made in magnesia crucibles heated in an Arsem vacuum furnace by melting pure iron and afterwards dropping in aluminium, the latter being suspended in the form of wire or rod from a very fine wire extended between insulating posts which passed through the cover of the furnace. At the required moment this was fused. In this way alloys containing up to 13 per cent. of aluminium were obtained, and are stated by the authors to be less contaminated with impurities than any previously made. The alloys classed as uncontaminated contain from 0·01 to 0·02 per cent. of carbon. Other alloys containing more carbon are classed as contaminated and are used to show the effects of carbon. Aluminium is a more powerful deoxidiser than silicon and does not commence to combine with iron until all the oxides present have been reduced. It forms solid solutions with iron throughout the range studied. The alloys have been studied chiefly from the point of view of their magnetic properties. Aluminium, like silicon, has a beneficial effect when added in small quantities. The best alloy obtained, containing 0·4 per cent. of aluminium, has a maximum permeability above 35,000 when annealed at 1100° C. The hysteresis loss for B. max. = 10,000 and 15,000 is 450 and 1000 ergs per c.c. per cycle respectively. The specific electrical resistance increases, about 12 microms for each per cent. of aluminium added up to 3 per cent. Above this the rate of increase falls off gradually.

OWING to the shortage of superphosphate prepared in the ordinary way with sulphuric acid various suggestions have been made to supply the deficiency (such as the action of nitre-cake on rock phosphate), or to use what ordinary superphosphate there is available to the greatest advantage. For the latter purpose admixture with insoluble phosphate has been advocated. Concerning this proposal, the results obtained by Mr. G. Scott Robertson (Journal of the Society of Chemical Industry, June 30) are of considerable importance. Mr. Robertson finds that when ordinary superphosphate is mixed with basic slag the greater part of the water-soluble calcium phosphate contained in the former reverts to the insoluble form almost at once by the action of the free lime in the basic slag, whilst on keeping the mixture a slower change in the same direction is observed Thus when a superphosphate containing 26 per cent. of water-soluble calcium phosphate was mixed with an equal quantity of basic slag (containing 1·7 per cent. of free caustic lime), the mixture, instead of containing 13 per cent. of water-soluble phosphate, contained only 5 per cent. immediately after mixing, and only 2·8 per cent. after keeping for fourteen days, after which period the composition altered but slightly. When the basic slag is replaced by an equal proportion of natural rock phosphate there is a much smaller reversion, so that there is no serious objection to such a mixture being used by farmers. A mixture of Gafsa rock phosphate with an equal weight of superphosphate contained 12·7 per cent. of water-soluble phosphate (instead of 13 per cent.) immediately after mixing, and 10·4 per cent. at the end of fourteen days. Gafsa phosphate (which rarely contains more than 0·75 per cent. of calcium oxide in the form of free carbonate) is probably the most suitable for mixing with superphosphate. Then come Egyptian phosphate, Florida pebble phosphate, Makatea Island phosphate, and Tunisian and Algerian phosphates, in order of suitability.

THE Scottish Motor Traction Company, which runs a number of motor omnibuses in Edinburgh and the district, has taken up the use of coal-gas as a substitute for petrol, and a photograph of one of its vehicles appears in the *Engineer* for September 14. The gas-holder consists of a large flexible container, which covers the entire roof of the vehicle, the arrangement being similar to that adopted in other vehicles of this type. The simplicity and low cost of the flexible receiver charged with gas at low pressure warrant careful consideration of the system as a war measure. Although the quantity of gas which can thus be carried is limited, this disadvantage is to some extent compensated for by the ease with which the gas-holder can be recharged. Further, high-pressure receivers are not easy to procure at the present time. Owing to the low pressure—about 0·2 in. of water—a meter delivering into the receiver races unless some form of throttle is interposed. A short length of small-bore piping, or a diaphragm with a suitable aperture, is recommended so as to retain the pressure drop in the meter within reasonable limits.

WRITING in the *Tohôku Mathematical Journal*, vol. xi., 3, Mr. Hastime Tanate discusses the logical foundations for negative and imaginary quantities and expresses the view that the existence of these quantities may be explained independently of any geometrical considerations.

