The engine commenced with an initial pressure of 1000 lb. on the square inch, and when the run was finished the gauge showed a remaining pressure of 300 lb. in the cylinders. The engine was perfectly under control throughout the trial, and was started and stopped with the greatest ease. Further experimental trials will be made on the Metropolitan line, but for the present the result is considered highly satisfactory.

Hudson's Bay as a Possible Outlet for the Northwest.

During the past summer the engineers of the Nelson River Railway Company have surveyed a railway route between Norway House at the outlet of Lake Winnipeg and Fort Churchill on the Hudson's Bay. The distance between these places is about three hundred and fifty miles. The surveyed route first follows the course of the Nelson River for a distance of nearly one hundred miles over a level country. The next part of the road is over a broken rocky country, where the Nelson River has a descent of nearly seven hundred feet to the lower plateau, where the country again becomes level, and continues so to Hudson's Bay. Upon entering this rocky range the surveyed route leaves the Nelson River, taking a more northerly course toward the valley of the Churchill River, which is reached at its entrance on the lower plateau, and continues to follow the course of the river to its outlet in Hudson's Bay. The estimated cost for building the road-bed is ten thousand dollars a mile on the plateau and seventeen thousand dollars a mile through the rocky portion of the route, or an average of twelve thousand dollars per mile along the whole route.

It is claimed that by this route it will be possible to transport grain from the Saskatchewan Valley to Liverpool for less than it will cost to carry it to Montreal by the proposed railway north of Lake Superior.

Professor Bell, of the Canadian Geological Survey, who sailed from Fort York, Hudson's Bay, and passed through Hudson's Straits in the latter part of last September, says that sailing vessels have sometimes considerable difficulty and delay in getting through, but steamships can make the voyage at any time between the first of May and November, as the straits are nearly one hundred miles wide in the narrowest part, and the channel is not obstructed by ice.

A Gigantic Electrical Battery.

An immense galvanic battery has been constructed for use in the lectures at the Royal Institution, London. It consists of 14,400 cells of chloride of silver and zinc elements. Each cell is composed of a glass tube about the size of a large test tube, stoppered with a paraffin wax stopper, through which the zinc rod and chloride of silver are inserted, a small hole being left to pour in the solution, which consists of a weak solution of chloride of ammonium (sal-ammoniac), the hole being fitted with a small paraffin stopper to make it air-tight. The tubes are mounted in trays, each containing 120 cells; eighteen trays are fitted in each cabinet. The battery, which is in the basement of the building, was begun in June, 1879, and finished in August, 1880. The charging of the battery occupied three persons a fortnight. A lightning flash a mile long could be produced by 243 such batteries, and yet Faraday has proved that the necessary amounts of electricity to produce a powerful flash of lightning would result from the decomposition of a single grain of water.

RUSSIAN BEER FLAGON.

The annexed engraving represents an example of Russian artistic metal-work. It is a massive silver flagon wrought in high relief, in a spirited design embodying an episode in

SILVER RUSSIAN BEER FLAGON.

the life of Peter the Great. With the exception of the waist of the vessel and knob of the cover the flagon is quite plain, but the relief portions are done in a style characteristic of Russian art.

SCALY-FINNED FISHES.

