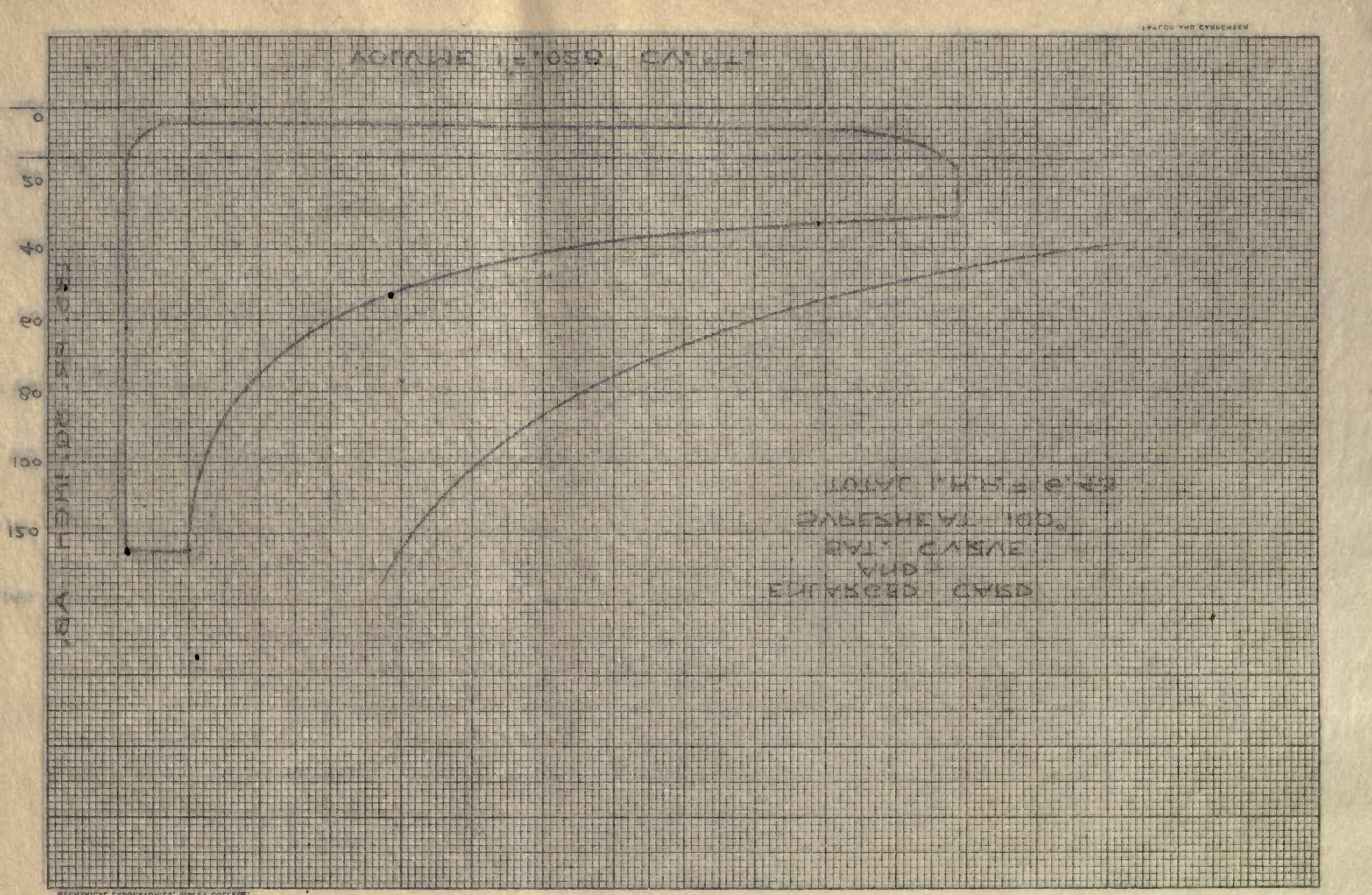
TAYLOR AND CARPENTER

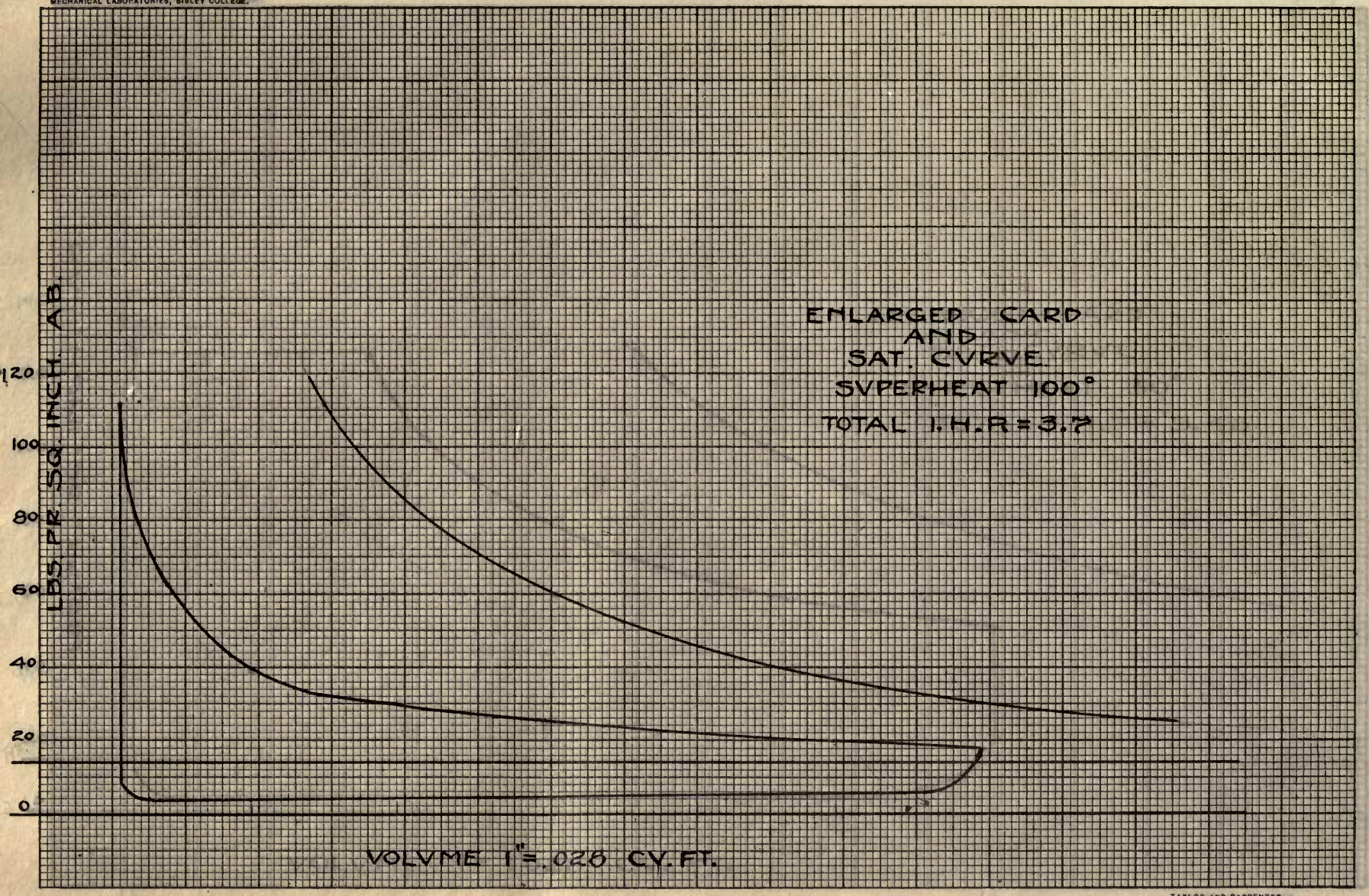

0
50
40
60
80
100
150
140

MECHANICAL LABORATORIES, BIBLEY COLLEGE.



