BRADLEY'S CUSHIONED HAMMER.

We spoke in high terms of this invention upon the occasion of its exhibition at the fair of the American Institute in this city. Since that time its use has been greatly extended, and it is now introduced into many of the most important manufacturing establishments in the country. Its manufacturers have received a great number of favorable testimonials from those who have proved its merits in practical and continued use The hammer is adjustable in line of action, length of stroke, rapidity of motion, and in weight and force of blow Each or any of these may be changed, and most perfectly controlled at the will of the operator. In addition to these desirable qualities, it is adaptable to any work which requires continuous, exact, positive, and forcible yet an elastic stroke The exceedingly difficult swaging of cotton-spindles, to which this hammer has been found eminently adapted, may be instanced as an illustration of the advantages possessed by it in work of this kind It is stated that no other hammer has been able to turn out cotton-spindles in quality and quantity as satisfactorily as this The capacity of the hammer is increased far beyond that of other hammers of its class, and at the same time it is compact and portable. As the use of the rubber springs obviates the stubborn jar of other hammers, it is far more durable and involves much less outlay for repairs All parts of the hammer are made of iron except the helve. The anvil-block has a foundation independent of that of the main bed, but the parts are so united as to transmit nearly the entire jar from the stroke of the hammer to the anvil-bed alone. The helve is nicely balanced, and swings upon two adjustable hardened steel eccentrics Motion is imparted to it by a broad steel eccentric, operating in connection with the clinch and the rubber cushions, the length of the stroke being governed by the adjustable eccentric The force of the blow is greatly influenced by the reactive and united action of the cushions. The action is so perfect that when the hammer is in rapid motion the hand, when placed upon the machine, can scarcely identify the strokes of the hammer. The action of the helve, through the use of the yoke and cushions, has a flexibility which resembles that of the smith's arm. It is claimed that the helve never breaks, and that the broad steel eccentric obviates friction and heat. The adjustable cushion at the apex of the standard assists the lower cushion in heavy work, and also checks the upward motion. A universal joint connection prevents any twisting of the yoke and consequent bind or friction A foot-treadle is used to apply and regulate the power, and is so arranged that the operator can stand in front or on either side. A gentle pressure of the foot upon the treadle raises the tightener to operate upon the belt, and thus varies the stroke in proportion to the pressure applied. On removing the foot, the treadle flies up, bringing a brake upon the balance-wheel, stopping it instantly. The hammer is thus always left up, and it cannot stop with the dies closed. This is considered a very important feature. — *American Artisan.*

VERTICAL ENGINE.

We illustrate on page 36, a very neat vertical engine of a type designed and patented by Mr. Jeremiah Head, of Middlesbrough, the particular engine shown being one constructed for the Middlesbrough Wrought Nail Company (Limited), by Messrs. H. Alexander & Son, of Cirencester. The conditions required to be satisfied by this engine were: that it should work direct upon a line of shafting on either side; that it should make 120 revolutions per minute; that it should go at a uniform speed, whether all the nail-making machines were in action, or some only, or none at all; that it should work as economically; that it should occupy little floor space; that there should be small liability to wear; and that repairs should be easily executed if necessary. To fulfil these conditions the following arrangements were made, embracing some mechanical novelties.

The crank-shaft is of cast steel, carried upon four bearings; the crank pin is larger in section than the rest of the shaft, to prevent the usual risk of breaking there. There are, as will be seen from our engraving, two flywheels, one on either side, equi-distant from the crank, and each close to a bearing. The crank and half the weight of the connecting rod are compensated for by weights upon the flywheels. The inner bearings are close to the cheeks of the crank. Within either flywheel is a sheave with a strap passing thence to corresponding sheaves upon the extremities of a horizontal spindle which drives the governor. On either side of the crank between the inner and outer bearings is an eccentric, the one for working the main slide, and the other for the expansion slide. These arrangements secure symmetry, equality of wear, and freedom for shaking at high speeds. The cylinder is intended to be steam jacketted in this type of engine, though it was not made so in the present instance. In the engine we illustrate the cylinder is 22 in. in diameter with 24 in. stroke.

The piston is one of the solid class, and is packed with Ramsbottom rings, but instead of being placed each in its own groove, as is the usual plan, these are inserted in pairs, in two grooves of twice the ordinary width, as shown at *y. y*, Figs. 4 and 5, on the opposite page. The rings forming each pair cross joint one with another, each one being prevented from turning by a small stud screwed into the bottom of the groove, and situated between the butt-ends of the ring. It is found that whereas Ramsbottom rings often stick, when placed between the two fixed surfaces of a single groove, they never do when one surface is a moving one, as in this arrangement. Greater security against leakage of steam past the piston is also obviously secured by crossing the butt joints of two rings in contact.

The main slide (see Figs. 4, 6, 7, and 9,) is cylindrical, controlling the steam in the ordinary way, so as to give a certain amount of lead and constant cut-off towards the end of the stroke. As will be seen from the detailed view Fig. 9, it has small grooves cut round it to prevent leakage past of the steam, but they do not make the entire circuit of the valve for a reason which will presently be explained. The main slide spindle is of cast iron, as well as the slide itself, for the latter being perfectly balanced but little force is required to move it Within the main slide is an expansion slide, similarly constructed, and actuated from the opposite end of the slide chest. The expansion slide *l*, is shown separately by Fig. 8. The two slides are carefully fitted and ground into their places, as is now frequently done with steam hammer valves, and in other cases where the cylindrical construction is used. When, however, these valves wear slack, which they are liable to do after a time, it is proposed to split them down one side from end to end, first drilling a series of holes, as shown in Figs. 8 and 9. By this device the internal pressure of the steam is utilised to keep them tight, while at the same time the stregth of the opposite side of the valve is so regulated as to prevent too much yielding, which would result in friction. When split the joint of the outer valve will be on the side towards the cylinder, while that of the expansion valve will be exctly opposite. Corresponding facings pass from top to bottom of the inner surface of the slide chest and of the main valve.

As will be seen from Figs. 4, 6, and 7, the slide chest is made removable from the cylinder, so that it, together with the valves, may be kept in duplicate if desired, and at any time changed in two or three hours' time. The main slide valve is worked direct by the corresponding eccentric. The expansion slide is worked from a weigh-shaft passing below the cylinder. The rod connecting the expansion eccentric with the lever upon this weigh-shaft is severed about half way up, the two ends terminating in blocks, working in two radial grooves in a horizontally situated vibrating link. By means of a weigh-shaft operated by the governor, as shown in Fig 3, two levers upon this shaft, and two curved links passing from the ends of these levers to the two parts of the eccentric rod, the link blocks already mentioned are held in position. The rise and fall of the governor obviously regulates the length of stroke of the expansion valve and so controls the cut-off of the steam.

The governor is of the cross-armed description, but has been improved in several particulars. It is driven by the horizontal spindle connected by two straps with the crank-shaft, as previously described, and as shown in Figs. 1 and 2 The pendant arms of the governor are furnished with links passing upwards to a small cylinder, which rises and falls around a piston secured to the top of governor spindle. A single stud placed vertically in the centre of the top cover of this cylinder and furnished with a small crosshead, forms a