J. Dominis. Sheet 1, 2 Sheets.

Ship's Implement.

No. 2,790. Patented, Sept. 30, 1842.

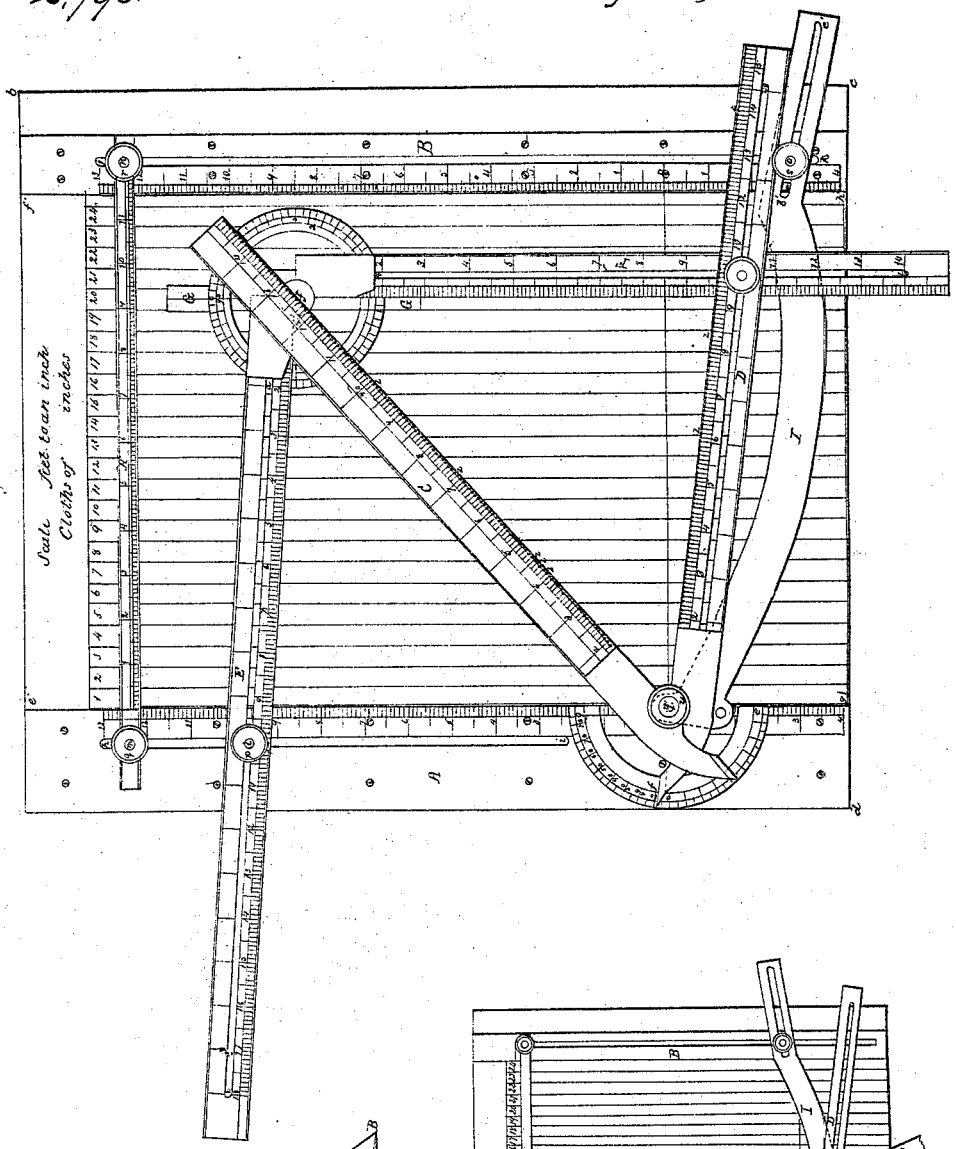


Fig. 1.

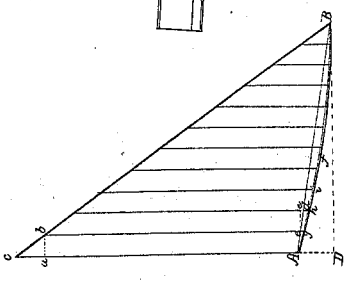


Fig. 2.

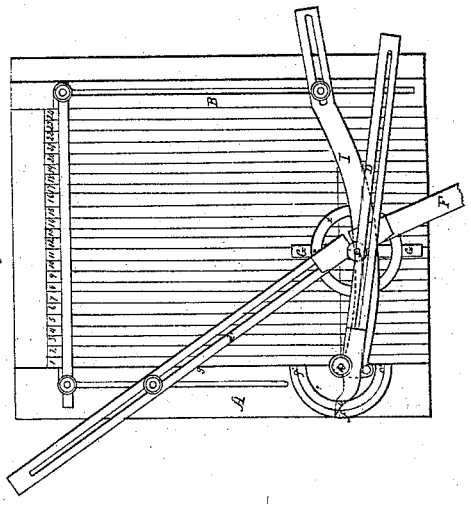


Fig. 3.

J. Dominis. Sheets, 2 Sheets.

Ship's Implement.

No. 2,790. Patented Sept. 30, 1842.

Fig. 4

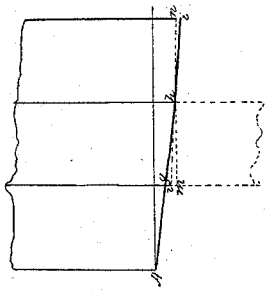


Fig. 10

Fig. 7

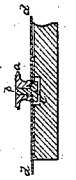


Fig. 9

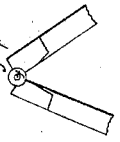


Fig. 5.

