portions and constituents of high explosives, it seems desirable that this information should be afforded by the manufacturers to the users of the explosive.

(3) In the storage of high explosives, it is desirable that every care should be taken to insure their being maintained in a proper condition. It is also certain that these explosives alter in character with age.

(4) It is essential that similar examinations of the working-places and precautions which are in force in mines where blasting-powder is used, should be rigidly observed when a high explosive is employed.

(5) In selecting a high explosive for use in a mine, it should not be forgotten that the risk of explosion is only lessened and not abolished by its use.

(6) All of the high explosives on detonation produce evident flame.

(7) The emission of flame from a blown out shot of a detonated high explosive is not prevented by the quantity or length of stemming used.

(8) In the case of a charge of a high explosive which has missed fire, if a short length of stemming (proved up to 8 inches) has been employed, the charge can be detonated by another cartridge of the explosive and additional stemming being placed in the hole in front of the original stemming.

The experiments were carried out under the direction of Mr. J. L. Hedley, H.M. Inspector of Mines, and Mr. A. C. Kayll, the Engineer to the Committee.

The sincere thanks of mining engineers are due to the Institute for bearing the great expense involved by the experiments, and to the many mining companies, associations, and private firms that have rendered valuable assistance in the matter.

THE UPSALA MEETING OF THE INTERNATIONAL METEOROLOGICAL COMMITTEE.[1]

AT the meetings of the International Meteorological Committee, held at the University of Upsala, in August, the secretary submitted a brief report, with the questions proposed for discussion. A statement of these, with the decisions, follows :—

International Bureau.—A report was presented by Prof. Hildebrandsson, in which the functions and cost of such a bureau were considered. The committee decided against its establishment.

Agricultural Meteorology.—Upon the proposition of Mr. Scott, it was decided that the methods employed to distribute weather predictions to farmers, and the results of climatological discussions relating to the crops in the various countries, be published.

Establishment of Stations for Cloud Observations.—Prof. Hildebrandsson presented a pamphlet containing a detailed account of the principal methods employed in these investigations. The committee adopted these resolutions :—

Since experience shows that the altitude of clouds can be easily determined with sufficient accuracy, the generalisation of these investigations in all countries is recommended, preferably by the use of the photographic process. Observations of direction and relative velocity should be made at as many stations as possible, and measures of height at a limited number of suitably distributed stations.

The value of these investigations would be greatly increased if made at the same epoch, therefore it is proposed that they be commenced May 1, 1896, and continued for one year.

The stations already promised are situated in Batavia, France, Norway, Portugal, Prussia, Roumania, Russia, Sweden, United States : Blue Hill, and Weather Bureau (six stations).

Cloud Atlas.—The committee appointed at Munich reported slightly modified definitions of some types in the Hildebrandsson-Köppen-Neumayer Atlas, and submitted photographs and pastels for reproduction in the new atlas, as well as instructions for observing clouds. These were adopted by the Permanent Committee after discussion and modification. (See subjoined report.) A special committee, composed of M. Teisserenc de Bort and Prof. Riggenbach, with Prof. Hildebrandsson as chairman, was appointed to publish the atlas, and the choice of the colour of each place, to represent as nearly as possible the natural conditions, was left to its discretion.

More Rapid Transmission of Telegrams.—Dr. Snellen presented a joint report with Dr. Neumayer on this question, in which the necessity of giving the meteorological dispatches precedence over others, by opening a circuit system with the other central bureaus, was urged. The introduction of simultaneous observations in the various countries was deemed necessary. The committee referred the matter to the International Telegraphic Bureau at Berne.

In more or less intimate relation with this question was a proposition by Dr. van Bebber, on the importance of further experiments in tele-meteorography. Dr. Snellen explained the telegraphic transmission of the traces of self-recording instruments by the Olland apparatus, which operates over a short distance at Utrecht.

Scintillation of Stars.—At the request of M. Ch. Dufour, this question, which had been the object of investigations by M. Montigny, of Brussels, was brought before the committee. Further study by him, together with that of M. Veutosa, on the atmospheric movements observed around stars, was encouraged.

Maritime Meteorology.—A proposition of the Russian Admiral Makaroff, on the necessity of an international convention to arrange for the discussion of the data contained in ships' logs, was not approved.

Psychrometric Observations below Freezing.—This question was introduced by Profs. Hildebrandsson and Mohn. The employment of Ekholm's method for the reduction of mean values was recommended, but a report of further investigations was requested.

Exploration of Upper Air.—A resolution received from the *Congrès de la Science de l'Atmosphère*, which had recently met in Antwerp, on the importance of the balloon ascents now being made at Berlin for meteorological purposes, was confirmed in a more general sense.

