

than the current. But the armature current distorts the magnetic field in the air gap and tends to cause destructive sparking at the commutator, this tendency being greater the larger the current in the armature coils. Where great increase of torque over the normal rating must be had, the continuous-current series motor offers this unique property, that the increase of current which gives the armature greater torque further strengthens this torque by adding to magnetic density in the air gap, and this addition reduces cross magnetization and the tendency to destructive sparking at the brushes. A. D. A.

THE AGREEMENT BETWEEN THE BRITISH GOVERNMENT AND THE CUNARD AND MORGAN COMBINE MERCANTILE FLEETS.

BY OUR LONDON CORRESPONDENT.

The British government has published the terms of its agreements arranged respectively with the Cunard Steamship Company and the Morgan Combine concerning the British vessels which were incorporated in the trust. The government comprises the three branches—the Admiralty, the Board of Trade, and the Postal Department. With regard to the Cunard Company, the government assumes practical control. The financial assistance comprises a loan of \$13,000,000 or less under certain circumstances, at a yearly interest of 2½ per cent, an annual payment of \$450,000, and the increase of the postal subsidy from \$310,000 to \$340,000 a year. The Cunard Company, on the other hand, in answer to this assistance, will build two new vessels of from 24 to 26 knots hourly speed, suitable for use as armed cruisers, and will place the entire Cunard fleet at the disposal of the government whenever required; will improve the mail service, and will guarantee that the company remain purely British both concerning its control and the shareholders. That is to say, no one but a British subject may be an official or have any share interest in the concern. The agreement is to remain in vogue for twenty years from the time the second new vessel departs on her maiden voyage.

Many important clauses are inserted in the agreement, to enable the government to control both the company and its vessels. The most important of these are broadly as follows:

The plans and specifications of the new vessels to be approved by the British Admiralty, who may make reasonable modifications in the designs to suit their especial requirements.

The ships are to be held at the disposal of the government for either purchase or hire. The purchase price is to be the market value of the vessel plus a 10 per cent bonus as compensation for loss or compulsory sale. Depreciation is to be set down at 6 per cent per annum upon the actual cost price of the steamship.

The payment for the hire of a vessel is to vary with its speed. In war time the Admiralty will provide the crew, but when the vessels are requisitioned for naval purposes during peace time the government is to have the option of the crews and will pay them for their services. The rate of payment will vary from \$6.25 without crew and \$7.50 with crew, for vessels of above 22 knots speed to \$4.37 without crew and \$5 with crew for vessels of between 14 and 17 knots speed, these rates being per ton per month. The company, on their part, are not to increase unduly freight or other charges and must not give undue preference against British subjects.

The company must not sell or dispose of any vessel of over 17 knots speed, without the sanction of the government. All the ships' officers, except the engineers, are to belong to either the naval reserve or the naval fleet reserve, and not less than one-half of the crew must belong to either of these two branches of the service. In the event of the new vessels failing to attain the minimum guaranteed sea speed of 24½ knots in moderate weather, but not falling below the minimum of 23½ knots, then the amount of the annual subsidy is to be decided by arbitration.

With regard to the mail service, the subsidy for which has been augmented to \$340,000 per annum, the service is to be accelerated and improved, and the new vessels are to be included. This payment is also to cover the transit of parcel mails up to a limit of 100 tons' measurement in either direction per week. Any failure in the mail service will result in the infliction of fines and penalties.

The government's control also comprises two nominees, who have the power to give votes equivalent to one-quarter of the number of votes possessed by the company's shareholders. In more explicit words the government holds one-quarter of the concern. Any person other than a British subject who acquires a share is to be forced to dispose of it within three days, failing which the share will be compulsorily sold at the market value to a British subject.

