dynamite was exploded below water, which caused the greatest consternation. A further progress up the river was stopped by the fact of the *Ellangowan* breaking the shank of her propeller.

The second paper furnished an account of Mr. Octavius C. Stone's explorations in the interior of New Guinea, from Port Moresby, in the east part of that island. It brought to notice the fact that the country was extremely fertile, and the natives of a superior character to the coast tribes, and well disposed and friendly to white men. It was greatly to be wished that no kidnapping parties would be allowed to exercise their nefarious traffic there, and so raise a bar against the possibility of future friendly intercourse between the two races. In the short discussion which followed admiration was freely expressed at the successful manner in which Mr. Macfarlane had journeyed into the interior without bloodshed.

INSTITUTION OF CIVIL ENGINEERS.

On March 21st a paper was read descriptive of "The Hydraulic Canal Lift at Anderton, on the River Weaver," by Mr. Sidingham Duer, B. Sc., Assoc. Inst. C.E.

The object of this lift was to transfer floating barges between the Trent and Mersey Canal and the river Weaver, and thus to afford an easy and expeditious means of communication between them without the expense and delay hitherto incurred in transshipping goods. The idea of lifting the laden barges by hydraulic power originated with Mr. Edward Leader Williams, Jr., M. Inst. C.E., at that time engineer to the trustees of the Weaver Navigation. He consulted Mr. Edwin Clark, M. Inst. C.E., on the subject, and after various designs had been considered, the arrangement of the details and the superintendence of the construction were entrusted to the author. The canal and river were close together at Anderton, but the level of the water in the canal was 50 ft. 4 in. above that in the river.

The water of the canal was conducted by a wrought-iron aqueduct, 162 ft. 6 in. long, across an arm of the river to the end of the lift. This aqueduct was in three spans, of 30 ft., 75 ft., and 57 ft. 6 in. It was 34 ft. 4 in. wide, and a central web divided it into two channels, each 17 ft. 2 in. wide. This central web and the sides of the aqueduct were 8 ft. 6 in. deep, and formed continuous girders, which carried the aqueduct and the water, 5 ft. 3 in. deep, contained within it. The total weight of the aqueduct and the water was 1050 tons, or about 6½ tons per lineal foot. Excepting at the end, where it rested on the masonry of a basin leading into the canal, the aqueduct was carried on cast iron columns.

The lift was double; each half consisted of a wrought-iron trough 75 ft. long and 15 ft. 6 in. wide, capable of containing barges floating in water 5 ft. deep. The sides of the trough were 9 ft. 6 in. deep at the centre, and 7 ft. 6 in. deep at the ends, and formed girders to carry the weight of the trough, water, and barges, which amounted to 240 tons. This weight was transmitted from the sides to the head of a central ram, 3 ft. in diameter, by cantilevers which radiated from the ram to the sides of the trough. The trough was thus supported and moved up and down by one central vertical ram, which worked in a press sunk within a cast-iron cylinder below the bed of the river. The pressure on the ram amounted to about 4½ cwt. per square inch. The trough had a lifting gate at each end, for the ingress and egress of barges, and there were corresponding gates in the aqueduct, so that boats could pass between the aqueduct and the trough according as they were to be lowered or had been lifted. The press under one trough was connected by a pipe, 5 in. in diameter, with that under the other trough, and thus water contained in one could pass freely into the other, by an equilibrium-valve in this pipe. There was also a small steam-engine continually pumping water into an accumulator, to assist in the working of a lift. Piping 4 in. in diameter passed from the accumulator to each of the presses, and the accumulator could be opened to either of the presses as required. All the valves for working this apparatus were under the control of one man in a valve-house on the top of the aqueduct. In working this lift, when one trough containing barges and water 5 ft. deep was at the top of the lift, the other, containing barges and water 4 ft. 6 in. deep, was in the river below. As the upper trough was heavier than the lower one, it followed that as soon as the valve on the 5-in. pipe was opened, the upper trough descended and lifted the lighter one out of the river, until, by becoming in its turn immersed in the river below, it lost part of its gravitation, and forced the lighter trough to within 4 ft. 6 in. of the top of the lift. The valve on the 5-in. pipe was now closed, and the remaining water in the press under the descending trough was allowed to run to waste into the aqueduct. The trough consequently descended into the river, and the barges it contained had been lowered from the canal to the river. Whilst this was going on the accumulator was opened to the press of the ascending trough, and this trough and barges were raised to within 6 in. of the top of the lift. The barges were lifted the remaining 6 in. by letting this depth of water into the trough from the aqueduct. Thus a depth of 6 in. of water over the area of the trough taken from the upper level was sufficient to lower one trough from the canal to the river, and at the same time, with a little assistance from the accumulator, to lift the other from the river to the canal. Automatic syphons insured a depth of 4 ft. 6 in. of water in an ascending trough. The edges of the gates were kept watertight with india-rubber, and the same material was used for making a joint between the troughs and the end of the aqueduct. The time required to lower one trough and to lift the other was three minutes, and the whole operation of transferring barges from the canal to the river and others at the same time from the river to the canal was eight minutes. In a chain of locks at Runcorn having the same fall a boat could only pass one way in one hour and a half. A very small staff was required to work the apparatus, and the total weekly expenses did not exceed £10. In addition to the time saved by this lift compared with a flight of locks having the same fall, it was stated that when the traffic was equal in each direction, only 6 in. of water over the area of the trough were used, instead of 50 ft. required by the locks.

