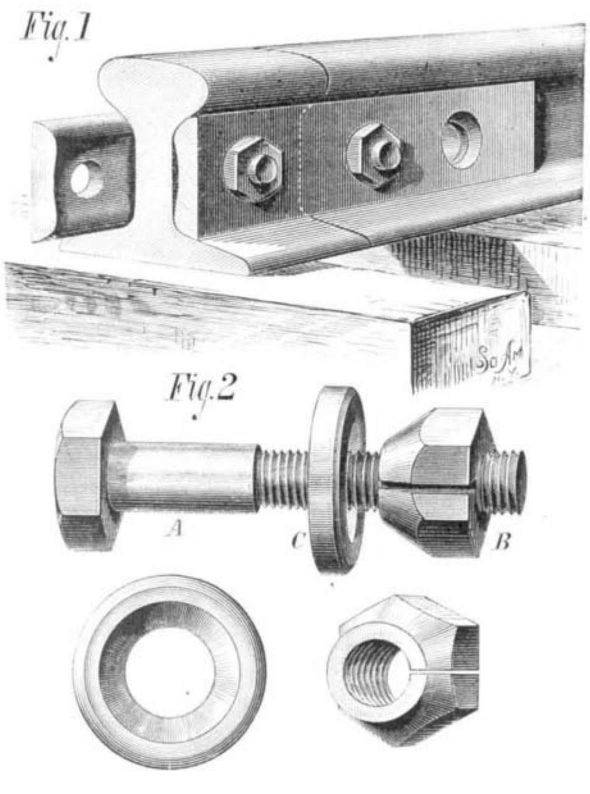
A NEW NUT LOCK.

A novel nut lock is shown in the accompanying engraving, Fig. 1 representing the device as applied to the fish plates of railway rails, and Fig. 2 shows the bolt, nut, and washer in detail.

While this improved nut lock is designed more especially for the purpose indicated, it may be used wherever a secure bolt is required.

The threaded portion of the bolt, A, decreases gradually and slightly in diameter from the outer end inward toward the head, and the nut, B, which is split lengthwise on one side, is made conical, and is fitted to a countersunk washer, C, or to countersunk holes in the fish plates, as represented in Fig. 1. The nut, when screwed down on the washer or fish plate, is contracted by the engagement of the two con



WHITMARSH'S NUT LOCK.

ical surfaces, and is thus made to bind the bolt so that it cannot become loosened accidentally by jarring or concussion. The conical nut and countersunk washer may be used advantageously in connection with ordinary bolts.

This improvement was recently patented by Mr. John W. Whitmarsh, of Galesburg, Ill., from whom further information may be obtained.

SIMPLE TELEPHONES.

The telephone, although now generally well known, is no less interesting than it was at first. There are many forms of this wonderful instrument, some of which are very simple, easily constructed, and easily operated, while others are more complicated. The principle is the same in all.

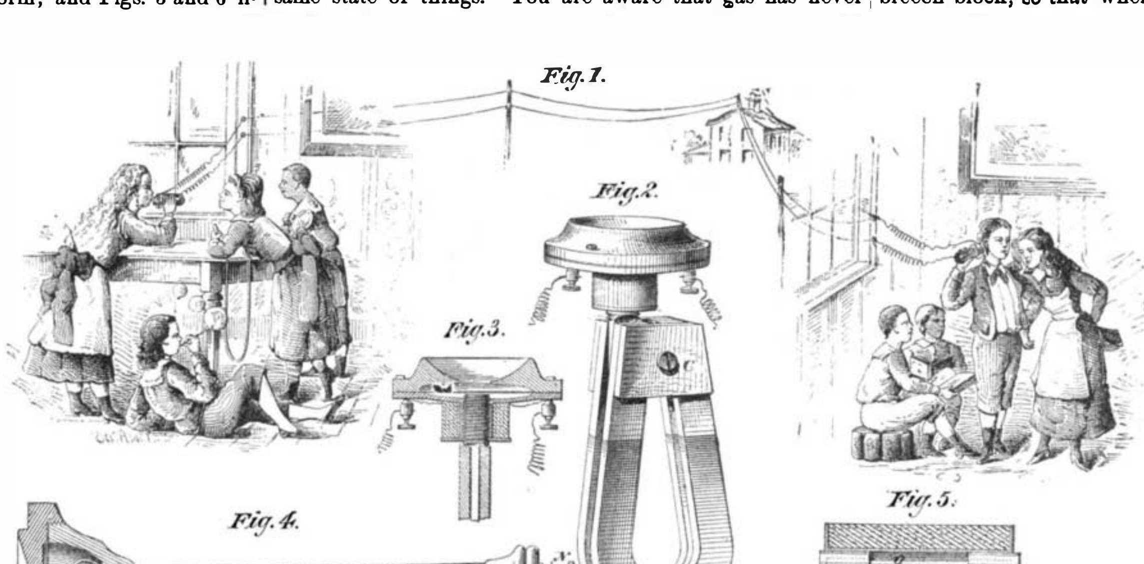
In the accompanying engraving, Fig. 1 represents a telephone doing service; Fig. 2 is an easily constructed instrument; Fig. 3 is a vertical section of a portion of the same; Fig. 4 is a telephone of the Bell form; and Figs. 5 and 6 illustrate methods of magnetizing bars for telephones.