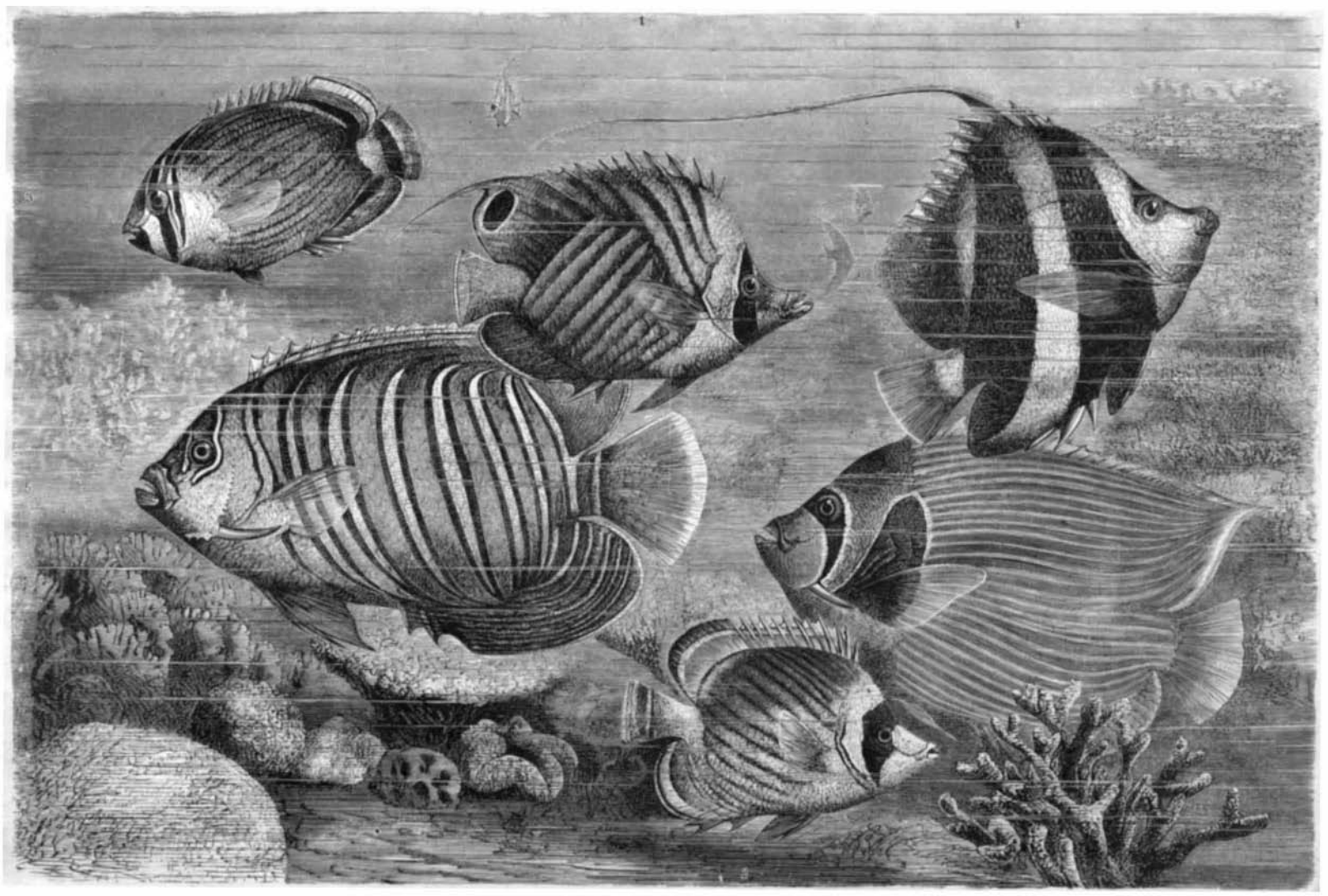
Our engraving represents members of a large family of fishes called by Dr. Günther *Squamipinnes* or scaly-finned fishes, because "the vertical fins are more or less densely covered with small scales;" but the spinous portions are not always scaly. These fishes are mostly carnivorous, and are inhabitants of the tropical seas and rivers. They are remarkable for their peculiar shape and their strange coloring. Their bodies are thin and very deep in proportion to their length, and their mouths are usually small.

The first group of this family have small mouths furnished with several rows of tiny, slender, and bristle-like teeth, which give them their scientific name *Chætodontina*, a term composed of two Greek words, the former signifying hair, and the latter a tooth. The colors of this group are brilliant and generally arranged in stripes or spots. Black and yellow are the prevailing colors, but blue and green are found in some species.