The lift was publicly opened by the trustees in July, 1875, and had given great satisfaction. The iron-work and machinery were constructed by Messrs. Emerson, Murgatroyd & Co., of Stockport and Liverpool, and the foundations, masonry basins, etc., were carried out by Mr. J. W. Sandeman, M. Inst. C.E., the present engineer to the Weaver Trustees.

ELECTRO-MOTIVE ENGINES.

The invention of Mr. E. Burgin, of Paris, consists of certain peculiar methods of constructing and arranging the elements or electro-magnets forming the generating cylinders of magneto-electric machines, and to the modes of lapping and connecting the several coils of such magnets, whereby currents of quantity or of tension are obtained. The same apparatus is applicable as an electro-motor when excited by a battery or magneto-electric machine.

NECESSITY FOR MORE SKILLED ARTISANS.

By JAMES M. BLANCHARD.

THE necessity for the acquirement of greater skill by the artisans of this country is a great and continually growing one, and all classes of people are, or should be, interested in having provision made for acquiring such skill. While it is true that we have many artisans whose attainments will compare favorably with persons standing at the head of similar occupations in other countries, and who are an honor to themselves and to the country, yet it is equally true that a large proportion of the class referred to are not in the possession of the requisite amount of skill to enable them to compete successfully with their more fortunate rivals. This condition in which they find themselves placed has grown out of two very popular but very grievous errors: First, the prevailing belief that any person of mediocre talent and acquirements who can not afford to educate himself for some profession, is quite fit for an artisan; and secondly, that any person having a fair endowment of natural abilities, but little or no education, is quite capable of becoming a successful mechanic.

It is these two prevailing opinions that have driven into the ranks of artisans so many persons who have not had the requisite training, and who, without fault upon their part, have flooded the market with unskilled labor. Before proceeding farther it may be well to define what is meant by, or what constitutes, skilled labor or a skilled artisan.

The answer to this is plain, and can be given in one word—training. But the requisite or proper training is of a duplex character; it is not enough that a person is skilled in the use of tools or the implements necessary to enable him to give form to whatever he may be engaged upon, he must also be trained to scientific methods of thinking and reasoning, so that when an idea is suggested the reasoning faculties may determine its correctness or error, in order that the hands may be relieved from the necessity of doing a large amount of unnecessary labor in determining facts which it is properly the province of the mind to do. It follows, then, that to enable a person to become a skilled artisan, he must first become a scientist to such an extent as to be able to understand fully the character and composition of the material which he may be called upon to manipulate, in order that he may be able to select the best for his purpose, and in order that he may logically and correctly determine the effects of the selection he may make.

As necessary as the education above hinted at is, a person may possess it all and yet be very far from being a skilled artisan. He must add to such acquirements a thorough practical knowledge of the art in which he proposes to engage, and hence the duplex training becomes an absolute necessity in the production of a skilled artisan.

