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(Illustrated articles are marked with an asterisk.)

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For the Week Ending December 4, 1897.

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THE PROPOSED SHIP CANAL FROM THE LAKES TO THE SEA.

It will be remembered that, under the River and Harbor Act of 1896, provision was made for a survey and estimates for a ship canal from the Great Lakes to the Hudson River at the point where it becomes navigable. The work was intrusted to Major Thomas W. Symons, Corps of Engineers, U. S. A., and his very able and exhaustive report has recently been made public. The subject is handled in an impartial and scientific manner, and in this respect is in refreshing contrast to much of the extravagant and misleading literature that has appeared on this subject.

Major Symons is of the opinion that a canal capable of transferring full sized ocean ships from the sea to the lakes and vice versa is not called for either by commercial or military considerations. Its cost would be prohibitive; not even on the most sanguine estimate would the receipts cover the interest on the outlay and the maintenance expenses; the deep sea ships, even if the canal were built, would not make much use of it, and the freight would be carried in a special type of barge which could just as well be accommodated in an enlarged and improved Erie Canal.

The report states at the outset that, to justify construction, the benefits to be derived from such a canal should be clearly shown to be suitably commensurate with its cost and the cost of maintenance and necessary improvements. Present and prospective conditions limit the depth of a ship canal to 20 feet. The canal should be entirely within United States territory, should terminate at a first class seaport and commercial and industrial center, so that home as well as export trade may reap the benefit. A ship canal by the St. Lawrence route to Montreal, or by the St. Lawrence-Champlain route to New York, does not, in the opinion of Major Symons, fulfill these conditions, and should not be considered by the United States.

The best route for a ship canal is by the Niagara River, Lake Ontario, Oswego, Oneida Lake and the Mohawk and Hudson Rivers. As to the advisability of bringing the deep sea vessels through to the lakes, it is stated that for the best economical results a special type of vessel is needed for the lakes, the canal and the ocean, and neither can replace the other without loss of efficiency. For economical transportation through a canal from the Great Lakes to the sea, special vessels differing from both the ocean and lake vessels are required. Two serviceable canals already exist between the Great Lakes and the Hudson River: the Erie Canal from Lake Erie and the Oswego-Erie Canal from Lake Ontario. These canals are being improved by the State of New York to such an extent that the capacity of the boats will be increased 70 per cent, and it will be possible to carry freight for about 60 per cent of the present cost.

It is estimated that the possible tributary tonnage of a ship canal would be 24,000,000 a year, of which 18,000,000 tons would be carried eastward and 6,000,000 tons westward. A ship canal to accommodate the present largest vessels on the lakes would cost $200,000,000, and the cost of operation and maintenance would be about $2,000,000 per year. Now the Erie Canal, after the present improvements have been carried out, will provide commercial advantages which to all intents and purposes will be equal to those which would be conferred by a ship canal. Moreover, if the Erie Canal were further improved by enlarging it so that it could accommodate 1500 ton barges, and the Mohawk River were to be canalized, such an improved canal, navigated by barges, would enable freight to be transported between the East and the West at a lower rate than could a ship canal navigated by the large lake or ocean steamers. Such an enlargement of the existing canal would cost only about one-fourth as much as the construction of a ship canal; and indeed, even if the ship canal were built, the business, for economic reasons, would be done, not in ocean bottoms, but in barges and boats that could just as well be accommodated in an enlarged and improved Erie Canal.

The proposed ship canal would have no military value, and, in view of the foregoing facts, its construction, in the opinion of Major Symons, is not a project worthy of being undertaken by the general government, as the benefits therefrom would not be commensurate with the cost. On the other hand, the enlargement of the Erie Canal is recommended as being likely to bring returns of a commercial kind fully commensurate with the cost of the work.

THE ANNUAL WAR OFFICE REPORT.

To any one who is accustomed to read the annual reports of Cabinet officers, it will be apparent that Secretary Alger has made a new departure in the annual departmental report which he has just issued. Instead of including only an original review of the reports of commanding generals and the heads of bureaus, his report consists of letters from these parties giving a synopsis of their reports and recommendations, supplemented with comments of his own.