Fig. 1 in our engraving represents a fish which is found in the Indian Ocean and the western part of the Pacific Ocean, and is called by the Arabian fishermen of the Red Sea the flag fish (*Chætodon setifer*), on account of the considerable lengthening of the fourteenth ray of the dorsal fin. Dark bands run in different directions upon the whitish ground of the body. A black band edged with white extends from the neck through the eye to the throat; it is widened on the under-side. Five or six blackish bands run obliquely from the front upward toward the dorsal fin, and from these lines eight or ten bands issue nearly at right angles, take a slight sweep downward, and then converge toward the tail. The region over the eye is also ornamented with four orange-yellow diagonal lines. The back part of the dorsal fin is lemon color, and has a black spot surrounded with an edge of white; above this the fin is a fiery red edged with black. The caudal fin is lemon yellow, ornamented on the back side with a crescent-shaped pale yellow and white-edged girdle, then with a cylindrical dark brown, black-edged girdle. The anal fin is orange color edged with black and seamed with white. The pectoral and abdominal fins are reddish-white. The dorsal fin has thirteen spinous and twenty-five soft rays, the anal fin three spinous and twenty soft rays; the pectoral fin has sixteen, the abdominal fin six, and the caudal fin seventeen rays. The length of the fish is about eight inches.

The coral fish (*Chætodon fasciatus*), Fig. 2, is about six and a half inches long. The main color of the head is white, with a broad black band extending from the crown of the head to the "præ-operculum," or front gill cover. The body is a bright yellow, ornamented with from nine to twelve brownish-black bands running obliquely from the front upward and back, reaching to the yellow fins. The lips are rosy red. The soft dorsal and anal fins have a black border. The caudal fin has near the end a lentiform black diagonal marking and a whitish edge. The dorsal fin has twelve hard and twenty-five soft rays, and the anal fin three hard and nineteen soft rays. This fish inhabits the waters extending from the Red Sea to China.

A third species of this group is the cliff fish (*Chætodon villatus*), Fig. 3. It is about four and a quarter inches long. The ground color of the body is lemon yellow, and has about thirteen longitudinal stripes. The head is ornamented with a broad black curved eye band, with a narrower band behind it running in the same direction. The brow has three or four diagonal lines, which, with the bands and the surroundings of the mouth, are black. The soft part of the yellow dorsal fin has a black edged band and an orange colored border. The anal fin has a bright yellow stripe extending the whole length with an orange colored border, and the black caudal fin has a broad rosy-red border. The dor-



1. FLAG FISH.—2. CORAL FISH.—3. CLIFF FISH.—4. CHARIOTEER.—5. DUKE FISH.—6. EMPEROR FISH.

sal fin has thirteen hard and twenty-one soft rays, and the anal fin has three hard and nineteen soft rays. This beautiful fish is found in the waters between Eastern Africa and the Society Islands.

Fig. 4 represents a remarkable fish which, on account of the peculiarly elongated dorsal spine, has received the name of long-spined chætodon or charioteer. It also exhibits well the scale covered fins. Both of the scientific names *Heniochus monoceros* are of Greek origin, the former signifying a charioteer—the long slender spine representing the whip; and the latter signifies "single horned," in allusion to the same peculiarity. The fourth dorsal spine is enormously elongated and whip-like, its use not being as yet ascertained. The prevailing color is grayish-yellow, which passes upon the breast and throat into a silvery white; the head is partially or wholly black, the side of the snout light. Two very broad black bands are drawn across the body touching the fins. The first extends from the back to the abdomen; the second is almost parallel with the first, and runs from the fifth to the eighth spine of the dorsal fin downward to the extreme end of the anal fin. The fins are lemon color where they are not touched with the bands. This fish inhabits the whole of the Indian Ocean.

Nearly forty species of the genus to which the duke fish (*Holocanthus diacanthus*), Fig. 5, belongs are now known. They all possess some remarkable peculiarity of coloring, and the front gill cover is armed with a strong sharp-pointed thorny spine. The ground color of the body is lemon yellow. There are eight or nine pale blue bands broadly edged with black extending diagonally across the body. The back of the head is black, and beautifully marked with blue longitudinal and diagonal lines. A blue stripe surrounds the eye, another runs down to the edge of the front gill cover. The pectoral, abdominal, and caudal fins are yellow. The soft part of the dark brown dorsal fin is striped with black and blue at the edge; the remainder is spotted with dark blue. The brown anal fin is ornamented with six or seven curved bright brown bands. Fourteen hard and nineteen soft rays support the dorsal fin; three hard and nineteen soft rays, the anal fin.

