

mathematical honourmen turn to engineering, they cease to go further in mathematics, as they find it pays better to qualify as engineers. The average mathematician who is not essentially by nature and genius devoted to pure mathematics, finds that it is more to his advantage, and is a far less arduous task, to qualify in physics, chemistry, or engineering, where he may find an outlet for his energies outside the teaching profession. Problems of the class contemplated by Mr. Paaswell depend essentially on a knowledge not so much of engineering as of *applied mathematics*, such as rigid dynamics, hydrodynamics, thermodynamics and conduction of heat, and elasticity, up to the standard of the old part ii. tripos, which is a less attractive sequel to part i. than the engineering tripos. Consequently applied mathematicians proper are few and far between, and a certain class of problems possessing no inherent difficulties is running to waste. Moreover, the few specialists interested in such work can only undertake it in the intervals between professional duties, often occupied with the teaching of engineering students of a very elementary standard.

MESSRS. DICKINSON and Osborne, of the U.S. Bureau of Standards describe in the April issue of the Journal of the Franklin Institute what they term an "aneroid calorimeter." It is an instrument in which equalisation of temperature is secured by means of the thermal conductivity of copper instead of by the convection of a stirred liquid. The calorimeter described, which consists of a thick walled cylindrical vessel of copper in the walls of which are embedded a coil of resistance wire to supply heat electrically, and a platinum resistance coil for use as a thermometer, has been found useful over a wide range of temperatures, and is applicable to a variety of problems. For use at low temperatures the calorimeter is mounted in a jacket surrounded by a bath of gasoline, the temperature of which can be controlled thermostatically to within a few thousandths of a degree at any temperature between -55° and $+40^{\circ}$ C., or can be changed rapidly in order to keep it the same as that of the calorimeter when heat is being supplied to the latter. A series of check experiments on the specific heat of water shows the order of reproducibility of results which can be obtained to be 1 part in 2000.

A NOTE on radiation pyrometers and their characteristics, by G. K. Buyers and P. D. Foote has been communicated to the April number of the Journal of the Franklin Institute. It heralds the publication of a very complete paper which is to appear from the Bureau of Standards. Some twenty instruments have been examined, including all the ordinary types commonly met with in practice, such as the four due to Féry, and the Foster, Thwing, and Brown pyrometers. It has been established that the Stefan-Boltzmann law, $E = a(T^4 - T_0^4)$, is not in general, except by accident, obeyed exactly by any of the pyrometers examined. The similar equation, $E = aT^4 \cdot T_0^{b-4}$ in which b is slightly different from 4 (usually neglecting the T_0 term) is, however, obeyed with sufficient exactness by all total radiation pyrometers. The main

NO. 2376, VOL. 95]

factors which influence the value of the exponent b are the geometry and mechanical construction of the instrument; the value of b for twenty thermo-electric pyrometers ranged from about 3.5 to 4.5. The same instrument of the Féry type may have a different exponent according to its use with or without the sector diagram for increasing the temperature range.

A HIGH-CAPACITY wagon for the South African railways is illustrated in *Engineering* for May 7, together with another wagon of special design and 160,000 lb. capacity, built for transport of whales. These wagons have been constructed by the Leeds Forge Co., Ltd., and are excellent examples of steel rolling-stock. The whale wagon is intended to carry whales over a special 3 ft. 6 in. line a few miles in length from the point where they are brought ashore to the factory, where they are dealt with for the extraction of oil, etc., not far from Durban. The bodies are hauled on to and off the wagon by windlasses. The line is very uneven, and it has been necessary to design the wagon with six-wheeled bogies, so as to keep the axle-loads down to the required limits and ensure the necessary flexibility.

SCREW pumps having blades like those of a steamer's propeller, mounted on a horizontal shaft, are a feature of several large pumping installations in the United States, particularly for drainage and flushing work, where large volumes of water must be handled promptly and rapidly. The latest and largest installation of screw pumps is at New Orleans, and is described in the *Engineer* for May 7. This installation is used in removing the storm-water drainage of the city and its surrounding district, lying between the Mississippi River and Lake Pontchartrain. Eleven screw pumps, 12 ft. in diameter, are now being built to supplement the present pumping equipment, so that the total pumping capacity will be 7,240,000 U.S. gallons daily. The rapid removal of storm-water by pumping has a marked influence upon the sanitary condition, since it enables the ground to dry out more rapidly, and thus reduces the unhealthy conditions which result from damp and water-soaked ground in a large city. The total annual rainfall in the district ranges from 62 to 75 in., most of the heavy rainfalls being due to severe but brief storms.

OUR ASTRONOMICAL COLUMN.

METEORS FROM HALLEY'S COMET.—Like the Perseids and Leonids, the meteors connected with Halley's famous comet probably constitute a complete ring. They were first discovered by Lieut.-Col. Tupman while cruising in the Mediterranean in 1870, when the parent comet was near aphelion, and Prof. Alexander Herschel pointed out the significant resemblance between the cometary and meteoric orbits.

This year, in the early mornings of the first week in May, Mrs. Fiammetta Wilson, of Bexley Heath, observed, notwithstanding rather unfavourable weather, several splendid specimens of the Halleyan meteors. Two of these were also recorded by M. Felix de Roy, hon. secretary of the Société Astronomique d'Antwerp, but now resident at Thornton

Heath. One of these, observed on May 6, at 2h. 52m. a.m., was as brilliant as the planet Jupiter, and travelled over an extensive arc from E. to W. (Kent to Wiltshire). Its height according to Mr. Denning's computations, was from sixty-nine to fifty-nine miles, its luminous flight extended over eighty miles at a velocity of about forty miles per second. The radiant point was at $339^{\circ}-2^{\circ}$. Another fine meteor from the same system was seen by Mrs. Wilson on May 6 at 3h. 23m. a.m., and a smaller one, also observed by M. de Roy, appeared on May 3 at 3h. 2m. a.m., with a height from forty-eight to forty miles. Radiant $335^{\circ}-2^{\circ}$. These new materials are interesting as affording further corroboration of the identity of the comet and meteors.

