of the air in the gauge ; its volume at the observed temperature ; the volume reduced to 48°, the temperature of graduation of the gauge at which the column of mercury, equivalent to an atmosphere, is very nearly 30 inches ; the elasticity of the compressed air, in inches of mercury ; the correction in the height of the column of mercury, for the depression produced in the cistern below ; the height thus corrected : the height, after subtracting the sensibly constant number for the column of water be tween the level of the steam-pipe from the boiler and the cistern of the gauge ; the total elasticity in inches of mercury ; the elasticity in atmospheres. The first line of numbers in the table is merely introduced for the convenience of presenting certain data required for subsequent calculation ; it gives the height of the mercury in the gauge before beginning the observations, after correct­ing for the height of the barometer.

A curve traced to represent these observations, the ordinates representing the pressures, and the abscissæ the

temperatures, is quite regular, until the temperature cor responding to eight atmospheres is attained, when it rises abruptly. This fact was explained, by examining the gauge ; it was found that the cement us< d in attaching the glass tube to its ferule had become softened, and had permitted the tube to rise. This defect was remedied and its recurrence prevented. It was then determined to repeat the entire series of observations, and to carry them as high as could be done, with reasonable convenience, aiming particularly, to embrace the range of working, pressures of the American engines.

The results are contained in the following table in which the observed data, and calculated numbers, are arranged as in the last table. This table extends to 9∙91 atmospheres, and to the temperature of 352° Fahrenheit.

Care was taken that the elasticities were increased not too rapidly, and the last numbers obtained, were verified by keeping the temperature sensibly constant for a considerable time.

Ταβle No. II.— Of the Elastic Force of Steam at Different Temperatures.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tempera­ture of Steam. | Tempera­ture of thermo­meter  scale. | Height of mercury in air gauge. | Temperature of air in gauge. | Volume of air nt ob­served tem­perature. | Volume of air at 48° Fah. | Elasticity of air in inches of mercury | .01 Height of gauge. | Height ½ .01 height. | Height + .01 height — 1.29 inches. | Total elas­ticity in inches of mercury. | Elastic force in atmospheres of 30 inches. |
| Fah.° | Fah.° | Inches. | Fah.° | Vols. | Vols. | Inches. | Inches. | Inches. | Inches. | Inches. | Atmos. |
|  |  | 5.56\* | 48 | 7.695 | 7∙695 | 25.67 | .06 | 5.84 | 4.55 | 30.00 | 1.00 |
| 2481/4 | 54 | 14.04 | 53 | 4.32 | 4.277 | 46.19 | .14 | 14.18 | 12.89 | 59.08 | 1.97 |
| 2691/2 | — | 17.34 | 52 | 3.05 | 3.026 | 65.29 | .17 | 17.51 | 16.22 | 8151 | 2.72 |
| 2841/2 | — | 19.64 |  | 2.17 | 2.152 | 91.76 | .19 | 19.83 | 18.54 | 110.30 | 3.68 |
| 2891/2 |  | 20.06 | " | 1.99 | 1.974 | 100.05 | .20 | 20.26 | 18.97 | 119.02 | 3.97 |
| 294½ | — | 20 56 | 53 | 1.82 | 1.802 | 109.63 | .21 | 20.77 | 19.48 | 129.11 | 4.30 |
| 2991/2 | *—* | 21.04 | 54 | 1.63 | 1.611 | 122.66 | .21 | 21.25 | 19∙96 | 142.62 | 4.75 |
| 304½ | *—* | 21.34 | 54½ | 1.52 | 1.500 | 131.66 | .21 | 21.55 | 20.26 | 151.92 | 5.06 |
| 310½ | *—* | 21.64 | " | 1.405 | 1.382 | 142.94 | .22 | 21.86 | 20.57 | 163.51 | 5.45 |
| 3143/4 | 58 | 22.04 | 55 | 1.25 | 1.233 | 160.26 | .22 | 22.26 | 20.97 | 181.23 | 6.04 |
| 3193/4 | — | 22.34 | 551/2 | 1.14 | 1.124 | 175.86 | .22 | 22.56 | 21.27 | 197∙13 | 6.57 |
| 3293/4 | — | 22.84 | 56 | 0.95 | 0.937 | 210.84 | .23 | 23.07 | 21.78 | 232.62 | 7.75 |
| 3341/2 | 66 | 22.94 | 57 | 0.92 | 0.904 | 218.60 | .23 | 23.17 | 21.88 | 240.48 | 8.02 |
| 3383/4 | — | 23 04 | 57½ | 0.887 | 0.870 | 226.92 | .23 | 23.29 | 22.00 | 248.92 | 8.30 |
| 345 | — | 23.24 | " | 0.82 | 0.805 | 245.44 | .23 | 23.47 | 32.18 | 267.62 | 8.92 |
| 348 | — | 23.34 | 58 | 0.787 | 0.771 | 256.05 | .33 | 23.57 | 22.28 | 278.33 | 9∙28 |
| 350 | — | 23.44 | " | 0.752 | 0.737 | 267∙97 | .23 | 23.67 | 22.38 | 290.35 | 9.68 |
| 352 | — ' | 23.50 |  | 0.733 | 0.719 | 274.92 | .23 | 23.73 | 22.44 | 297.36 | 9.91 |
| 346 | — | 23.28 | 62 | 0.807 | 0.785 | 251.78 | .23 | 23.61 | 22.22 | 274.00 | 913 |

