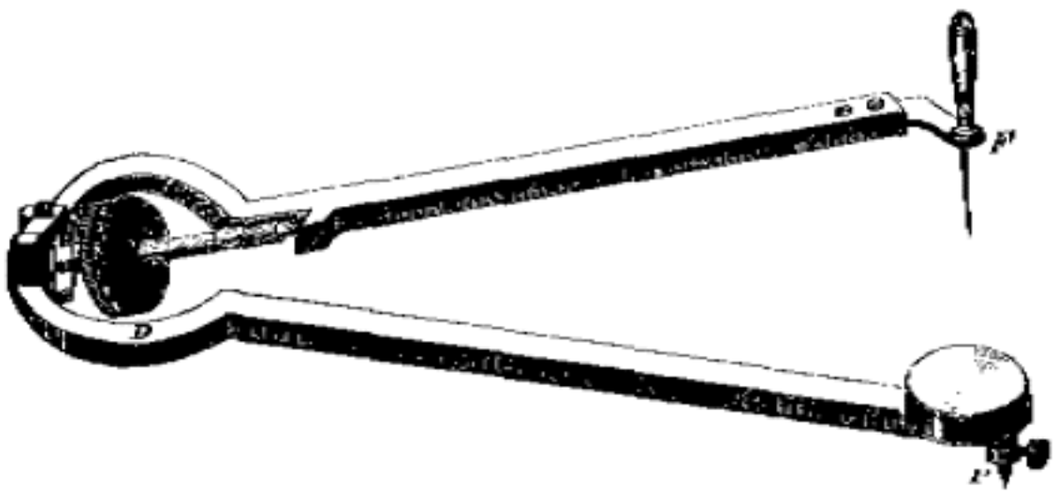
AMSLER'S POLAR PLANIMETER.

The Planimeter is used to measure the area of any plane surface, whatever the outline may be. Persons even who do not understand mathematics are easily able to use it and arrive at the results much more quickly than a skilful mathematician employing the ordinary calculations. The accuracy of the instrument surpasses all practical requirements.

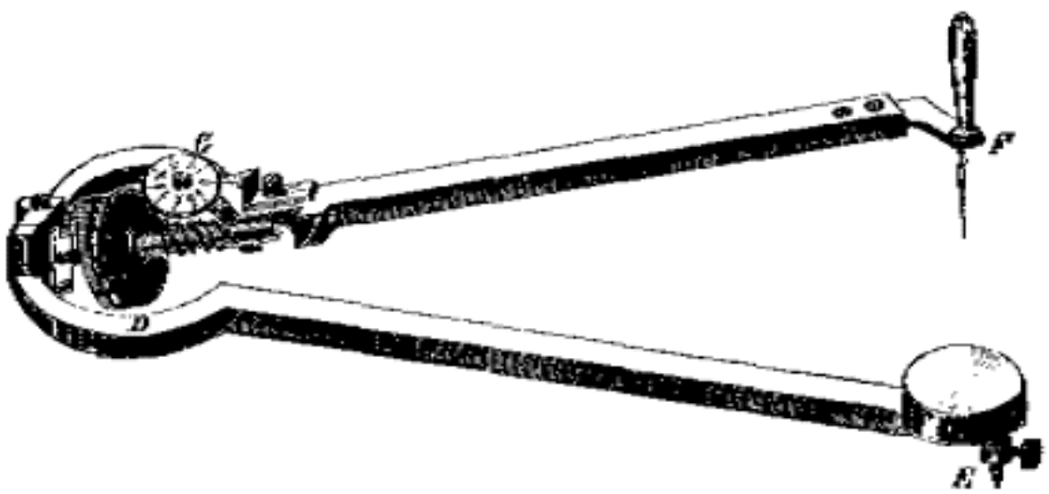
We furnish three different styles of this instrument.

No. 1.



No. 1 represents the Planimeter as designed to measure the area in square inches and decimals of a square inch, in its simplest form—it having but one wheel; the figures on this wheel represent units, the intermediate graduations, tenths, and the vernier gives the hundredths. Limit of measurement, 10 square inches.

