

fixed to a very fine 18-inch horizontal engine, at the Pomona Show, Manchester. This engine was a good specimen of a comparatively cheap and serviceable steam motor. Cheapness of detail and construction had been fully attended to where it did not interfere with efficiency. We understand that there are several variable expansion gears at work, and doing well, in different parts of the country and abroad. Two sister engines to the one exhibited, and fitted with Rigg's Governor, are driving the contractor's machinery on the site of the new Law Courts in the Strand.

The construction of this valve gear is very simple and is clearly shown in our illustration. The engine is fitted with the ordinary three-port slide valve, driven by separate eccentric tumblers and rods.

The eccentric tumbler of the expansion valve is free to work in a slot in a line with the throw of the tumbler, upon a square boss keyed to the shaft. The position of the tumbler in the line of its throw, is determined by two sliding inclined faces, moving in a direction perpendicular to the line of throw of the eccentric. These sliding inclined faces are part of a hoop forging, which embraces the square block keyed to the shaft, and has its extremities united by a heavy weight. This V hoop and weight form the governor. It is held in its normal position by a stiff spiral spring surrounding a strong pillar guide. Under any acceleration of speed, the weight tends to fly from the centre by centrifugal force, compressing the spring until the speed once more relaxes, and the spring resumes its normal condition. The effect of this sliding motion of the V hoop and inclined faces is to alter the throw of the expansion valve eccentric tumbler, and in this way to alter its point of cut-off much in the same way as by the hanging links of the locomotive.

In the one extreme abnormal position of the eccentric tumbler the expansion valve admits the steam for the full length of the stroke; in the other extreme position, the expansion valve will cut-off the steam supply almost altogether, by not allowing the steam ports to be open for any appreciable time. Only sufficient steam is then admitted to drive the engine unloaded.

We may, in conclusion, draw attention to the great simplicity and small number of parts in the whole governor gear and variable expansion arrangement. This is most valuable from the customer's point of view both for small cost and durability, and to meet the views of those most economically inclined, the governor gear can be attached to the eccentric tumbler of the single valve, with equal governing effect. The clean cut-off of the expansion arrangement is well shown in the accompanying indicator diagram.

These valves are supplied by Messrs. Wheatley, Kirk and Price, of Manchester.

—Iron.

### TO STRETCH DRAWING PAPER.

Lay the sheet flat on the board with that side undermost that is to be drawn upon, and with a sharp knife pare the thick edges from the paper; draw a wet sponge freely and rapidly over the upper side, beginning at the centre, damping the entire surface and allow the sheet to rest for a few minutes till all be damped through, and the surface water disappears. Those parts which appear to revive too soon retouch with the wet sponge, the damping should be done as lightly as possible and with little friction; now turn the sheet over and place it exactly in position on the board, and lay a straight edge or squares on the paper within  $\frac{1}{4}$  of an inch of the edge of the paper, and fold back a margin upon it, smear over this margin with melted glue, the paper is then folded back on the board and the superfluous glue pressed out with a paper folder or other smooth article, the same operation being rapidly applied to the other edges the sheet is then left to dry.

**PAPER FRICTION PULLEYS.**—These superior mechanical contrivances are made by cutting pieces of pasteboard into a circular form, and of the desired diameter of the pulley, and placing them in layers one on the top of another, cementing properly with a good coat or glue between each layer, pounding or pressing them together as close as possible, and leaving a perforation in the centre of each, for the shaft. When you have got enough of these layers together to give you the proper breadth of pulley, allow the glue to harden, then turn it off to a smooth finish in a lathe. Secure each side of the pulley with a good stout iron flange large enough to cover the entire diameter, or nearly so, and with proper usage it will last a long time.

## AID TO THE ART OF DRAWING.

(Continued.—See illustrations on page 24, January Number.)

### THE PERSPECTIVE RULER.

Fig. 12 is a simple arrangement for drawing lines in correct perspective, and avoids the difficulties happening when a vanishing-point is marked at a considerable distance from the drawing, and the lines drawn therefrom by a long ruler. It consists in three arms of equal length pivoted together at one end by a screw-clamp. Two pins are inserted in the drawing-board against which two arms of the "perspective lineal," as it is termed, abut. The angle of these arms and the position of the pins are governed by the distance required for the vanishing-point, as the greater the angle, the further the same is removed, and *vice versa*. Once adjusted, the parts are clamped firmly together and the lines ruled by the upper side of the arm which rests upon the paper. Of course, the arms at an angle are always kept in contact with the pins, while the ruling arm, which is the lowest of the three, is moved up or down about the paper. This instrument is easily made of seasoned wood or metal. Two are necessary, right and left handed, owing to the construction, for use on each side of the board.

### THE PANTAGRAPH.

In concluding our series, we add an engraving of the pantagraph, Fig. 13, a quite useful instrument, in which the principle involved is that of the proportional compass. There are four rulers, joined together at their intersections, and having at two of the angles, supports terminating in round points, or smoothly running casters. At one of the other angles is a weight to which the apparatus is pivoted, and which holds it in place, and at the fourth corner is a tracing-point, shown in the hand of the operator. Directly across the frame thus made, and pivoted at its ends to the centres of two of the bars, is a fifth ruler, through the middle of which passes a pencil. Along half the length of the two side-bars, and also of the central bar, are made perforations, so that the length of said rulers can be shortened as rendered necessary. The tracing-point is moved over the outline to be followed, and its motion is communicated to the series of rulers which by a kind of parallel movement actuates the pencil to describe precisely the same line, equal in dimension to that of the copy, or enlarged or reduced. Space forbids our entering into the mathematical demonstration of how this instrument reduces or enlarges, but generally it may be stated that the scales of the two drawings are to each other as the distances of the pencil and of the tracing-point from the fulcrum or pivot of the pantagraph, and these distances are adjusted by altering the position of the joints in the holes above noted. Any good mechanic can make the instrument for himself from hard wood, though metal is better. Care must be taken in constructing the joints, as looseness or bad fitting in such places greatly impairs the accuracy of the copy. In fact, any of the devices we have described require but little skill, though perhaps some time and patience in their manufacture. But if properly finished in a workmanlike manner, none will fail to be handy and useful additions to any apprentice's collection of drawing-tools.

It is stated that a new line of British-built screw steamers will shortly begin running between Boston and New York and the west coast of South America by way of the Straits of Magellan.

The quickest miles of the recent trial trip of the postal train between New York and Chicago were 20, in which the time per mile ranged from 51 to 56 sec. The last 71 miles before reaching Elkhart was run in 71 minutes.

In order to manufacture brown ochre, expose in a cast iron revolving retort, to a cherry-heat heat, a mixture of 110 parts yellow ochre with five parts of common salt for two hours. The product forms a brown ochre of unchangeable hue.

M. MOUCHON, a mathematical professor, has lately presented to the Academy of Sciences at Paris a curious apparatus, by which the solar heat may be so concentrated as to propel a small steam engine. It is by means of a reflector, having the form of an ordinary sunshade, inclined at an angle of 45 deg. on the axis, that M. Mouchon has succeeded in obtaining so curious a result. The heat of the sun penetrates through the sides of the vases which contain the water, and in eight minutes five pints of water may be caused to boil. M. Mouchon, in answer to some questions from the President of the Academy, gave the most satisfactory explanation, and convinced all present of the practicability of his invention,—which is Ericsson's.