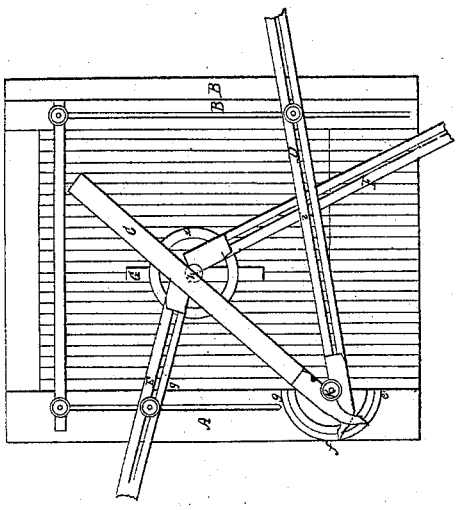
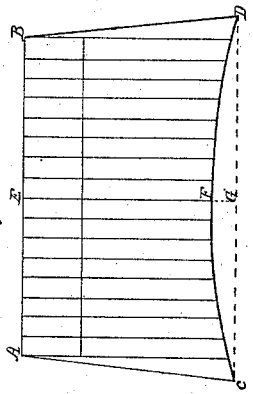


Fig. 6.



UNITED STATES PATENT OFFICE.

JNO. DOMINIS, OF THE SANDWICH ISLANDS.

INSTRUMENT FOR MEASURING SAILS.

Specification of Letters Patent No. 2,790, dated September 30, 1842.

To all whom it may concern:

Be it known that I, JOHN DOMINIS, a citizen of the United States of America, but now residing in the Sandwich Islands, in the Pacific Ocean, have invented new and useful mathematical scales and tables for determining the gores, roaches, and proportions of sails for cutting the same from rolls of canvas.

The said invention, the principles thereof, and manner in which I have contemplated the application of the same by which it may be distinguished from others of a like character, together with such parts or combinations I claim as new and desire Letters Patent therefor granting to me an exclusive property in the same for fourteen years, I have herein set forth and described, which description taken in connection with the accompanying drawings herein referred to forms my specification.

As sails of different kinds and for different vessels are formed of strips of cloth or canvas sewed together, after they are cut to proper shapes and lengths, and as it is customary to cut said strips from what is usually termed a roll or bolt of canvas, it becomes desirable to accomplish the same, with as little waste of material as possible, or in other words so to measure the lengths and gore of each strip that when the whole are sewed together, the sail thus formed shall possess the required shape, and in nautical language set well when adjusted and exposed to the action of the wind.

In order that the use and adaptation of my improvements may be more particularly understood, I shall proceed to illustrate the mode usually practiced of cutting the cloths of a sail from a long or extended strip of canvas.

We will suppose for the sake of explanation that we wish to cut up a roll of canvas for the purpose of converting the same into a sail usually termed a jib. To cut the first cloth (presuming the canvas is square on the end) it is necessary to set up from the end a certain determined distance (called the gore on the foot, and which we will suppose six and one half inches), on either selvage of the canvas and there make a suitable mark. Then cut from the said mark diagonally across the canvas to the extreme point of the opposite selvage and thus we shall have formed the foot gore for the first cloth. Next measure up on the selvage from the foot or mark above mentioned the length of the after leach (which suppose forty two feet), then from the extremity of the distance so measured set downward another certain determined distance called the gore on the stay and which we will suppose to equal four feet and four inches. Next following the filling thread so marked across the strip of canvas to the opposite selvage and make a suitable mark thereon, which mark will be in a line perpendicular to the selvage. Next cut the cloth from the last mentioned mark diagonally to the mark, denoting the length of the first cloth and thus we form the stay gore for the first and second cloths. Turn the canvas so as to bring the longer selvage even in a line with the shorter selvage of the first cloth. Measure down by this cloth for the length of the second cloth and mark it; thence take a thread as before to the opposite selvage; thence set off six and one-half inches (the foot gores) downward; mark it and cut diagonally as before to the mark denoting the length of the second cloth on the opposite selvage, and thus we obtain the foot gore or slope of the second and third cloths. Turn the canvas on the foot, as before, on the head, and continue measuring turning and cutting until all the cloths are so prepared.

The above is the process by which a bolt of sail cloth is generally cut up, and from the same it will be easily seen that in order to prevent waste and to make the cloth come together so as to give to the sail its intended form when finished, great care is requisite in finding the true distances to measure down on the selvage to obtain the gores on the stay and foot.

Having thus premised, I shall now proceed to explain the construction and application of the mathematical scales and tables.

Figure 1, represents the different scales attached to their board. Two scales A and B being placed parallel to each other and at a suitable distance apart are screwed down or otherwise properly secured to a table or board *a b c d*, Fig. 1. The inner edge of the scale A is divided into inches, which divisions are subdivided into tenths, or in any other convenient manner. A semi circle *e f g*, graduated to degrees is described on the scale A as seen in the drawing the chord of the semi circle being formed by the inner edge of the rulers. The opposite scale B has its inner edge divided and subdivided in a similar manner to the first; and each of these scales has an elongated slot *h i j k* formed in it parallel with its inner edge. Each of the slots is placed directly over a suitable groove or channel cut out of the wood under the same, and which is of sufficient breadth and depth to receive and allow full play back and forth the heads of common screws *l m n o*, in which screws the milled clamping nuts *p*, *q*, *r*, *s*, are screwed, the said nuts serving to confine the rulers E, F, &c. in different positions in which they may be adjusted to each other on the board as will be hereafter explained. The heads of the screws *l*, *m*, *n*, *o* being larger in diameter than the width of the slots *h*, *i*, *j*, *k*, are drawn upwards against the underside of the scales A, B, or sides of the slots, when the milled clamping nuts are screwed down, and thus the rulers or scales E, F, are confined when adjusted to any particular position. A section of one of the screws, milled nuts, scales, and channel or groove under the latter is given in Fig. 7 where *b* is the screw, *a* the milled nut, *d d* the scale, *e* the channel in the woodwork, for the head *c* of the screw *b* to move in.