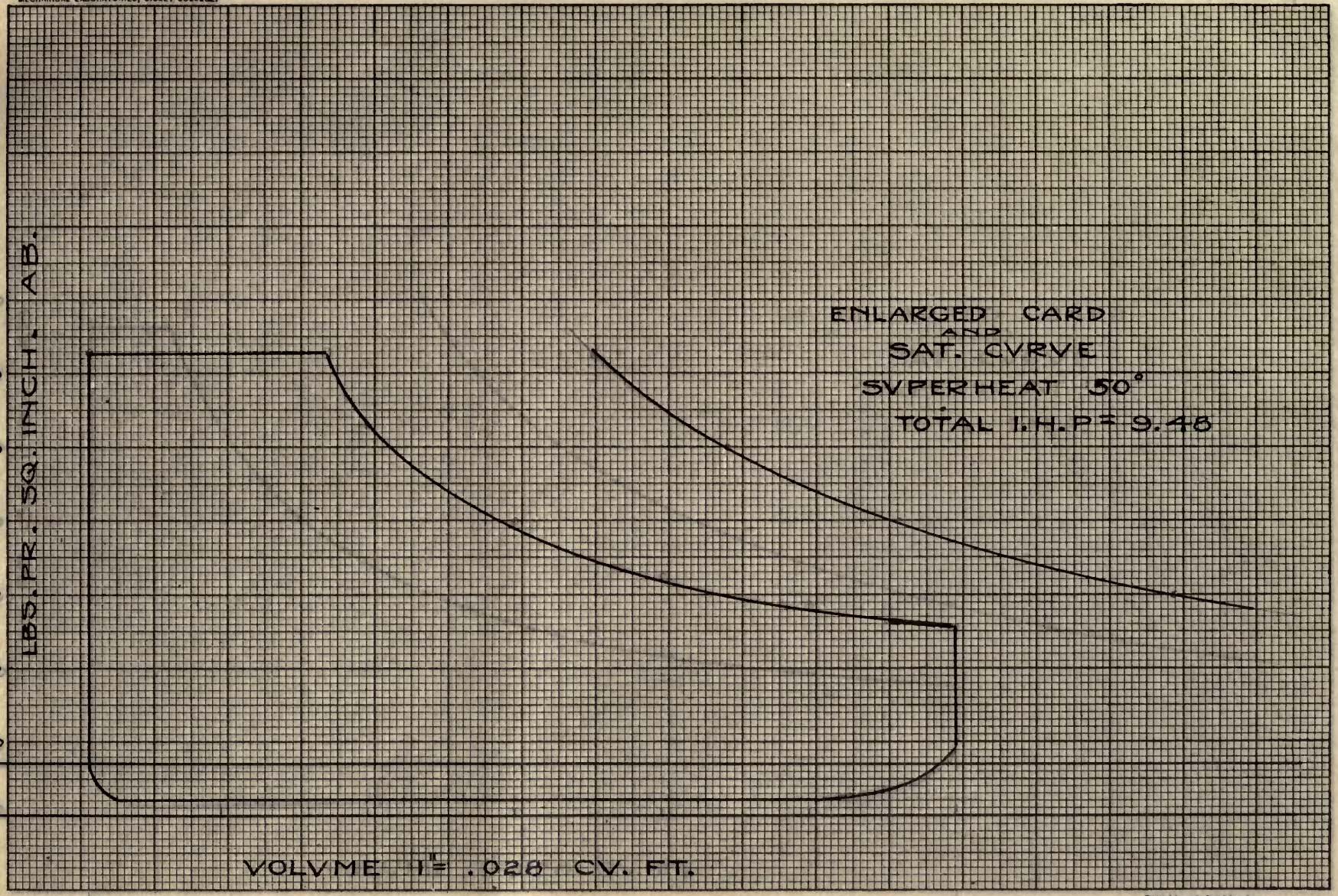
TAYLOR AND CARPENTER


0
50
40
60
80
100
150
TEMPERATURE, °F



AVOIDABLE LOSS (A.L.)
UNAVOIDABLE LOSS (U.L.)
CAVITATION
SATURATION
ENTRANCE CURVE
0
1
2
3
4
5
6

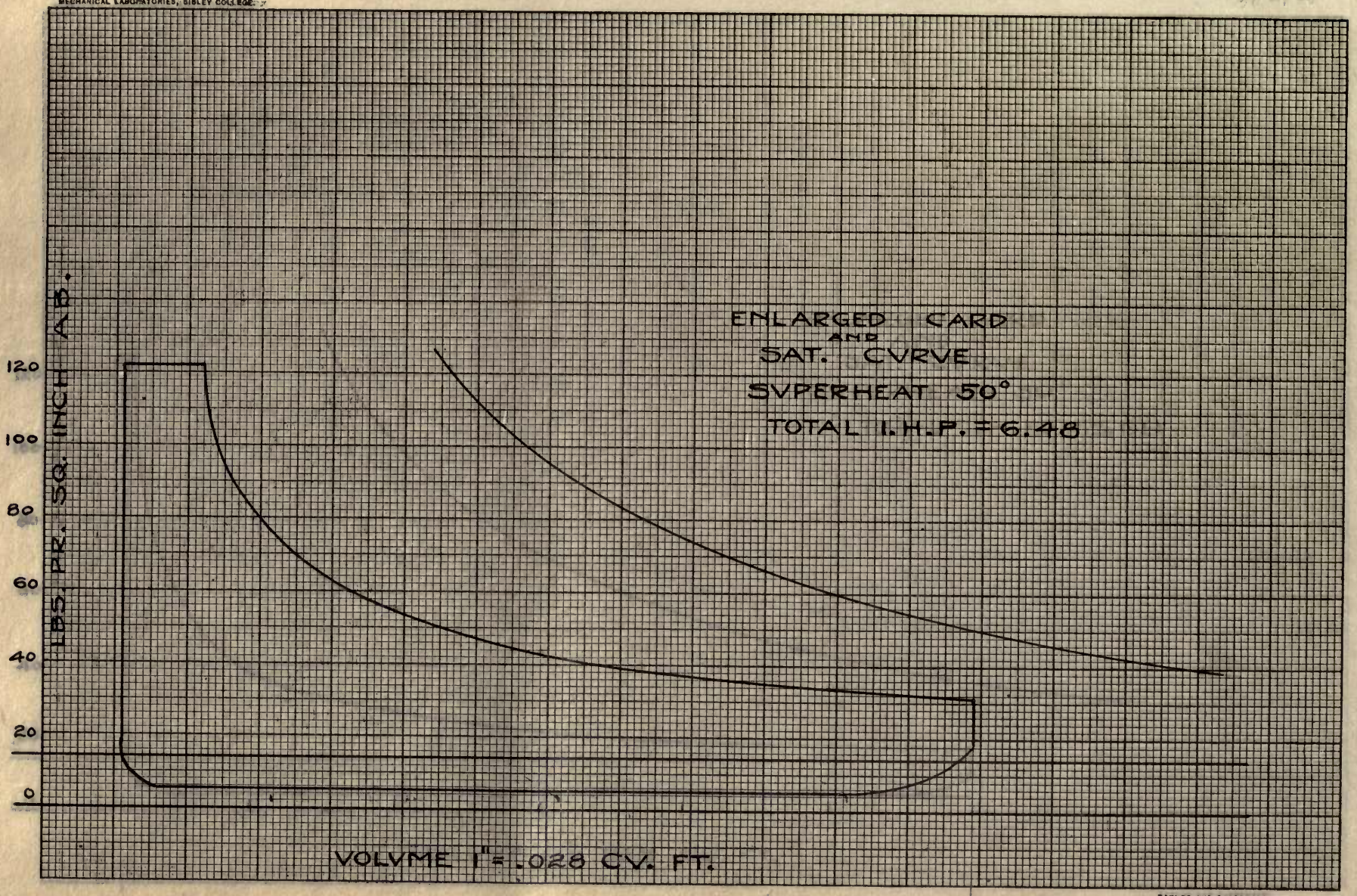
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