It is estimated that $96,258,445 is necessary to carry out the recommendations of the War Department. Of this sum $48,728,160 is asked for carrying out river and harbor improvements, and this is the largest item contained in the estimates. The Secretary considers that, in view of the fact that the demands upon the Treasury just now are exceptionally large, the suggested appropriation for river and harbor improvement is excessive, and that the grant should be largely reduced below the estimates. In this connection special attention is invited to the fact that the continuous contracts for which the War Office is at present responsible will require an expenditure of over $17,000,000 during the fiscal year ending June 30, 1899, and of amounts in the following four years decreasing to $345,000 during the fiscal year ending June 30, 1903.

Regarding the sea coast defenses and the much needed increase in the army, the Secretary has little to say, and he relies upon the reports of the major-general of the army, the chief of ordnance, and the chief of engineers to make the necessary impression. According to the estimate of the latter official, the amount required for sea coast defenses is $13,378,571—a larger sum than was ever before asked for since the present system of fortifications was begun, the appropriation for the current year being $9,517,141, and for the last fiscal year, $6.345,158.

Secretary Alger is of the opinion that it will be wise economy to push forward the work of sea coast fortifications to the fullest extent, for the reason that, though the work is expensive while it lasts, this item of expense will cease altogether as soon as the present scheme has been completed. "Sea coast defenses," the Secretary goes on to say, "are being rapidly constructed, and they should be completed at the earliest possible date. I cannot emphasize this too strongly, and therefore urge that the full amount of the estimate be appropriated."

The urgent plea of Gen. Miles for the formation of two additional regiments of artillery is strongly indorsed. The general states that we are erecting great sea coast batteries without providing the necessary skilled men to man them.

These costly works should, as soon as completed, be manned by a sufficient force to care for and preserve them, and to become familiar with the handling of the guns, the manipulation of which requires that experienced artillerymen should be on hand at all times to operate them. "A battery costing from $100,000 to $500,000 ought not to be manned by a corporal's guard." The increase called for by Gen. Miles would require a number of new barracks. The present appropriation for these is $420,000 and the estimate submitted by the quartermaster-general is for $2,000,000, an increase of $1.580,000. The increase is a large one; but it is perhaps the most logical and absolutely necessary appropriation recommended by the Secretary; for to spend millions on fortifications and then refuse to provide the men to man them would be the very height of inconsistency and folly. Another item necessitated by our new venture in guns and forts is a needed appropriation of $2,500,000 for army transportation necessary to move heavy ordnance, guns, gun carriages, etc.

Of special interest just now is the reference in the report to the creation of the military reservation of Fort St. Michael, at the mouth of the Yukon River. It is suggested that the creation of further military reservations would be the best means of preserving order in the Territory. It is requested that a boat be provided for transportation and patrol on the Yukon. The Secretary is of the opinion that 100,000 people may be gathered in the Yukon district during the coming year, and he urgently suggests that some adequate measures be adopted to send a military force to that Territory to guard persons and property.

Secretary Alger says of the proposed deep water canal to the Great Lakes that "it marks the beginning of a new era." He quotes the statement of the chief of engineers that the commerce passing through the St. Mary's Falls Canal to and from Lake Superior alone, during the navigable season of 1896, included 16,239,061 tons of freight, valued at $195,146,842, and through the Detroit River, coming from Lakes Superior, Michigan and Huron, about 27,900,000 tons, valued approximately at $300,000,000.

NEW PATENT OFFICE RULES.

In order to harmonize the Patent Office practice with the new patent laws, which go into effect January 1, it has been necessary to make some substantial changes in certain of the rules. These new rules will also be enforced on January 1. They are too long to print in full, but a few of the following changes may be noted:

The new rules specify that no invention is patentable that has been described in any printed publication two or more years before the filing of the application. Heretofore, if a foreign patent has been taken out before an American patent, the term of the latter was limited to the expiration of the foreign patent, which often shortened greatly the term of the United States patent. Under the new rules, no such limitation will be brought about.

Rule 24 specifies that a patent may be obtained for any new invention or discovery which "has not been patented or described in any printed publication in

this or any foreign country before the invention or discovery thereof or more than two years prior to the application, and not in public use or on sale in the United States more than two years prior to the application."