COMET 1915a (MELLISH).—The following ephemeris is a continuation of that given last week:—

	R.A. (true)			Dec. (true)	Mag.
	h.	m.	s.		
May 14 ...	19	9	32	... -22 42.1	
16 ...	14	29	...	25 19.2	5.9
18 ...	20	2	...	28 15.4	
20 ...	19	26	22	... -31 32.7	5.6

The comet is rapidly moving southwards, and on May 18 will be found a little to the eastward of τ Sagittarii.

THE AUSTRALIAN SOLAR OBSERVATORY.—The March number of the *Scientific Australian* contains a short communication by Mr. P. H. Baracchi on the demand for an Australian Solar Observatory. Mr. Baracchi enumerates the several steps that have been taken to secure such an observatory for Australia, and directs attention to the selected site known as Mount Strombo, the highest summit of a group of hills situated about 6.5 miles west of the centre of the Federal capital and about 2500 ft. above sea-level. For the purpose of testing the "seeing" at the site for the period of a year, Mr. Baracchi and his assistant, Dr. Baldwin, erected in 1911 a 9-in. refracting telescope on the site and built a 19-ft. dome to house it. The result of the observations showed that the local conditions fulfilled the most essential requirements for any class of delicate astronomical work. As yet nothing is very definitely known concerning the future of the observatory, but Mr. Baracchi states that "the Commonwealth authorities seem well disposed to expand the Mount Strombo Observatory, and make it a permanent astronomical institution, including a solar department, but no further steps have, as yet, been taken."

PHOTOGRAPHING THE CORONA.—Writing in the May number of the *Observatory*, Mr. E. B. Knobel directs attention to the subject of whether the best means are employed in photographing the solar corona, and whether our knowledge of the structure of the corona has advanced since the introduction of the photographic dry plate. He is of the opinion that "no results have been secured comparable in value to the photographs of the corona in 1871, which were obtained with wet collodion plates. . . ." and that the time has arrived when the whole question should be investigated and the results of this investigation made use of on the next occasion of a total solar eclipse. In his communication he considers the merits of the three processes—daguerreotype, wet collodion, and dry plates. He refers to the difficulty in the daguerreotype process requiring much practice and experience, and to the principal drawback to its employment for the corona in that the image is only visible by reflected light, and that long exposures are necessary. He points out, however, the perfection of the resulting image. Mr. Knobel advocates strongly a serious attempt to revive the wet collodion process. He says: "There are no difficulties that cannot be

surmounted. . . . All the procedure . . . requires practice and experience, and the assistant should have some familiarity with chemical operations. It ought not to be difficult to find a suitable man to train up for eclipse work among process-workers in collodion, as he would already be practised in some of the operations." It is hoped, as Mr. Knobel suggests, that some of the funds provided by the Joint Permanent Eclipse Committee may be utilised to defray the expense of the necessary training in what is almost a lost art, so that the process may be brought into use again for eclipse work.

CIRCULARS OF THE UNION OBSERVATORY, JOHANNESBURG.—A batch of circulars of the Union Observatory, Johannesburg, has just come to hand dealing with a great number of varied observations. Circular No. 19 deals with the proper-motion stars south of declination -19° , and contains three tables of great interest. The first is a list of all stars for which the proper motion is known to exceed a fifth of a second of arc in either right ascension or declination. It includes also many double stars the proper motions of which exceed $0.1''$, and a few stars of small proper motion. Table II. consists of those stars for which radial velocities have been published. The third table indicates groups of stars showing community of motion. The six groups given are the sun group, or group nearly stationary with regard to the sun, the 61 Cygnus, Taurus, π Mensa, α Centaurus, and δ Lepus groups. Circular No. 20, among other communications, gives an account of the discovery of variable stars, etc., with Pulfrich's blinkmicroscop, with remarks upon its use in astronomy. Circular No. 21 is devoted to observations made of the transit of Mercury in November last, a 9-in., two 6-in., and a 4-in. telescope being employed. In Circular No. 22 an orbit and observations of comet 1914e are given. This comet, as mentioned in this column last week, was discovered independently by several widely distributed observers. Observations of the Galilean satellites of the planet Jupiter made during the period April 8 to December 31, 1914, form the subject of Circular No. 23. These observations are in continuation of the series commenced in 1908. The present series has been compared with the times given in the American ephemeris, which are founded very closely on Damoiseau's tables, but the 1915 comparisons will be made with the Nautical Almanac, as Samson's tables have now been adopted.

SHELLFISH AND SEWAGE.

IT is perhaps only by chance that the conclusion of the work of the Royal Commission on Sewage Disposal should almost coincide with the Shellfish Regulations issued by the Local Government Board. Nothing like the task performed by the Sewage Commission had ever been attempted by a similar body. It met throughout three reigns, during which time its personnel underwent notable changes. It interpreted liberally its "terms of reference," and conducted an inquiry which was most comprehensive in scope. It employed a scientific staff who carried out investigations of quite the best kind, and made reports which, for a long time to come, must be regarded as authoritative. It suggested legislation based on great knowledge of the conditions that were to be improved.

After all this it was with a kind of shock of surprise that those interested in the development of the inshore fisheries read the Shellfish Regulations of the Local Government Board, which were published on February 16, and came into force on March 1. For