

pounds. Hence the wires can suffer a reduction of strength of 10 per cent and yet be within the demands of the specifications.

The city may consider itself fortunate, then, that as far as the ultimate strength of the completed bridge is concerned, it will suffer no permanent harm from the fire. The loss will be one of time, and for this the contractors for the cables will have to make good at a rate of so many thousand dollars a month, as specified in the contract. Fortunately, the footbridges had done their work and were about to be removed. The suspender cables are practically all hung, and as soon as the wreck of the footbridges has been removed, the work of building the floor and roadways of the bridge will proceed.

THE RAISING OF PEAS AND ASPARAGUS IN THE WEST.

To the Easterner, used to his garden bed of peas a few feet square, the idea of growing this product in beds of 2,500 acres and of harvesting and thrashing peas like so much wheat, is a revelation. The West just now holds in store many such agricultural surprises for those from a distance.

In Longmont, Col., the land is prepared for peas just as it is for wheat. The regular wheat drills are used in sowing peas. Two rows of peas are sowed and then a space equal to that occupied by two rows is skipped, thus leaving 21 inches between the double rows for cultivation and irrigation purposes. When the sprouts begin to appear above ground, a harrow is run over them for the purpose of removing the small weeds, and this operation is repeated a number of times during the early part of the season; but a small per cent of the peas are torn out by this process. When the pea-vines become large enough to cultivate, a corn cultivator is used in throwing earth up to them; when five to six inches in height, a furrow for water is made between the rows. The water is brought to the head of the rows in the highest part of the field by a broad ditch. This ditch in turn is a lateral from a main ditch of 30 to 40 feet in width and carrying water from a mountain stream.

The harvesting of peas is begun at the time favorable to the best results, and regardless of the few blossoms and flat-podded peas, all are mowed down by a cutter which runs just beneath the ground. Then the hayracks arrive and great loads of

peas on the vines are hauled to the nearby canning factory and are ready for the thrashing operation. The thrashing is done by means of machines constructed especially for this purpose.

When the peas have been shelled by means of these machines, they next are put through grading machines which sort out the different sizes. The very small peas which are thus obtained represent the immature ones, which would be of much larger size if harvested and packed at a later date. After grading the peas in the manner referred to, they are next parboiled or blanched and are then put upon zinc-lined tables. Here they are looked over by a force of girls, who pick out not only the occasional old peas or weed seeds that may have crept in, but also all broken peas. After this operation the peas are washed again and are then ready to go into cans.

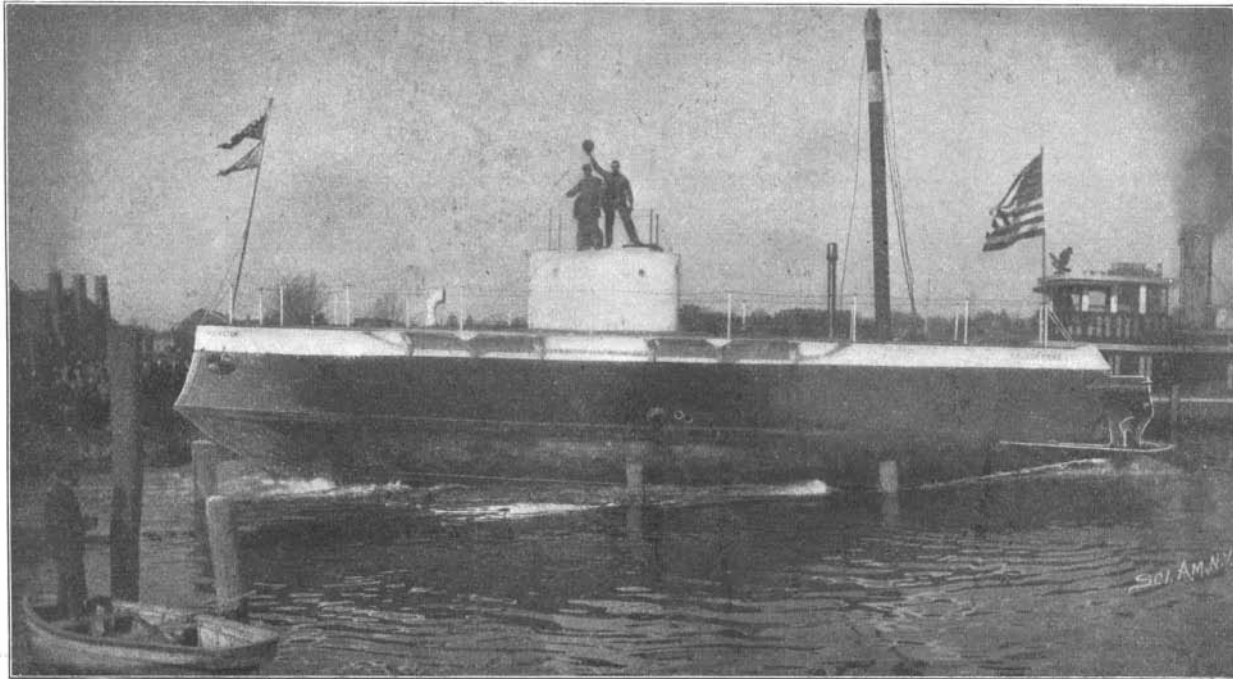
The filling of the cans is accomplished by means of machinery. Each machine fills twelve cans at one time. At the factory at Longmont 40,000 cans are filled in a day. After the cans are filled with peas a weak brine is added, and then the capping machines are put into service. These machines solder the caps on the cans at the rate of 40,000 per day. After capping, the cans are put into iron retorts; the lids of these retorts are bolted down, and the peas are cooked in the cans by means of steam. The labeling of the cans then takes place; this is accomplished by machinery.