The center of the semicircle *e f g* has a screw 8 projecting perpendicularly therefrom, on which a clamping nut or head U is secured and serves to confine the rulers C and D, &c., in any desirable positions. The graduations or divisions of the ruler A commence at the center of the semicircle *e f g*, and are numbered or extend each way as represented by the Figs. 3, 4, &c., in the figure. The divisions of the ruler B are similar and are directly opposite those of the ruler A as exhibited in the drawing—that is to say, the straight or base line, from the center of the screw *t* or semicircle *e f g*, to the zero of the opposite ruler, is perpendicular to the inner edges of each ruler.

The rulers C, D are formed as represented in the drawing, in which it will be observed that their ends resting on or near the graduated semicircle *e f g*, are pointed and their edges chamfered for the convenience of reading the angular distances of each ruler on the semicircle, which will be hereafter more particularly explained. The rulers C and D are divided into inches and subdivided into tenths commencing from the center of the semicircle *e f g*, and denoted by Figs. 2, 3, 4, 5, &c., as represented in the drawing.

Two other scales or rulers E F are joined together, at one end of each, by a common rule joint, so as to be easily opened and closed or adjusted to any required angle with each other. Each ruler has an elongated slot *v w*—*v w* cut through the same, through which the clamp screws pass, which confine the rulers in any required position on the board. At the point of junction of the rulers E F, and situated under the same, a full graduated circle *x* is so affixed as to be freely revolved or turned about on its axis, the said axis passing through the center of the joint of the rulers, and having a small wire point or pin *y* projecting upward perpendicularly therefrom, see Figs. 9 and 10. Small holes *z z z* are drilled through the divisions of the rulers C and D and the pin *y* is passed through either of these holes according to circumstances which will be more particularly understood or explained hereafter.

The circle *x* is graduated to degrees and has a ruler G connected to it, as seen in the figure, and whose ends project beyond the circle as therein denoted. The diameter of the circle being extended beyond the circumference is marked on the projecting ends by a line passing through the center of the upper face of the entire ruler, as will be seen by reference to the drawing.

Another ruler H formed and divided into inches and lengths and having clamp screws and nuts as represented in the drawing, will be hereafter explained as also a curved ruler I one end of which is placed on the center pin or screw *t* and is formed with holes and otherwise shaped as represented partly by dotted lines and partly as otherwise exhibited in the drawing. The other end of the ruler I has an elongated slot *b′ c′*, through which a sliding screw passes upward from the slot in the ruler B, and by the milled nuts thereon we are enabled to confine the ruler in whatever position we place the same on the board *a b c d* as will be readily understood by inspection of the drawing. The ruler I is for obtaining the roach and sweep of sails as will be hereinafter explained.

A card or sheet of paper *e′ f′ g′ h′* is laid on the board *a b c d* between the rulers A and B. One edge of the paper viz, *e′ g′* is to be cut perfectly straight and is to be placed in continuity with the inner or grad-

uated edge of the ruler A, and to this edge lines are drawn parallel to the same and to each other at a distance therefrom and apart from each other, proportionate to the widths of cloth or canvas used in making the sail. For canvas of different widths there should be separate sheets of paper, proper ruled for each, which may be used as occasion requires.

If our canvas is twenty nine inches wide and the seams take up one inch thereof we rule the lines at a distance apart from each other proportionate to twenty eight inches, which if we use a scale of five feet to an inch, would equal seven fifteenths of an inch. Also for cloths of twenty three inches width, deducting one inch for the seams, we have twenty two inches, which if we use the above scale of five feet to an inch, will give us eleven thirteenths of an inch, for the distance for ruling the lines apart from each other; and so on with any other width of canvas. The spaces between the ruled lines represent the strips of canvas in each sail as will be hereafter explained, and are numbered 1, 2, 3, 4, 5, &c., as seen in the drawing.

Having thus described the construction of the mathematical scales, I shall now proceed to explain the method of forming the tables accompanying the same, which are herein given and make a part of my specification.

Cloths of 22 inches.