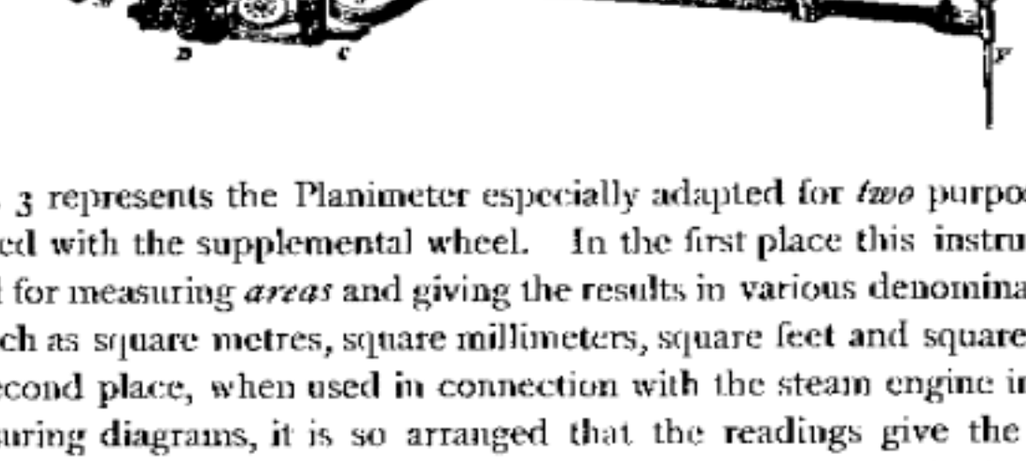
No. 2.



No. 2 represents the same instrument with the addition of the horizontal wheel, the figures on which mark the tens. This instrument is superior to

those having only one wheel, inasmuch as with one wheel it is necessary in measuring areas of more than ten inches to add ten units to the result, and also, in starting with an old reading, the limit of measurement is so small (10) that quite often the second reading is less than the first; then ten has to be added to the second. The area is given in square inches and decimals, reading the same as in No. 1. Limit of measurement, 100 square inches.

No. 3.



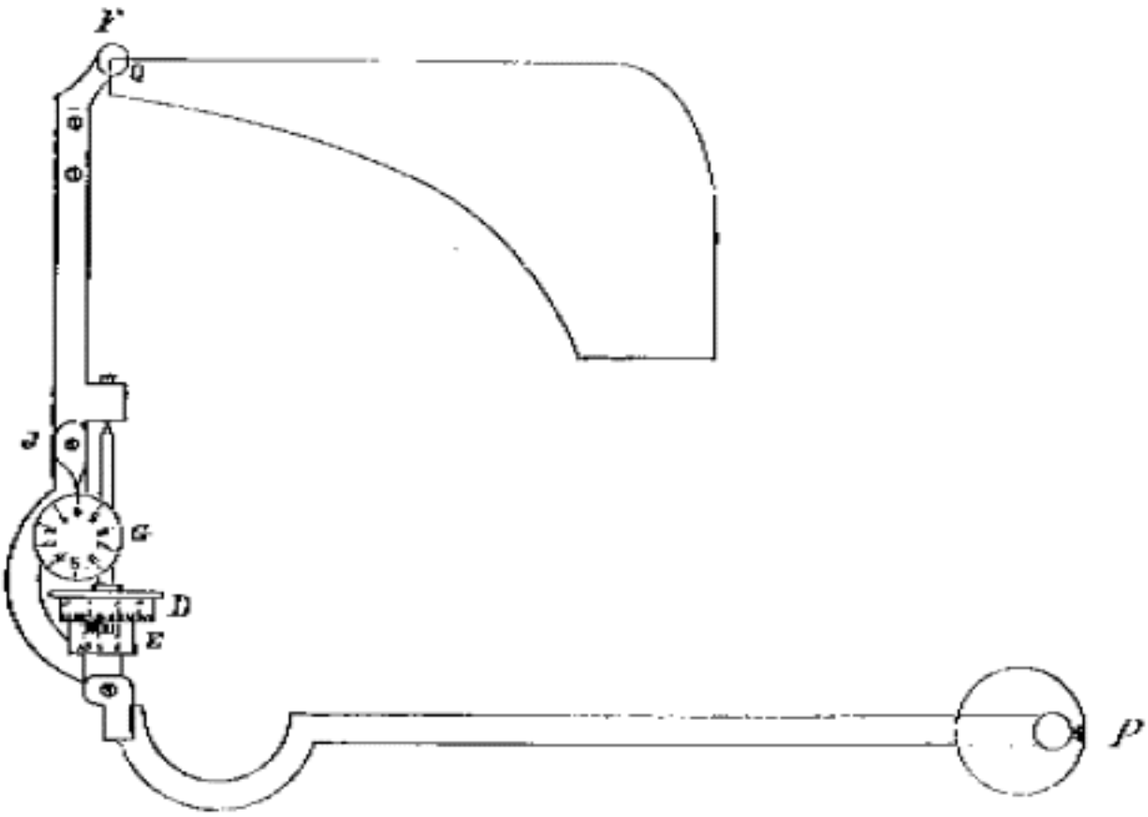
No. 3 represents the Planimeter especially adapted for *two* purposes, and is supplied with the supplemental wheel. In the first place this instrument is arranged for measuring *areas* and giving the results in various denominations of value, such as square metres, square millimeters, square feet and square inches. In the second place, when used in connection with the steam engine indicator, for measuring diagrams, it is so arranged that the readings give the *average height* of the diagram, at once, in fortieths of an inch, which, multiplied by the factor corresponding to the indicator spring in use, gives the mean pressure in pounds per square inch. The figures on the wheels of this instrument represent different quantities and values, according to the adjustment of the sliding bar. See general instructions for No. 3 on following pages. The numbers engraved upon the sliding bar are used only in measuring areas of surfaces. This instrument will measure surfaces of larger area than No. 1 or 2.