The emperor fish (*Holocanthus imperator*), Fig. 6, is still more beautiful. The smutty sulphur-yellow head is adorned with a brownish black brow and eye band, which is edged with bright blue. The region over the pectoral fins has a large black spot bordered with yellow which stands out distinctly from the violet blue color of the body. The body is ornamented with a large number of curved yellow stripes extending throughout its entire length. The abdomen and breast are a greenish brown, the fins bluish, their rays brighter or darker orange color merging into black. The brown anal fin is decorated with blue curved longitudinal lines. This fish has also the thorny spine on the front gill cover. It is an inhabitant of the Indian Ocean.—*Brehm's Animal Life.*

MISCELLANEOUS INVENTIONS.

An improved buckle has been patented by Mr. N. L. Anderson, of Sioux Falls, Dakota Ter. The invention consists of a curved, looped, and barred frame, through which the trace is designed to pass, having a vertical stud projecting from the upper edge of the rear bar and designed to enter the trace, and, in combination therewith, of a tongueless barred and curved frame designed to be secured in the hame tug, locking with the tongue frame in such a manner that a strain upon either trace or tug will apply a corresponding pressure to compress the trace between the tongue bar of the one frame and the cross bar of the other frame.

Messrs. Cristobal Benavides and Joshua P. Arthur, of Laredo, Texas, have patented an improved sheep shears, so constructed that the blades are separable from the handle.

Mr. Minard M. Smith, of New York city, has patented a series of coated alkali balls attached together and traversed by a common wire passing through the entire series.

An improved shoulder pad has been patented by Mr. Isaac N. Stern, of New York city. This invention consists in a hollow segment-shaped pad, made of some air-tight material, such as rubber or oiled silk, which pad is inflated and placed between the cloth of the coat and its lining at the joint of the sleeve and shoulder.

An improved stop for oil can spouts, which allows for inlet of air when oil is poured from the can, has been patented by Messrs. Winfield S. Ricker and Robert H. M. Barker, of Cambridgeport, Mass. The invention consists in a spring finger lever provided with disks covering the neck and spout of the can, and fitted so that they may be simultaneously opened by pressing the lever, to permit of the oil being poured out and to admit air into the can, the lever being also adapted to be moved aside to open the neck for filling.

Mr. John D. Brooks, of Jersey City, N. J., has patented a surface condenser, more particularly for marine engines, which provides large condensing surface in a small space. It is constructed with a series of narrow steam condensing spaces of annular corrugated form in cross section with intervening cold water spaces of similar form.

Mr. George B. Stetson, of New Bedford, Mass., has patented a twist drill grinding machine. The invention consists of a sliding head adjustable on a suitable standard, so as to be moved toward or from the grinding wheel, and supporting a horizontally swinging bed, on which is mounted a chuck or jaws for holding the drills to be ground, and supporting also a sliding plate or fulcrum, a system of levers connecting the same with the chuck or jaws, whereby the latter may be vertically adjusted. And it consists, further, of a stop and a drill guide attached to the chuck, and of novel arrangements of grinding wheels and other parts of the machine.

Mr. Samuel H. Bakewell, of Lansing, Iowa, has patented a pump which reduces the comparative pressure of the water on the piston, and the power required to work the pump, and which throws water both during the ascent and descent of the piston.

Mr. William D. Peebles, of Breckenridge, Texas, has patented a balanced piston engine, which may be operated by water, steam, air, or other gas, and may be run at high speed.

Mr. Edward A. Eustice, of Greenvale, Ill., has patented a sulky plow so constructed that it can turn a square corner and can be readily adjusted to deep or shallow furrows. As the team starts forward in a new direction the plow is turned at right angles or at the angle which the new direction makes with the former direction, and at once begins to cut a furrow, no ground being left unplowed and no wide space being required for turning the machine. The machine is turned by the draught applied to the draw-rod (each horse drawing his own share) instead of by side pressure upon the tongue.