Next Congress.—It was decided to convene a non-official congress at Paris in September 1896.

THE CLASSIFICATION OF CLOUDS.

In the cloud classification of Hildebrandsson and Abercromby, published in the Hildebrandsson-Köppen-Neumayer Atlas, in 1890, the word "diurnal" is added to the definition of Group D, so that it becomes :—

D. Clouds formed by the diurnal ascending currents.

In this way, the cumulus arising from a mass of aqueous vapour ascending through calm air is distinguished from the nimbus caused by the general ascension of the whole mass of moist air.

With this change the classification of the ten principal forms is :—

(*a*) Detached or rounded forms (most frequent in dry weather).
(*b*) Wide-spread or veil-like forms (wet weather).

A. Highest clouds, mean height 9000 metres.
  (*a*) 1. Cirrus.
  (*b*) 2. Cirro-stratus.
B. Clouds of mean altitude, 3000–7000 metres.
  (*a*) 3. Cirro-cumulus.
  (*a*) 4. Alto cumulus.
  (*b*) 5. Alto-stratus.
C. Low clouds, 1000-2000 metres.*
  (*a*) 6. Strato-cumulus.
  (*b*) 7. Nimbus.
D. Clouds formed by the diurnal ascending currents.
  8. Cumulus. Top, 1800 metres; base, 1400 metres.
  9. Cumulo-nimbus. Top, 3000–5000 metres;* base, 1400 metres.
E. Elevated fog, below 1000 metres.
  10. Stratus.

N.B.—As the heights of the clouds marked * do not agree with the heights of these clouds found at Blue Hill, Mr. Rotch has asked that the altitude of the low clouds be placed below 2000 metres simply, instead of between 1000 and 2000 metres, since the bases of nimbus are frequently below 1000 metres; and also that the superior limit of the tops of the cumulo-nimbus be raised to 8000 metres.

The following are descriptions of the clouds, modified from those in the Hildebrandsson-Köppen-Neumayer Atlas.

[1] Extracted from a report by Mr. A. Lawrence Rotch, in the December number of the *American Meteorological Journal.*

(1) CIRRUS (Ci.).—Isolated feathery clouds of fine fibrous texture, generally of a white colour. Frequently arranged in bands which spread like the meridians on a celestial globe over a part of the sky, and converge in perspective towards one or two opposite points of the horizon. (In the formation of such bands, Ci. S. and Ci. Cu. often take part.)

(2) CIRRO-STRATUS (Ci. S.).—Fine whitish veil, sometimes quite diffuse, giving a whitish appearance to the sky, and called by many cirrus haze, sometimes of more or less distinct structure, exhibiting confused fibres. The veil often produces halos around the sun and moon.

(3) CIRRO-CUMULUS (Ci. Cu.).—Fleecy cloud. Small white balls and wisps without shadows, or with very faint shadows, which are arranged in groups and often in rows.

(4) ALTO-CUMULUS (A. Cu.).—Dense fleecy cloud. Larger whitish or greyish balls with shaded portions, grouped in flocks or rows, frequently so close together that their edges meet. The different balls are generally larger and more compact (passing into S. Cu.) towards the centre of the group, and more delicate and wispy (passing into Ci. Cu.) on its edges. They are very frequently arranged in stripes in one or two directions.

(The term cumulo-cirrus is given up as causing confusion.)

(5) ALTO STRATUS (A. S.).—Thick veil of a grey or bluish colour, exhibiting in the vicinity of the sun and moon a brighter portion, and which, without causing halos, may produce coronæ. This form shows gradual transitions to cirro-stratus, but, according to the measurements made at Upsala, has only half the altitude.

(The term stratus-cirrus is abandoned as giving rise to confusion.)

(6) STRATO CUMULUS (S. Cu.).—Large balls or rolls of dark cloud which frequently cover the whole sky, especially in winter, and give it at times a wave-like appearance. The stratum of strato-cumulus is usually not very thick, and blue sky often appears in the breaks through it. Between this form and the alto-cumulus, all possible graduations are found. They are distinguished from nimbus by the ball-like or rolled form, and because they do not tend to bring rain.

(7) NIMBUS (N.).—Rain clouds. Dense masses of dark formless clouds with ragged edges, from which generally continuous rain or snow is falling. Through the breaks in these clouds there is almost always seen a high sheet of cirro-stratus or alto-stratus. If the mass of nimbus is torn up into smaller patches, or if smaller clouds are floating very much below a great nimbus, the former may be called Fracto-nimbus ("Scud" of the sailors).