GENERAL INSTRUCTIONS.

It is necessary first to make sure that the instrument is in good condition. The roller-wheel ought to play easily without touching the vernier. The pivots ought to turn very easily, but without dead motion or back-lash. The needle point ought to project but very little. The outside edge of the roller-wheel especially, is very delicate, and will bear neither the least injury or spot of rust upon its rolling surface. It is very necessary that the arms and tracer should not be bent, and that if using No. 3, the sliding bar should be in its proper position. Care should also be taken to have a flat even surface for the roller-wheel to travel upon.

DIRECTIONS FOR USING THE PLANIMETER.

To find the area of a figure with No. 1 or 2, place the instrument on the drawing (whether a plan or an indicator diagram), in about the position shown, that is to say, so as to allow perfect freedom of motion in every direction in which it is necessary to move: sink the needle-point, P, a little, so that the needle will remain fixed, and place the weight upon it.



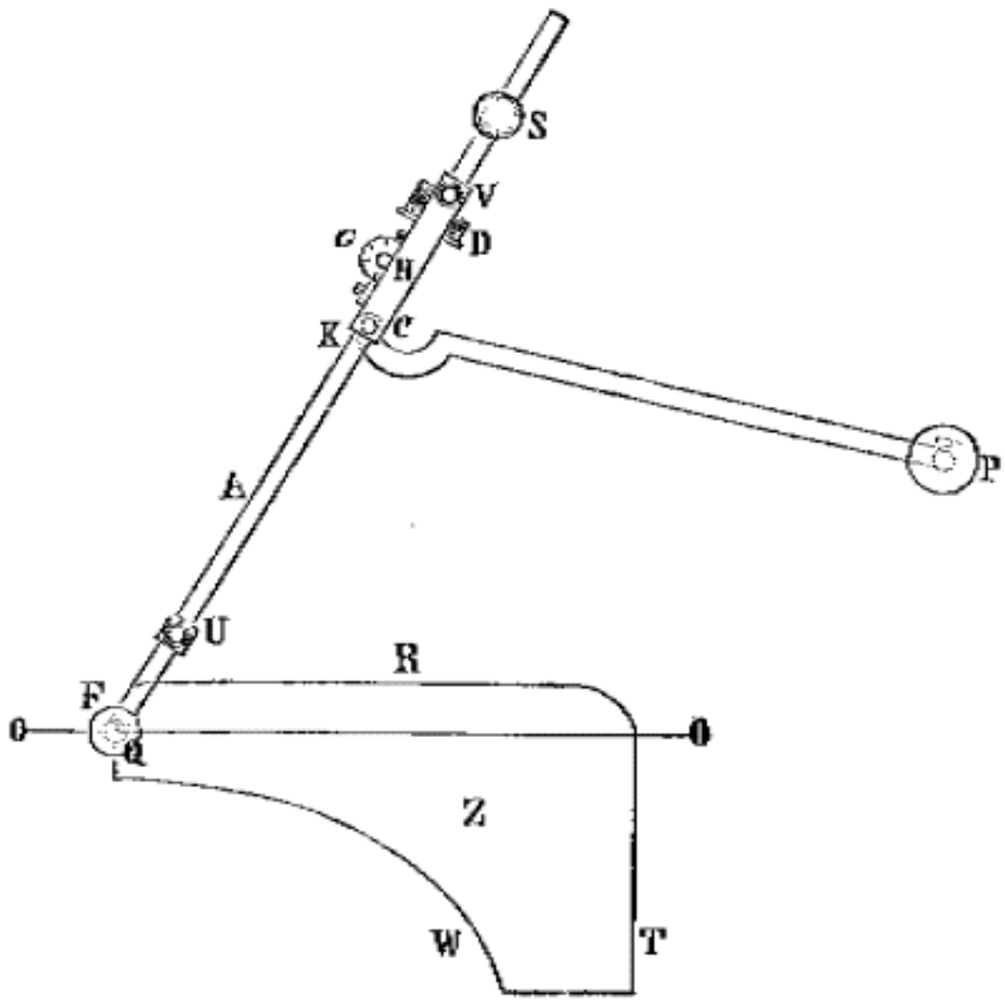
Then place the point of the tracer, F, upon any given point, say Q, of the outline of the figure to be measured, and either adjust the wheels to their respective zeros or take a first reading where they happen to stand: follow the outline of the figure carefully with the tracer point, moving in the direction taken by the hands of a watch, returning to the starting point Q; then the index must be read.

If we are using a No. 1 Planimeter, and have started from zero, suppose we find that the highest figure on the roller wheel, D, that has passed by zero on the vernier is 2, which in this style of Planimeter represents units, and we find the number of intermediate graduations that have also passed zero on the vernier to be 4, then we find the number of the graduation on the vernier, E, which exactly coincides with a graduation on the wheel to be 8; then we have 2.48 square inches as the area of drawing. If we start with an old reading instead of from zero, the first reading should be deducted from the second reading, then the *difference* represents the area of the drawing. If the amount of the first reading should exceed that of the second, 10 should be added to the second reading before subtracting. If the figure is drawn to a scale, multiply the result by the square of the scale for the actual contents of

the surface which the drawing represents. If it is an indicator diagram, and we have found the areas, as per above directions, to be 2.48, divide this by the length of the diagram, which we will assume to be 4 inches, and we have .62 inches as the average height; multiply this by the scale or number of the spring, which in this instance we will call 40, and we have 24.8 pounds as the average pressure per square inch on the piston.

