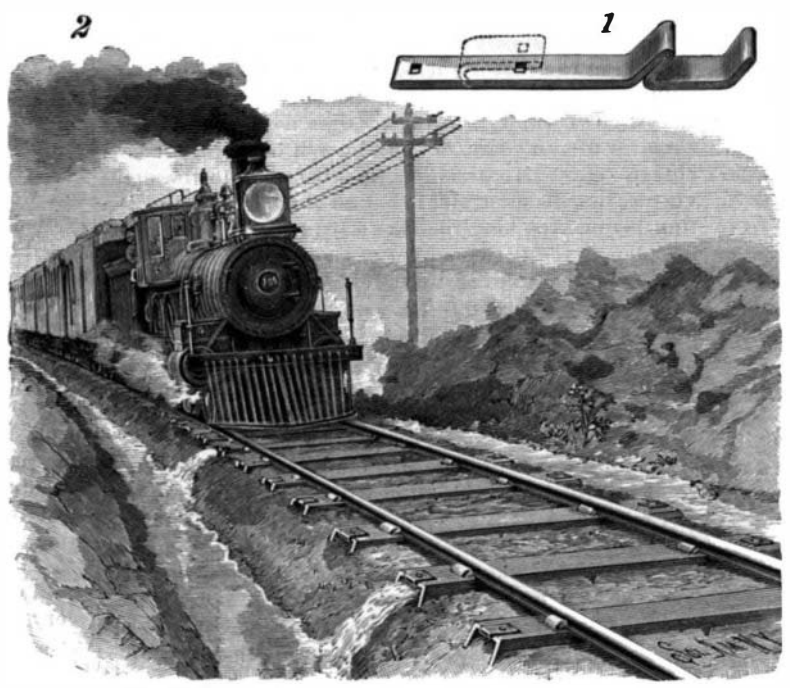
A METALLIC TIE AND RAIL FASTENING.

The illustration represents the use of a hollow metal tie, designed to be self-ballasted, or form a gutter for the escape of water when desired, and also a rail fastening for employment therewith, the construction being simple and cheap, and the tie possessing a necessary amount of elasticity. The tie and fastening form the subject of two patents issued to Mr. Bridges Smith, of Macon, Ga. The tie is formed from a sheet metal blank, bent down at right angles on its parallel sides, and cut inward diagonally at its lower edges to form points for anchoring the tie in place, a portion also being bent inward horizontally between the points, thus forming a mainly rectangular body. When the hollow tie thus formed is put in place, it may be filled with earth, clay, or other suitable ballast, or, if laid where water is liable to seek a passage across the railroad bed, the filling is omitted and a plate is inserted adapted to cover the bottom of the hollow space of the tie, which is thus made to serve as a passageway for the water. To fasten the rail to the tie, a flat plate of malleable metal is employed, bent at one end to form two flanges, as shown in Fig. 1. These flanges are passed upward through slots formed for the purpose in the upper surface of the tie, one of the flanges being adapted to rest upon the top of the rail base at one side, while the other flange is bent backward to clasp the rail base on its other side. The outer end of the fastening plate is also doubled over to lie flat upon the top of the tie, to which it is firmly secured by a bolt passed through the tie and two sections of the plate, the bolt hole in the tie having a slightly elongated form to allow for the expansion and contraction of the fastening plate.



SMITH'S RAILROAD TIE AND RAIL FASTENING.

Mines and Mining—Bituminous Coal in Pennsylvania.