The amount of the subsidy to be paid every year has been deduced by careful investigation. The committee appointed by the Parliament for this inquiry reported that a sum of \$552,500 would be necessary to

indemnify a company for the financial loss they would sustain by running a 24-knot vessel in time of peace, which sum would have to be increased to \$745,000 for a 25-knot boat. On this basis the increase between these two figures would amount to \$1,297,500 for two vessels each of 24½ knots. This payment, however, has been compromised by reducing the rate of interest upon the loan of \$13,000,000 from the normal outside market rate of 5 per cent to 2¾ per cent.

In the case of the Morgan combine, the agreement is also extended over a period of twenty years, but the government stipulates that in any postal, military, or naval services wherein it may require the utility of the vessels of any of the British steamship companies merged into the combine, they are to be treated precisely the same as other British shipping concerns. One exception, however, is made, and that is the construction of ships of "uncommercial speed" which the government may specially require to be constructed and which are principally intended for war purposes.

The combine undertakes that a majority of the directors of the British companies shall be British subjects; no vessel is to be transferred to a foreign registry without the consent of the British Board of Trade; the ships are to carry the same quota of officers and crew of British subjects as the government stipulates upon other British vessels engaged in the same trade; the government is to have the option of purchasing or hiring any vessel on arranged terms; and one-half of the tonnage at least added to the combine in successive triennial periods from September, 1902, when the agreement was signed, is to be British. With respect to the last clause, reservation is made concerning the ships of "uncommercial speed" and vessels purchased from other than British or American sources which have been running for not less than two years. In the case of any dispute arising between the two parties, the matter is to be referred to the British Lord Chancellor, who is to be the arbitrator, and whose decision either concerning law or fact is to be regarded as final.

From these two agreements it will be recognized that the British government has concluded a fairly powerful bargain, and while it practically acquires the Cunard Company, no antagonism is displayed to the mercantile combine.

MORE INFORMATION ABOUT THE PRIZE FOR A DUST-ARRESTING RESPIRATOR.

The council of the Society of Arts are prepared to award, under the terms of the Benjamin Shaw Trust, a prize of a gold medal, or twenty pounds, for the best dust-arresting respirator for use in dusty processes, and in dangerous trades.

The council are well aware that for many years past the necessity for such an apparatus has been recognized. As far back as 1822 the society awarded its gold medal to Mr. J. H. Abraham, of Sheffield, for a magnetic guard to protect persons employed in dry grinding. The apparatus described in the society's "Transactions" (vol. xl., 1822, p. 135) includes a respirator to cover the mouth and nose. This respirator was fitted with magnets, for the purpose of arresting the fine particles of steel thrown off in the process of pointing needles, and in other processes of dry grinding. Although the invention was greatly appreciated at the time, it appears never to have come into practical use, the main objection to it having been, it is believed, raised by the workpeople themselves, who feared that the lessened risk attached to their employment would lower their wages. Similar considerations have, it appears, stood in the way of the introduction of various appliances intended to limit the risks associated with all trades in which the workpeople breathe a dusty atmosphere. The council, however, think that such considerations are likely to have less weight at the present time, and they hope that the offer of a prize may draw the attention of inventors to the matter, so that it may result in the production of some suitable piece of apparatus, despite the difficulties with which the solution of the problem is surrounded.

The apparatus will be required to fulfill the following conditions:

- (1) It must be light and simple in construction.
- (2) It should be inexpensive, so as to admit of frequent renewal of the filtering medium or of the respirator as a whole; or alternatively it should be of such construction that it can be readily cleaned.
- (3) It should allow no air to enter by the nostrils or mouth except through the filtering medium.
- (4) It should not permit expired air to be re-breathed.
- (5) The filtering medium, though it should be effective in arresting dust particles, should not offer such resistance as to impede respiration when worn for some hours under the actual conditions of work.
- (6) It is desirable that it should be as little unsightly as possible.