TAYLOR AND CARPENTER

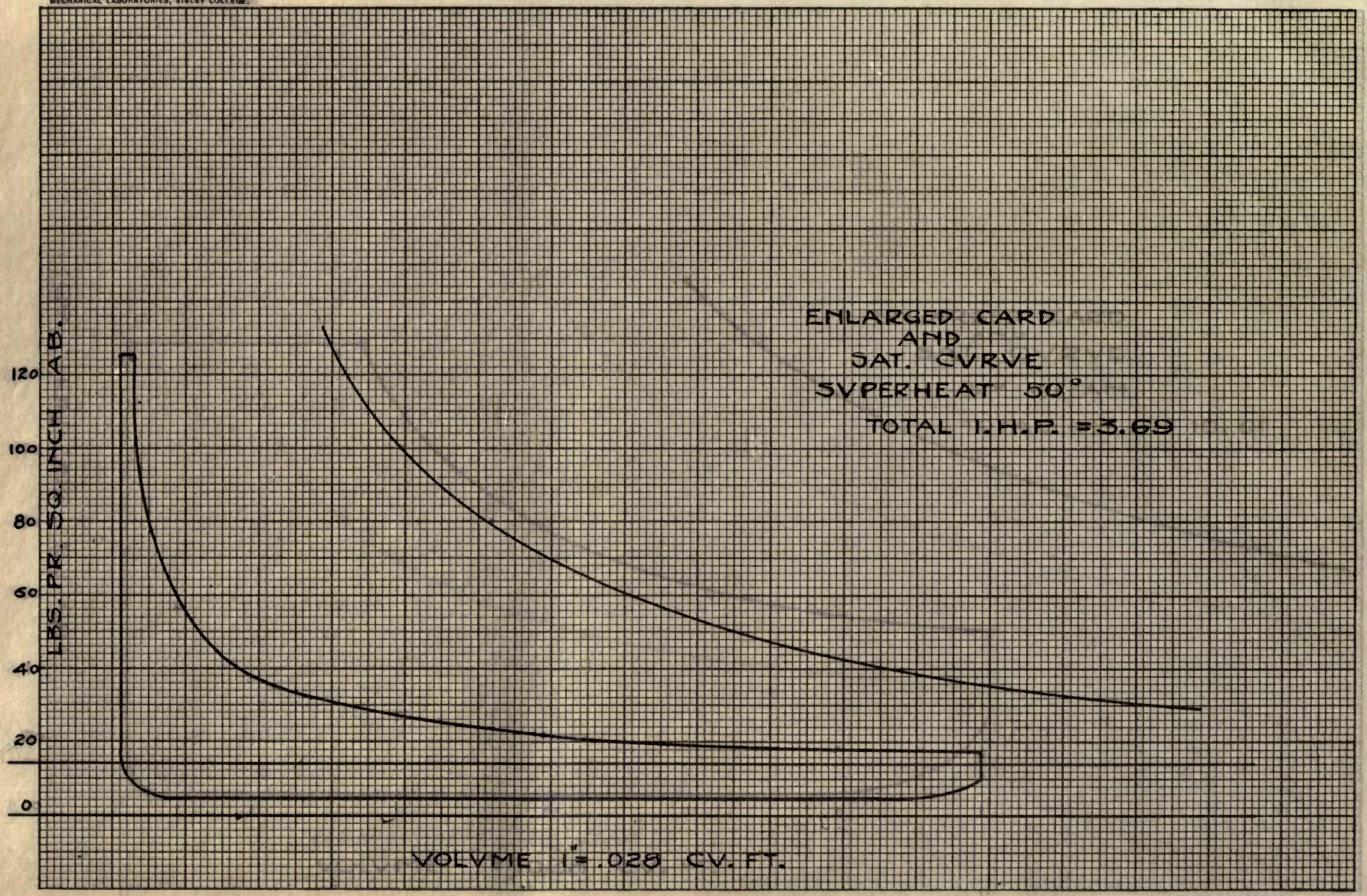
VOLTAGE LOSS ACROSS CAVITY
FREQUENCY DEVIATION IN KILOCYCLES
0
4
8
12
16
20
24
EXPERIMENTAL 20° BAKELITE CAVITY
THEORETICAL CURVE
ENDURANCE CARD