No. 1		No. 2		No. 3		No. 4		No. 5		No. 6		No. 7		No. 8		No. 9		No. 10		No. 11		No. 12		No. 13		No. 14		No. 15		No. 16		No. 17		No. 18		No. 19		No. 20	
	In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.		In.
1	0	1	1	1	1	1	2	1	2	1	2	1	3	1	3	1	3	1	4	1	4	1	5	1	5	1	5	1	6	1	6	1	7	1	7	1	7	1	8
2	1	2	2	2	2	2	3	2	4	2	5	2	5	2	6	2	7	2	8	2	8	2	9	2	10	2	11	2	12	2	12	2	13	2	14	2	15	2	16
3	1	3	2	3	3	3	5	3	6	3	7	3	8	3	9	3	10	3	12	3	13	3	14	3	15	3	16	3	17	3	18	3	20	3	21	3	22	3	24
4	2	4	3	4	5	4	6	4	7	4	9	4	11	4	12	4	14	4	15	4	17	4	18	4	20	4	21	4	23	4	24	4	26	4	28	4	29	4	31
5	2	5	4	5	6	5	8	5	10	5	12	5	14	5	15	5	17	5	19	5	21	5	23	5	25	5	27	5	29	5	31	5	33	5	35	5	37	5	38
6	2	6	5	6	7	6	9	6	12	6	14	6	16	6	18	6	21	6	23	6	26	6	28	6	30	6	32	6	34	6	36	6	39	6	42	6	44	6	46
7	3	7	5	7	8	7	11	7	13	7	16	7	19	7	22	7	24	7	27	7	30	7	32	7	35	7	38	7	40	7	43	7	46	7	49	7	51	7	54
8	3	8	6	8	9	8	12	8	15	8	19	8	22	8	25	8	28	8	31	8	34	8	37	8	40	8	43	8	46	8	49	8	52	8	56	8	59	8	62
9	4	9	7	9	10	9	14	9	17	9	21	9	24	9	28	9	31	9	35	9	38	9	42	9	45	9	49	9	52	9	55	9	59	9	62	9	66	9	70
10	4	10	8	10	12	10	16	10	19	10	23	10	27	10	31	10	35	10	39	10	43	10	47	10	50	10	54	10	58	10	61	10	66	10	70	10	74	10	78
11	4	11	9	11	13	11	17	11	21	11	26	11	30	11	34	11	38	11	43	11	47	11	51	11	56	11	60	11	64	11	68	11	73	11	77	11	81	11	86
12	5	12	9	12	14	12	19	12	23	12	28	12	33	12	37	12	42	12	47	12	51	12	56	12	61	12	66	12	70	12	74	12	80	12	84	12	89	12	94
13	5	13	10	13	15	13	20	13	25	13	30	13	35	13	40	13	46	13	51	13	56	13	61	13	66	13	71	13	76	13	80	13	86	13	92	13	96	13	102
14	6	14	11	14	16	14	22	14	27	14	33	14	38	14	44	14	49	14	55	14	60	14	66	14	71	14	77	14	82	14	87	14	93	14	99	14	104	14	110
15	6	15	12	15	18	15	24	15	30	15	35	15	41	15	47	15	53	15	59	15	65	15	71	15	77	15	82	15	88	15	93	15	100	15	105	15	112	15	118
16	6	16	13	16	19	16	25	16	32	16	38	16	44	16	50	16	57	16	63	16	69	16	76	16	82	16	88	16	94	16	100	16	107	16	114	16	120	16	126
17	7	17	13	17	20	17	27	17	34	17	40	17	47	17	54	17	60	17	67	17	74	17	81	17	88	17	94	17	101	17	106	17	114	17	121	17	128	17	134
18	7	18	14	18	21	18	29	18	36	18	43	18	50	18	57	18	64	18	72	18	78	18	86	18	93	18	100	18	107	18	113	18	121	18	129	18	136	18	143
19	8	19	15	19	23	19	30	19	38	19	45	19	52	19	61	19	68	19	76	19	83	19	91	19	98	19	106	19	114	19	120	19	129	19	136	19	144	19	152
20	8	20	16	20	24	20	32	20	40	20	48	20	56	20	64	20	72	20	80	20	88	20	96	20	104	20	112	20	120	20	128	20	136	20	144	20	152	20	160
21	9	21	17	21	25	21	34	21	42	21	51	21	59	21	67	21	76	21	85	21	93	21	102	21	110	21	118	21	127	21	134	21	144	21	152	21	160	21	169
22	9	22	18	22	27	22	36	22	45	22	53	22	62	22	71	22	80	22	89	22	98	22	107	22	116	22	125	22	133	22	140	22	150	22	160	22	169	22	178
23	9	23	19	23	28	23	37	23	47	23	56	23	65	23	75	23	84	23	95	23	103	23	112	23	122	23	131	23	140	23	148	23	159	23	168	23	177	23	188
24	10	24	19	24	29	24	39	24	49	24	59	24	69	24	78	24	88	24	98	24	108	24	118	24	128	24	137	24	147	24	157	24	167	24	176	24	186	24	196
25	10	25	21	25	30	25	41	25	51	25	61	25	72	25	82	25	92	25	103	25	113	25	123	25	134	25	144	25	154	25	162	25	174	25	185	25	195	25	206
26	11	26	21	26	32	26	43	26	54	26	64	26	75	26	86	26	96	26	107	26	119	26	129	26	140	26	150	26	161	26	170	26	182	26	193	26	204	26	215
27	11	27	22	27	34	27	45	27	56	27	67	27	78	27	90	27	101	27	111	27	123	27	134	27	146	27	157	27	168	27	178	27	191	27	202	27	213	27	224
28	12	28	24	28	35	28	47	28	59	28	70	28	82	28	94	28	105	28	117	28	129	28	140	28	152	28	164	28	176	28	185	28	199	28	210	28	222	28	233
29	12	29	24	29	37	29	49	29	61	29	73	29	85	29	97	29	110	29	122	29	134	29	146	29	159	29	171	29	183	29	193	29	207	29	220	29	232	29	244
30	12	30	25	30	38	30	51	30	63	30	76	30	89	30	102	30	114	30	126	30	140	30	152	30	165	30	178	30	190	30	202	30	216	30	229	30	242	30	254
31	13	31	26	31	40	31	53	31	66	31	79	31	93	31	106	31	119	31	132	31	145	31	159	31	172	31	185	31	198	31	209	31	225	31	238	31	252	31	264
32	14	32	28	32	41	32	55	32	69	32	83	32	96	32	110	32	124	32	138	32	151	32	165	32	179	32	193	32	206	32	218	32	234	32	248	32	262	32	275
33	14	33	29	33	43	33	57	33	71	33	86	33	100	33	114	33	128	33	143	33	157	33	172	33	186	33	200	33	214	33	226	33	243	33	257	33	272	33	286
34	15	34	30	34	45	34	59	34	74	34	89	34	104	34	119	34	130	34	149	34	163	34	178	34	193	34	208	34	223	34	235	34	252	34	267	34	282	34	297
35	15	35	31	35	46	35	62	35	77	35	92	35	108	35	123	35	139	35	154	35	170	35	185	35	200	35	216	35	231	35	244	35	262	35	278	35	293	35	308
36	16	36	32	36	48	36	64	36	80	36	96	36	112	36	128	36	144	36	160	36	176	36	192	36	208	36	225	36	240	36	253	36	272	36	288	36	304	36	320
37	17	37	33	37	50	37	66	37	83	37	99	37	116	37	133	37	149	37	166	37	183	37	199	37	215	37	232	37	249	37	262	37	282	37	299	37	315	37	332
38	17	38	34	38	52	38	69	38	86	38	103	38	120	38	140	38	155	38	172	38	190	38	206	38	224	38	240	38	258	38	272	38	292	38	310	38	326	38	344
39	18	39	36	39	54	39	71	39	89	39	107	39	125	39	143	39	160	39	178	39	196	39	214	39	232	39	249	39	268	39	282	39	303	39	321	39	338	39	357
40	19	40	37	40	55	40	74	40	92	40	111	40	123	40	148	40	166	40	185	40	203	40	222	40	240	40	258	40	277	40	293	40	314	40	332	40	351	40	370
41	19	41	38	41	57	41	76	41	96	41	115	41	134	41	153	41	172	41	191	41	211	41	229	41	249	41	268	41	287	41	302	41	325	41	344	21	363	41	382
42	20	42	40	42	60	42	79	42	99	42	119	42	139	42	159	42	179	42	198	42	218	42	238	42	258	42	278	42	298	42	314	42	337	42	357	42	377	42	396
43	20	43	41	43	62	43	82	43	103	43	123	43	144	43	164	43	185	43	206	43	226	43	247	43	267	43	288	43	309	43	326	43	349	43	369	43	390	43	411
44	21	44	42	44	64	44	85	44	106	44	128	44	149	44	170	44	191	44	212	44	234	44	255	44	276	44	298	44	320	44	336	44	361	44	383	44	404	44	425
45	22	45	44	45	66	45	88	45	110	45	132	45	154	45	176	45	198	45	220	45	242	45	264	45	286	45	310	45	332	45	354	45	376	45	398	45	420	45	440