Mr. Edward A. Fisher, of Worcester, Mass., has patented a castanet which consists of two pieces or strips of wood, the longer of which has an aperture made through it from side to side near its lower end, and an insulated plate secured over the aperture, while the shorter piece has a ball, preferably of wood, attached by a rigid shank to its lower end, the castanets being operated by holding them between the fingers of one hand and striking the ball against the metal plate. The tone produced is musical, and by using a number of the instruments on each hand a tune can be played.

Mr. Rector R. Wilson, of Stewart, Ohio, has patented a locomotive which provides a substitute for springs supporting a locomotive engine on driving wheels and trucks. The engine is free to swing laterally as well as longitudinally, and rides more easily and with less wear upon the rails. The supporting frame is itself supported upon standards resting upon the boxes of the driving wheels.

Mr. Henry S. Rogers, of Auburn, N. Y., has patented a boot and shoe shave and head cutter. It is a combination tool for trimming edges of boot and shoe soles, cutting beads, and cutting strips on the bottom of the soles. A handle carries an adjustable slide having an adjustable stripe-cutting knife attached and also carrying a combined shave and bead cutting knife.

Oil, Tallow, and Tow.

Considering that the materials referred to in the heading of this article are in such general use in coal and other mines, a few remarks upon them will probably be read with interest, especially if we point out some simple ways in which their qualities may be tested.

Olive oil used for engine lubricating should not be contaminated by earthy or other impurities, nor should it contain any acids, which act detrimentally on machine journals, springs, and the sliding surfaces of the steam distributing organs. The presence of acid in oils may be detected by immersing litmus paper into the oil. The paper will be reddened in color if acid be present in the liquid. It may be safely asserted that every impurity or oil adulteration is detrimental to lubricating purposes. By them the oil becomes thickened and soils the lubricating wicks. Care should also be taken to retain the oils as pure as possible, which can be done by keeping the lubricating vessels well closed. Egg like substances, which cause the oil to turn bad and to become sticky, rendering it quite unfit for lubricating purposes, may be more or less distinctly detected by their turbid appearance.

Lubricating oils should not be too thick, in order that they may be easily absorbed and able to run between the bearing brasses; nor should oil, on the contrary, be too thin, so that it may remain for some time between the bearing surfaces of rotating shafts, etc., without losing its lubricating property. If the oil runs too easily, a waste must ensue by a too rapid consumption.

Perhaps the simplest way to test the consistency of various oils would be by the employment of a flat iron bar, 4 or 6 feet long, and channeled with equal grooves. This should be inclined, and an equal number of drops of the various oils allowed to fall on the top of the bar, care being taken to observe which quality travels the greatest distance in certain times. This will at once indicate which of the oils is the thinnest or the most liquid. The narrower the streak which the oil leaves behind it in traveling down the bar the greater is its consistency. For lubricating purposes, that quality is the best which has traveled furthest after the lapse of several days, provided, of course, that the oils have been poured in precisely equal quantities on to the bar. Oil which has dropped, or which has been taken out of the lubricators, should not be again used for oiling journals and brasses; it is far better to collect it in separate vessels, and after letting it stand, to use it up for the guide bars.

The most common and the most pernicious adulteration—which may be detected both by smell and taste—is the oil obtained from the cotton seed. This substitute is much thicker, and deteriorates the quality of olive oil. It speedily turns the latter bad, and so renders it worse than useless.

Engine parts which come in contact with the live steam are best lubricated by tallow, because the high temperature of the steam easily evaporates oil. It is not economical to pour melted tallow into the cylinders or valve boxes; the steam mostly carries this away into the condenser or into the open air. Consequently, tallow is best to be used in the lubricators adapted to receive it, as then the whole of the rubbing surfaces are covered with a thin film of tallow, because of its falling drop by drop into the main steam pipe, whence the live steam takes it into the valve box and passes it on to the cylinder, where it then falls on to the rubbing surfaces.

The stuffing glands of both cylinder and valve chest should be amply lubricated with tallow. It is unquestionable that much annual expense might be saved to steam users were they to take more active interest in watching and checking the wasteful modes in which their engines are lubricated, and in enforcing upon their engine drivers greater economy in this respect. Thus, the use of large oil cans with small lubricators, the pouring of oil on to gliding surfaces, which usually gives more oil to unexposed surfaces than to the bearings, and the overfilling of lubricators, are some of the most prevalent of wasteful habits practiced in engine houses.