Having shown the necessity for a thorough training of that portion of the people who propose to become artisans, it remains to point out how such training may be had and paid for in order that the poorest in worldly goods may avail themselves of the advantages it offers.

The writer is well aware that, as a rule, the class of people he is speaking of are not able to send their sons to the schools where they, by spending years of time, could acquire the theoretical part only of the training required; the services of such youth being an actual necessity to the support of the family, they must be put where they can be earners of money, and not spenders; but, were this otherwise, there are no schools within the reach of the poorer classes where both branches of the training referred to can be had; and as a consequence, a person desiring to fit himself for the greatest amount of usefulness as an artisan must first spend years in acquiring what is called an education, after which he must "learn a trade," a process which involves the expenditure of an unnecessary amount of time and money.

What seems to be required for the benefit of this class of persons is the establishment of one or more polytechnic schools, where both the theory and practice required can be had by allowing the student to divide his time between labor and study, a portion of each day being devoted to each, thus enabling him to acquire in five years what it would require eight to do under any of the present systems; added to which would be the great advantage of being in a position to compare theory with practice in case of there being a difference between them. The benefits derived from such schools and such training which would accrue to railroad companies, and to private employers of the people thus educated, would be incalculable, as it would enable them to provide their establishments with a class of men who are in possession of facts, and who would be able to determine at once what pretended improvements to adopt and what to reject; at the same time it would enable them to have the greatest amount of work done with the least possible outlay of money for shops and tools. Every observant employer knows that when he employs two mechanics for the same kind of work, even though they may be physically the equals each of the other, he does not get the same character or quantity of work from both, and the reason is that one is more skilful than the other, and it is probable that he is in advance of his fellow in this respect because he has been more methodical in his thought, and has subordinated his hands to his brains; and it is also probable that had both of these parties been trained in a school where one method of thought and action was presented for both, they would have been equals, and that the usefulness of both would have been enhanced as well as the profits of the employer.

The necessity of greater skill in our artisans having been shown, it remains to be shown how the facilities for acquiring it can be obtained.

The United States Patent Office is a bureau of our government, established ostensibly for the protection of the citizens who, by their superior knowledge or by the exercise of their inventive faculties, are able to produce any new and useful art, machine, manufacture, or composition of matter, or any improvement upon any art, machine, manufacture, or composition of matter, and shall under certain conditions have a patent therefor which shall, for a stipulated number of years, give them the exclusive right to make and sell the same. This bureau is by law self-sustaining; it is not and can not be any expense to the government, but the funds for its support are raised by a tax or charge made against each individual who applies for a patent, and it is out of the fund thus created that all the expenses of the office are paid. It should be stated here that the inventors are taxed upon whatever property they may own in all respects like other citizens, and that the tax for examining their inventions is an extra one, one to which no one else is subject.

Of the fund thus created there is now in the Treasury of the United States, to the credit of the Patent Office, nine hundred thousand dollars or more, which shows that the tax is more than is necessary for the maintenance of the bureau. It does not seem to admit of a doubt that the money alluded to as in the United States Treasury is in equity the property of the inventors of the country and of no one

else; and it is believed that the most daring financier of the times would hesitate to say that it could equitably be appropriated for any purpose outside of one that would be directly in furtherance of their interests. Holding, as I do, that this fund must either be spent for the benefit of inventors or squandered in the interests of those who have no right to it, I venture to suggest that it be set aside for the establishment of such a school or schools as are herein proposed. It may be said that the amount is not enough to establish such a school and to sustain it when in operation; but to this view may be opposed the fact that it is at least more than sufficient to build all the necessary buildings for two or three such institutions, and to furnish them with all the appliances necessary for the prosecution of the studies of those placed therein, and that the interest upon the remainder, and the small amount of tuition-fees that could properly be charged, would furnish the funds to keep them in successful operation; and should this not be the case, Congress could make an appropriation therefor, without its being the most reprehensible act that it ever committed. The writer is aware that polytechnic schools in which many branches of art or science are taught are in existence in many countries, including our own; but they do not comprehend all that he conceives to be necessary to the proper training of artisans. They should be schools in which many branches of art and science are taught conjointly rather than where many branches of art or science are taught, in order that all the training which the most skilful artisan requires can be obtained. This, being our Centennial year, seems to be an appropriate time to move in this matter, and as it is presumed that many if not all of the inventors of the country who are still alive will be there, it is suggested that they meet in their respective towns, counties, or cities, and select delegates to a convention to be called by said delegates at some suitable period during the continuance of the Exposition at Philadelphia, to consider the propriety of petitioning Congress for an appropriation of the funds above alluded to, and for the purpose stated.

