REINFORCED CONCRETE IN GREENHOUSE CONSTRUCTION.

By WILLIAM MCDONALD.

THE rediscovery of cement is quite recent, and while it has been used extensively in engineering and architectural work, both of which terms are fast becoming synonymous, yet cement in the form of concrete has only received its greatest impetus since the application of various forms of steel rods and expanded metal as reinforcing materials. This application is possible on account of the expansion of both materials being nearly equal, while the steel supplies the great tensile strength which the concrete lacks. It has been successfully applied to greenhouse construction, both in hollow concrete blocks and also in monolithic form. It is, however, the latter application which is here illustrated, as it is only in this way that the reinforcing can be applied. There is no doubt that the general application of concrete in the future will be in the monolithic form, for the reason above stated. The only objection in greenhouse work is the dampness, which keeps the houses cold in the winter; but this is obviated in a degree by using a damp course of coal tar ½ inch thick just above the level of the ground.

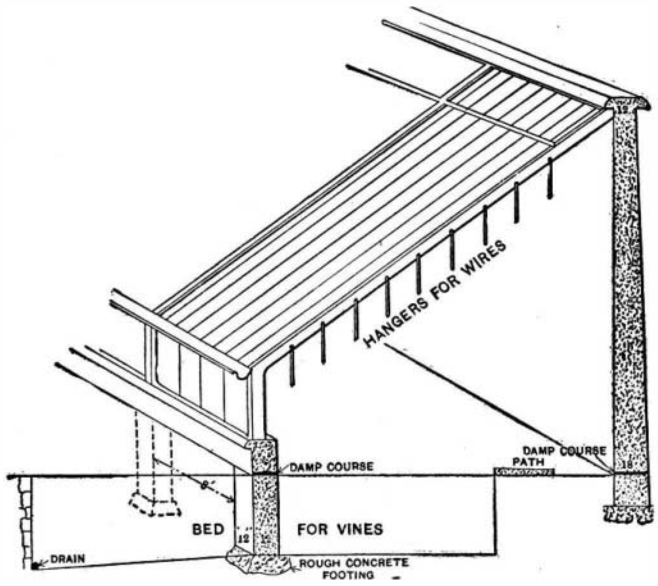

Fig. 1.—Isometric View Indicating Construction. Spacing for a Grapery.

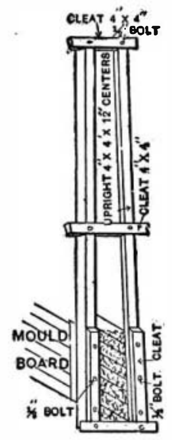

Fig. 2.—Cross Section of Mold, etc.

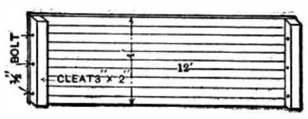

Fig. 3.—Elevation of Mold Board.

The best application of reinforced concrete is to graperies, the construction of which is indicated in Fig. 1 of the illustrations. These having to be supported on pillars so that there may be room for the roots of the vines both outside and inside, large spans are used as indicated in the engraving, these being represented 8 feet in the clear. The wall is 18 inches high and 12 inches thick, reinforced with 1 per cent of steel per volume, equal to eight ½-inch rods or four ¾-inch rods. The wall then really becomes a beam with 8 feet span. For the rear wall a section 18 inches wide at the bottom and 12 inches at the top is adopted with rough concrete footing. The molds for this are formed of 4 x 4-inch timbers placed 12 feet on centers and joined by cleats and bolts so as to give an accurate cross section of wall. These are to be braced as indicated in Fig. 2 until the first course of concrete is placed. The mold board, an elevation of which is shown in Fig. 3, is 4 x 12 feet, and constructed of ¾-inch boards planed on the inside and with cleats to bolt them to the uprights. Each time before they are used the molds should be oiled outside with dead oil.

The concrete should be composed of one part cement to two parts of clean, sharp sand and four of small broken stone. The mixing is very important, and as a general thing is not properly done. The sand for a batch should be spread evenly on the mixing board, and covered uniformly with the cement, after which they should be turned over twice while dry. The stone and the water should then be added, care being taken to wet the stones thoroughly; in fact, it is a good plan to wet them beforehand. The mixing is then completed and the concrete shoveled into the mold and lightly tamped.