MECHANICAL LABORATORIES, BIBLEY COLLEGE



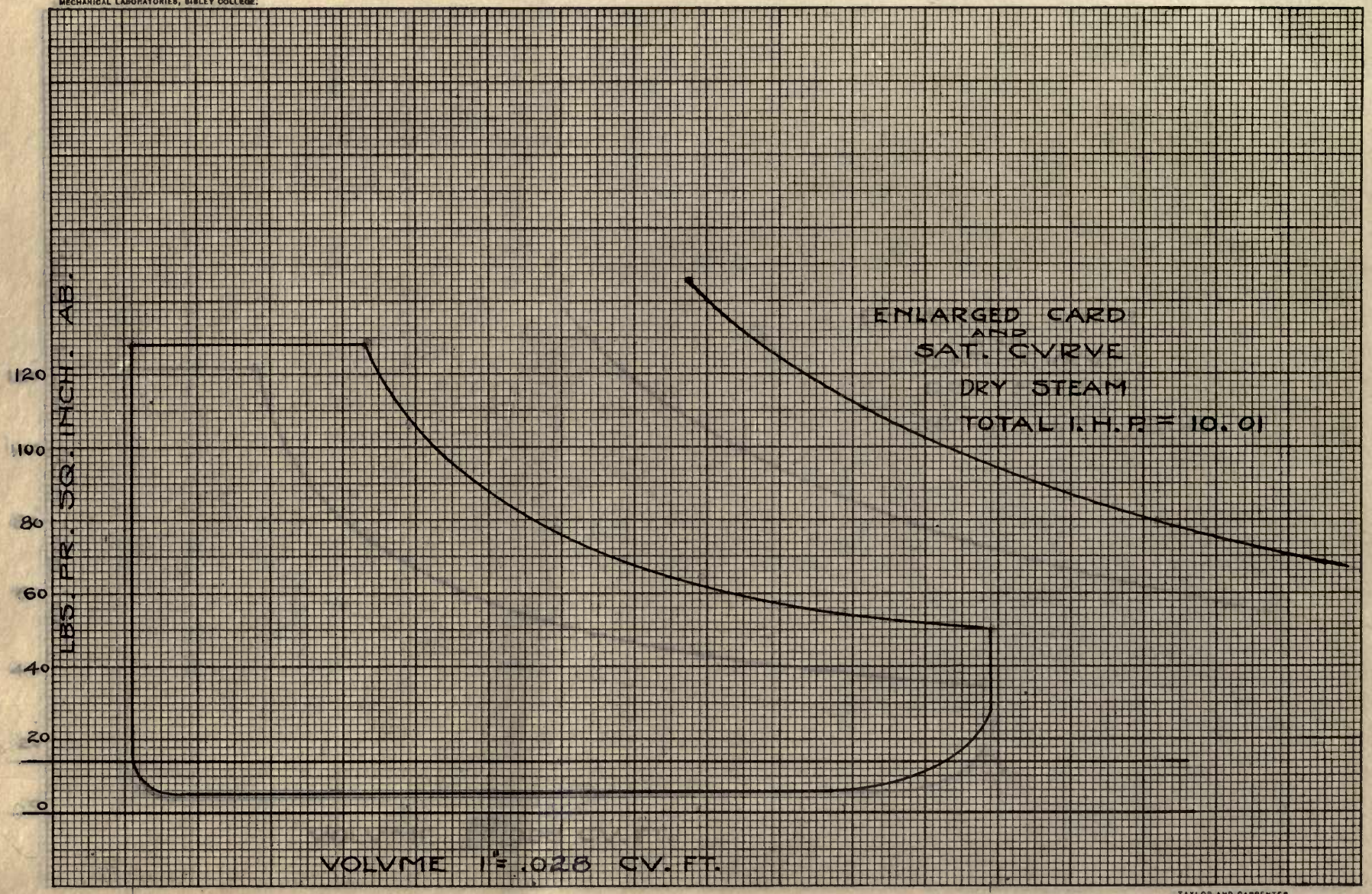
TAYLOR AND CARPENTER

AVERAGE HEAT-LOSS CAV. FILM
TOTAL FILM + PANEL
SAVES HEAT 20%
PAINTED CAVITY
CLEAVAGED CAVITY



0
50
40
30
20
100
150
ADSORBED CONC. (mg/g)
EQUILIBRIUM CONC. (mg/l)
EQUILIBRIUM DATA FOR ADSORPTION OF PHENOL BY ACTIVATED CARBON

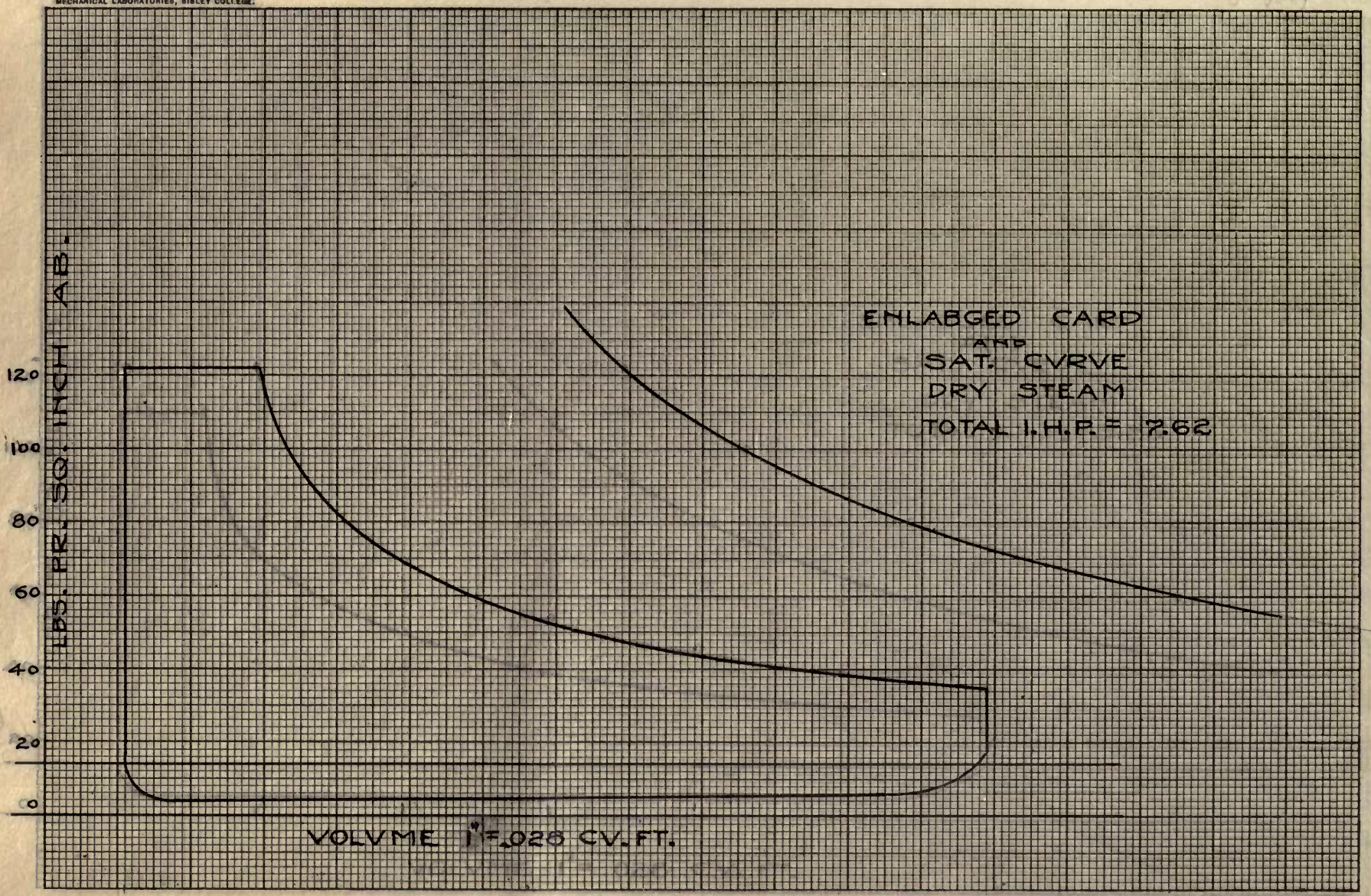
MECHANICAL LABORATORIES, BIBLEY COLLEGE.