Rule 29.—The receipt of letters patent from a foreign government will not prevent the inventor from obtaining a patent in the United States unless the application on which the foreign patent was granted was filed more than seven months prior to the filing of the application in this country, in which case no patent shall be granted in this country.

Rule 31 (last paragraph).—"The application must be completed and prepared for examination within one year after the filing of the petition."

Sections 39 and 46.—Rule 2 governs the preparation of the forms of the petition, oath, etc.

Rule 63 states the order in which applications in the Patent Office shall be examined.

Rule 75 brings out the fact that an application may be rejected provided a patent or printed description of the invention has been published more than two years prior to the date upon which the application was filed in this country.

Rule 77 specifies that neglect to prosecute an application within a period of one year will be held as an abandonment of the same.

Rule 98, Section 9.—"Interference will not be declared between an original application filed subsequently to December 1, 1897, and a patent issued more than two years prior to the filing of such application, or an application for a reissue of said patent."

New Rules 166, 168, 171 and 198 touch upon technical rules of practice which need not be mentioned in these columns. The attention of foreign inventors should be particularly called to the new law, as the operation of this law is so much less liberal to foreigners than the present practice that it will be necessary for them to take precautions lest the time within which the United States application must be filed should lapse and the chance of procuring a United States patent thereby be lost.

A GREAT FIRE IN LONDON.

The greatest fire which has visited London for more than two centuries started at 12:55 o'clock on the afternoon of November 19, in the heart of the City, within a short distance of the place where the great fire of 1666 had its origin. It raged for five hours, destroying one hundred and fifty warehouses and a few dwelling houses, involving a loss which is variously estimated from five to twenty million dollars. An area of about seven acres, including about eight streets, was swept over by the flames. The cause of the fire is supposed to have been an explosion of gas. Practically the entire fire-fighting force of London was summoned to the scene, and the streets were soon blocked with goods which were being removed from the warehouses. The historical church of St. Giles, which was the scene of the burial of Milton and of the marriage of Cromwell, was saved. The fire was under control at nine o'clock in the evening. The fire apparatus was handicapped by wagons full of goods which blockaded the streets.

The disaster is likely to raise a spirited discussion as to the methods of conducting the London fire department.

It is very probable that the accounts of the fire which have been cabled are erroneous as regards the length of time which elapsed before the first engine reached the scene of the conflagration, but there is no doubt that the London fire alarm system is totally inadequate. We understand that it has only about one-tenth as much telegraph service as New York for communicating fire alarms.

The fundamental difference between the fire departments of London and New York is briefly as follows: The theory of the London firemen is that, when an alarm is sounded, one fire engine company will be sufficient to extinguish it; so, when an alarm is given at a fire box, the commander of the station rings a bell which summons the firemen throughout the house, and the driver, whose official title is "coachman," takes the horses from the stable in the rear and hitches them to the engine. This engine then proceeds to the fire. Arriving at the scene of the conflagration, if the officer finds that the fire is a serious one, he sends the "coachman" or one of the firemen back to the fire house to telephone to the other stations for reinforcements. As may readily be judged, this results in serious delay, in which valuable time is lost, and time is everything at the beginning of a fire. As each fire engine house has to be telephoned to separately, some little time is likely to elapse before a proper force is mobilized at the scene of the fire. In New York the theory of fire fighting is entirely different. Here the idea is that every alarm of fire is likely to be serious, and in a few seconds after the alarm has been sounded one of the engines summoned is sure to be on the scene of the fire. After the alarm has been given, the operator at the fire headquarters at once sends out the number of the box to thirty engine houses, and the first tap on the key would result in sending 120 horses from their stalls. By the time that the number of the box had been given, the thirty companies would be ready, and three engines, two hook and ladder companies, the insurance patrol and two battalion chiefs would be on their way. The officer in charge of the first company to arrive would, if he judged that the fire appeared to be serious, go to the nearest box and send in another alarm and have eleven more companies at the fire. With a system like that which we have outlined there is little wonder that, while there are more fires in New York than in London, the losses by fire are greater in the latter city. The average fire loss in London in a year is $6,000,000, whereas the average loss from fires in the city of New York has been so steadily reduced in late years that it only amounts to about $3,500,000. The average loss by fire in New York was last year about $800, whereas the average loss from fires in London is $1,200. The outfit of the London fire brigade consists of 68 engines of various styles, 100 hand engines and 135 fire escape or truck companies. New York has 66 fire engines, 69 hose carriages, 28 hook and ladder trucks, and 5 water towers, exclusive of the fire boats. Of course, the area and density of population of London is far greater than that of New York City proper. New York also has splendid fire boats constructed with reference to prompt service, while London's five fire boats are floats upon which fire engines are located. They are towed to the scene of the fire by tugs.