The telephone shown in Fig. 2 employs two ordinary U-magnets, which may be of any convenient size, and may be bought at almost any hardware store or toy shop. A soft iron core is clamped between two similar poles of the magnets, and is threaded to receive the spool, which has formed on it a flange for supporting the diaphragm and mouthpiece. The ends of the wire which forms the coil are connected with the binding posts screwed into the flange. The disk or diaphragm consists of ordinary ferrotype plate, such as may be purchased from any photographer.

The telephone shown in Fig. 4 has a wooden handle, which contains a round bar magnet, K, having on one end a coil, L, of fine insulated wire. The terminals of the coil are connected with the binding posts, N, at the end of the handle. The iron disk, J, is supported in the mouthpiece near the end of the magnet.

When sound waves strike the disk of the transmitting telephone, the disk vibrates in front of the magnet, and as it is itself a magnet by induction its power is constantly changing as it vibrates. As the plate moves toward the coil a current is induced in the latter, which traverses the whole length of the wire connecting it with a distant instrument; as the plate returns, a reverse current follows. These undulating currents produce in the disk of the receiving instrument vibrations which are similar to those in the transmitting instrument.

For the benefit of any who may desire to construct a telephone, we have published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, complete directions, with full sized drawings, for making a working telephone.



SIMPLE TELEPHONES.

British Mining and Metallurgical Interests.

It is an accepted and indisputable fact that the mining and metallurgical interests of Great Britain are in all respects ahead of those of all the world beside, but it is doubtful whether even we ourselves properly grasp the enormous magnitude of the industries placed under those heads. The statistical features of our mines and metal manufactures, as given in the preface to Messrs. Kelly's new "Engineering Directory," however, strike one with peculiar force, and give us an impressive idea of their power and importance. From this source we gather that the total number of collieries, mines, and pits classed under carboniferous and metalliferous mines amount to over 5,000; in which total, however, is included a number of fireclay, limestone, purbeck, and various other workings, which, perhaps, hardly come under the category of mines. The principal mines are: Coal, 3,722; iron and ironstone, 600; lead, 390; copper, 80; tin, 103; zinc, 11; iron pyrites, 36; barytes, 25. The number of persons, male and female, employed as miners above and below ground, according to the returns issued for the year 1877, was 494,391. Of these 57,395 were employed in and about the metalliferous mines, the remainder thus: Coal miners, 268,091; copper miners, 3,063; tin miners, 10,617; lead miners, 14,563; iron miners, 20,930; undefined, 38,712. Outside the ranks of the miners proper are the following: Workers and dealers in coal, 68,860; ditto in copper, 5,758; ditto in tin and quicksilver, 26,199; ditto in zinc, 1,728; ditto in lead and antimony, 3,729; ditto in brass and other mixed metals, 54,366; and ditto in iron and steel, 360,356. Taken from another and slightly varied point of view, the statistics as to the number of persons employed in each particular branch of the leading metallic manufactures read thus: Iron and steel, 341,965; copper, 3,289; coppersmiths, 2,295: brass manufacturers, braziers, etc., 20,983; locksmiths, bell-hangers, etc., 7,154; gas-fitters, 8,615; wire workers, 7,435. These are still further particularized in the "occupations of the people" as under: Engine and machine makers, 106,437; spinning, weaving ditto, 9,668; agricultural implement ditto, 3,617; millwrights, 7,538; tool makers and dealers, 7,453; file ditto (including females), 9,001; saw ditto, 1,930; cutlers, 17,066; whitesmiths, 8,588; blacksmiths, 112,035; nail manufacturers (including females), 23,231; anchor smiths, 4,163.—*Ironmonger.*