Cloths of 22 inches.

For 1 cloth.			For 1 cloth.			For 1 cloth.			For 1 cloth.		
Deg.	Ft.	In.	Deg.	Ft.	In.	Deg.	Ft.	In.	Deg.	Ft.	In.
46	1	11	56	2	9	66	4	1	76	7	4
47	2	0	57	2	10	67	4	4	77	7	11
48	2	1	58	2	11	68	4	6	78	8	8
49	2	2	59	3	1	69	4	9	79	9	5
50	2	3	60	3	2	70	5	0	80	10	4
51	2	3	61	3	4	71	5	4	81	11	7
52	2	4	62	3	5	72	5	8	82	13	00
53	2	5	66	3	7	73	6	0	83	14	11
54	2	6	64	3	9	74	6	5	84	17	5
55	2	7	65	3	11	75	6	10	85	20	11

Cloths of 28 inches.

No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15	No. 16	No. 17	No. 18	No. 19	No. 20
In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 0	1 1	1 1	1 2	1 2	1 3	1 3	1 4	1 4	1 5	1 5	1 6	1 6	1 7	1 7	1 8	1 8	1 9	1 9	1 10
2 1	2 2	2 3	2 4	2 5	2 6	2 7	2 8	2 9	2 10	2 11	2 12	2 13	2 14	2 15	2 16	2 17	2 18	2 19	2 20
3 1	3 3	3 4	3 6	3 7	3 9	3 10	3 12	3 13	3 15	3 16	3 18	3 19	3 20	3 22	3 24	3 25	3 27	3 28	3 29
4 2	4 4	4 6	4 8	4 10	4 12	4 14	4 16	4 18	4 20	4 21	4 24	4 25	4 27	4 29	4 32	4 33	4 36	4 37	4 39
5 2	5 5	5 7	5 10	5 12	5 15	5 17	5 20	5 22	5 24	5 27	5 29	5 32	5 34	5 37	5 39	5 42	5 44	5 47	5 49
6 3	6 6	6 9	6 12	6 15	6 18	6 21	6 24	6 26	6 29	6 32	6 35	6 38	6 41	6 44	6 47	6 50	6 53	6 56	6 59
7 3	7 7	7 10	7 14	7 17	7 21	7 24	7 28	7 31	7 34	7 38	7 41	7 44	7 48	7 51	7 54	7 58	7 62	7 65	7 69
8 4	8 8	8 12	8 16	8 20	8 24	8 28	8 32	8 35	8 39	8 43	8 47	8 51	8 55	8 59	8 63	8 67	8 71	8 75	8 79
9 4	9 9	9 13	9 18	9 22	9 27	9 31	9 36	9 40	9 44	9 49	9 53	9 58	9 62	9 66	9 71	9 76	9 80	9 84	9 89
10 5	10 10	10 15	10 20	10 25	10 30	10 35	10 40	10 44	10 50	10 53	10 59	10 64	10 69	10 74	10 79	10 84	10 89	10 94	10 99
11 5	11 11	11 16	11 22	11 27	11 33	11 38	11 44	11 49	11 54	11 60	11 65	11 71	11 76	11 82	11 87	11 93	11 98	11 104	11 109
12 6	12 12	12 18	12 24	12 30	12 36	12 42	12 48	12 53	12 60	12 65	12 71	12 77	12 83	12 89	12 95	12 102	12 107	12 113	12 119
13 6	13 13	13 19	13 26	13 32	13 39	13 45	13 52	13 58	13 65	13 71	13 78	13 84	13 90	13 97	13 104	13 110	13 116	13 122	13 129
14 7	14 14	14 21	14 28	14 35	14 42	14 49	14 56	14 63	14 70	14 77	14 84	14 91	14 98	14 105	14 112	14 119	14 126	14 132	14 140
15 7	15 15	15 23	15 30	15 37	15 45	15 52	15 60	15 68	15 75	15 82	15 90	15 98	15 105	15 112	15 120	15 128	15 135	15 142	15 150
16 8	16 16	16 24	16 32	16 40	16 48	16 56	16 64	16 72	16 80	16 88	16 96	16 104	16 112	16 120	16 128	16 137	16 144	16 152	16 162
17 9	17 17	17 26	17 34	17 43	17 51	17 60	17 68	17 77	17 85	17 94	17 103	17 111	17 120	17 128	17 137	17 146	17 154	17 162	17 171
18 9	18 18	18 27	18 36	18 45	18 55	18 64	18 73	18 81	18 91	18 100	18 109	18 118	18 127	18 136	18 146	18 155	18 164	18 173	18 182
19 10	19 19	19 29	19 39	19 48	19 58	19 67	19 77	19 87	19 96	19 106	19 116	19 126	19 135	19 145	19 154	19 164	19 174	19 183	19 193
20 10	20 20	20 31	20 41	20 51	20 61	20 71	20 81	20 92	20 102	20 112	20 123	20 133	20 143	20 153	20 163	20 173	20 184	20 194	20 204
21 11	21 21	21 32	21 43	21 54	21 65	21 75	21 86	21 97	21 108	21 118	21 129	21 140	21 151	21 161	21 172	21 183	21 194	21 204	21 215
22 11	22 23	22 34	22 45	22 57	22 68	22 79	22 90	22 102	22 113	22 124	22 136	22 147	22 159	22 170	22 181	22 192	22 204	22 215	22 226
23 12	23 24	23 36	23 48	23 59	23 71	23 83	23 95	23 107	23 119	23 131	23 143	23 155	23 166	23 178	23 190	23 202	23 214	23 226	23 238
24 12	24 25	24 37	24 50	24 62	24 75	24 87	24 100	24 112	24 124	24 137	24 150	24 162	24 174	24 187	24 200	24 212	24 224	24 237	24 249
25 13	25 26	25 39	25 52	25 65	25 78	25 91	25 105	25 117	25 131	25 143	25 157	25 170	25 183	25 196	25 209	25 222	25 235	25 248	25 261
26 14	26 27	26 41	26 55	26 68	26 82	26 96	26 110	26 123	26 137	26 150	26 164	26 178	26 191	26 205	26 219	26 232	26 246	26 260	26 273
27 14	27 29	27 43	27 57	27 71	27 86	27 100	27 114	27 129	27 143	27 157	27 170	27 185	27 200	27 214	27 228	27 242	27 257	27 271	27 186