Most of the London steam fire engines are small, weighing on the average about 3,200 pounds, against our engines, which weigh about 10,000 pounds. It will be readily seen that this means a large decrease in steam capacity. The hose is also smaller than that which we use, and in London there is not an adequate supply of water. The London fire department uses on an average 20,000,000 gallons of water a year. Last year the city of New York used for its fire service 45,000,000 gallons, about one-third being taken from the rivers. The London fire brigade is also hampered by lack of facilities for transporting the apparatus to the fire. In 1895 London had only 137 horses, and in many emergencies horses had to be hired to transport the apparatus. Of course, this interfered greatly with the celerity with which the apparatus should be brought to the scene of the fire.

London has about 700 firemen, while New York has about 1,300 in actual service, of all grades. London pays its firemen $516 a year, while New York pays $1,000, $1,200 and $1,400 a year, according to the length of service, while the officers receive salaries in proportion. The total expenditure for maintenance and outlay of all kinds for the London fire department in the year ending March 30, 1893, was $750,000. This also includes what was disbursed for pensions. The cost of maintenance of the New York fire department for about the same period was $2,305,645, without the payments which were made for pensions.

The stinted allowance which is given to the London Fire Brigade has always been detrimental to the improvement and strength of their department, but it is likely that the last serious fire will enable the brigade to obtain a fairly adequate appropriation for the work which they have to do. It is to be hoped that the system of sending in the alarms will be changed to that in vogue in America. It is the first law of modern fire fighting to mobilize the largest number of engines in the quickest time in the smallest space, and fire engineers are now arranging hydrants in many cities so that thirty engines can be placed around a single block.

Mr. Charles T. Hill, in the New York Sun, gives an example of the speed with which fire companies are mobilized in New York. An alarm was received at 11:41 A. M. and the third alarm at 11:45 A. M., four minutes later. In that four minutes five horses were hitched and proceeded to the fire. The officer in charge saw the magnitude of the blaze, hastened to a box and sent in a third alarm signal. This was received at fire headquarters and sent from there to all the companies throughout the city. The fire, which was in Platt Street, was in an oil warehouse. It was one of the narrowest streets—comparable to the streets in London—in a building full of oil and combustible materials, surrounded by buildings filled with stock of like nature, forming the ideal combination for a big conflagration; yet, so well was the fire handled, that the "relief signal" was sent over the wires at 1:24 o'clock P. M., notifying the rest of the department that the fire was under control. In less than two hours a threatening fire was found and conquered, and only a fraction of the entire working force of the department was engaged.

THE HEAVENS FOR DECEMBER.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The right ascension of the sun on December 1 is 16 h. 32 m. 43 s. and its declination south 21 deg. 56 m. 16 s. On December 31 the sun's right ascension is 18 h. 45 m. 5 s. and its declination south 23 deg. 2 m. 55 s. On December 21 it reaches its most southern declination, 23 deg. 27 m. 13 s., and on that date, at 8 hours, the sun enters Capricornus and winter begins.

MERCURY.

Mercury is evening star, and is at its greatest heliocentric latitude south on December 8, at 9 hours. On December 20, Mercury will be at its greatest elongation eastward from the sun, 20 deg. 3 m., and this, consequently, will be the best time to look for this shy little planet. Its southern declination is, however, unfavorable. On December 24, at 11 h. 41 m., Mercury will be in quite close conjunction with the moon, when the planet will be 24 minutes of arc south of the moon.

