stations. The actual weight of fuel used at Winnington is one pound per h.-p.-h. This is substantially the same as the figure for the record-breaking steam-engine in marine practice already referred to; but the latter uses the most costly, the gas-engine the least expensive, fuel, and this is the vital matter. The gas-engine now has attained a mechanical efficiency of about 85 per cent. and a thermal efficiency exceeding 25 per cent.; both figures representing the practical limit in steam-engine practice also, although the former is sometimes exceeded. In both engines the efficiency, on the basis of the brake horse-power, is about twenty per cent., occasionally one or two units higher.

The Mond gas, with a thermal content of 150 *B. T. U.* per cubic foot, sells for twopence per thousand; this can be compared with our own illuminating and natural gases, storing 600 and 1,000 *B. T. U.*; of which, respectively, 16 and 9 cubic feet are used in good gas-engines, per horse-power-hour, while of the Mond gas at least 75 cubic feet are demanded.

Summing up the case: It may be said that the best work of the large gas-engine gives a thermal efficiency substantially the same as that of the very best steam-engine while it employs a fuel which is considerably cheaper than is employed where this comparison is, as here, made on the basis of fuel consumed. Its 'cost of plant,' on a large scale, is now quite as low.

The balance sheet of the best single gas-engine reported stands thus:

	Heat transformed, *B. T. U.*.....	33.65
Heat received	Heat lost	
from	Cylinder-jacket.....	19.28
the fuel	Piston.....	4.94
B. T. U.	Exhaust valve.....	3.34
100.	Total in cooling water...	27.00
	Heat waste in exhaust, etc.	38.79
		100.00

This is superior to any steam-engine performance yet reported.

During the discussion, Mr. Donkin reported in tabular form the best results of tests of gas-engines made in the United States with natural gas, the richest gas-fuel, either natural or artificial, available for large engines. The best figures in the table are those obtained in a Sibley College test of a Westinghouse gas-engine and reported by Messrs. Millar and Gladden in the *Sibley Journal* of June, 1900. The power developed was, net, 606 *H. P.*, the mechanical efficiency of the machine 90 per cent., the heating value of the gas about 1,000 *B. T. U.* per cubic foot, the consumption ranging from 10 cubic feet per *B. H. P.* to 8.8 for the indicated power. This gives a thermal efficiency of 25.5 per cent. The same figure is obtained, according to Mr. Donkin's tables, in Mr. Humphrey's test of an engine of a similar power of English make using Mond gas.

The twentieth century opens with the gas-engine for the first time in its century of evolution seriously competing with the steam-engine in important commercial work on a large scale.

R. H. Thurston.

THE U. S. GEOLOGICAL SURVEY.

For the support of the U. S. Geologial Survey for the fiscal year ending June 30, 1902, Congress appropriated at the session just closed about $1,018,000, an increase of $52,000 or more over the present year's appropriation. Indeed, there was a strong disposition in Congress to make a material increase, notably for the extension of hydrographic investigations.

Of the several sums appropriated $250,000 is for the topographic surveys, including a report on the topography and geology of the territory adjacent to the 49th Parallel, west of the 110th Meridian. For the survey of the forest reserves there is $130,000, the same as the present year. For geologic surveys the amount is $150,000—no increase—and for the continuation of the investigation of the mineral resources of Alaska, $60,000. For paleontologic researches there is $10,000. For chemical and physical researches relating to the geology of the United States there is granted $20,000, being $10,000 more than the sum appropriated for the present year. The increase will enable the Director to carry on needful and long neglected physical researches in connection with the chemical work of the Survey. For want of funds the Survey has had no physical laboratory for some years.

For the collection of data and the preparation of a report on the mineral resources of the

United States there will be $50,000, the same as for the present year, but an increase as compared with former years.

The appropriation for gauging streams and determining the water supply of the United States, including the investigation of underground currents in arid and semi-arid sections is likewise the same as this year—$100,000.

With a view to meeting as far as possible a very strong demand from the people for an extension of the hydrographic work of the Survey, there was practical unanimity in Congress in favor of a large increase in the allowance for this work. The increase was provided for in the form of an amendment to the River and Harbor Bill, and hence, like many other items covering meritorious objects, it went down to defeat in the last hour of the session with that now famous measure.

Other items under the appropriation are for engraving and printing, preparation of illustrations, rent of quarters, etc. There is $12,000 for furniture for a new addition to the Survey building in Washington.

Congress also granted upwards of $15,000 to cover deficiencies for the current year.

SCIENTIFIC NOTES AND NEWS.

DR. CHARLES F. CHANDLER, professor of chemistry in Columbia University, has been appointed by the President a member of the Board of Visitors of the U. S. Naval Observatory, in the place of Mr. Clair McKelway, of Brooklyn, who did not accept the position.

THREE expert geologists from the U. S. Geological Survey have been detailed to make a geologic and mineral reconnaissance of the Island of Cuba. They are Dr. C. Willard Hayes, Mr. T. Wayland Vaughan and Mr. A. C. Spencer. Mr. Spencer has not yet started from Washington, but Messrs. Hayes and Vaughan have already reached the island and taken up their work, after conference with the military governor. It is expected that these geologists will accomplish results of distinct economic value to the island. The assignment of these United States geologists to work in Cuba is made at the request of Major-General Wood, the military governor, and of Secretary of War Root, and is with the approval of Secretary of the Interior Hitchcock. The expenses will be met by the Cuban Government.

PROFESSOR S. M. BABCOCK of the University of Wisconsin, inventor of the Babcock milk test, was, on March 27th, presented with a medal, voted him by the State for giving his inventions free to the world. Exercises were held in the Assembly Chamber of the Capitol in the presence of both Houses of the Legislature, the university faculty, Supreme Court, university regents and many prominent citizens of the State. Governor Lafollete presided and addresses were made by him, by ex-Governor W. D. Hoard and others.

AN influential committee has been formed in Italy to celebrate the fortieth anniversary of Professor Paul Mantegazza's entrance on his career as a teacher. This event will be celebrated at Florence on April 30th, and at the same time the thirtieth anniversary of the Italian Society of Anthropology. It is proposed to collect a sum of money to be used for the endowment of the new laboratory of anthropometry which Professor Mantegazza has established at Florence.

THE University of Aberdeen is about to confer the honorary degree of LL.D. on Professor Virchow, of Berlin, and on Major Alfred W. Alcock, superintendent of the Indian Museum, Calcutta, and professor of zoology in the Medical College of that city.

PROFESSOR C. LLOYD MORGAN gave the Croonian Lecture before the Royal Society on March 21st, the subject being 'Studies in Visual Sensation.'

DR. RICHARD R. WETTSTEIN VON WETTERSHEIM, professor of botany at the University of Vienna, has been elected president of the Zoological and Botanical Society of Vienna.

M. HUMBERT has been elected a member of the section of geometry of the Paris Academy of Sciences to fill the vacancy caused by the death of M. Hermite, and M. Normand has been elected a correspondent in the section of geography and navigation in the room of the late General de Tillo.

THE Medical Club of Philadelphia gave a re-