In the line of agriculture, Longmont boasts, further, of the largest asparagus bed in the world. This bed comprises 120 acres and contains three-fourths of a million plants. The rows are about six feet apart, and the plants are 12 to 15 inches apart in the rows. The growing of asparagus of late has been attracting a great deal of attention throughout the United States. The Agricultural Department at Washington has been

giving it especial attention, and has issued a bulletin to farmers dealing especially with asparagus culture. This bulletin is known as Farmers' Bulletin No. 61. At Long Island and New Jersey asparagus growing has been carried on for many years, but as the great West is being opened it admits of this cultivation upon a much larger scale than could be carried on in the more thickly populated sections of the country. The accompanying photograph of the asparagus field at Longmont gives some idea of the extent of the industry and its employment of both teams and men.

As asparagus is grown to a greater or less extent in many parts of the world, and as it has been known since the early days of the Romans, there are many authorities in many lands who have written upon its culture, and widely diversified have been the methods outlined. There are to-day advocates of both deep and shallow planting. There is also a difference of opinion among growers as to the distance necessary between the plants. It is conceded that, as a rule, the rows should run north and south, so as to secure the full benefit of the sunshine. Loosening the soil at the bottom of the plants and placing manure about their roots has been largely abandoned while, instead, the tops are now given the bulk of attention.

The bulletin sent out from Washington contains many interesting points about asparagus, including its history, a few points of which we will epitomize: Asparagus was first known to the Romans as a medicinal plant. It then grew to a great size. Pliny was able to record spears of asparagus weighing three to the pound. The Gauls, Germans and Britons learned of its value from the Romans and engaged in its cultivation. In France, Holland, Germany and Hungary it was early gathered for the wealthy classes by the



LAUNCH OF THE SUBMARINE BOAT "PROTECTOR."

peasantry. The earliest settlers brought asparagus seed to America and found the soil and climate suitable. Besides Long Island, New Jersey, and Colorado, asparagus is now cultivated to quite an extent in the Mississippi valley and on the Pacific slope. The demand for asparagus to-day is greater than the supply.

One more agricultural novelty in Colorado demands attention. It is an 80-acre currant patch. As far as is known, this is the largest currant patch extant. It is situated like the asparagus bed at Longmont. In this currant patch there are 135,000 plants set out in rows seven feet apart. The plants are three and a half feet apart in the rows. One hundred and fifty hands, old and young, are employed at picking time. One and one-fourth cents per pound is paid for picking, which enables expert pickers to make as high as \$2.50 per day. A currant bush in Colorado will produce at least a gallon of currants. Some produce 10 gallons. Owing to irrigation, it is claimed that the berries are superior in flavor to those grown under other conditions.

THE SUBMARINE BOAT "PROTECTOR."

BY WALDON FAWCETT.

The submarine torpedo boat "Protector," which was recently launched at Bridgeport, Conn., and is now nearing completion, is the invention of Mr. Simon Lake, who has been a student of underwater navigation for over twenty years. His first experimental undertaking in the field was made with a vessel only fourteen feet long, but in which three men remained submerged at one time for the interval of one hour and fifteen minutes. Later he built the "Argonaut," which served to first bring Mr. Lake's inventions to widespread public attention. The "Argonaut" as originally constructed was only 36 feet in length; but after use in an experimental manner for about a year, the

craft was enlarged to a length of 66 feet, with 10 feet beam and 120 tons displacement. This vessel has been in almost continuous use for wrecking and kindred operations for about three years past, and has traveled thousands of miles under her own power along the Atlantic coast, and in the Chesapeake and Delaware Bays and Long Island Sound.