28 15	28 31	28 45	28 60	28 75	28 89	28 104	28 119	28 134	28 149	28 163	28 179	28 193	28 208	28 224	28 238	28 253	28 268	28 283	28 298
29 15	29 32	29 46	29 62	29 78	29 93	29 109	29 124	29 140	29 155	29 171	29 186	29 202	29 217	29 233	29 248	29 264	29 280	29 295	29 311
30 16	30 34	30 48	30 65	30 81	30 97	30 113	30 129	30 146	30 162	30 178	30 190	30 210	30 226	30 243	30 259	30 275	30 291	30 307	30 324
31 17	31 35	31 50	31 67	31 84	31 101	31 118	31 135	31 151	31 168	31 185	31 202	31 219	31 235	31 253	31 269	31 269	31 286	31 303	31 337
32 17	32 36	32 52	32 70	32 87	32 105	32 122	32 140	32 158	32 175	32 193	32 210	32 228	32 245	32 263	32 280	32 298	32 315	32 333	32 350
33 18	33 37	33 55	33 73	33 91	33 109	33 127	33 146	33 164	33 182	33 200	33 218	33 236	33 255	33 273	33 291	33 309	33 327	33 346	33 364
34 19	34 38	34 57	34 76	34 94	34 113	34 132	34 151	34 170	24 189	34 208	34 227	34 246	34 264	34 284	34 303	34 321	34 340	34 359	34 378
35 19	35 39	35 59	35 79	35 98	35 118	35 137	35 157	35 176	35 196	35 216	35 235	35 255	35 274	35 294	35 314	35 333	35 353	35 373	35 392
36 20	36 41	36 61	36 81	36 102	36 122	36 142	36 163	36 183	36 203	36 224	36 244	36 265	36 285	36 305	36 326	36 346	36 366	36 386	36 407
37 21	37 42	37 63	37 84	37 105	37 127	37 147	37 169	37 190	37 211	37 232	37 253	37 274	37 295	37 317	37 338	37 359	37 380	37 401	37 422
38 22	38 44	38 66	38 87	38 109	38 131	38 153	38 175	38 197	38 219	38 241	38 263	38 284	38 306	38 329	38 350	38 372	38 394	38 416	38 438
39 23	39 45	39 68	39 91	39 113	39 136	39 159	39 181	39 204	39 227	39 249	39 272	39 295	39 317	39 340	39 362	39 386	39 408	39 431	39 455
40 24	40 47	40 71	40 94	40 117	40 141	40 165	40 188	40 212	40 235	40 258	40 282	40 306	40 329	40 342	40 376	40 400	40 424	40 446	40 470
41 24	41 48	41 73	41 97	41 122	41 146	41 170	41 195	41 219	41 244	41 268	41 292	41 316	41 341	41 365	41 390	41 414	41 436	41 463	41 487
42 25	42 50	42 76	42 101	42 126	42 151	42 176	42 202	42 227	42 252	42 278	42 302	42 328	42 354	42 388	42 404	42 429	42 454	42 479	42 504
43 26	43 52	43 78	43 104	43 131	43 157	43 183	43 209	43 235	43 262	43 287	43 313	43 340	43 366	43 392	43 418	43 444	43 470	43 502	43 523
44 27	44 54	44 81	44 108	44 135	44 162	44 189	44 217	44 243	44 271	44 298	44 325	44 352	44 378	44 406	44 433	44 460	44 486	44 516	44 542
45 28	45 56	45 84	45 112	45 140	45 169	45 196	45 224	45 252	45 280	45 308	45 336	45 364	45 392	45 420	45 448	45 476	45 504	45 532	45 560

Cloths of 28 inches.

For 1 cloth.			For 1 cloth.			For 1 cloth.			For 1 cloth.		
Deg.	*Ft.*	*in.*	*Deg.*	*Ft.*	*in.*	*Deg.*	*Ft.*	*in.*	*Deg.*	*Ft.*	*in.*
46	2	5	56	3	5	66	5	3	76	9	6
47	2	6	57	3	7	67	5	6	77	10	1
48	2	7	58	3	9	68	5	9	78	11	0
49	2	8	59	3	11	69	6	1	79	12	0
50	2	9	60	4	1	70	6	5	80	13	3
51	2	11	61	4	2	71	6	9	81	14	9
52	3	0	62	4	4	72	7	2	82	16	7
53	3	1	63	4	7	73	7	7	83	19	0
54	3	2	64	4	9	74	8	2	84	22	2
55	3	4	65	5	0	75	8	8	85	26	7

These tables are produced by trigonometrical calculations on the principle of having the course and departure given to find the difference of latitude. The course may be supposed to represent the angle, which the two sides of a sail make with each other, denoted in the tables by the sign —°— for degrees, the departure the width of canvas to be connected into a sail—represented in the tables by the heading "cloths of 22 inches," "cloths of 28 inches," &c. and the difference of latitude the depth to be measured up or down on the selvage for obtaining the gore on the foot, stay or leach as hereinbefore explained, and which is exhibited in each of the columns adjacent to those denoting degrees. This latter is arranged in the tables to the nearest inch, fractions of inches being omitted as of no importance in practice.