OUR ASTRONOMICAL COLUMN.

DISTRIBUTION OF SPIRAL NEBULÆ.—The distribution of spiral nebulæ has been further investigated by Dr. R. F. Sanford, with the aid of photographs obtained with the Crossley reflector (Lick Observatory Bulletin, 297). The photographs were taken with exposures of the order of twelve hours, the object being to find out whether new nebulæ could be detected in regions of the Milky Way which have hitherto seemed barren of them. They afford no evidence of undiscovered faint nebulæ in the regions where they have not previously been found with shorter exposures. It is shown that there is greater average brightness for the extra-galactic than for the galactic spirals, and that the nebulæ which lie nearest to the Milky Way are on the average of larger angular size than those away from it. F. G. Brown has shown that the larger nebulæ in general are the brighter, but this is not true of spiral nebulæ near the Milky Way, which are large and faint. Thus, if angular size be taken as a criterion of distance, it follows that something cuts off the light from the galactic spirals, thereby letting only the nearer ones be perceptible, and then only with diminished brightness. An arbitrary and general distribution of the spiral nebulæ can be best harmonised with the observed features of the distribution by assuming the existence of an obstructing medium, which is irregularly scattered throughout the galaxy. It is considered probable that the spirals are not only outside our own system, but that they can have no intimate connection with it dynamically.

THE GREAT SOLAR PROMINENCE OF 1916, MAY 26.—A detailed account of the great eruptive prominence of 1916, May 26, which reached a maximum height of half a million miles, and in some parts attained a velocity of 457 km. per second, has been given by Mr. Evershed (Kodaikanal Bulletin, No. 55). One of the most striking results of the measurements of the photographs is to show that all parts of the prominence were moving radially outwards from a point in the chromosphere at the base of the main column. It is considered probable that an eruptive prominence begins as an unusually dense low-lying mass of gas which may persist without much change for several days, and then suddenly become unstable, becoming subjected to a force which tears it to shreds and sends the frag-

ments flying into space with accelerating speed. The dissipating force, as indicated by the great prominence, lies at the surface of the sun, and may be localised in a very restricted area. The main stem consisted of a stream of rapidly moving gas, which was brilliantly luminous when it formed a continuous column, but so soon as the continuity was broken by the stoppage of the supply of gas from the chromosphere, the separate detached masses faded very rapidly. The rapid fading is probably to be explained by the extremely low density of the gas involved. Mr. Evershed argues that the density is so small that the gas can have no temperature in the ordinary sense; its emissive power will thus be dependent only on absorption of photospheric radiation, which is apparently insufficient to maintain luminosity at great heights. A remarkable feature of the great eruption was the practically simultaneous fading of the entire prominence.

COLOURS OF STARS IN GALACTIC CLOUDS.—In continuation of his work on the colours and magnitudes of stars in clusters, Dr. Harlow Shapley has determined the colours and magnitudes of 300 stars in the galactic clouds surrounding the cluster Messier 13 (*Astrophysical Journal*, vol. xlvi., p. 64). A wide range of colour is apparent among these stars, and the distribution of spectral types among the 14th magnitude stars appears to be much the same in this distant galactic region as in the immediate vicinity of the sun. Stars of all colours are included in each interval of magnitude, and so far as colour is an index of intrinsic luminosity, this may be accepted as an indication of considerable difference in the distances of such stars. The wide dispersion in magnitude of both blue and red stars suggests that the extent of the stellar clouds in the line of sight is relatively very great, possibly greater than the distance to the nearer boundary. The cluster Messier 11 proves to be a physical group in the midst of the star-clouds, which on their own part have the general appearance, and some of the properties, of an enormous, but definitely outlined, physical system. There is as yet no certain evidence of the existence of dwarf stars either in the cluster or in the galactic clouds. The cluster stars are probably giants in luminosity, and the distance of the group is of the order of 15,000 light-years.

GERM-CELLS AND BODY IN INHERITANCE.