During the Spanish-American war Mr. Lake sought to interest the United States government in his inventions, but was unsuccessful. However, of his own accord, he gave a most convincing demonstration of the practical usefulness of such a vessel for mining operations, by means of an exhibition with the "Argonaut" at the mine fields abreast of Fortress Monroe, Va., and as a result of this disclosure of the possibilities of the invention, the United States Navy Department encouraged the construction of the "Protector."

The "Protector," which is covered by more than two hundred patents, most of which are essentially basic, is in design radically dissimilar to any other submarine boat. The divergence in design is perhaps most noticeable in the hull, which, in the case of the "Protector," is shipshape instead of cigar-shaped. The "Protector" is about 70 feet in length, 11 feet beam, and, when submerged, will have a displacement of 170 tons. In the center of the upper deck of the boat is an elliptical conning tower protected by an armored sighting-hood.

The motive power of the boat is furnished by gasoline engines actuating twin screws, when running awash or on the surface, and by means of storage batteries when submerged. The facilities for gasoline storage give the vessel a steaming radius (on the surface) of over 1,500 miles. The surface speed of the

vessel is eleven knots, and it is claimed that she can maintain a subsurface speed of seven knots under any conditions. The storage batteries for utilization for underwater propulsion may be recharged directly from the gasoline engines when the latter are engaged in propelling the boat on the surface.

The "Protector" may be operated submerged at the full speed of seven knots for three hours continuously, without recharging the storage batteries. The air tanks, charged at a pressure of 2,000 pounds to the square inch, are capable of supplying sufficient air to enable a crew of six men to remain submerged for sixty hours. Incidentally it may be

noted that the head space in the hull is such as not to necessitate the maintenance of cramped positions by the members of the crew, and the sleeping quarters are very satisfactory, consisting of folding berths somewhat on the order of those with which the ordinary sleeping car is equipped.

The armament of the "Protector" will consist of three 18-inch Whitehead torpedoes, for the discharge of which she has three tubes, one being located on either side of the bow and the third in the stern. The submerging of the boat is accomplished by the same general plan adopted in other submarine craft—the admission of water to submerging tanks. When submerged, however, save for the armored sighting-hood, the boat has a reserve buoyancy, and in order to totally submerge it is necessary to employ the hydroplanes, of which there are two on either side of the vessel. In explanation of the action of these hydroplanes, it may be stated that when the hydroplanes are tipped, the force of the passing water upon the inclined surfaces bodily shoves the craft below the surface, while a horizontal rudder at the stern serves to preserve automatically the balance of the boat.

The vessel will be surprisingly speedy in its changes of station. To change from ordinary cruising condition to that of deck awash will require but three seconds, and an equal interval will suffice for submergence from the awash condition to the exposure of only the sighting-hood. Complete submergence may be accomplished in less than a minute. The "Protector" can, if desired, be sent to the bottom without any interruption of the operation of the batteries; but in all probability the plan to be usually followed will provide for the stoppage of the machinery. The actual descent will be accomplished either by the admission of water to the tanks or by drawing the vessel down by the use of wire cables attached to two anchors,

previously lowered to the ocean bed from anchor wells in the bottom of the boat. These anchors serve a double purpose, inasmuch as they, as well as a large section of the keel of the vessel, may, in the event of accident, be cast adrift, and the boat thus lightened will, of course, rise to the surface.

A unique feature of the Lake type of submarine boat is found in the fact that the craft is equipped for travel upon the bottom of the ocean, being fitted with two large steel wheels which are fitted on the keel line, one in advance of the other, and which may be raised or lowered at will. The propellers push the boat forward just as when she is afloat, but the wheels tend to keep the vessel upon a straight course, once the bearings have been taken. The "Protector" is also fitted with several other adjuncts which have not appeared in any other submarine craft, among the number being a device which indicates exactly the distance traveled on the bottom, and a telephone equipment which enables persons on the submerged vessel to communicate with those on shore. This would, of course, prove of advantage in war operations. The lines of the hull are such as to give the vessel a great reserve of buoyancy in every condition save that of total submergence upon the bottom, and this ability to secure absolute horizontal stability without imposing other than a reasonable movement of weights therein will it is claimed, enable the newcomer in the submarine field to be readily controlled in rough weather.