For the tables indicated in Fig. 4 gravel is substituted for the broken stone, and the proportions are 1 part cement, 2 parts sand, and 3 parts gravel. In constructing the tables place a footing of concrete about 9 x 9 inches, and 9 inches deep under each iron pipe support, making sure that the pipe is firmly bedded in the concrete. It is also essential that the tops of the pipe supports be bedded in the concrete tables. Now place the mold in position with the supports under them as indicated in Fig. 5. As a table also forms a beam, the reinforcing rods are placed the length of the table, using for the purpose ½-inch square steel rods. The material is mixed as before and placed in position, a smooth skin being worked up on top of the table. The position of the mold for the rounded end is made to unscrew from the general mold. The upright rod imbedded in the concrete is all that is necessary for the support of the tables.

The above are simply examples of the application of this method of reinforced concrete construction, and the great advantage of it is that any small contractor with sufficient care can make a very satisfactory job. The same construction can also be applied to the walls and floor of the stoke hole to form pipe supports or for potting sheds, toolhouses, gardeners' cottages, etc.—Carpentry and Building.

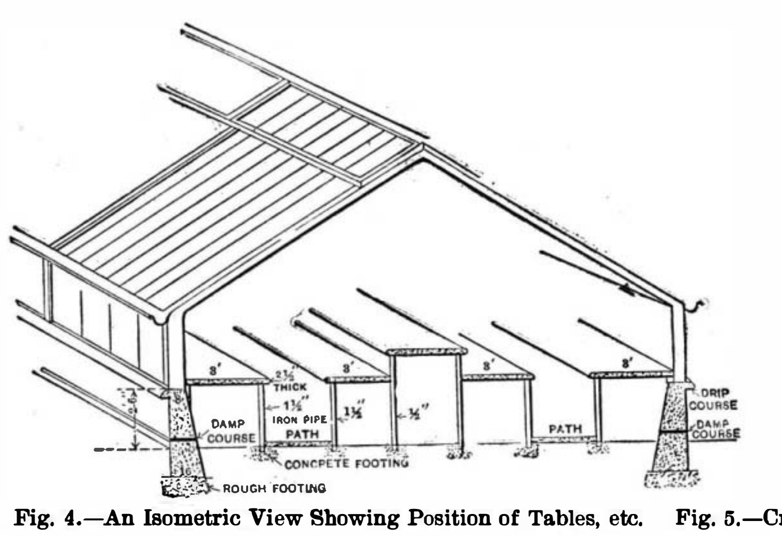

Fig. 4.—An Isometric View Showing Position of Tables, etc.

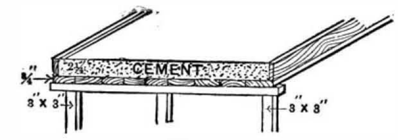

Fig. 5.—Cross Section of Mold Board for Tables.

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PROGRESS OF ASTRONOMY IN 1906.*

By E. WALTER MAUNDER.

THE SUN.—The state of the sun's surface during the year ending October 31, 1906, points to the sunspot maximum being already passed; a marked falling off in both the numbers and areas of sunspots having been noticed since the beginning of 1906. While 1905 was remarkable for the number of giant groups very easily visible to the naked eye, these have been rare during 1906, the most striking outburst being one that commenced on the visible hemisphere on July 27, and rapidly increased in size until by the end of the month it had attained an area of twelve hundred millionths of the sun's hemisphere. The tendency has been rather for spots of moderate size to form in long processions parallel to the solar equator; a very remarkable instance of such a procession was observed in November, 1905, and another not quite so pronounced in March, 1906. October, 1906, was a very quiet month; indeed the sun was then entirely free from spots on no fewer than seven days. A similar falling off has been remarked with respect to the faculæ, but it has been less pronounced than with the spots; the mean area of which for 1906 was about three-fourths of that for 1905. On the whole the maximum seems to have fallen about the end of 1905 for faculæ and prominences, while the maximum for spots should probably be placed at least six months earlier. Yet a caution must be observed in deciding thus soon as to the precise date of the turn of the cycle, for sunspots generally continue to be very active for fully four years at maximum during which they exhibit several strongly marked fluctuations, before the period of decline definitely sets in. It is therefore even yet somewhat premature to conclude that no further marked recrudescence of activity will be witnessed in the course of the present cycle.

