ings. Great difficulty has been experienced in dealing with the different classes of workmen, and in the adjustment of rates of wages. Men brought up to one trade naturally find it hard to estimate the dues of those practising an entirely different trade; and when they are required to assign higher wages than they can hope to receive, to men whose superiority they are unable to appreciate, the difficulty becomes all but insurmountable. The practical result in the Ouseburn Works has been a strike for higher wages in one of the departments—one of the evils which cöoperation was specially expected to prevent. The society also suffered severe losses through mismanagement, the taking of orders at too low a price, and other errors, due to lack of technical and practical knowledge on the part of their chief adviser, who was more of a philanthropist than a man of business.

As in other countries, so in England, success in cöoperation seems to be limited to moderate undertakings. When the business is of a kind that cannot be carried out advantageously on a modest footing, the cöoperative principle is best applied to the execution of parts of the work; in this way the system can be made available in the largest undertakings, after they have been suitably subdivided, the general administration remaining in the hands of an individual owner or company.

As Mr. Brassey observes: Where no special personal influence is needed for the purpose of securing clients and customers, and where the internal economy of the establishment can be conducted by a regular routine, there will be no disadvantage in the management of a board or council. But when no transaction can be completed without long and difficult negotiations: when an undertaking is of a kind that cannot be conducted in accordance with fixed rules, and the emergencies which must, from the nature of the case, arise are always unforeseen, and must be met on the spot by an administration upon whose skill and conduct all will depend; in such a case the cöoperative system pure and simple becomes impossible, and the attention of masters and workmen wishing to work together in friendly alliance should rather be employed to devise schemes whereby the equable distribution of profits among the workmen may be combined with the necessary concentration of authority in their employer.

Perhaps the most noteworthy alliance of this sort is that in connection with the collieries of Messrs. Briggs. To avoid, if possible, the delays and losses incident to strikes, this firm voluntarily took their miners into partnership some years ago, dividing the profits above a certain amount annually among the workmen, in proportion to their several earnings. Last year nearly seventy-five thousand dollars in gold were so distributed as the workmen's share of the profits, several receiving as much as thirty pounds ($150) each. About half of this sum has been returned to the company in premiums on shares applied for by the miners. Inasmuch as the owners receive as high a rate of interest on their investment as they had ever made in their best years before the workmen were given an interest in the profits, while the risks and annoyances formerly arising from strikes and labor quarrels are entirely avoided, it is clear that the alliance is mutually beneficial to all concerned.

The experience of Messrs. Fox, Head, & Co., who adopted a similar plan eight years ago, has been quite as favorable to this mixed system. Their plan secures to every person employed a pecuniary interest in the success of the business, as far as possible in proportion to his services. Every one engaged, whether as laborer, clerk, foreman, manager, or partner, is paid at the rate customary in the district for his particular work. The capital employed is remunerated by a specified rate of interest. Provision is made out of the profits of manufacture for keeping the works in repair, and to cover renewals and depreciation, and a fund is maintained as a provision against losses by bad debts. This done, the surplus profit is annually divided into two parts; one to be paid to the capitalist, the other to be divided among those employed, in proportion to their earnings. The sums already divided among the workmen amount to between thirty thousand and thirty-five thousand dollars. A superior class of workmen are secured, and they stay longer at the works than ordinarily.

HINTS TO ARCHITECTS AND BUILDERS.

The late Lord Lytton, in "The Coming Race," pictured a condition of society in which mere manual labor was performed by machines, so that the only duties devolving upon men and women were those requiring the use of the intellect. Although in practice we are far from the realization of that idea, it is in strict keeping with the spirit of modern progress, and also agrees with the laws of true philosophy. It will be generally admitted that the reasoning powers of man are his most valuable possessions, and that undue muscular effort is not favorable to their development. It will likewise be generally conceded that the invention of machinery which lessens manual labor and cheapens the operations in which it is employed, contributes directly to the prosperity and intellectual advancement of the human race. The savage carries on commercial affairs by transporting articles of trade on the backs of men or in canoes impelled by oars. Wagons drawn by beasts of burden, and vessels moved by the force of the wind, mark a second stage of progress. Then come railroads and steamers, still furtherfacilitating the operations of trade; and it is not impossible that these modes of transport may be displaced by still greater improvements. With each of these changes the world becomes better and richer, so that there is great encouragement for showing how improvements may be made, wherever it seems possible.