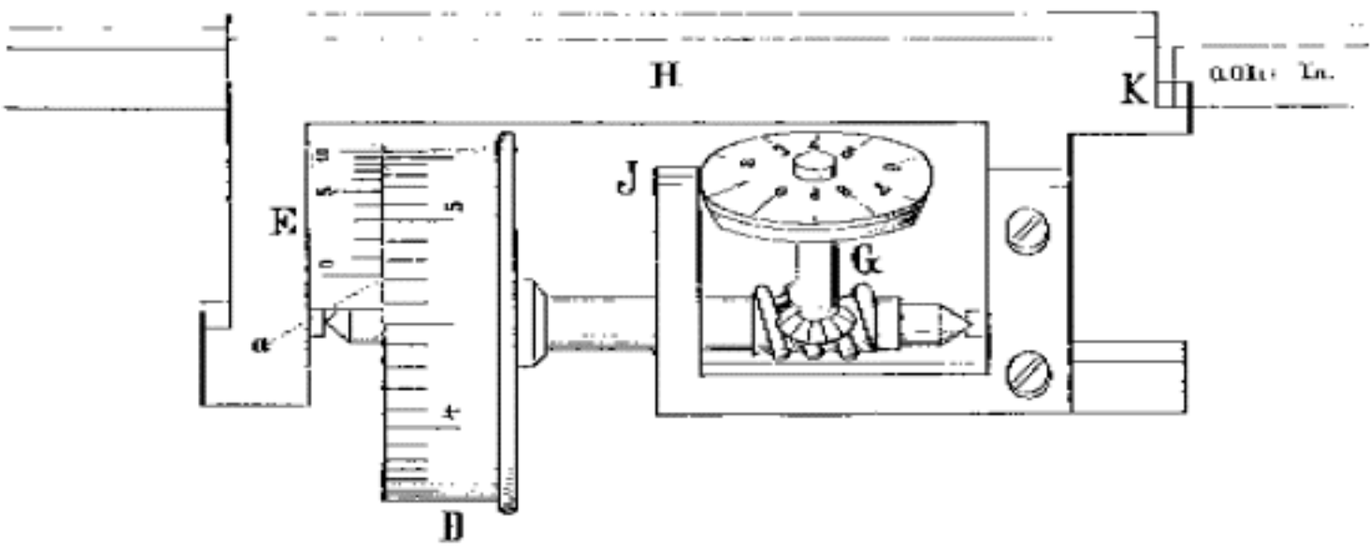
No. 2 is used in the same manner as No. 1, but the care and trouble incident to No. 1 is obviated by the use of the second wheel, G, which registers the tens, avoiding the necessity of starting from zero, and making it more desirable for measuring larger areas.

No. 3 is somewhat differently manipulated, although the same general principle pertains. In the first place, the figures used for recording, represent different quantities and values, according to the adjustment of the sliding bar.

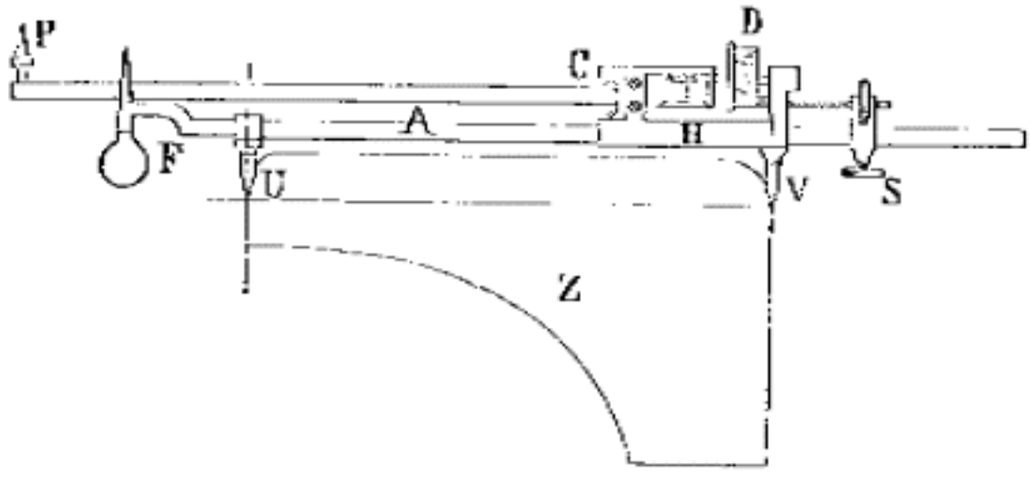


It will be noticed that in this instrument the arm A, carrying the tracer point, is capable of being varied in length. This is for the purpose of registering the result in various denominations of measurement, the value of which are well known, such for instance as square millimeters, square feet, square inches, etc., etc. The sliding bar A, is graduated with several vertical lines, alongside of which is engraved the particular value given to the smallest

denomination that this instrument is capable of registering, which of course is found on the vernier and is the unit of measurement. In measuring areas with this instrument, after the drawing is fastened to some flat surface, set the instrument, by loosening the clamp-screw S, and sliding the bar A, so that the division representing the particular denomination of measurement which you desire the result to be registered in, (0.01 □ in. for instance), exactly coincides with the vertical line marked on the inner end of the sleeve H — at K; then fasten again the set screw S; proceed then in the same manner as described for Nos. 1 and 2.