A new determination of the stellar magnitude of the sun has been made by Prof. Ceraski, who employed the planet Venus as an intermediary for the comparison between the light of the sun, and of Polaris, Procyon, and Sirius; comparing Venus with the sun by day, and with the stars named by night. He found the sun's light one million times greater than Polaris × 290550; Procyon × 77630; or Sirius × 17045. The weighted mean of these three determinations gives the stellar magnitude of the sun as —26.59, or as Prof. Ceraski prefers to express it, as 26.59 *super magnitude.*

The calorific radiation of the sun has been determined afresh by MM. Millochau and Féry from observations made at three different levels; viz., Meudon altitude 150 meters, Chamonix, 1030 m., and Mt. Blanc, 4810 m. The maximum observed temperature at the last named station was 5590 deg. absolute; giving, when roughly corrected for the atmospheric absorption, 5610 deg. absolute, for the final result.

A research which promises important results has been initiated by Prof. Hansky at Pulkowa in the photographic registration of the forms and movements of the granulations of the solar surface. Prof. Hansky found that he was unable to recognize the forms of the granulations in successive photographs taken by M. Janssen at Meudon, but by taking photographs at intervals of from fifteen to thirty seconds on a scale of nearly two feet to the solar diameter it was found possible to trace the changes and movements to which the granulations were subject. After an interval of a minute, the same granulation was usually recognized with difficulty. The dimensions and rates of motion of the granulations varied within wide limits but their mean diameter was about 1.9 second, and mean speed about 21 kilometers per second.

The Sunspot Cycle.—The uncertainty as to our present position in the sunspot cycle, lends great interest to an attempt which Prof. A. Schuster has made to examine the precise nature of the sunspot periodicity. The method which he has employed in the analysis of the sunspot numbers of the last 150 years, is an application of Fourier's theorem, and he claims to have discovered in addition to the well-known cycle of 11.125 years, a number of minor periodicities, the integration of which in their varying intensities, produces the irregularities of the cycle actually observed. These minor periods are 4.78, 8.32, 9.25, 13.5, and 13.75 years; and Prof. Schuster points out the most strongly marked of these are, like the 11.125 period, simple sub-multiples of 33.375; while two-fifths of that period gives very nearly the value of the shorter 13-year period. The multiplicity of these periods, their near approach to commensurability, and the fact that they undergo suppression for considerable intervals of time, throw grave suspicion upon their reality, which it is to be hoped that the promised publication of the details of his investigation, will enable Prof. Schuster to remove. In the meantime, Prof. Schuster regards the relation of these periods to 33.375 years, which is nearly the revolution period of the Leonid Meteors, as a strong confirmation of his view that the secret of the sunspot variation is to be found in meteoric influence. Indeed in the Observatory for May, 1906, he claims to trace the "third of a century" cycle by means of Chinese sunspot observations as far back as A.D. 188, and draws attention to a coincidence, noted by Prof. Turner, namely, that the Leonids only entered the system in A.D. 126. He considers it possible that a meteoric stream might pick up some of the negative ions which had previously been projected outward by the sun, and if it did so, might at perihelion, supposing that it was then within a few solar diameters of the sun, affect the luminosity and shape of the corona, the variation of the spot phenomena following as a secondary effect of the coronal disturbance. The occasional disappearance of a period might be accounted for if it is supposed that radioactive matter is irregularly scattered through space, and that the meteor streams sometimes traverse a barren, and sometimes a rich region. It will be seen that in its present form, at any rate, Prof. Schuster's theory is confined to the mere suggestion of vague possibilities, hardly consistent with what we know of any meteor stream; certainly not with the Leonids which have their perihelion passage at about one hundred solar diameters from the sun.

Sunspot Spectra.—A number of valuable papers on this subject have appeared during the year, chiefly in the Astrophysical Journal. Besides the actual catalogues of "widened lines," and of "Maunder's bands" observed, the two chief questions debated are: "What is the cause of the darkness of sunspots?" and "Are sunspot spectra represented in stellar spectra?" On the first of these two questions Messrs. Hale and Adams do not accept Evershed's suggested defense of Maunder's view that the darkness of a sunspot is in part due to diminished radiation; for Evershed supposed that the maximum of intensity of the sunspot spectrum might be displaced into the extreme ultraviolet; while they found it was displaced to the infrared. They also reject Fitzgerald's suggestion brought forward by Dr. W. E. Wilson, that the great convection currents which must exist within such a gaseous layer as that seen in a sunspot, would limit effective radiation to quite a shallow stratum. They therefore conclude "that the darkness of sunspots may be sufficiently well accounted for by absorption alone." Messrs. Hale and Adams are also quite unable to support Lockyer's view that at the period of sunspot maximum the lines due to known elements are replaced by

* Popular Astronomy.