No one can have walked through this city with observant eyes and have failed to notice the tendency, in constructing new buildings, to place the foundations a little lower, and raise the roof a little higher, than in former structures. Another fact will also strike him: that it frequently takes nearly as long to make the foundations (meaning the part below the sidewalk) of a modern building, as it does to complete the superstructure; and he has doubtless often considered whether it might not be possible to devise some method by which this operation could be quickened and cheapened. Of late years many improvements have been adopted in the building trade. The pleasant occupation of the son of Erin, who told his friend that in this "illigant country" all he had to do was to "put some bricks in a little box, and go with them up a high ladder," is fast disappearing. The elevator, which has done so much in increasing the hight of modern buildings, has been introduced to carry up the materials of construction, so that it is now not uncommon to see one or two horses or a small engine doing the work that was formerly performed by a score of men. This is very well as far as it goes; but further improvements are demanded. Take, for example, the case of the basement of a building which requires an excavation to a depth of thirty or forty feet. Ordinarily, the hole is dug in shelves or terraces, so that the workmen can throw the excavated material from the lower part to the shelf above, whence it will be thrown by another set of workmen to the next shelf above, and so on, until it reaches the surface, and is shoveled into carts to be carried off. In this manner the bottom is finally reached, and then, as each successive shelf is cut away, a platform of boards is put up; and upon this the dirt is thrown, to be transferred as before, by different sets of laborers, to the carts. If any one who has a little time to spare will witness an operation of this kind, taking pains to notice the contents of a cart, and the various manipulations these contents pass through before they are ready to be carried off, a very simple sum in arithmetic will convince him that this excavation is a tolerably expensive affair. Take, for instance, the case of a foundation forty feet below the surface, in which the materials will have to be transferred, from platform to platform, at least six times, and then once more into the carts, making seven transfers in all, and requiring seven times as many men as would be needed if the dirt could be shoveled directly into the carts. This mode of stating the problem will doubtless suggest the idea to the attentive reader to let the dirt be shoveled directly into the carts, and avoid all these transfers. It would not be difficult to accomplish this. Usually, in such an excavation, as soon as the bottom is reached in the center, a crane is set up to be used in moving foundation stones, etc., into their places. Now, when the excavation is made to such a depth that a transfer of dirt is required before it can be thrown to the surface, let the crane be brought into requisition. A small steam engine connected with the hoisting gear will furnish the power for raising and lowering weights. Let, then, the cart bodies be so arranged that they can be detached from the axles, lowered to the place where the workmen areexcavating, and, when filled, be hoisted and again connected to the wheels. An arrangement of this kind would effect a radical change in the time and cost of deep excavations, and it seems strange that it has not been adopted ere now. Of course, a mere outline is attempted in this article, without much attention to minor details. It might be found better, for instance, instead of detaching the cart bodies, to shovel the dirt into boxes, so that it could be hoisted out and dumped into the carts; or still some other method might bepreferable. It is only intended to lay stress upon the principle that it is always better and cheaper to perform work by a single operation and with a single gang of men than by several. It is quite likely that there are many other details of the builder's trade that could be improved. No matter what they are, however, they will be performed correctly if they conform to the principles of using the cheapest power and the fewest number of operations possible. Architects and builders are deeply interested in carrying out these principles, since the cheapening of construction is sure to increase their business. It may be added that the principles given above are equally applicable to all operations in which muscular effort is required; and the most successful business men are those who appreciate this fact.

PNEUMATIC BURIAL.

Graveyards existing in the midst of thickly populated districts have been pronounced by sanitarians the world over a source of disease, and hence a standing menace to the people in their vicinity. In many of the cities of Europe, where burying grounds within the corporate limits are much more common than in the newer towns of our own country, the effect of the promulgation of the above knowledge has been a wholesale removal of the dead to new cemeteries situated far in thesuburbs. This proceeding has resulted in a largely increased outlay necessary to defray the expense of a procession and more extensive funeral paraphernalia; while in Roman Catholic countries, where it is customary for mourners to follow the body to the grave bareheaded, it has caused much personal inconvenience, owing to the length of the journey, in inclement weather. Accordingly, various schemes have been suggested to avoid the above mentioned difficulties, among which plans is that of transporting the dead by means of pneumatic tubes. This idea has been ingeniously and ably worked out by Mr. F. Von Felbinger, an accomplished engineer, and Mr. J. Hubetz, an architect of Vienna, and by them submitted to the municipal council of that city. We have been favored by Mr. Von Felbinger with copies of the working drawings, and a description of his plan.

It is proposed to erect a great monumental hall or temple, which is to be divided into three portions, a middle hall and two smaller ones, the former to be devoted to the use of Roman Catholics, and the latter respectively for Protestants and Israelites. These apartments will be subdivided into chapels suitably furnished and decorated.