Before closing this article I desire to appeal to the inventors of this great country not to let this opportunity pass unimproved, it being as favorable a one as is likely to present itself for insisting that the money which is now on hand, that which has been taken from them, and all that may accrue from the same source in the future, shall be placed within their control in order that they may build to themselves a monument in the form of such a place of training for artisans as has been described, and that they may dedicate it to such uses for all time. Let us as one man join in asking this as our right, not as a subsidy for something to be done in the future, or as a reward for past favors, but as a right, which it clearly is, because it is a fund accumulated by a tax levied upon the few for their benefit and not for the benefit of the many; were it otherwise, it would be contrary to the spirit of the institution and the fundamental laws of the country.

I find that as early as March 3d, 1849, fifty thousand dollars was appropriated from the Patent Office fund for the erection of the building in which the office is located; and it is clear to me that the government ought to refund that amount and all others that have been thus appropriated, with interest upon the same up to the time when it is paid. I find that in the year 1838 the receipts of the Office were \$4721.44 more than the expenses; in 1839 they were 2716.49, and they have increased gradually from that time to 1875, when they were \$21,795.65; from which fact some idea can be gathered of the amount of interest that has accrued upon the amounts thus accumulated. Let me express the hope that editors to whose knowledge this proposition may come will in their own way bring it to the attention of their readers, in order that the parties interested may act upon the hints presented, if in their judgments it shall seem best.

Much more could with propriety be said upon this subject, but as it is only designed at the present time to direct attention to this subject, more need not be said except to inform any person interested that should any facts or figures be required in relation to this fund, the writer will cheerfully undertake to furnish them.

GOLD IN INDIA.

THE Madras newspapers have lately given some account of the Colar gold-fields, in Mysore, and of the operations which have just been commenced there by the Ooregum Gold-Mining Company. The auriferous quartz reefs are said to extend for a length of nearly twenty miles, and are only about twelve miles distant from a station on the Madras Railway. The company has already sunk one main and two auxiliary shafts, the former of which is expected to cut the reef at about 60 feet. The works have been so recently begun that it is not yet possible to form any accurate idea as to the probable results, but it seems to be thought that the field is one of great richness; moreover, it has a history which is said to go as far back as the year 1293, when Allageen, a general in the service of the Emperor of Delhi, returned from an invasion of Mysore, bringing with him a large amount of gold. Hyder Ali and Tippoo Sahib would also appear to have worked the mines. Should it turn out that the reefs can be profitably worked, the facts that they are situated at an elevation of 3800 feet, and that the climate is good, will doubtless tempt many Europeans to try their fortunes there.

NEW SUBSTITUTE FOR GOLD.

THE following is a new metallic alloy which is now very extensively used in France as a substitute for gold: Pure copper, 100 parts; zinc, or preferably tin, 17 parts; magnesia, 6 parts; sal-ammoniac, 3.6 parts; quicklime, 1.8 parts; tartar of commerce, 9 parts, and mixed as follows: The copper is first melted, then magnesia, sal-ammoniac, lime, and tartar are added separately and by degrees, in form of powder. The whole is next stirred briskly for about half an hour so as to mix thoroughly, after which the zinc is added in small grains by throwing it on the surface and stirring it until it is entirely fused. On this being done the crucible is then covered and the fusion maintained for about 35 minutes, after which the surface is skimmed and the alloy is ready for casting. This alloy has a fine grain, is malleable, and takes a splendid polish. It does not corrode readily, and for many purposes is an excellent substitute for gold.

LONDON, April 1.—In consequence of the dulness of trade, all the ironworkers of the great Sheepbridge, Atlas, and Cyclops Iron Works, in Sheffield, have been discharged. The employees of the Phoenix and Dronfield Bessemer-Steel Works have agreed to accept a considerable reduction instead of discharge.