Now it is well known that the area EF *e* DE is equal to ABFE multiplied by the hyperbolic logarithm of AD/AE, = L. AD/AE, and the whole area ABFc DA is = ABFE x (1 + L. AD/AE). Thus let the diameter of the piſton be 24 inches, and the preſſure of the atmoſphere on a ſquare inch be 14 pounds ; the preſſure on the piſton is 6333 pounds. Let the whole ſtroke be 6 feet, and let the ſteam be ſtopped when the piſton has deſcended 18 inches, or *1,5* feet. The hyperbolic logarithm of 6/1,5 is 1,3862943. Therefore the accumulated preſſure ABF *c* DA is = 6333 × 2,3862943, = 15114 pounds.

As few profeſſional engineers are posseſſed of a table of hyperbolic logarithms, while tables of common lo­garithms are or ſhould be in the hands of every perſon who is much engaged in mechanical calculations, let the following method be practiſed. Take the common logarithm of AD/AE, multiply it by 2,3026 ; the product is the hyperbolic logarithm of AD/AE. The accumulated preſſure while the piſton moves from AB to EF is 6333 × 1, or simply 6333 pounds. Therefore the ſteam while it expands into the whole cylinder adds a preſſure of 8781 pounds.

Suppoſe that the ſteam had got free admiſſion during the whole deſcent of the piſton, the accumulated presſure would have been 6333 × 4, or 25332 pounds.

Here Mr Watt obſerved a remarkable reſult. The ſteam expended in this caſe would have been four times greater than when it was ſtopped at 1/4th, and yet the accumulated preſſure is not twice as great, being nearly 5/3ds. One-fourth of the ſteam performs nearly 3/5ths of the work, and an equal quantity performs more than twice as much work when thus admitted during 1/4th of the motion.

This is a curious and an important information, and the advantage of this method of working a steam-engine increaſes in proportion as the ſteam is ſooner ſtopped ; but the increaſe is not great after the ſteam is rarefied four times. The curve approaches near to the axis, and ſmall additions are made to the area. The expenſe of ſuch great cylinders is considerable, and may Sometimes compenſate this advantage.

|  |  |
| --- | --- |
| Let the fleam be flopped at | Its performance is mult. |
| **1/2** | 1,7 |
| **1/3** | 2,1 |
| **1/4** | 2,4 |
| **1/5** | 2,6 |
| **1/6** | • 2,8 |
| **1/7** | 3, |
| **1/8** | 3,2 |
| **&C.** | &c. |

It is very pleaſing to obſerve ſo many unlooked- for advantages reſulting from an improvement made with the ſole view of leſſening the waſte of steam by condenſation. While this purpoſe is gained, we learn how to husband the ſteam which is not thus wasted. The engine becomes more manageable, and is more eaſily adapted to every variation in its taſk, and all its powers are more eaſily computed.

The active mind of its ingenious inventor did not stop here : It had always been matter of regret that one-half of the motion was unaccompanied by any work. It was a very obvious thing to Mr Watt, that as the ſteam admitted above the piſton preſſed it down, ſo ſteam admitted below the piſton preſſed it up with the ſame force, provided that a vacuum were made on its upper side. This was eaſily done, by connecting the lower end of the cylinder with the boiler and the upper end with the condenſer.

Fig. 11. is a repreſentation of this conſtruction ex­actly copied from Mr Watt’s figure accompanying his ſpecification. Here BB is a ſection of the cylinder, ſurrounded at a ſmall diſtance by the caſe 1111. The ſection of the piſton A, and the collar of leathers which embraces the piſton rod, gives a diſtinct notion of its conſtruction, of the manner in which it is connected with the piston-rod, and how the packing of the piſton and collar contributes to make all tight.

From the top of the cylinder proceeds the horizon­tal pipe. Above the letter D is obſerved the seat of the ſteam valve, communicating with the box above it. In the middle of this may be obſerved a dark ſhaded circle. This is the mouth of the upper branch of the ſteam pipe coming from the boiler. Beyond D, below the letter N, is the ſeat of the upper condenſing valve. The bottom of the cylinder is made ſpherical, fitting the piſton, ſo that they may come into entire contact. An­other horizontal pipe proceeds from this bottom. Above the letter E is the ſeat of the lower steam valve, opening into the valve box. This box is at the extre­mity of another ſteam pipe marked C, which branches off from the upper horizontal part, and deſcends ob­liquely, coming forward to the eye. The lower part is repreſented as cut open, to ſhow its interior confor­mation. Beyond this steam valve, and below the letter F, may be obſerved the ſeat of the lower conden­ſing valve. A pipe deſcends from hence, and at a ſmall distance below unites with another pipe GG, which comes down from the upper condenſing valve N. Theſe two eduction-pipes thus united go downwards, and open at L into a rectangular box, of which the end is ſeen at L. This box goes backward from the eye, and at its farther extremity communicates with the air pump K, whoſe piston is here repreſented in ſection with its butterfly valves. The piſton delivers the water and air laterally into another rectangular box M, darkly ſhaded, which box communicates with the pump I. The piſton-rods of this and of the air-pump are ſuſpended by chains from a ſmall arch head on the inner arm of the great beam. The lower part of the eduction-pipe, the horizontal box L, the air-pump K, with the communicating box M between it and the pump I, are all immerſed in the cold water of the condensing ciſtern. The box L is made flat, broad, and shallow, in order to increaſe its ſurface and accelerate the condenſation. But that this may be performed with the greateſt expedition, a ſmall pipe H, open be­low (but occasionally ſtopped by a plug valve), is inſerted laterally into the eduction-pipe G, and then divides into two branches ; one of which reaches within a foot or two of the upper valve N, and the other approaches as near to the valve F.

As it is intended by this conſtruction to give the piston a ſtrong impulſe in both directions, it will not be