hole. Besides this, the piston rod of a "jumper" is burdened with the whole weight of the chisel, which increases as the hole becomes deeper, and requires additional power as the work proceeds or else loses in speed, whereas it is claimed that in the Warsop arrangement the moving weight is constant, and the only difference which can take place is a slight absorption, of power by the inertia of a long chisel when boring a deep hole; and that moreover, with a reduced weight of piston or mass in motion, a greater number of blows can be struck in a given time, representing an increase of effective work In the section, C is the cylinder or main body and frame of the machine. An inner cylinder or casing D, fits accurately into the cylinder C at its upper part, and this casing is free to partially rotate in the outer cylinder In the top of the casing D is firmly fixed a twisted bar, E, which may be either flat, square, or a round bar rifled with spiral groove cut in it This bar passes through a disc F of steel firmly fixed in the piston or ram G down the centre of which a hole is bored to receive the full length of twisted bar E. At the opposite end of the piston rod is firmly fixed or cottered a head H having two wings h^1, h^2, fitting grooves cast in the frame C and capable of sliding freely up and down them The head H is made to rest upon or strike at each blow an anvil or cap I having a recess at its lower part made to receive a drill or chisel The end of the anvil is formed with a rim around it, against which the end of the main body or frame rests. This base or rim of the anvil I has teeth cut around its periphery, into which gear a smaller toothed wheel J attached to or formed in one piece with the rod K and handle L, in such a manner that by turning the handle L the drill inserted in I will be rotated The reciprocating action of the piston G is as follow:—In the casing D are formed or cut four narrow longitudinal slots or portways. These slots correspond, one at the top and one at the bottom at the opposite slide of the casing, with corresponding portways in the cylinder C, and in such a manner that, when the casing is partially turned round, one port at the top and one at the opposite side are closed, and the other two are open Compressed air is admitted to the cylinder through the opening B, passes alternately through port 2 or 1 into the casing D, forces the piston G up and down, the steam or air escaping or exhausting alternately through ports 3 and 4, and out at the passage A. The partial rotation of D in the cylinder, and consequent regulation of the air to and exhaustion from the interior is effected by the reciprocating motion of the piston —which is prevented from turning round by the wings h^1, h^2, —causing the bar E to twist, or partially turn backwards and forwards, at each stroke in the hole made to receive it in the disc F, the motion given to the bar and casing being greater or less as the twist in the bar is greater or less By this means the piston G and top H are made to give a succession of rapid blows on the anvil I, and consequently to the drill point or cutting edge of the tool inserted in the anvil The drill is constantly being turned round by the handle L, the machine being prevented from turning round by a sleeve or slide M, which is firmly fixed to a tripod or heading stand Compressed air enters through one handle, while the other serves as an exhaust pipe. There is no striking action in the valve arrangement, which is designed to eliminate all loss from clearance spaces. This simple little tool may be easily carried about by one man, and may be put to work without even having the hole started by hand, as is not uncommon at present It has been successfully used, we understand, on the toughest sandstone without sticking fast, even when boring at the rate of 18in. per minute, and it has been equally successful on the Mount Sorrel granite, the hardest in the kingdom, which it pierced with a 1¼in. drill at the rate of 3ft. per hour, a feat which has never before been accomplished, so far as we are aware, by any power drill. The Warsop rock drill will do good work with air or steam at 16 lb per square inch the maximum pressure at any time need never exceed 20 lb. Messrs. Tangye Bros and Rake of Newcastle-on-Tyne, the licencees, inform us that they are at present under contract to supply a drill on this principle to bore 6in holes The weight of the apparatus, as represented in the woodcut, for boring 1½ in. holes, is only 65 lb.; larger sizes are light in proportion.

RECIPROCITY COUPLINGS FOR RAILWAY CARRIAGES.

The absolute necessity that exists for the introduction of secure and easily-manipulated couplings for railway carriages in place of those at present in use will be understood when it is remembered that, as admitted by the railway companies themselves, over 26,000 railway servants are annually killed or injured, and that these accidents, in a great number of cases occur whilst they are performing the operations of coupling or uncoupling trains. There is no little danger also to the general public from the hurried and consequently often imperfect manner in which this operation is performed, as the history of more than one fatal casualty shows, and the adoption of an improved system or apparatus has been strongly and repeatedly urged upon the railway authorities by the Government Inspector, Captain Tyler, whose extensive experience and special knowledge in railway affairs lends weight to any recommendation he may make.

Still, looking to the extent of the rolling-stock—there being nearly half a million railway waggons and other carriages in England alone—it is important that the desired change should be of such a character as not to necessitate any great displacement, while, at the same time, it is of equal importance that the new apparatus should be of easy application, and so simple that its working should be within the capacity of any railway porter. Farther, vehicles fitted with it must be capable of coupling themselves together automatically, without the intervention of manual labour, of ready disconnection without the necessity of men placing themselves between the carriages, and the couplings must work equally well with spring and block buffers, and do their work exposed to rough usage, dust, dirt, vibration, and exposure to all weathers. All these conditions appear to be fulfilled by the apparatus patented by Mr. Attwood Brockelbank. It possesses, in addition, provision for the effective tightening of the carriages; so that, whether they require to be tightened, loosed, or wholly uncoupled, all necessity for railway servants passing between the carriages is avoided, and each process is performed from any desired part of the vehicle and by one identical action. By its means, Mr Brockelbank says, an engine can couple up any number of trucks or carriages to make up a train by simply running up the buffers together, drivers can take up a train or leave it at will. These are valuable qualities, both as regards economy and safety, for they would effect a very considerable saving of time, labour and expense, in shunting operations, while drivers would be enabled in emergencies, such as in the Merthyr casualty, to follow a running train and secure it and they would be similarly enabled in another class of difficulties, as in the fatal accident at Guildford, to attach or withdraw their engines at discretion. The economical adoption of the new couplings is of prime importance The first cost would be trifling, they could be readily adapted to existing rolling-stock, for the couplings are fitted to the present draw-bar, the spring-action is maintained, and they can be used in conjunction with, while they allow of the gradual displacement of the present system. The experimental trials already made have been very successful, and the new couplings have been most favourably spoken of by many civil engineers of eminence. Altogether, whether we regard the combined simplicity and ingenuity of its construction, the facility and economy with which it may be adopted, the security it affords against accidents to passengers, and the promise it gives of some diminution of the terrible yearly slaughter of railway servants, we must regard this invention, should it at all fulfil the hopes and promises of its inventor, as one of the very first importance.

As has been already shown, the object of the invention is two-fold—first, to simplify the connecting means for the carriages composing railway trains, and secondly, to obviate the present necessity for railway servants passing between the carriages in coupling or uncoupling them, which is one of the most fertile sources of accident, and often fatal accident, to that useful and hard-worked class. The construction and *modus operandi* is as follows: — On waggons there is a combined hook and loop suspended so as to turn on pivots, and prevented by means of stops from falling below a horizontal line, in such a manner that when the ends of the two waggons are brought together the hook of one will slide over the end and into the loop of the other, and the connection is effected and disconnection accomplished from either side of the waggon by an ordinary lever. For carriages the connecting is effected in exactly the same manner by the coupling.

The engravings on page 64, will more fully explain the structure and indicate the action of the Brockelbank couplings.—*Iron.*