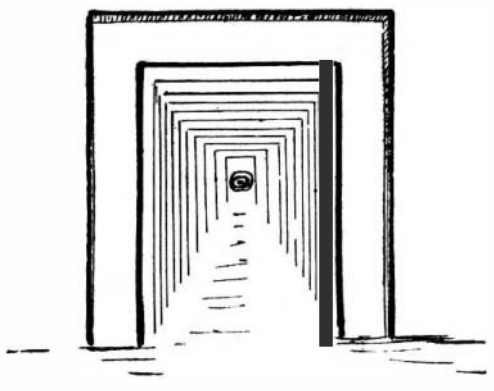
Mr. Robert P. Porter, Superintendent of Census, states in Census Bulletin No. 67, relating to bituminous coal in the State of Pennsylvania, which was prepared by Mr. John H. Jones, special agent, under the supervision of Dr. David T. Day, special agent in charge of the Division of Mines and Mining of the Census Office, that the output of the bituminous regions in the State was 36,174,089 short tons in 1889. The total value of the output is given as $27,953,215, or an average of 77·2 cents per short ton at the mines. The average number of persons employed in 1889 was 53,780, the amount paid for wages being $21,142,051. The output of small local banks and farmers' diggings is reported at 820,197 short tons. No report of this product has heretofore been attempted. The collection of this data was intrusted to resident special agents familiar with the territory under their charge, and the product of this important element of the coal industry in Pennsylvania is authentically given. The quantity sold to the local trade and to employes by regular establishments, together with this neighborhood mining, amounts to 1,590,651 short tons, or 4·40 per cent of the entire production. The amount of coal manufactured into coke during the year 1889 was 10,190,588 short tons, or 28·17 per cent of the total production. Altogether, the report shows a remarkable increase in the bituminous operations throughout the State.

The bituminous coal deposits of Pennsylvania form the northern extremity of the great Appalachian coal fields, and to a greater or less extent underlie all the territory of the State lying west of the crest of the Allegheny Mountains. The counties of Bradford, Tioga, Potter, Warren, Crawford, Venango, Forest, Elk, Cameron, Clinton, and Lycoming, in the northern portion of the State, exhibit only detached basins of the lower measures, which, however, are extensively mined, and the product finds ready markets for manufacturing purposes and for steam. The remaining counties, bounded by the western and southern State lines and a line drawn northward along the eastern boundaries of Fulton, Huntingdon, and Center counties, thence westwardly along the northern boundaries of Clearfield, Jefferson, Clarion, and Mercer, embrace an almost unbroken area of one or more of the important beds belonging to the carboniferous measures.

The counties of Allegheny, Westmoreland, Washington, Greene, and Fayette, situated in the southwestern corner of the State, contain the upper productive measures, at the bottom of which lies the notable Pittsburg bed, yielding in the vicinity of Pittsburg a gas coal of the highest quality; to the eastward the coking coals from which the celebrated Connellsville coke is made, and to the southward the Cumberland steam coals of Maryland. Small areas of this bed also occur in Indiana, Somerset, and Beaver counties. The remaining counties referred to contain only the lower productive measures, ranging from the isolated areas of the Pittsburg bed to the Brookville bed, the lowest in the lower productive series, and the Mercer, Quakertown, and Sharon beds in the conglomerate series. The product from this territory, as well as that from the southwestern counties wherever the lower measures are being mined, is classed in the trade as semi-bituminous, containing, as it does, less than 18 per cent of volatile combustible matter. While an excellent quality of coke is produced from coals mined in some localities from these lower measures, the distinctive advantages consist in their superiority as steam and rolling mill fuels, being much sought after for locomotive and steamship uses. In the Freeport and Kittanning beds of the lower productive series, cannel coal of good quality has been found to overlie the seam for considerable areas in certain localities, but on account of the veins being thin and troublesome to separate in mining it is not deemed of much commercial value.

RIFLE RANGE.

Target practice is a *sine qua non* where a regiment of soldiers, volunteer or regular, is to be efficiently maintained or worked into serviceable condition; and the possibility of keeping up, or starting, a good shooting range is at present, in many places, a source of much consideration and thought, the dilemma that some localities find themselves in being aggravated in an enlarged proportion as the population multiplies and the land increases in value in that locality.



Rifle practice is a source of much pleasure and healthful recreation, also creating a spirit of rivalry and emulation among the various members of a corps to such an extent that degrees of perfection are reached that would not otherwise be obtained. It also stimulates the young men, especially, to take an interest in the other duties devolving on a volunteer that, under other circumstances, would become tedious and irksome, but which are necessary to the successful and proper development of a well drilled and disciplined soldier.

