rivet head, which finds resistance against the fixed die and is pressed into shape. Fig. 1 will show the relative position of the several parts of a riveting machine ; S is the standard, on the top of which is the fixed die D ; the piston rod die is indicated at P ; the rivet R, and the section of the boiler to be riveted by B ; C C show the chains which support the section of boiler, which are attached to the crane above. Now, it will be seen that to do good work the axes of the two dies must be in exact line. If one is higher than the other, or if the piston varies to the right or left, the result will be an imperfect rivet. These errors we should not expect to find in a well made machine, under the supervision of a careful, intelligent man. But another difficulty, and one which even the best machine cannot overcome, is carelessness in the adjustment of the rivet holes in the plates to be riveted. If the axis of the rivet hole is not coincident with the axes of the dies, an imperfect rivet will be the result, and the imperfection will be increased in proportion to the variation. To make this plainer : If the man in charge is careless in adjusting his work to the machine — that is, if he elevates it too high or lowers it so that the rivet hole is a little below the dies, or if the materials swings or sways to the right or left, the result will be an imperfectly formed and weak rivet. This is a difficulty that is not confined to any one shop ; we have it in connection with the work of some of the best shops.

Fig. 2 to 6 are specimens of rivets which have been carelessly driven, and which we have selected from a collection of rivets that have been gathered up from different places.

From the foregoing it will be readily seen that this class of imperfect work is solely the result of carelessness on the part of the man in charge of the machine. When the boiler is all riveted up, it may be next to impossible to detect the true character of the work. But when leaks begin to appear and repairs become necessary, the defective workmanship becomes apparent. Boiler makers cannot be too careful in having competent workmen for such service, for in addition to the risk of impairing a well earned reputation, a very weak boiler may be unwittingly put to service.

EXTRACTION OF LEAD FROM ORE.

In the various lead-smelting districts of the world, it is strange to note the variety of methods of reduction in vogue, the various classes of furnaces employed, as well as the differences in fluxes and fuel, etc., employed in each district in the common object of separating the lead from the gangue. It is found, however, that each one of the various methods pursued and furnaces employed has usually special advantages to recommend it for adoption in that particular locality ; and that frequently a furnace or method which in one locality appears to work more satisfactorily and afford a better result than another working in a different locality, would, if transferred to the new district and worked under the altered conditions of ore, fuel and flux, prove an entire failure.

The considerations which thus determine the method of reduction to be pursued and the furnace to be employed in the smelting of the lead ore of any locality are : First, the nature and yield of the ore to be treated ; second, the character of the gangue or vein stuff ; third, the nature of the available fluxes ; fourth and most important, the nature and abundance of fuel in the district ; and fifth, the means of transportation of material.

The processes employed for the smelting of lead ores may be classed according to the type of furnace employed, as, according to Greenwood, first, the methods of smelting in England, France and Carinthia ; second, the methods in which cupola furnaces are employed, as practised in the Hartz, Silesia, etc. ; and third, the methods of reduction in open hearths, as in the ore furnace or Scotch hearth, and the American hearth. But Dr. Percy supersedes these classifications by grouping the various processes employed for the smelting of galena or other sulphur compounds of lead under three types, according to the agent employed to effect the decomposition of the ore and the separation of the lead, thus : First, "air reduction processes," in which atmospheric air, aided by heat, forms the reducing agent ; second, the "iron reduction or precipitation process," in which iron, or an oxidized compound of iron which, under the furnace conditions yields iron, is employed for the separation of lead ; third, the method of "roasting with subsequent deoxidation of the product by carbonaceous matters ;" while, fourth, for the smelting of ores of lead, such as carbonates, silicates and oxides in which the metal exists wholly in the oxidized state, it is necessary to reduce the metal either by carbon or iron, or both of these agents may be employed.—*Mining and Sci. Press.*

DEVELOPMENT OF THE PRACTICAL USES OF ELECTRICITY.

The popular existence of the electric light is due entirely to the application of steam, gas, or water power to the dynamo-electric machine. By this means electricity can be generated much more cheaply and effectively than by batteries. Before the dynamo machine existed the electric light was so expensive a scientific appliance that it could not even claim a place in the catalogue of luxuries. To whom the credit of the first complete dynamo machine is to be attributed, is doubtful, but its principle was undoubtedly embodied in one of the most important discoveries of Faraday, that of the mechanical production of electric currents. This germ idea is contained in the Gramme machine, in those of Siemens, Edison, and many other inventors. These all produce a strong electric current capable of giving a good light within about a mile radius. This current once obtained, the next step was its conversion into light. A sensation was created when, following Sir Humphrey Davy's idea, certain inventors exhibited carbon candles, into which the electric current was sent by steam power, and which that current consumed, giving forth at the same time a strong light. About this time, 1876, M. Jablochkoff applied the carbons in a way which rendered all mechanism for their regulation unnecessary. This light is now known technically as "arc" lights, from the arch of light produced, as the current leaps from the point of one carbon to that of another, and was called by Sir Humphrey Davy the voltaic arc. Of this class of lamps no less than fifteen collections are shown at the International Electric Exhibition now being held in London. These lights were impractical for domestic purposes, and the next problem to be solved was the domestic electric light. This has been accomplished by sending the electric current through a horseshoe-shaped carbon thread, formed of vegetable matter—bamboo and esparto grass—and placed within a pear-shaped glass globe, from which all air has been removed. This is called the incandescent light since it is given forth from the carbon film, when this is heated to an incandescent state by the electric current. There can be but little rivalry between the arc and this class of lights. Each has its peculiar advantages for particular purposes. The globe and the carbon film remain intact after burning from 600 to 1,000 hours, and when the film is burnt away both globe and carbon are readily replaced. Already the carbon light has won a position which ten years ago would have been regarded as fabulous. It is to be seen in all the important streets of the great cities of both hemispheres ; the largest houses are adopting it ; railway trains are lighted by it ; the piers in New York ; it is taken under ground and under water, and the boring operations of the tunnels under the English channel and the Hudson river are carried on with more than usual rapidity by its aid. At St. Etienne, in France, the Furens Falls have been utilized to supply the town with electricity.

Not less rapid has been the growth of the telephone system as a means of communication, supplementing that of the telegraph. In the larger cities of America and Europe, and, it may soon be added, in those of India and Australia, telephonic exchanges have been established. In London, the Telephone Company, during October and November, 1881, sent 19,500 messages per day, containing, it is estimated, 1,950,000 words, while the General Post Office Telegraphs carried 35,000 messages per day during the same period, containing only 700,000 words. The cost of the telegrams to the public was $8,750 ; while the charge for the telephone messages was only $405 ! This is the practical result of the telephone, and it represents an amount of time, money, and trouble saved which mere figures are unable to express.

The miscellaneous uses to which electricity can be applied are discovered to be more and more numerous. In the wide field of railway signalling it will soon have a more prominent place than ever. As a locomotive agent it has entered upon a practical stage in a number of cities in Europe. In the domain of science it measures the speed and pressure of the wind, the velocity of a shot, and regulates clocks. In that of art it reproduces engravings, records music, and under its lights photographs can be taken. In that of industry and agriculture railways may be driven by it, land ploughed, fire damp detected, and plants grown. Indeed, it would be difficult to limit the sphere in which electricity may not shortly be applied. All prognostications heretofore made regarding its failure have