On December 27, at 11 hours, Mercury will be at its ascending node, and three hours later the planet will be apparently stationary.

The right ascension of Mercury on the fifteenth day of the month is 18 h. 58 m. 18 s. and its declination south 24 deg. 53 m. 55 s.

VENUS.

Venus is morning star. It will be in conjunction with Mars on December 8, at 9 hours, when Venus will be 47 minutes of arc north of Mars. On December 12, at 3 hours, Venus will be in conjunction with Saturn, when Venus will be 56 minutes of arc south of Saturn. Venus and the moon will be in conjunction on December 22, at 5 hours, when the planet will be 3 deg. 40 m. north of the moon. On December 30, at 6 hours, Venus will be in conjunction with Mars, when Venus will be 40 minutes of arc north of Mars.

On the first of the month Venus rises at 5 h. 36 m. and crosses the meridian at 10 h. 35 m. A. M.

On the last day of the month Venus rises at 6 h. 48 m. and crosses the meridian at 11 h. 16 m. A. M.

The right ascension of Venus on the fifteenth of the month is 16 h. 35 m. 21 s. and its declination south 21 deg. 22 m. 15 s.

MARS.

Mars is in the morning sky, and having passed conjunction with the sun in November, is slowly emerging from the sun's overpowering radiance. On December 22, at 11 h. 34 m., Mars is in conjunction with the moon, with the planet 2 deg. 26 m. north of the moon. The conjunction of Mars and Venus has just been referred to in the section on Venus. On the first of the month Mars rises at 6 h. 56 m. and crosses the meridian at 11 h. 37 m. A. M. On the last day of the month Mars rises at 6 h. 44 m. and crosses the meridian at 11 h. 14 m. A. M.

The right ascension of Mars on the fifteenth day of the month is 17 h. 2 m. 48 s., declination south 23 deg. 15 m. 5 s.

JUPITER.

Jupiter is morning star, and becoming quite well placed for telescopic observation, coming as it does into quadrature with the sun on December 30, at 2 hours. At that time it will be 90 deg. west of the sun.

Its position will continue to improve as it moves over 90 deg. more of its stupendous pathway, and it comes into opposition with the sun. We shall resume our notes on the phenomena of the satellites of Jupiter next month.

On December 18, at 2 h. 22 m., Jupiter will be in conjunction with the moon, when the planet will be 6 deg. 50 m. north of the moon.

On the first of the month Jupiter rises at 1 h. 46 m. and crosses the meridian at 7 h. 42 m. A. M. On the last day of the month Jupiter rises at 11 h. 47 m. and crosses the meridian at 5 h. 52 m. the following morning.

The right ascension of Jupiter on the fifteenth day of the month is 12 h. 31 m. 17 s. and its declination south 2 deg. 1 m. 8 s.

SATURN.

Saturn is morning star. Its conjunction with Venus, on December 12, has been referred to in the section on Venus. Saturn is in conjunction with the moon on December 21, at 11 h. 27 m., when Saturn will be 5 deg. 47 m. north of the moon.

Saturn rises on the first of the month only a few minutes before the sun, having passed conjunction but a few days before. On the last of the month it rises at 4 h. 56 m. and crosses the meridian at 9 h. 43 m. A. M.

The right ascension of Saturn on the fifteenth day of the month is 16 h. 16 m. 24 s. and its declination south 19 deg. 34 m. 36 s.

URANUS AND NEPTUNE.

Uranus and Neptune are also classed as morning stars at the opening of the month.

The former is just emerging from the sun's rays, but Neptune is in opposition to the sun on December 12, at 3 hours, and changes to evening star. It is well placed, therefore, for telescopic observation.

The right ascension of Neptune on the fifteenth day of the month is 5 h. 21 m. 25 s.; declination north 21 deg. 45 m. 17 s.

ALGOL.

Minima of the variable star Algol will occur as follows in Greenwich mean time:

Day.	Hour.	Minute.
December 2	14	45
8	8	23
14	2	1
19	19	39
25	13	16
31	6	54

Alternate minima only are given. Others can be found by using the period 2 days 20 h. 49 m.

Smith Observatory, Geneva, N. Y., November, 1897.