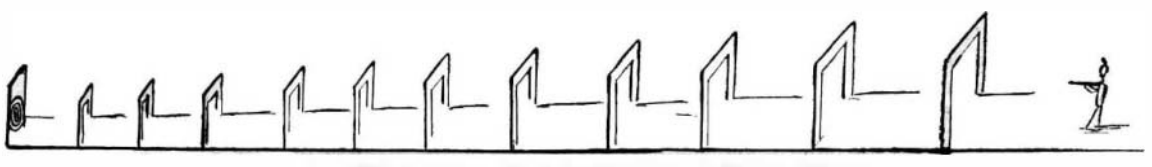
There are many places that have sufficient space within their garrison inclosure for short ranges, and others that have in their immediate locality large commons of sufficient area for all distance shooting. The rifle is, however, such a formidable weapon, and the regular as well as the volunteer service supply so many of the *raw recruit* class that the unwary traveler jeopardizes his life and limb should he find it necessary to pass within a radius of some hundreds of yards of the shooter on practice day. The direction of the butt of the rifle could, doubtless, be excepted, and considered a safe course in which to steer during even the novitiate of the future veteran of the musket.

The accompanying diagram illustrates a method of adapting a limited space to a serviceable and safe shooting range.

As the range need not in any respect be different from those at present in use, the bullet guards only require explanation. The guards should be of sheet iron, or other bullet proof substance, and so arranged as to present a broad surface all around the target, when looking toward the latter from the firing point, as represented in the small figure. The width of the surface of the guards would depend on the distance they are placed apart. Standing at the shooting box the full outline of the target is seen, but no open space, the surrounding iron of the target overlapping all open space not covered by the guards in front, so that, after passing through all the guards in its course to the target, the bullet, no matter how badly directed, could not get over nor on either side of the target to the open country beyond. In like manner, should the bullet take an eccentric direction, after passing all guards but the last, that one would save it from traveling into space, and similarly back to the first guard, which would stay the bullet of the most erratic marksman on the ground.

The widths and heights of the guards would have to be made to suit the range. Their distance apart would allow of wider or narrower surface, and the length of range would affect the height to allow of altitude of bullet in its proper course. A flange on the outer edge of each guard is desirable.

Toronto, May 19, 1891. A. C. PAULL.



A NOVEL FORM OF GUARDS FOR RIFLE RANGES.

The Phosphorescence of Diamonds.

In the New York *Sun*, Mr. G. F. Kunz, the well known expert in gems, has recently called attention to a property of the diamond which may serve as a means of distinguishing it from other substances. Referring to the paper of Robert Boyle "On a Remarkable Diamond that Shines in the Dark," published in the Transactions of the Royal Society in 1663, Mr. Kunz remarks that this paper has been indirectly alluded to by a number of authors, but never read. Among a quantity of facts Boyle mentions one diamond that phosphoresced simply by the heat of the hand, absorbed light by being held near a candle, and emitted light on being rubbed. He stated that many diamonds emitted light by being rubbed in the dark. The experiments made by Mr. Kunz show conclusively not only that Boyle's statement that some diamonds phosphoresce in the dark after exposure to the sunlight or an arc of electric light is true, but also that all diamonds emit light by rubbing them on wood, cloth, or metal, a property which will probably prove of great value in distinguishing between the diamond and other hard stones, as well as paste, none of which exhibit this phenomenon, and will be welcomed by the general public who do not possess the experience of the dealer in diamonds. The property is evidently not electric, or it would not be visible on being rubbed on metal.

Yet Room for Inventions.

Of all the sack-tying devices, none has proved of practical utility to the extent, at least, of supplanting the old fashioned way of tying with a string. A good sack tie would take wonderfully.

The man who invents a slow-moving feeding device for roller mills that will feed any sort of material, coarse or fine, heavy or light, will have a fortune. Of course it is claimed that there are several on the market, but there are not. Saying nothing disparaging of the many excellent machines for the purpose, they either do not do the work on soft stuff or else they run so fast that they are defective as to long life in good condition. The inventor can get up a slow-moving, perfect feed-regulating machine will have a fortune.

In building a mill it is the case too often that not enough attention is given to the height according to the breadth. This is sure to result in too many elevations and too many choking spouts. All of which means a hard mill to run, a mill that reduces stock, improperly, by elevator and conveyor friction, and a fuel consumer to no advantageous purpose.—*The St. Louis Miller.*