TAYLOR AND CARPENTER

ROTAMETER LOAD CALIBRATION
TOTAL PRESSURE
REY DIESEL
EQUIVALENT
ENHANCED CURVE

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

ENLARGED CURVE

EVAPORATE
DRY SEASON

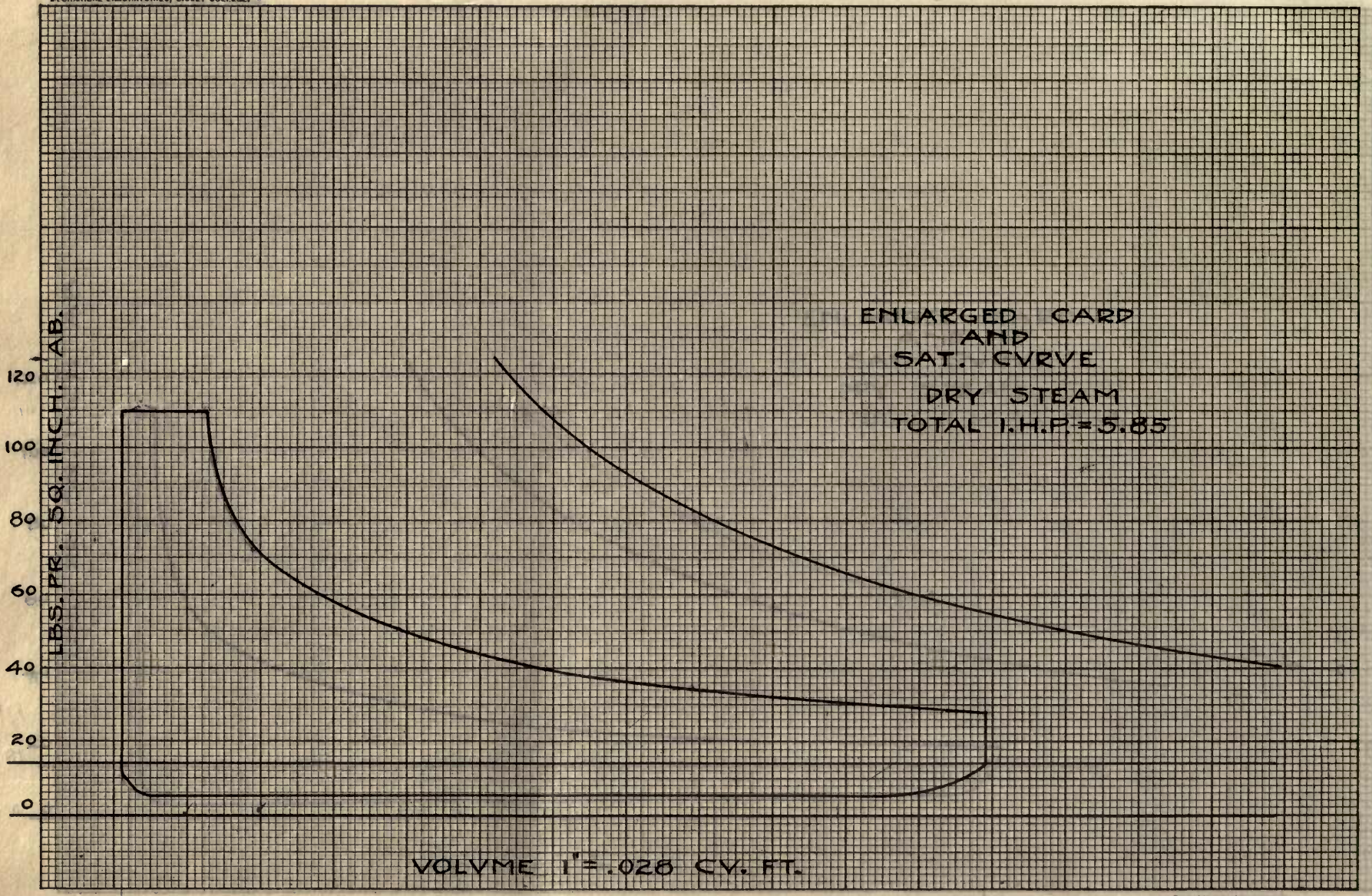
JOINT H.H. factor

Spring H.H. = 1.5

VOLUME 1 = 250 CM³.

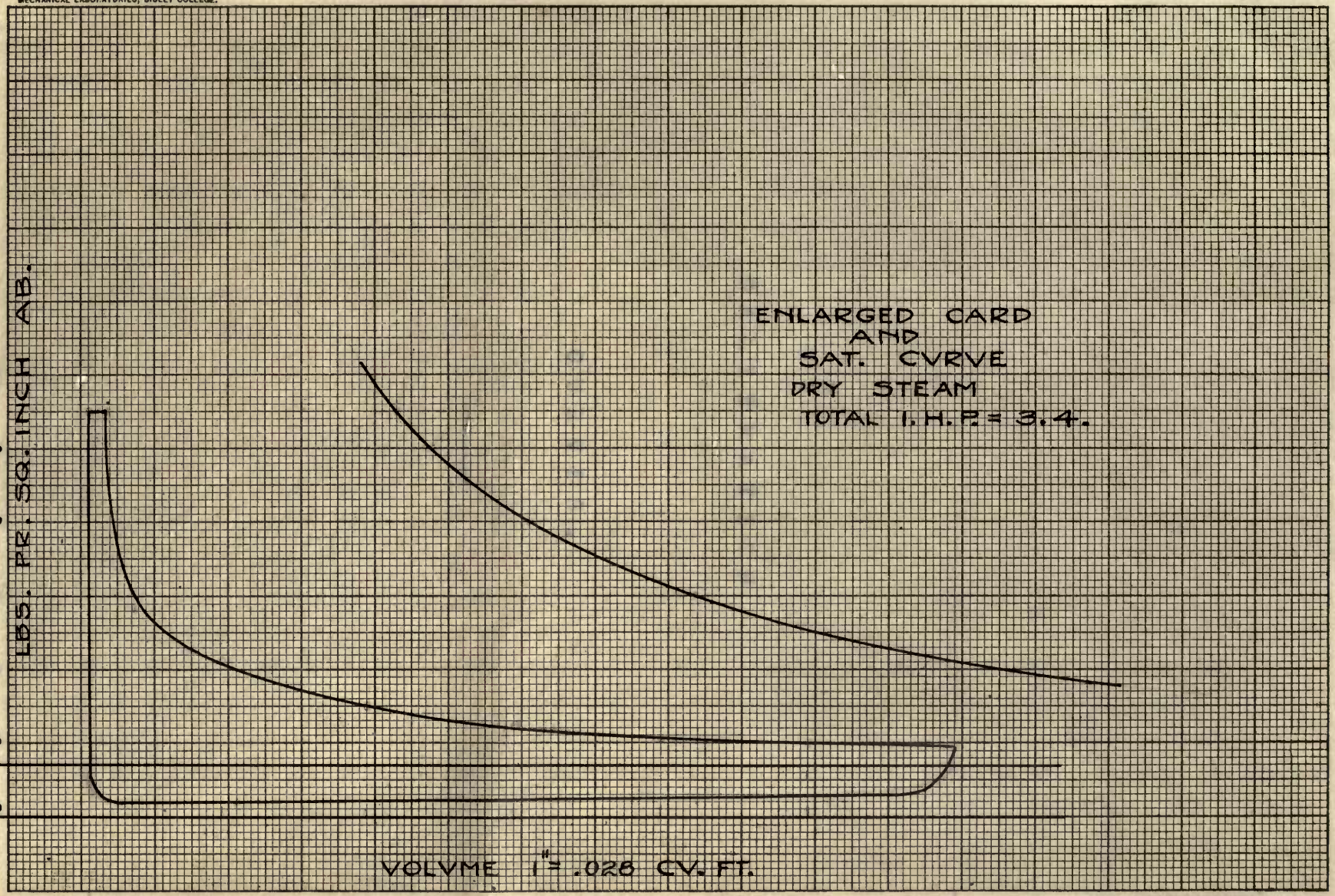
0 5 10 15 20 25 30 35 40 45 50

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



TAYLOR AND CARPENTER

ПРОЦЕНТ ПО ЦЕННЫМ БУМ.
0
20
40
60
80
100
120
ДОХОДНОСТЬ ОБЛИГАЦИЙ ГОСЗАЙМА 1957 ГОДА
ДОХОДНОСТЬ ОБЛИГАЦИЙ ГОСЗАЙМА 1947 ГОДА
ДОХОДНОСТЬ ОБЛИГАЦИЙ ГОСЗАЙМА 1948 ГОДА