On a funeral taking place, the body in its coffin will be deposited in a sarcophagus in the center of one of the chapels, and the ceremony proceeded with. At the conclusion, the chief mourner touches a spring, when the sarcophagus sinks noiselessly through the floor. This corresponds to the public burial, as, so far as the mourners are concerned, they have nothing further to do with the body. On its arrival, however, in the cellar, men stationed for the purpose attach a check to the bier, showing to which cemetery it is to be forwarded, and place the body, with three others, in an iron car which fits in a subterranean tube, running on tracks placed therein, after the plan described by us as followed in the construction of the experimental section of the pneumatic railway under Broadway in this city. This tunnel in Vienna will be 15,000 feet long, and the carriages will be propelled through its entire length, by means of a blast of compressed air, in about ten minutes.

The tubes are so arranged that the car can be started off to any cemetery by a separate road. On reaching its destination, a small building erected as a terminus, the bodies are removed and buried by officials in the places previously designated by the relatives of the deceased.

The estimated cost of establishing this plan in Vienna is $500,000. This provides for a tunnel about five feet in diameter, a 150 horse power engine, and all the necessary machinery, and buildings of remarkable architectural beauty. The latter it is proposed to locate in a prominent portion of the city, and to surround with a large and handsome garden, so that the gloomy aspect and associations generally peculiar to funereal edifices will be avoided.

COMPRESSED AIR MACHINERY.

A paper on compressed air machinery, recently read by Mr. William Daniel before the British Institution of Mechanical Engineers, is a valuable contribution to our knowledge of a class of mechanism, regarding which trustworthy information is not abundant. A very complete series of experiments was conducted by the aid of an air compresser having two steam cylinders, each 16x30 inches, working compressing cylinders of like dimensions, and the whole mounted on a receiver 24 feet long by 5 feet diameter, which formed the bed plate. After the compressed air was led to a portable engine and there cooled, it was admitted to two cylinders, 10 by 12 inches, which drove an engine working a friction brake. By means of indicator diagrams, taken from this last mentioned engine, as well as from both the steam and air cylinders of the compresser, a record was obtained of the losses of power which took place at various stages. From the data a table was completed, the results of which show that, when working with air at 40 lbs. pressure, the usual effect obtained on the brake was only $25\frac{1}{4}$ per cent of the power indicated on the steam cylinders of the air compresser, while with 34 lbs. pressure the efficiency reached 27 per cent; with 28 lbs., 28 per cent was gained; with 24 lbs., 35 per cent, and with 19 lbs., $45\frac{1}{2}$ per cent. The loss of efficiency due to increased pressures may be ascribed to the conditions of the experiment and the increased loss of heat from the air, attendant upon the higher degrees of compression.

Mr. Daniel advocates the use of compressed air machinery for mines, and points out the economy which must result from the fact that, when the motor is idle, there is no loss except the interest of money expended on the machinery, which is much less than that incurred where animal power is employed. He also suggests that the ventilation of the mines would be improved by the discharge from the engines, while the air, being always available in the pipes, could be used to dilute an outflow of gas.

The discussion of Mr. Daniel's paper elicited a number of practical suggestions. Mr. C. W. Siemens pointed out that the developmentof heat during the compression of air might be avoided by the injection of water into the air-compressing cylinder, this water taking up the heat as fast as it appeared; while the formation of ice in the engine cylinders might be prevented by similar means, the water in this case giving up heat to the air during the expansion of the latter. Mr. Firth stated that he had got rid of any difficulty with ice by enlarging the exhaust openings. Mr. Brotherhood described his three cylinder engine, as used for working the Whitehead fish torpedo. This had three cylinders, each $1\frac{3}{8}$ inches by $1\frac{1}{2}$ inches stroke, driven by a pressure of 450 lbs. per square inch, admitted through a reducing valve from a reservoir of air, stored at 900 lbs. per square inch. This engine had run at 2.225 revolutions per minute, developing $2\frac{1}{2}$ horse power, or 0·28 horse power for each pound of its weight. Mr. Cowper suggested that radiating ribs, cast on the cylinders of air compressers or of engines using compressed air, might serve the purpose of facilitating the emission or absorption of heat.

A CHEAP GALVANIC BATTERY.—Mr. W. M. Symons proposes a cheap but convenient galvanic battery; each of the zinc plates was two inches square, and covered with fustian or other fabric, outside which thick copper wire was wound to form the other plate; the exciting liquid was weak chloride of zinc. Pairs of plates thus made could be arranged in series to form a battery to give out weak currents for a great length of time.

PERU, with three millions of people (a large part Indian) has twenty-six newspapers. These are published at Lima, Callao, Cuzco, Iquique, Tacna, Puno, Arequipa, Trujillo, Piura, Chiclayo, Cajamarca, Tarapacá, Ica, and Ayacucho.