It should be noted that the prize is offered for a respirator intended merely to arrest dust, and not for a

chemical respirator designed to arrest poisonous fumes. The applications of such chemical respirators are more limited, and there are special requirements connected with them. The council have, therefore, preferred to limit the range of their present offer to the simpler and more important cases of dust, either dust of all kinds or of some special character, e. g., iron or steel.

Inventors intending to compete should send in specimens of their inventions not later than December 31, 1903, to the secretary of the Society of Arts, John Street, Adelphi, London, W.C. Such specimens must be accompanied by full descriptions, and in cases in which the apparatus has been put into actual use, the experience of such use should be given.

Competitors intending to patent their inventions should be careful to obtain protection, as the council of the society cannot undertake any responsibility as regards the secrecy of the whole, or of any part, of an invention submitted to them.

The prize will be awarded on the report of judges appointed by the council.

The competition is not limited to British subjects.

The council reserve to themselves the right of withholding the prize, of extending the time for sending in, or of awarding a smaller prize or smaller prizes.

SCIENCE NOTES.

Science is nothing but trained and organized common sense, differing from the latter only as a veteran may differ from a raw recruit; and its methods differ from those of common sense only so far as the guardsman's cut and thrust differ from the manner in which a savage wields his club.—Engineering Record.

Calcite, when perfectly transparent and free from flaws, has great value for optical purposes. The locality which has yielded the largest quantity of fine calcite crystals is near Eskifjörður, Iceland, and for this reason crystals of good quality are commonly termed Iceland spar.—Engineering and Mining Journal.

The latest addition to the German language is the word "knusperchen," meaning a little thing that can be nibbled. This is the word that has just taken the prize offered by some German educational society for the best translation of the noun "cake."

Phosphorus dissolves slowly in most of its solvents. Sometimes frequent agitation for weeks is required before saturation is effected. C. Stich (Pharm. Zeit.) has determined its solubility in the following liquids, the weights given being the weights of phosphorus in 100 grammes of saturated solution: Almond oil, 1.25; oleic acid, 1.06; liquid paraffin, 1.45; water, 1.0003; acetic acid, 96 per cent, 0.105.

The general public, we fear, is not acquainted with the dangers arising from arsenic coloring matter in wall paper. A recent death in Palmer, Mass., is directly attributed, by the medical authorities, to this cause. The trouble which resulted so disastrously made its appearance a year and a half ago in what seemed to be nervous dyspepsia. Two months of travel abroad seemed to greatly improve the patient, but on returning home he soon grew worse again. On account of certain conflicting symptoms which could not be readily accounted for, a specialist was called in and gave it as his opinion that there was arsenic poisoning in the system. An investigation was then made which resulted in the discovery of arsenic colors in the wall paper of the sitting room. This room had been papered shortly previous to the appearance of the first symptoms. The wall paper was at once removed, but the disease had by this time progressed so far that it was impossible to save the life of the unfortunate victim.

Andrews (Chicago Medical Recorder) mentions the usefulness of the tuning-fork in the diagnosis of fractures, especially of the long bones. The test is made by placing the bell of a stethoscope over the bone near the supposed fracture, where the soft tissues are as thin as possible, and the handle of a tuning-fork as close to the bone as possible beyond the supposed seat of fracture. The sound will be transmitted through the shaft of the bone to the stethoscope and through the stethoscope to the ears of the examiner. When the bone is intact, if the test is properly made, the sound of the fork will be heard with great distinctness; but if there is a lack of continuity, the sound will either not be heard at all or will be heard very faintly. By comparing the intensity of the sound on the suspected side with the sound heard under similar conditions on the normal side, the question of continuity of bone can be determined. The test for fractures is based upon the fact that bone is an excellent conductor of sound waves, while the soft tissue of the body conducts sound waves very poorly. The bell of the stethoscope should fit tightly to the skin and when comparing the sound and injured sides the instruments should be placed in the same relative positions. The sound waves will be transmitted through a fracture if the two ends are crowded together; also through a joint, especially if the articular surfaces are forced together.