For instance, if on first reading, we find the figure 1, on the horizontal wheel G, is opposite or is the highest number that has passed the fixed line J, on the post, and that on the roller-wheel D, 47 has passed zero on the vernier E, and that the number of the line on the vernier which coincides with a line on the roller-wheel is 3, we will write 1,473; then after tracing carefully the outline of the drawing, following the directions of the hands of a watch, returning to the starting point, O, the index must be again read. Suppose that we find 2,361, the first reading must then be deducted from the second, leaving in this case 888. Then in this case, 888 x 0.01 = 888 square inches, or if the bar is set at the division marked 10. □ mm, 888 x 10. = 8.880. square millimeters; or if on division marked 0.0001 □ ft., then 888 x 0.0001 = 0.0888 square feet. Thus we have the area in any denomination we choose. If the drawing is to a scale, multiply the result by the square of the scale and we have the actual area of whatever the drawing represents. To measure a very large drawing it is necessary to place the needle point, P, on the inside of its perimeter. In this case, before making the subtraction, we must add to the second reading the number which is found marked upon the upper side of the sliding bar A, just above the division we are using at the time; after which proceed as before. In measuring indicator diagrams with this instrument, instead of placing some division on the sliding bar opposite the mark K, we proceed as follows:



After the diagram is fastened to some flat surface, set the sliding bar, by taking the whole length of the diagram measured on a line parallel with the atmospheric line, accurately between the steel points upon the upper side of the bar, then clasp the bar by means of the screw S, then place the instrument in position and trace the outlines as before, noting the figures as before, but in this case the figures on the horizontal wheel stand for hundreds, while those on the roller-wheel indicate tens, the intermediate graduations units, and the vernier gives the decimal. The result of the reading or readings will be the ***mean height*** of the diagram in $\frac{1}{10}^{\text{ths}}$ of an inch. Suppose the readings to be as before, then $\frac{88.8}{40} = 2.22$ inches. This quotient multiplied by the vertical scale of the diagram will give the mean pressure per square inch exerted on piston in pounds; thus, $2.22 \times 40 = 88.8$. A simpler process is to multiply the reading by the factor corresponding with the scale used, as for instance, the factor of 40 scale is 1, and $88.8 \times 1 = 88.8$, which is the mean pressure in pounds per square inch on the piston.

SPRINGS,....	8	12	16	20	24	30	40	50	60	80	100
FACTORS,..	0.2	0.3	0.4	0.5	0.6	0.75	1.0	1.25	1.5	2.0	2.5

Should different scales than these be required, the factor will be furnished therewith.

PRICES.

No. 1.—Single Wheel, German Silver, in case.....$20.00
" 2.—Double " " " " 25.00
" 3.— " " " " " 30.00

AREA OF CIRCLES, FROM 1/64 TO 26 INCHES.

ADVANCING BY AN EIGHTH.