HEAD-ON COLLISION OF TRAINS IN LOS ANGELES, CAL.

The terrific effects of a head-on collision of trains, each running about twenty miles per hour, are shown in the accompanying illustrations. The accident occurred October 18 in Los Angeles, Cal., on the Southern California Railway. A northbound freight train of about twenty-five refrigerator, box and coal cars drawn by a ten-wheel locomotive collided with a string of eight passenger coaches drawn by a switching locomotive. The switching locomotive was in front of the string of coaches, but was running backward southbound. The engineer of the freight train was hurled back from his cab on to the tender, and his injuries may prove fatal. The other men in the train crews escaped without severe injuries. The trains carried no passengers.

Burning Pulverized Coal.

The promises of economy gains from burning pulverized coal have for years led to persistently recurring experiments and each new venture in the field has been heralded with claims of final success. After all, however, experience in every instance seems to have ultimately demonstrated that it is difficult to obtain combustion of such fuel with as small an amount of air per pound of fuel as can be obtained in the best practice with coal fired on an ordinary grate, and this has always tended to make the economy lower than with the usual method. Besides this, the power required to operate the coal pulverizer and feeder has counted against the efficiency of the plant as a whole, and there is generally some difficulty from the collection of ashes and unconsumed particles of coal in the back connections of the boilers. Judging from all available data, these drawbacks still remain to be overcome.—Cassier's Magazine.

Gustave A. Barth, of Stapleton, S. I., has invented a very simple and convenient duplex wafer for fastening two sheets of paper together. The wafer is made in disk form and consists essentially of a many-ply body of paper, the layers of which are fastened together in the usual manner. The faces of the body are coated with an adhesive substance. It is simply necessary to moisten the coatings, to apply the wafer with one face to one of the sheets of paper, and then to press the second sheet upon the other face of the wafer in order to fasten the two sheets together. In separating the sheets of paper it is necessary only to pull the sheets apart, so that the body of the wafer separates along the division lines of the plies or layers. One ply with its coating will adhere to the one sheet and the other ply with its coating to the other.

The Successors of the Sea Serpent.

Ever since the sea serpent, which annually bobbed up in the newspapers during the dog days, disappeared in the depths of the ocean, apparently never again to trouble credulous readers, the imaginative reporter has drawn upon the animal kingdom for harrowing tales. Acting on the principle that a story is all the more credible if told with minute details, picturesque phenomena are described in lengthy accounts, in which, however, the name of the observing scientist, or of the particular spot where the observation was made, is never mentioned. Very often a foreign scientific journal is cited as the source of the writer's information. If an attempt be made to verify these fantastic descriptions, it is often found that the particular journal from which the information was supposed to be derived has no existence. For that reason the impression seems to prevail among journalists that a very large number of the most interesting occurrences in animal life are simply figments of the imagination.

An ingenious German writer has collated the accounts that have appeared in European papers, and gives us the results of his work in an entertaining article. The first animal that attracted his attention was the American turtle, which according to an imagi-

belted fish were found to return constantly to the brook where they were hatched. Doubtless the late Baron von Münchhausen of blessed mendacious memory would enjoy these stories to the top of his bent. The critic in question states that it is hardly credible what good German burghers will swallow. Everybody knows that a salmon, after having attained a certain size, swims toward the sea, and returns to his old haunts only after he has increased his weight by several pounds. A metallic band fastened about him during the early stages of his growth would manifestly kill him.

Such stories have been published, not once, but many times. They recur at regular intervals, like the old mother-in-law jokes in the comic papers. The subjects most frequently treated in Europe are the large fish that weighs so many pounds that it takes many men to carry it; the old lady who knew Frederick the Great when she was a child; the faithful dog who was sold to some one who carried him off a hundred miles, and who returned with unerring instinct to his former master; the spider tamed by an imprisoned criminal (sometimes the spider is a fly); and the cat that defends her master's canary from the attacks of a rival cat.

It is perhaps pardonable to tell a few interesting lies of events that may have happened during the lifetime of a fictitious old lady. But the stories of animal life that figure so prominently just now both in American and European newspapers are sources of error often harder to eradicate than the tales of the living young to which the eel is said to give birth, or of the badger which is said to live from its own fat in winter-time.

Astronomical Problems.