(8) CUMULUS (Cu.).—Piled clouds. Thick clouds whose summits are domes with protuberances, but whose bases are flat. These clouds appear to form in a diurnal ascensional movement which is almost always apparent. When the cloud is opposite the sun, the surfaces which are usually seen by the observer are more brilliant than the edges of the protuberances. When the illumination comes from the side, this cloud shows a strong actual shadow; on the sunny side of the sky, however, it appears dark with bright edges. The true cumulus shows a sharp border above and below. It is often torn by strong winds, and the detached parts (Fracto-cumulus) present continual changes.

(9) CUMULO-NIMBUS (Cu. N.).—Thunder cloud; shower cloud. Heavy masses of clouds, rising like mountains, towers, or anvils, generally surrounded at the top by a veil or screen of fibrous texture ("false cirrus"), and below by nimbus-like masses of cloud. From their base generally fall local showers of rain or snow, and sometimes hail or sleet. The upper edges are either of compact cumulus-like outline, and form immense summits, surrounded by delicate false cirrus, or the edges themselves are drawn out like cirrus. This last form is most common in "spring squalls." The front of storm clouds of great extent sometimes shows a great arch stretching across a portion of the sky, which is uniformly lighter in colour.

(10) STRATUS (S.).—Lifted fog in a horizontal stratum. When this stratum is torn by the wind or by mountain summits into irregular fragments, they may be called Fracto-stratus.

INSTRUCTIONS FOR OBSERVING CLOUDS.

At each observation there are to be recorded:—

(1) *The Kind of Cloud*, designated by the international letters of the cloud name, which may be more exactly defined by giving the number of the picture of the Atlas most nearly representing the observed form.

(2) *The Direction from which the Clouds come.*—If the observer remains completely at rest during a few seconds, the motion of the clouds may be easily observed relatively to a steeple or mast erected in an open space. If the motion of the cloud is very slow, the head must be supported. Clouds should be observed in this way only near the zenith, for if they are too far away from it the perspective may cause errors. In this case nephoscopes should be used, and the rules followed which apply to the particular instrument employed.

(3) *Radiant Point of the Upper Clouds.*—These clouds often appear in the form of fine parallel bands, which, by an effect of perspective, seem to come from one point of the horizon. The radiant point is that point where these bands, or their direction prolonged, meet the horizon. The position of this point on the horizon should be recorded in the same way as the wind direction, north, north-north-east, &c.

(4) *Undulatory Clouds.*—It often happens that the clouds show regular, parallel, and equidistant streaks, like the waves on the surface of water. This is the case for the greater part of the cirro-cumulus, strato cumulus (roll-cumulus), &c. It is important to note the direction of these streaks. When there are apparently two distinct systems, as is to be seen in clouds separated into balls by streaks in two directions, the directions of the two systems should be noted. As far as possible, observations should be made on streaks near the zenith to avoid effects of perspective.

(5) *Density and Position of Cirrus Banks.*—The upper clouds frequently take the form of felt or of a more or less dense veil, which, rising above the horizon, resembles a thin white or greyish bank. As this cloud form has an intimate relation to barometric depressions, it is important to note:—

(*a*) The density—

0 meaning very thin and irregular.
1 meaning thin but regular.
2 meaning rather dense.
3 meaning dense.
4 meaning very dense and of dark colour.

(*b*) The direction in which the veil or bank appears densest.

Remarks.—All interesting details should be noted, for example:

(1) On summer days all low clouds generally assume particular forms resembling cumulus more or less. In this case, there should be put under *Remarks*, "Stratus or Nimbus Cumuliformis."

(2) It sometimes happens that a cumulus has a mammillated lower surface. This appearance should be described by the name of "Mammato-cumulus."

(3) It should always be noted whether the clouds appear stationary, or whether they have a very great velocity.

The text of the Atlas is to be in French, English, and German.

ENDOWMENT FOR SCIENTIFIC RESEARCH AND PUBLICATION.[1]

II.

IMMEDIATELY connected with our colleges and universities is another field, in which additional endowments are greatly needed, viz. for fellowships in science for post-graduate studies.

Upon the post-graduate workers the future of science, and the recruits for future teachers and professors, must necessarily depend. In that view the importance of post-graduate endowments in science can scarcely be magnified. The great majority of the young men from whom all the new recruits must be drawn have little or no pecuniary means. After graduating, often through many difficulties, they must face the question of their future calling. They must consider what promise of a reasonable and comfortable support a life devoted to science affords. If this risk should not deter them, still there are many with talents of a high order who would be absolutely unable to proceed further in the advanced scientific studies necessary to qualify them to enter upon remunerative scientific

[1] Address delivered by Mr. Addison Brown, at a meeting of the Scientific Alliance of New York. Reprinted from Smithsonian Report, 1892.

(Continued from page 167.)