Columns No. 1, No. 2, &c., to No. 20 represent the degrees and departure or depth of gore for any numbers of breadths of cloths of canvas in the sail, corresponding to the number of the column. For instance in the table of "cloths of 22 inches," if we wish to ascertain the whole gore in fifteen cloths the angle of gore being twenty-five degrees we look at 25° in the column of degrees of No. 15 and opposite to it in the right hand adjacent column we have 154 as the whole

depth of gore. The process of finding the depth is as follows:

$$\frac{\text{log. cosine } 25°}{\text{log. } 330} = \text{No. of inches in 15 cloths} = \frac{\text{log. sine } 25°}{\text{log. } 154} \text{ approximately}$$

or as expressed in figures

$$\frac{\text{log. cosine } 25° = 9.95728}{\text{log. } 330 = 2.51851} = \frac{\text{log. sine } 25° = 9.62595}{\text{log. } 153.87 = 2.18718}$$

Therefore for 153.87 we insert 154 in the tables.

Having thus found the whole depth of gores one-fifteenth of 154 or $10\frac{1}{4}$ inches (near enough for practice) will give the depth for one cloth which is nearer by one-quarter of an inch than is denoted in the double column No. 1, of the table against 25 degrees. I have here given but two tables as these are amply sufficient to exhibit the method on which others for cloths of less or greater width may be constructed.

Having thus explained the principles on which the tables are calculated, their application in practice will be easily understood by the following explanation of finding the gores of different sails. Suppose we desire the stay and foot gores of a jib we proceed as follows. Fig. 2, represents a jib the dimensions of which we will suppose to be equal to forty-five feet on the stay B C; twenty-six feet on the foot or A B and thirty-three feet on the after leach or A C. If desired to find the stay and foot gores, represented by C *a* for the former and *c d* for the latter we arrange the scales as seen in Fig. 3; that is to say we take a distance *h f* on D of five inches and two-tenths of an inch which, as the scale is five feet to an inch, is the required distance, representing twenty-six feet. Next take on ruler A a distance *g h* equal to six inches and six-tenths of an inch, this being the proportional distance for thirty-three feet, the length of the after leach. Lastly take nine inches from *f* to *g* on ruler E, first placing the upright point *y* Fig. 1, of the center of the rulers E F, through the small hole in the division of ruler D expressing five inches of two-tenths of an inch. Then bring the division expressing nine inches on the edge of ruler E to correspond with the division six inches and six-tenths of an inch on ruler A, and turning down the clamping nuts the space *f g h*, Fig. 3 will represent the required shape of the jib, the parallel lines on the card or paper under the ruler showing the number of cloths or strips of canvass in the same. The index *i* of the ruler D will denote in the graduated semicircle *e f g* Fig. 1, or *e' f' g'* Fig. 3 the numbers of degrees in the angle of the foot gore, which we will suppose to be eight degrees (8°) that is the angle *c e d* Fig. 2, is equal to eight degrees. In the table headed "cloths of 28 inches" we find against 8° in the double column No. 1, four inches (4 inches) as the depth of the foot gore for each cloth or *c d* Fig. 2=4 inches. But if we wish to obtain this measurement more exactly, we have only to count the number of cloths in the sail, which in Fig. 3 is found to be eleven. Then looking in double column No. 11, against 8° we have 43 inches for the whole gore; which divided by 11, (the number of cloths) gives a result of $3\frac{10}{11}$ inches, as the true depth of the foot gore of each cloth. In practice four inches are sufficiently near.

The next operation is to ascertain the angle of the stay gore or C *b a*, Fig. 2. The graduated circle *x* Fig. 1, with the rule G should be brought into the position denoted in Fig. 3; that is to say, turn the circle round in its center until the side of the rule G is parallel to the perpendiculars denoting the seams of the cloths; then the angle subtended between the inner edge of the rule E and the zero of the upper limb of the circle *x* or center line of the rule G will be the complement of the angle required which in this case we find is (34°) thirty-four degrees; subtracting this from (90°) ninety degrees we have (56°) fifty-six degrees for the angle of the stay gore. Now on looking in the tables in the double column of degrees above (45°) forty-five degrees, against (56°), we find 3 feet and 5 inches as the depth of C *a* Fig. 2, or the stay gore for each cloth.

As the foot of a jib for large vessels is seldom cut on a straight line but cuved as seen at A *f* B, Fig. 2, or in nautical language "with a sweep," the mode I adopt for finding the gores on the foot for each cloth is thus described. Bring the ruler I into the position denoted by the dotted lines in Fig. 3, or so that the curve of its upper edge shall pass through the point *f*. Then that portion of the curve of the ruler between *h* and *f* will exhibit the sweep of the foot.

The ruler I is not formed with any particular curve but such a one may be adopted as will answer for different sails—or instead of one ruler we can employ two or three of different curves according to the

pleasure and taste of the sailmakers. The ruler I being in the position above mentioned, clamp it by the nut —*k*—. Next we remove the rulers E F G and circle *x* leaving the rulers D and I. First we wish to obtain the angle on which to cut the gore, A *g* Fig. 2, or the angle made by a chord A *g* with a line drawn through *g* parallel with D B. We move the ruler D, downward until its upper edge coincides with the intersection of the line between the cloths 1, and 2, Fig. 3 and the upper curve of the ruler I. This intersection corresponds with the point *g* Fig. 2. Then the fiducial edge of the index —*i*— of the ruler D will denote the number of degrees in the angle required which in this case is (19°). Then looking in the table we find in column No. 1, against (19°), in the adjacent column, the number 10 or ten inches as the depth of the first gore. Then on cutting the first and the stay gores of the first and second cloths, in the manner before mentioned we measure off the length *h g* Fig. 2, of the after selvage of the second cloth by applying it to the free selvage of the first cloth. Our next operation is to obtain the angle of *g h*. Move the ruler D a short distance upward until its upper edge coincides with the point *h* or end of the divisional line between the second and third cloths. By inspecting the semicircle *f g h* Fig. 2, we thus have the angle made by a straight line drawn from A to *h* Fig. 2, and a line through the point *h* parallel D D, say equal to (18°). Now looking in the table double column No. 2 against (18°) we find 18 inches, as the depth of gore for two cloths. Then (18—10) eighteen minus ten leaves 8 inches as the depth of the gore of the second cloth.