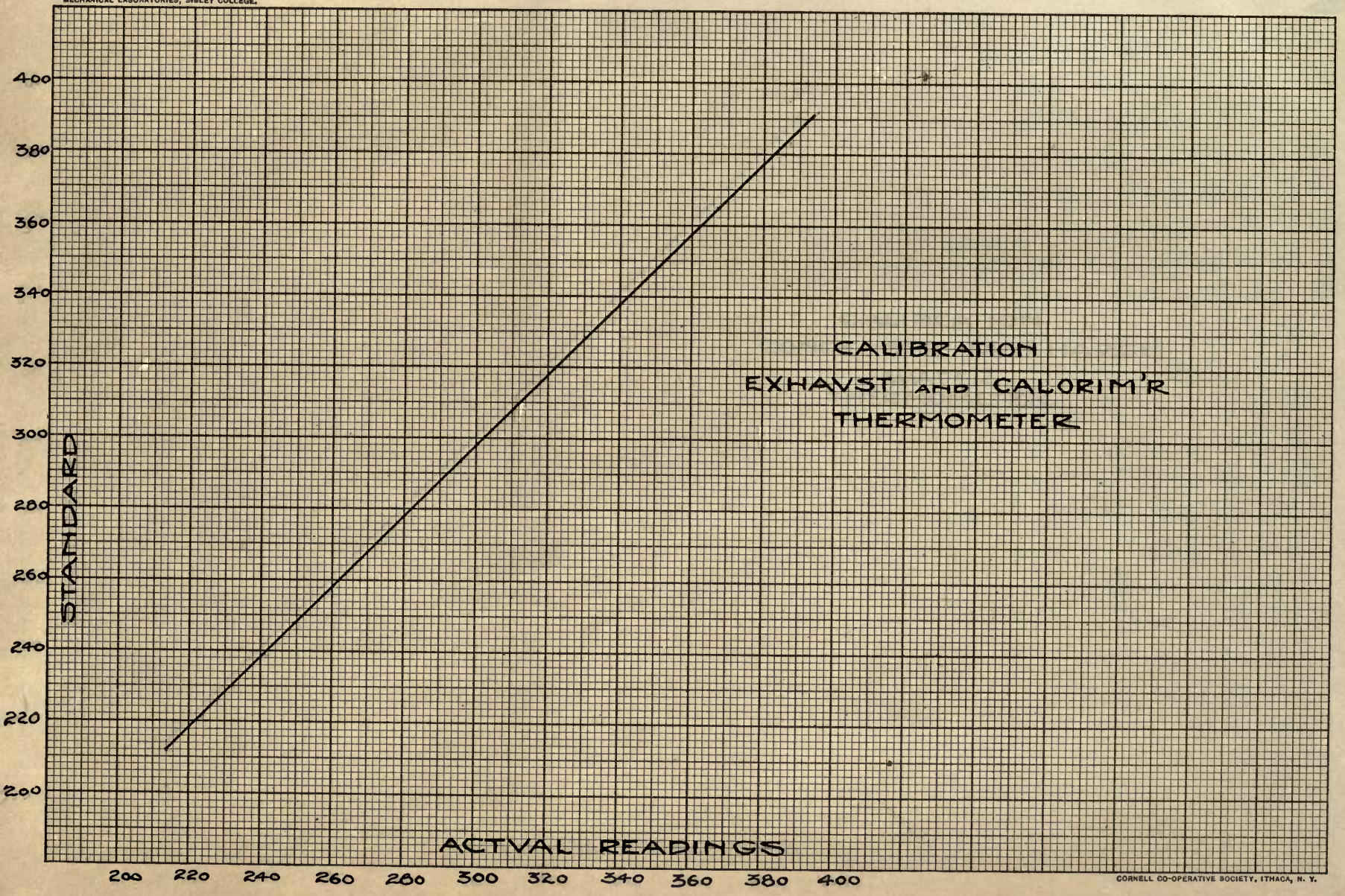
TAYLOR AND CARPENTER

ENDURANCE
DAY 4TH
MARTE 1924
TEMPERATURA
ATMOSFERICA

CALIBRATION

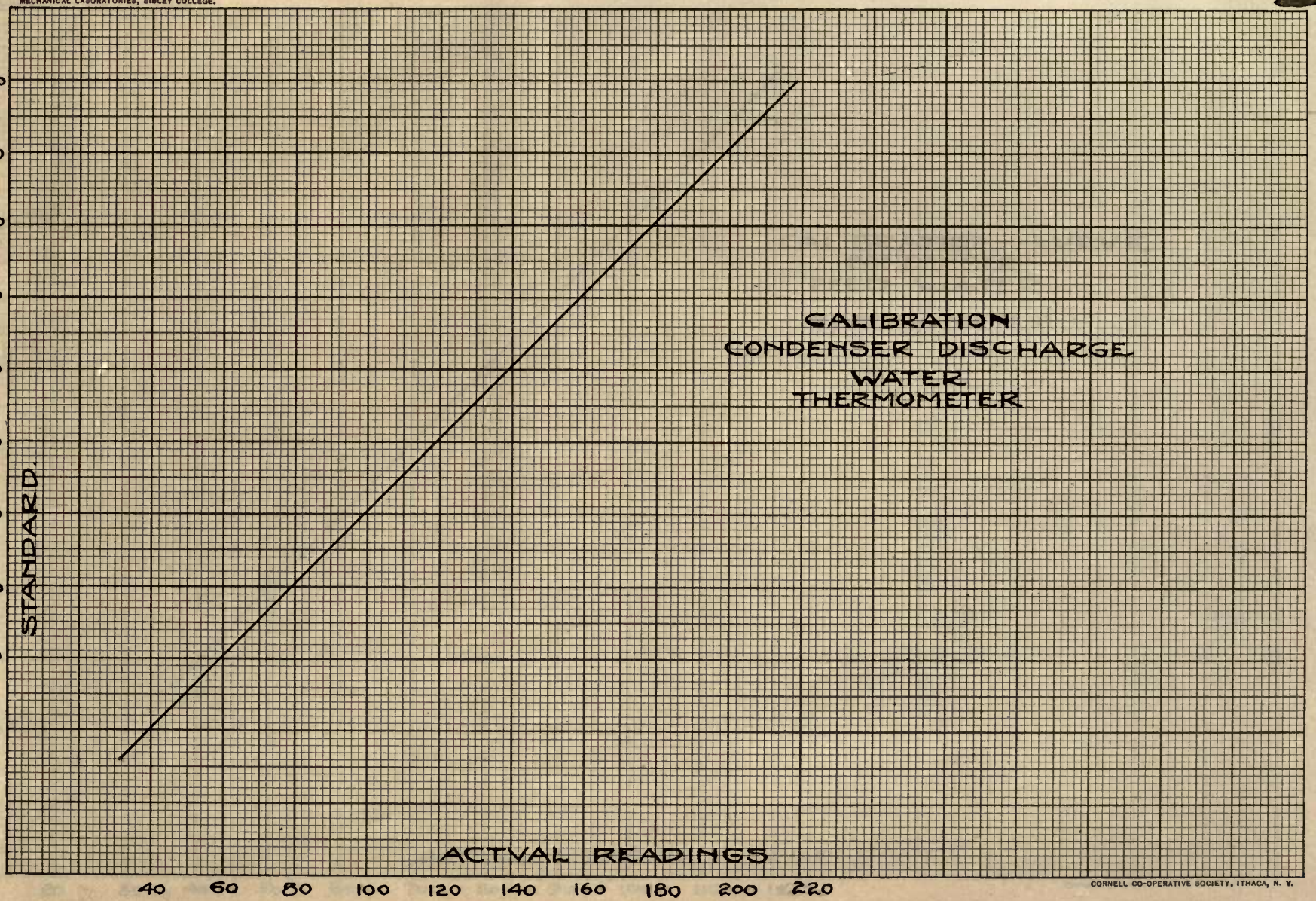
CURVES.