IN NATURE for March 15 of this year (pp. 55–56) some account was given of a summary of Dr. Raymond Pearl's researches on the progeny of alcoholised fowls. A later and much fuller description of this important work has now appeared in the *Journal of Experimental Zoology* (vol. xxii., 1917, pp. 125–86, 241–310), under the title of "The Experimental Modification of Germ-cells." This paper is divided into three sections, the first of which describes the general plan of the experiments, and the second the effect upon the domestic fowl of the daily inhalation of ethyl alcohol and other substances, while the third discusses the effect of parental alcoholism and certain other drug intoxications on the progeny. The general results of the experiments have already appeared in NATURE (*loc. cit.*). Dr. Pearl alcoholised his fowls by inhalation because the birds refused to drink alcohol, even if highly diluted; Prof. Stockard had previously found it impossible to administer alcohol to guinea-pigs satisfactorily by the stomach, and had therefore also adopted the inhalation method. While the progeny of Stockard's guinea-pigs had been as a rule weakly and deformed, the offspring of Pearl's treated fowls were stronger, though less numerous, than those of his "controls." In the case of the birds the effect of the alcohol on the germ-cells seems therefore to have been selective, whereas with the rodents it was utterly deleterious. A possible cause of the difference, which does not seem to have occurred to Dr. Pearl, may be the great contrast between the respiratory mechanism in birds and in mammals; the residual air in the lungs of the latter might be expected to increase the effect of the inhaled poison. Further, the excessive degradation of the offspring of Stockard's guinea-pigs suggests that the germ-cells of those animals are peculiarly sensitive to adverse influences.

The temptation to argue from these divergent results to the terribly practical problem of alcoholism in the human race is great, and Dr. Pearl does not altogether resist it. Clearly, however, the effect of the inhalation of ethyl alcohol by a Plymouth Rock hen, or even by a guinea-pig, cannot be closely compared with the effect of alcohol swallowed by the whisky- or beer-drinker. The latter effect can be studied elsewhere than in biological laboratories.

Another aspect of the affection of germ-cells is illustrated for plants by Mr. S. Ikeno's "Studies on the Hybrids of *Capsicum annuum*," part ii., "On Some Variegated Races," in a recent number of the *Journal of Genetics* (vol. vi., No. 3). A variegated race of this species appeared in 1913 by mutation, producing, exclusively by self-fertilisation, plants which have always variegated foliage, but which differ widely in the intensity of the variegation. Self-fertilised flowers on green branches of a variegated plant yield variegateds, in the majority of which the variegation is slight. By hybridising variegated with green the degree of variegation in the offspring is diminished. Variegation is transmissible in either the male or the female line, but the transmission "is not through the nucleus, but through the cytoplasm; especially the plastids contained therein may be regarded as organs of transmission," and the author believes that some cytoplasm containing plastids may be introduced by the male gamete into the zygote. Analogous cases of plant-inheritance have been previously discussed by Correns, Gregory and others. Variegation depends upon the presence of plastids which have no power of forming chlorophyll, which may, indeed, be regarded as diseased, so that though the character is due to a kind of infection suffered by the germ-cells, it is not strictly blastogenic.

The same part of the *Journal of Genetics* contains a paper by Dr. R. Ruggles Gates on "Vegetative Segregation in a Hybrid Race of Œnothera (*Œ. rubricalyx* × *biennis*," in which somewhat similar questions are raised. The bud-colour character shows Mendelian segregation, which may reasonably be considered dependent on normal chromosome distribution in meiosis. But in the size of petal there is a range of variation that suggests "somatic variation and segregation . . . determined by diversities appearing in nuclear or cytoplasmic material during somatic mitoses." Here, therefore, we have another example of the necessity for clearing issues in the study of inheritance.

The broader aspects of evolution are discussed by Dr. Raymond Pearl in an article entitled "The Selection Problem" (*American Naturalist*, vol. li., 1917, pp. 65–91). Insisting on the necessity of experimental proof and the determinative action of germinal characters, he concludes that "natural selection is no longer generally regarded as the primary, or perhaps even a major, factor in evolution." Yet, in stating that "natural selection is, from the point of view of modern genetics, a somatic theory," he surely goes far beyond the available evidence, and seems to ignore the principle that characters of selection-value must be re-