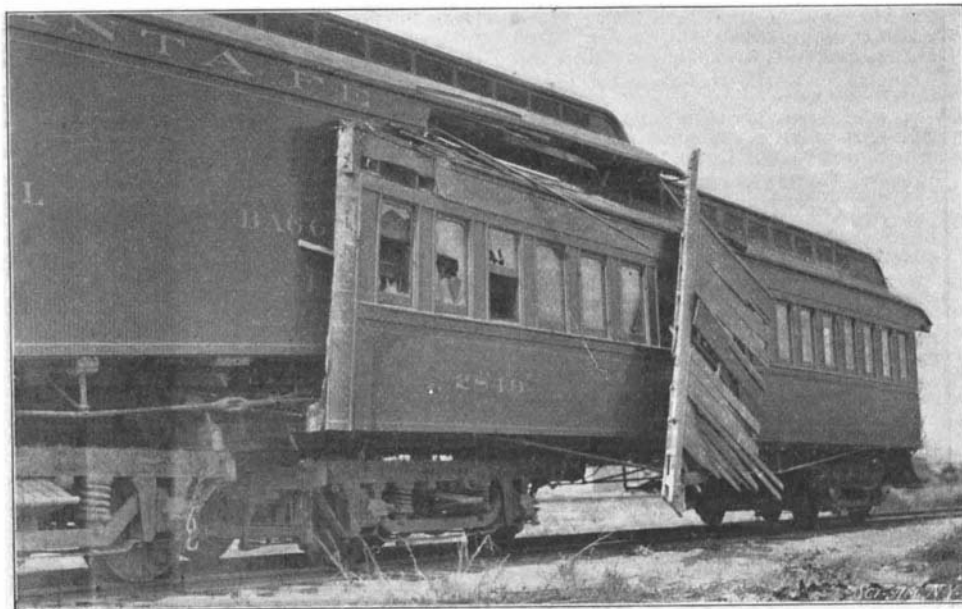
Some time ago Prof. Darwin of Cambridge pointed out that if a star revolved on its axis with a certain velocity, that of a few hours, the star would tend to divide into two, and the form it would take before complete separation would be that of a dumb-bell, or rather two pears joined top to top. This deduction was purely theoretical. During the past two years an examination of the light changes of some recently discovered variable stars reveals this very condition of things. For example, one star in the southern sky goes through a certain regular series of light-changes in seven hours; and an examination of these light-changes indicates that the star is a twin system, the two bodies composing it being in contact. This dumb-bell system revolves round the common center in seven hours, the most absolute confirmation of the theoretical conclusions. Then there is another variable star in the southern sky the light-changes of which show that the two stars composing the system are no longer in contact, separation has just taken place, the nexus between them is broken, and two worlds, full born, have started on that outward spiral which in the course of ages will carry them far remote from one another.

The Scholer suction dredge "Nicolaus," which is working on the Kaiser Wilhelm Canal, is claimed to be a great improvement on the ordinary suction dredge. By using a head of peculiar construction on the suction pipe, the volume of water lifted with the dredged material can be regulated and limited to the minimum quantity required. This head is a closed receiver, into which the material is pushed, and into which the necessary amount of water can be admitted. The material and water are mechanically mixed in this receiver and then lifted by the pumps into hoppers of 400 cubic meters capacity. In working in compact soil, water under pressure can be admitted to the head to assist the excavator.

A patent case involving a thing no less important than a bung hole occupied the attention of the courts in Toledo, Ohio, recently. The decision was rendered in the case of Ulrich Ruedy against the Toledo Bushing Company, and decreed that the plaintiff was entitled to one-fifth interest in the invention for improving bung holes and bushing. The plaintiffs were instructed to assign Ruedy that portion of the profits.



The Locomotive of the Freight Train After the Collision.



The Forward End of the Passenger Train After the Collision.

HEAD-ON COLLISION OF TRAINS IN LOS ANGELES, CAL.

native reporter was subjected to a very rigorous examination, in order to show what an intellectual beast it was. The creature was made to thread a most intricate labyrinth in order to reach its food. The turtle was said not only to have succeeded in accomplishing this task, but even to have picked out the very shortest way to the trough. In a second and more difficult journey, the animal accidentally rolled down an incline. Ever since that accident the turtle insisted on rolling down the incline, simply because it found that the journey could thus be more quickly completed. To such a fantastical tale, a very serious journal devoted half a column, despite the fact that it constantly bemoaned the limited amount of space at its disposal.

The inhabitants of the watery element have also exercised a peculiar attraction upon the newspaper writer. Not long ago that sense of place which is said to be one of the most peculiar faculties of fishes was made the subject of a picturesque article. It was stated very positively that every salmon during the spawning season returns to the very brook in which it was itself hatched. Who was the observer of this interesting phenomenon is not stated. It was, however, very seriously asserted that "a scientist" had belted certain salmon with metal bands, and that these