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



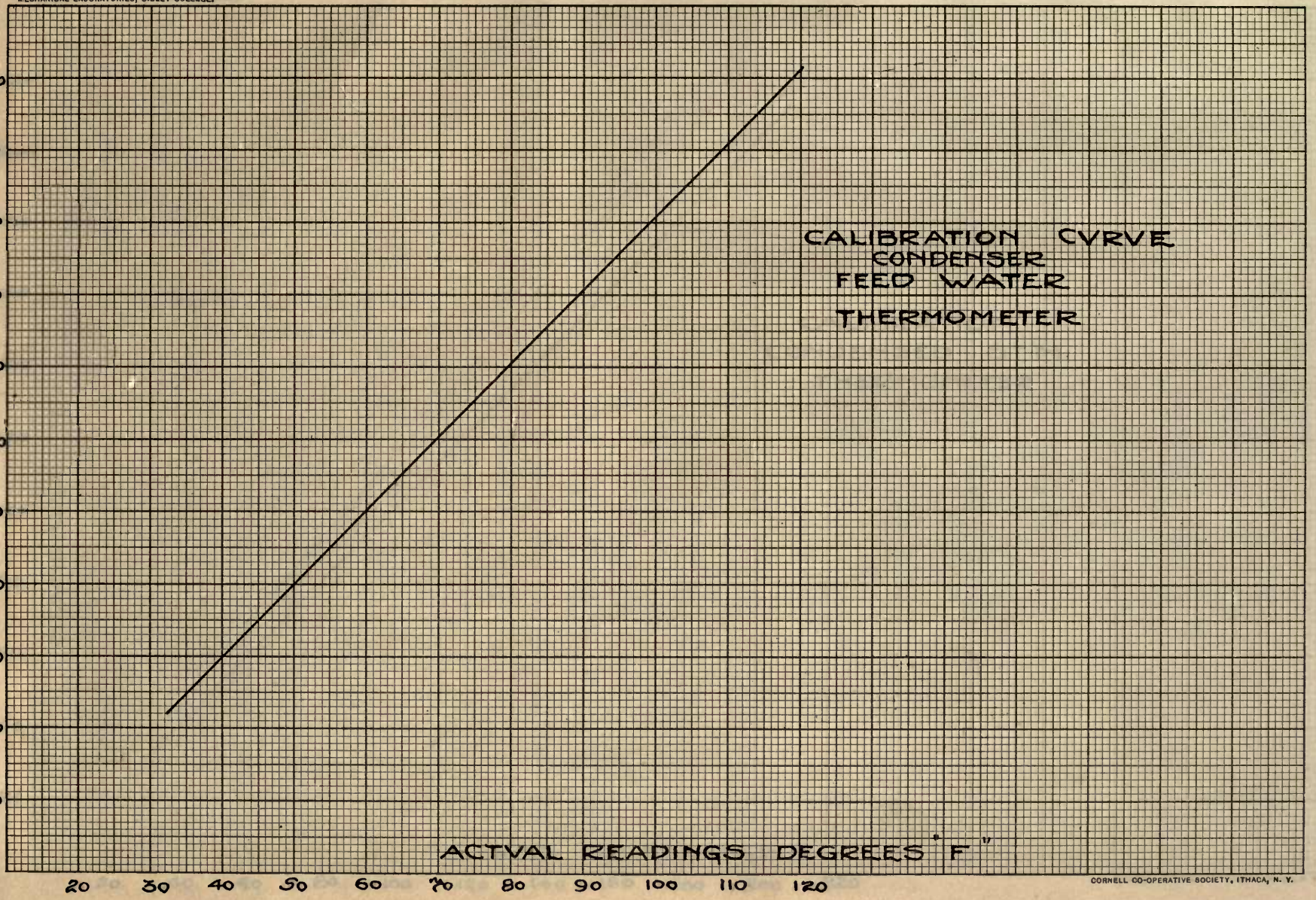
ΕΚΛΑΥΣΗ ΣΤΟ ΓΑΛΒΑΝΟΜΕΤΡΟ
ΜΕΤΑΒΑΛΛΟΜΕΝΗ ΑΝΤΙΣΤΑΣΗ
ΓΑΛΒΑΝΟΜΕΤΡΟ
ΜΕΤΑΒΑΛΛΟΜΕΝΗ ΑΝΤΙΣΤΑΣΗ

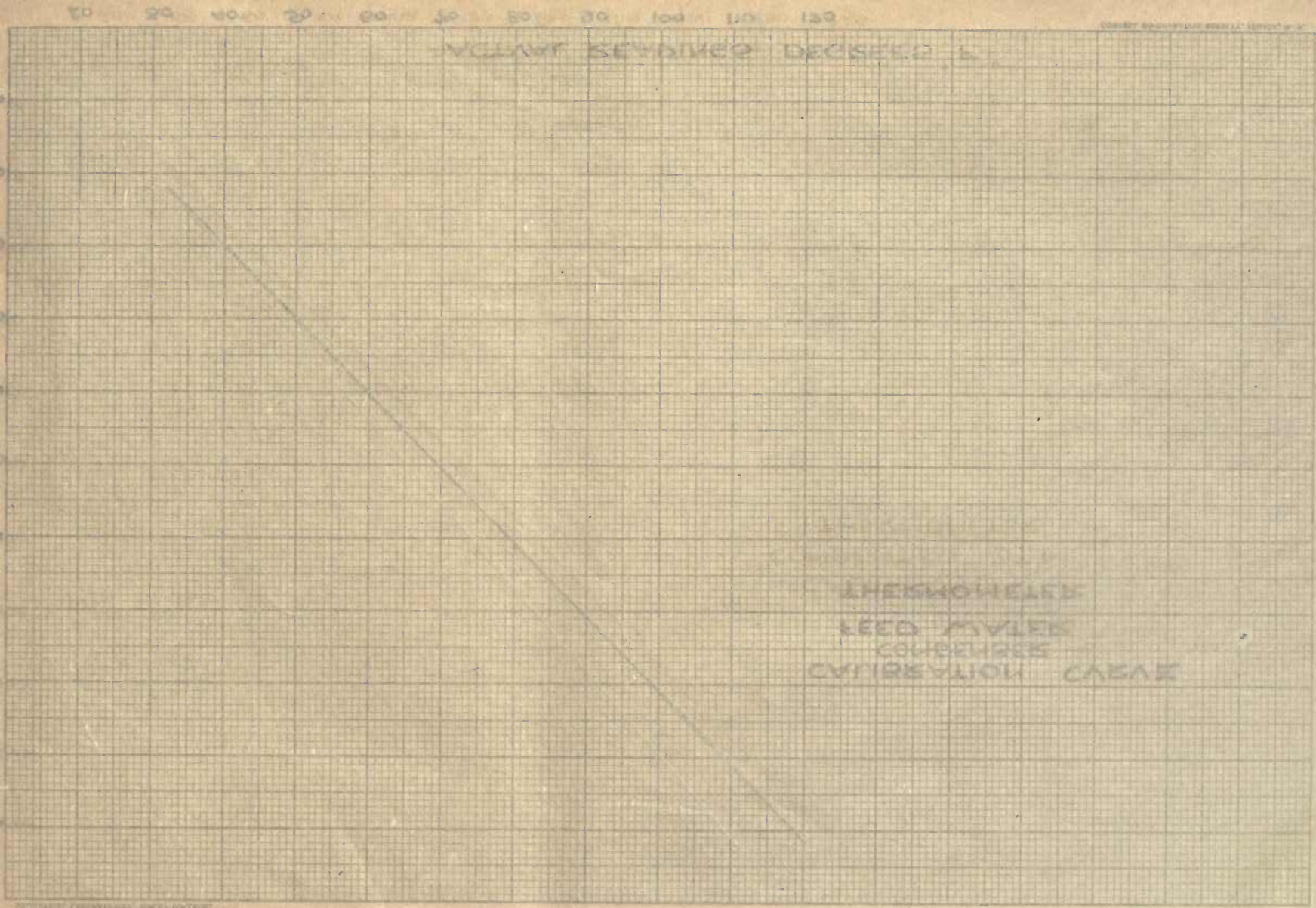
MECHANICAL LABORATORIES, SIBLEY COLLEGE.