For the foot of the third cloth we move the ruler D upward as before, and read off the angle between the points A *i* and an imaginary line through *i* Fig. 2, parallel to D B which in this case suppose to be (16°). Against (16°) in No. 3, denoting the third cloth, we find 24 inches as the whole depth of gore. Therefore subtracting from the same 18 or the sum of the depths of the first and second cloths we have (6) as the depth of gore of the third cloth. Then as in Fig. 4, as we are to form the foot of the third cloth, which we have already shaped on the angle of the foot *g h* of the second cloth, we must set off two inches from *g* to *l*. Then *l m* will be equal *n i* or six inches. Cut from *h* to *l* and we obtain the true shape of the foot of the third cloth. We continue, in a similar manner for the remaining cloths having previously made our calculations of the differences *g l* for each cloth; if we are correct in setting off and cutting the slope A *g* of the first, we shall find no difficulty in proceeding with the rest and thus we are enabled to cut a jib with or without a sweep on the foot.

I now proceed to exhibit the application of the scales to finding the gores on the head, foot, and mast or fore leach of a trysail of the following dimensions.

Hoist on the trysail mast=24 feet.
Length of trysail on the foot=37 feet.
Do Do. head=27 feet.
Do of diagonal=39 ft. 6 inches.
Do after leach=37 feet.

The rulers will be arranged as exhibited in Fig. 5; and in order to dispose them as therein represented, we first lay on ruler —C— the length from *k* to *h* corresponding to the diagonal which would be seven inches and nine-tenths of an inch. Through the division hole we insert the projecting pin *y*, Fig. 1, for the intersection of the rulers E and F, Fig. 5. Then lay off *g h* on ruler E equal to five inches, and four tenths of an inch, which gives us the length of the trysail on the head; also lay off *g k* equal to seven inches and four-tenths of an inch corresponding to the after leach. Clamp C and E in this position. Next set off *h i* on F equal to four inches and four tenths of an inch and *i k* on D equal to seven inches and four-tenths of an inch. The space *g h i k* circumscribed by the rulers will thus exhibit the exterior of the trysail while the card or ruled paper on the board will show the number of cloths in the same.

The gore on the head is found by bringing the circle *a* and ruler G into the proper position denoted in Fig. 5, when we shall find that the ruler E will cut on the graduated circle *x* the angle of the head gore which in this particular instance will equal (16°). Then looking in the tables under double column No. 1 we find against (16°) 8 inches as the depth of gore required.

The gore on the foot is determined by the angle which the index of the ruler D indicates on the graduated semicircle. *e′ f′ g′* which in this particular case is twelve degrees (12°) against (12°) in the tables we find 6 inches as the depth of the foot for each cloth .

The gore on the mast or fore leach is determined by the angle which the inner edge of the ruler F′ cuts on the graduated circle *x*, which is the complement of the angle of gore. In this case the gore angle will equal (65°) and the depth of the gore will equal 5 feet.

The next sail in order is the square mainsail Fig. 6, and we now proceed to determine the gore on the side leaches and roach of the foot by the application of the scales and tables. As on inspection of Fig. 6 it will be perceived that both sides of this sail

are alike, or A E F C equals D B E F we have only to project one-half by the scales. In this case it will readily be seen from the foregoing explanation, that by laying off on the ruler E, from its point of junction with the ruler F, half of the length of the head of the sail or E B, and placing the edge of said ruler perpendicular to the lines of canvass, or to the edge of A, and also setting up F E on ruler A and B D on ruler F we can obtain the angles for the side gores; and also by reversing the ruler I so as to form the roach of the foot or F D, we can obtain the angles of the gores of the feet of strips or cloths, in a similar manner and by similar principles to those heretofore described in the explanation of the mode of finding the sweep of a jib. As all this will be easily understood by any sail maker, from the principles heretofore explained, it is unnecessary to go into any more particular description of the same. As a straight ruler H divided as seen in Fig. 1, and having screws and nuts a^3 b^3 is sometimes convenient, during the operations of determining the angles and dimensions of other sails, and may be used according to the pleasure of the sail maker, I have added one to my collection of scales, but I do not consider it as embraced in my main collection, but merely secondary to the same.

Having herein-above explained the construction of my mathematical scales, and tables together with their practical application, I now proceed to specifically point out, such parts thereof I claim to be my invention—

1. I claim, the scales A and B, in combination with the scales C D E F, ruler G, and circle x, the whole constructed, arranged, graduated and operating together, substantially in the manner above mentioned and described, for the purpose of determining the angle of the gores on the head, foot and leaches of different sails as herein above explained.

2. I also claim, the combination, with the above specified parts of the ruled table or card e' f' g' h', constructed and arranged substantially as above described for the purpose of determining the number of breadths or cloths of canvass in a sail, in the manner herein-before explained.

3. Furthermore, I claim, the curved ruler I, constructed and arranged substantially as above described, in combination with the ruled table or card e' f' g' h' and the scales A and D, for the purpose of determining the angles of the gores of the roach or sweep of the foot of a sail, in the manner herein before explained.

In testimony that the above is a true description of my said invention and improvement I have heretofore set my signature this fifth day of December in year eighteen hundred and forty.

JOHN DOMINIS.

Witnesses:
WM. JARRETT,
WILLIAM LADD.