\* This observation shows the corrected height of the gauge before the experiments.

There is one observation, namely, that at 3293/4°, which observations of temperatures and pressures incidentally is certainly recorded erroneously ; but omitting this one, made during the other experiments of the committee, are the rest which are given, present very tolerable regu brought together in the annexed table.

larity in the curve traced to represent them. For the A column is added to the table, to show the number sake of adding to the force of these results, the scattered of observations employed in obtaining the results.

TablE No. III *Of the Elastic Force of Steam at Different Temperatures.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tempe­rature of Steam. | Temperature of thermo­meter  scale. | Height of mercury | Tempera­ture of | Volume of | Volume of air at 48° Fah. | Elasticity of air in | + .01 Height of gauge. | Height of gauge | Height +.01 height—1.29 inches. | Elasticity of steam in | Elastic force in atmos­pheres. | No. **of ob** |
| in air gauge. | air in gauge. | served tem­peratures. | Inches of mercury. | + .01 height. | inches of mercury. | serva  tions. |
| Fah.° | Fah.° | Inches. | Fah.o | Vole. | Vole. | Inches. | Inches. | Inches. | Inches. | Inches. | Atmos. |  |
|  |  | 3.91\* | 59 | 8.35 | 8.169 | 27.34 | .04 | 3.95 | 2.66 | 30.00 | 1.00 |  |
| 234 | 54 | 8.80 | 55 | 6.39 | 6.301 | 35.45 | .09 | 8.89 | 7.60 | 43.05 | 1.43 | 1 |
| 2391/4 | 62 | 9.94 | 61 | 5.94 | 5.788 | 38.59 | .10 | 10.04 | 8.75 | 47.34 | 1.58 | " |
| 2451/4 | 68 | 11.16 | 63 | 5.46 | 5.300 | 42.14 | .11 | 11.27 | 9∙98 | 52.12 | 1.74 | 5 |
| 2501/4 | 70 | 12.54 | 63 | 4.92 | 4.776 | 46.77 | .12 | 12.66 | 11.37 | 58.14 | 1.94 | 4 |
| 2561/4 | 73 | 13.88 | 64 | 4.38 | 4.243 | 52.64 | .14 | 14.02 | 12.73 | 65.37 | 2.18 | 5 |
| 2623/4 | 77 | 15.14 | 64 | 3.89 | 3.768 | 59.27 | .15 | 15.99 | 14.00 | 73.27 | 2.44 | 2 |
| 271 | 70 | 16.34 | 65 | 3.43 | 3.316 | 67.35 | .16 | 16.50 | 15.21 | 82.56 | 2.75 | 4 |
| 278 | 75 | 17.44 | 70 | 3.01 | 2.882 | 77.49 | .17 | 17.61 | 16.32 | 93.81 | 3.13 | 3 |
| 288½ | 75 | 18.74 | 68 | 2.50 | 2.403 | 92.94 | .19 | 18.93 | 17.64 | 110.58 | 3.69 | 3 |
| 291 | 76 | 19.14 | 65 | 2.36 | 2.282 | 97.88 | .19 | 19.33 | 18.04 | 115.92 | 3.86 | 2 |
| 292½ | 65 | 19∙44 | 63 | 2.25 | 2.184 | 102.26 | .19 | 19.63 | 18.34 | 120.60 | 4.02 | 3 |
| 300 | 73 | 20.12 | 65 | 1.98 | 1.494 | 117.33 | .20 | 20.32 | 19.03 | 136.36 | 4.55 | 4 |
| .3031/2 | 74 | 20.54 | 66 | 1.82 | 1.756 | 127.27 | .20 | 20.74 | 19.45 | 146.72 | 4.89 | 1 |

\* This observation shows the corrected height of the gauge before the experiments.