As with oil, so tallow also should be as pure as possible, and be free from all foreign matters, which are to be detected in a turbid appearance. If the use of impure tallow is at times rendered compulsory, it should be melted down before use. After scumming the surface, the pure tallow may be poured off, but the bottom sediment should be rejected. As the bottom of tallow casks are generally dirty, it is also advisable to go through the same melting-down operations when the bottoms are nearly reached. Tallow contains more or less of fatty cells, which, though not injuring the appearance, deteriorate the quality of the tallow very much for lubricating purposes. To test tallow in this respect, all that is required is to take a sample and to boil it well with water. The fat collects together on the water surface, when it is allowed to go cold. If the tallow is free from these fatty cells, then its under surface will be comparatively even; but if otherwise these cells will show themselves there not unlike roots. According to the greater or less abundance of these roots, the purity or impurity of the tallow may be judged. As a proof against the tallow being rancid, the water in which it is boiled should not act as an acid on litmus paper.

Tow which is intended for engine purposes should be clean, free of roots, sand, etc. Its fiber should be solid and strong, or it is otherwise rotten and not well adapted to this purpose. Tow which is rough to the touch and which contains much unbroken fiber, is of secondary quality. Prime qualities are advantageously chosen, and in this state tow presents long, delicate, and soft fibers of white color. It is true the cost of purchase is in this case enhanced, but the ensuing smaller consumption more than amply covers the extra expense of prime cost. Cotton-waste may be equally advantageously used.

To utilize cotton-waste or tow over again, *i. e.*, to clean it, water-glass may be diluted with three parts of water, and the tow or waste immersed and worked round with a stick. After half an hour's soaking the liquid may be let off, and hot water poured on to the waste, which should be then well rinsed. If the original soft touch is required to be regained, the waste or tow may be rinsed a second time in lukewarm water, when it will be found, after drying, to be equal to new. Particular care should be taken when using the water-glass not to allow it to touch the skin, hence the stirring of the liquid should not be done by the bare hand.

Tow which has been once wet is not so efficacious, because it does not absorb the oil so well. If it has by mistake been steamed, it should be aired, to prevent it from moulding, etc. If the tow is not clean it should be carefully beaten in small parcels to cause the impurities to fall out. Oily tow which is merely kept for lighting up fires should not be allowed to be thrown anywhere. It should be kept carefully in a place by itself, and caution observed to prevent spontaneous combustion.—*Colliery Guardian.*

Gold and Silver Statistics.

The Director of the Mint has submitted to the Secretary of the Treasury a report upon the production of precious metals in the United States for the fiscal year ending June 30, 1880, which shows the following amounts by States and Territories:

	Gold.	Silver.	Total.
Alaska	$6,000		$6,000
Arizona	400,000	$2,000,000	2,400,000
California	17,500,000	1,100,000	18,600,000
Colorado	3,200,000	17,000,000	20,200,000
Dakota	3,600,000	70,000	3,670,000
Georgia	120,000		120,000
Idaho	1,980,000	450,000	2,430,000
Montana	2,400,000	2,500,000	4,900,000
Nevada	4,800,000	10,900,000	15,700,000
New Mexico	130,000	425,000	555,000
North Carolina	95,000		95,000
Oregon	1,090,000	15,000	1,105,000
South Carolina	15,000		15,000
Utah	210,000	4,740,000	4,950,000
Virginia	10,000		10,000
Washington	410,000		410,000
Wyoming	20,000		20,000
Other sources	14,000		14,000

Daniel Atley Webster.

Daniel Atley Webster, for forty years connected with the Croton Aqueduct Department, died recently in this city. It is said that there are not more than a thousand dwellings in this city in which Mr. Webster did not personally superintend the introduction of Croton water. The method of tapping street mains for the introduction of house pipes, invented and patented by him, is in use wherever there is a public water system. Mr. Webster's name is associated with many other important inventions.