DIAM.	AREA.	DIAM.	AREA.	DIAM.	AREA.	DIAM.	AREA.
1/64	.000192	5.	19.635	12.	113.098	19.	283.529
1/32	.000767	-1/8	20.629	-1/8	115.466	-1/8	287.272
1/16	.003068	-1/4	21.6476	-1/4	117.859	-1/4	291.01
1/8	.012272	-3/8	22.6907	-3/8	120.277	-3/8	294.832
3/16	.027612	-1/2	23.7583	-1/2	122.719	-1/2	298.648
1/4	.049087	-5/8	24.8505	-5/8	125.185	-5/8	302.489
5/16	.076699	-3/4	25.9673	-3/4	127.677	-3/4	306.355
3/8	.110447	-7/8	27.1086	-7/8	130.192	-7/8	310.245
7/16	.15033	6.	28.2744	13.	132.733	20.	314.16
1/2	.19635	-1/8	29.4648	-1/8	135.297	-1/8	318.099
9/16	.248505	-1/4	30.6797	-1/4	137.887	-1/4	322.063
5/8	.306796	-3/8	31.9191	-3/8	140.501	-3/8	326.051
11/16	.371224	-1/2	33.1831	-1/2	143.139	-1/2	330.064
3/4	.441787	-5/8	34.4717	-5/8	145.802	-5/8	334.102
13/16	.518487	-3/4	35.7848	-3/4	148.49	-3/4	338.164
7/8	.601322	-7/8	37.1224	-7/8	151.202	-7/8	342.25
15/16	.690292	7.	38.4846	14.	153.938	21.	346.361
1.	.7854	-1/8	39.8713	-1/8	156.7	-1/8	350.497
-1/8	.99402	-1/4	41.2826	-1/4	159.485	-1/4	354.657
-1/4	1.2272	-3/8	42.7184	-3/8	162.296	-3/8	358.842
-3/8	1.4849	-1/2	44.1787	-1/2	165.13	-1/2	363.051
-1/2	1.7671	-5/8	45.6636	-5/8	167.99	-5/8	367.285
-5/8	2.0739	-3/4	47.1731	-3/4	170.874	-3/4	371.543
-3/4	2.4053	-7/8	48.7071	-7/8	173.782	-7/8	375.826
-7/8	2.7612	8.	50.2656	15.	176.715	27.	380.134
2.	3.1416	-1/8	51.8487	-1/8	179.673	-1/8	384.466
-1/8	3.5466	-1/4	53.4563	-1/4	182.655	-1/4	388.822
-1/4	3.9761	-3/8	55.0884	-3/8	185.661	-3/8	393.203
-3/8	4.4301	-1/2	56.7451	-1/2	188.692	-1/2	397.609
-1/2	4.9087	-5/8	58.4264	-5/8	191.748	-5/8	402.038
-5/8	5.4119	-3/4	60.1322	-3/4	194.828	-3/4	406.494
-3/4	5.9396	-7/8	61.8625	-7/8	197.933	-7/8	410.973
-7/8	6.4918	9.	63.6174	.16	201.062	23.	415.477
3.	7.0686	-1/8	65.3968	-1/8	204.216	-1/8	420.004
-1/8	7.6699	-1/4	67.2008	-1/4	207.395	-1/4	424.558
-1/4	8.2958	-3/8	69.0293	-3/8	210.598	-3/8	429.135
-3/8	8.9462	-1/2	70.8823	-1/2	213.825	-1/2	433.737
-1/2	9.6211	-5/8	72.7599	-5/8	217.077	-5/8	438.364
-5/8	10.3206	-3/4	74.6621	-3/4	220.354	-3/4	443.015
-3/4	11.0447	-7/8	76.5888	-7/8	223.655	-7/8	447.69
-7/8	11.7933	10.	78.54	17.	226.981	24.	452.39
4.	12.5664	-1/8	80.5158	-1/8	230.331	-1/8	457.115
-1/8	13.3641	-1/4	82.5161	-1/4	233.706	-1/4	461.864
-1/4	14.1863	-3/8	84.5409	-3/8	237.105	-3/8	466.638
-3/8	15.033	-1/2	86.5903	-1/2	240.529	-1/2	471.436
-1/2	15.9043	-5/8	88.6643	-5/8	243.977	-5/8	476.259
-5/8	16.8002	-3/4	90.7628	-3/4	247.45	-3/4	481.107
-3/4	17.7206	-7/8	92.8858	-7/8	250.948	-7/8	485.979
-7/8	18.6665	11.	95.0334	18.	254.47	25.	490.875
		-1/8	97.2055	-1/8	258.016	-1/8	495.796
		-1/4	99.4022	-1/4	261.587	-1/4	500.742
		-3/8	101.6234	-3/8	265.183	-3/8	505.712
		-1/2	103.8691	-1/2	268.803	-1/2	510.706
		-5/8	106.1394	-5/8	272.448	-5/8	515.726
		-3/4	108.4343	-3/4	276.117	-3/4	520.769
		-7/8	110.7537	-7/8	279.811	-7/8	525.838
						26.	530.93