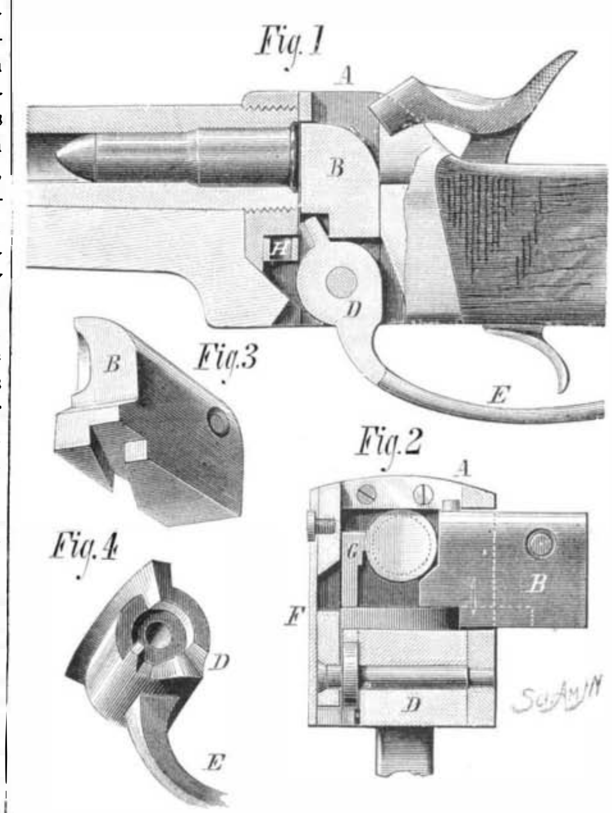
Coal Gas does not Injure Book Bindings.

In a recent letter published in the *Library Journal*, Professor Wolcott Gibbs, of Harvard University, says:

"You will remember that some time since I made an examination of the binding of books in the Public Library, supposed to be injured by the products of the combustion of coal gas. I arrived at the conclusion that there was no sufficient evidence to show that such was the case. I have since made a careful examination of books in the Athenæum, College, and Astor Libraries, and have found precisely the same state of things. You are aware that gas has never been used in the College and Astor Libraries at all, and that in that of the Boston Athenæum gas is largely used in the reading-room, but not in the library proper. I found in each a large number of old books bound in calf, which presented the same appearance as those which I saw at the Public Library. These were all old books and all bound in calf. Mr. Wilson, binder to Little & Brown, and a man of large experience, told me that he was satisfied that the trouble was in the tanning of the leather and not in the action of gas, the older kinds of leather used by binders being of poor quality and badly tanned. I analyzed a number of samples of the leather in my own laboratory, and find no free acid whatever. On the whole, therefore, I see no reason to change my opinion in the matter."

NEW BREECH-LOADING RIFLE.

The manufacture of firearms has reached such a state of perfection in this country that nearly all the world looks to us for rifles. American inventors, by their activity in this direction, indicate a determination to maintain supremacy both as to quality and quantity of production. Our engrav-



McALPINE'S BREECH-LOADING RIFLE.

ing represents one of the most recent improvements in breech-loading firearms, the invention of Mr. James McAlpine, of 316 Chapel street, New Haven, Conn.

The invention consists mainly in a novel device for operating the laterally-moving breech block and for working the shell ejector.

In the engraving, Fig. 1 is a side view, partly in section. Fig. 2 is a transverse section, taken through the breech at the rear of the breech block.

Fig. 3 is a detail perspective view of the breech, and Fig. 4 is a detail view of the actuating cam. In the breech, A, there is a mortise for receiving the breech block, B, which carries a percussion pin that is in position to be struck by the hammer when the cartridge is to be exploded. Below the breech block there is an actuating cam, D, which is nearly cylindrical in form, having a flange on its periphery which is disposed spirally. This flange engages a groove in the breech block, so that when the actuating cam is turned on its pivot by means of the handle, E, projecting from one of its sides, the breech block will be moved laterally so as to expose the bore of the rifle. A detent spring, F, is secured to one side of the breech, and carries a pin which rests in one of two concavities in the end of the actuating cam, and thus holds the operating lever in either of its positions. Upon the pivot with the actuating cam there is a cartridge-ejecting lever, G, which receives its outward impulse by engagement with a shoulder on the actuating cam. It is afterward moved by the spring, H, so as to completely eject the shell.

The breech is opened by the revolution of the actuating cam, a cartridge is inserted in the barrel, the breech is closed by the upward movement of the handle, E, and the cartridge is exploded in the usual way. The breech is opened by a downward movement of the handle, which also ejects the shell. The advantages claimed for the improvement are: That the movements of the acting parts are positive. The parts are simple, strong, and few in number, so that the construction is not complicated or expensive. The breech is tightly and securely closed when the parts are in firing position, and yet is readily opened for ejecting the car