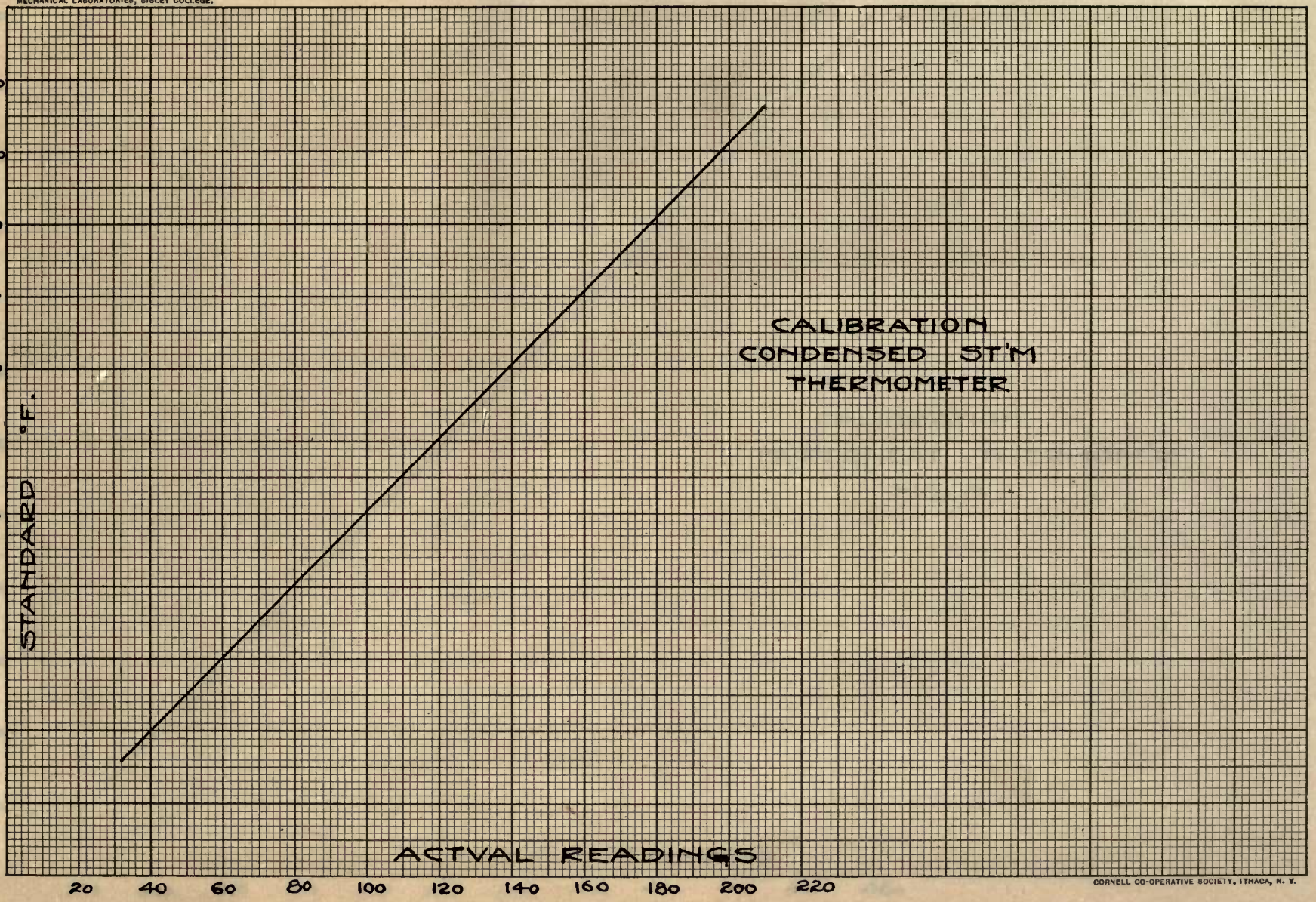
ACTUAL PRESSURE
CONDENSER DISCHARGE
EXTRAPOLATION
LABORATORY
MEASURED

MECHANICAL LABORATORIES, SIBLEY COLLEGE.



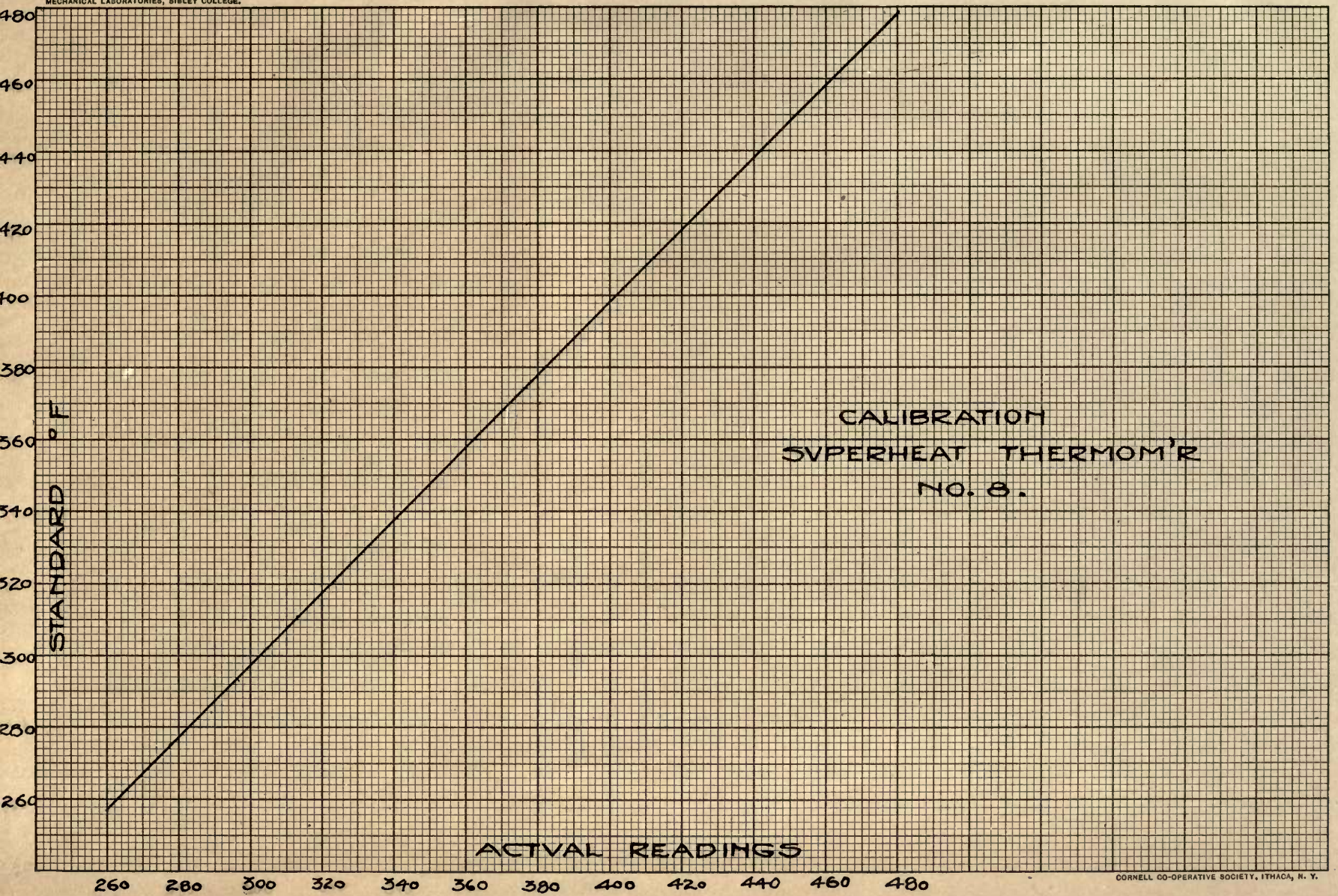


MECHANICAL LABORATORIES, SIBLEY COLLEGE.



ΔΙΑΓΡΑΜΜΑ
ΔΙΑΚΡΙΤΗΣ ΚΑΛΩΔΙΟΥ
ΜΕΤΡΗΣΕΩΝ
ΣΥΓΚΕΝΤΡΩΤΗ
(ΔΙΟΡΘΩΜΕΝΗ)

MECHANICAL LABORATORIES, BIBLEY COLLEGE.



CALIBRATION
POTENTIAL DIFFERENCE
MEASURED