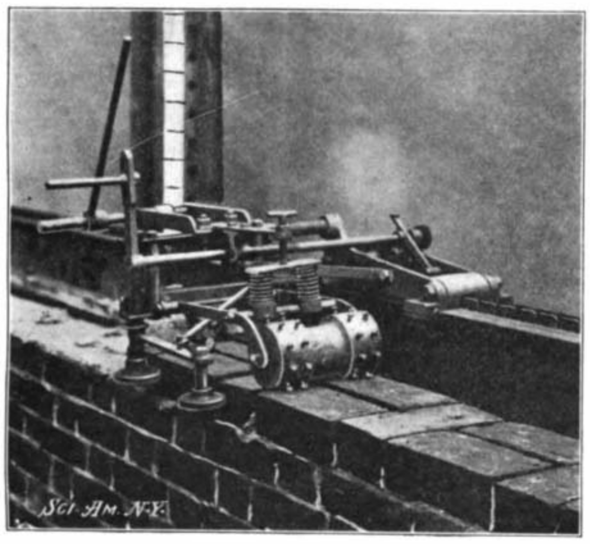
A MACHINE FOR LAYING BRICKS.

A machine which is intended for plain bricklaying, such as walls and the like, is an invention which must be credited to the ingenuity of an Englishman, Mr. John H. Knight, of Barfield, Farnham.

Vertical posts, *A*, are set in the ground about 15 feet apart, adjacent to the wall to be built. To these posts a wooden girder *B* is secured, upon which a 6-inch by ¼-inch steel plate *C* is screwed. Upon the bed thus formed the machine itself runs. The driving mechanism consists of a toothed pinion meshing with a pitched chain along the girder, motion being given to the pinion by the gears *E* and the handle *F*. A guide bar *G* secured to the girder forms a straight-edge for the face of the bricks, which are fed to the machine by hand. A pawl *M*, operated by the handle *N*, serves to press one brick back against the previous brick. Each brick, as it moves back, pushes a ridge of mortar in front of it, so that the vertical joint between the two bricks is filled up. Guide wheels *HH'* press the bricks against the straight-edge. A bricklayer usually pats the top of each brick with his trowel; this mechanical bricklayer does the same. A spiked roller *J* performs this slight task, the desired amount of pressure being imparted by a stout spiral spring *S*, and adjusting screws.



A BRICKLAYING MACHINE.

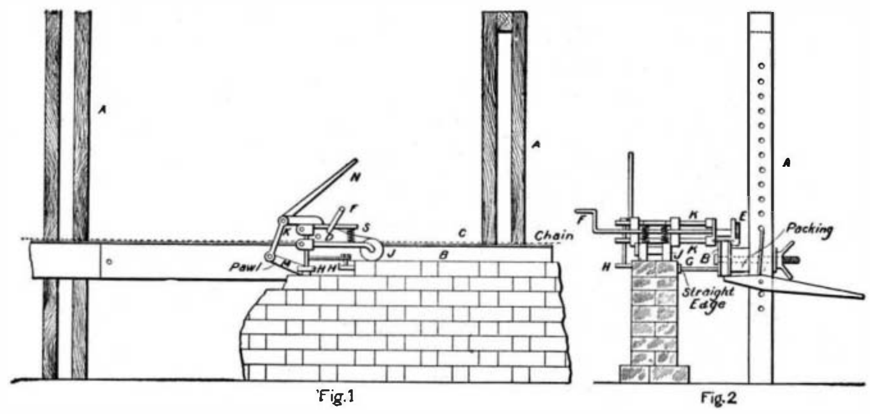


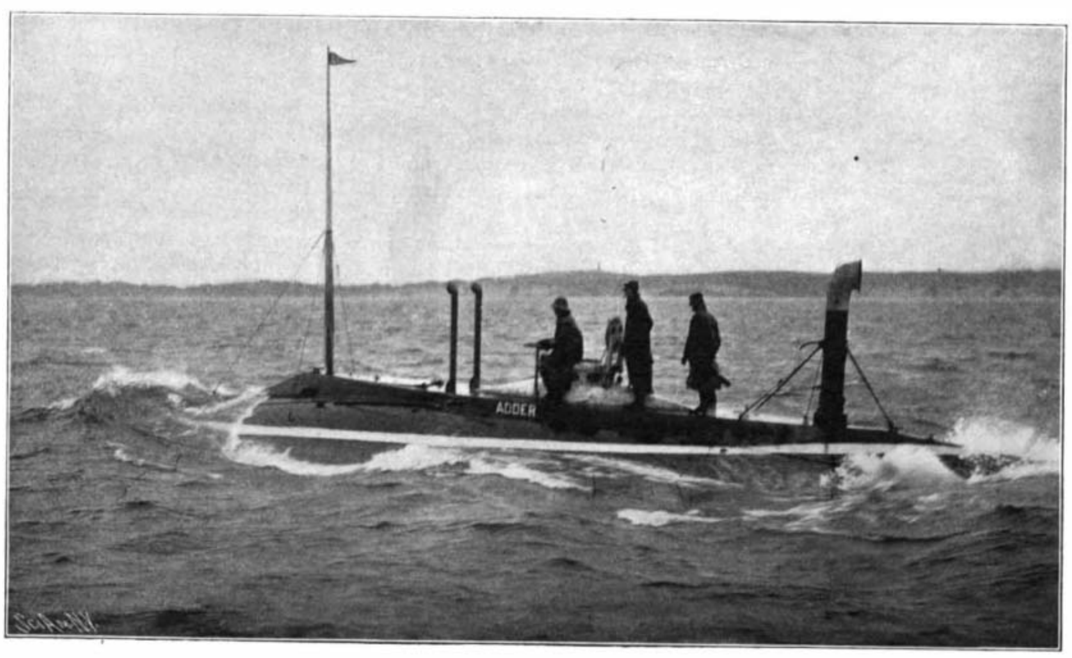
DIAGRAM OF THE BRICKLAYING MACHINE.

The mortar is run out by hand in front of the machine. After each course of bricks has been laid, the girder on which an operator performs is lifted by hand three inches. Holes are bored in the posts to form catches for a lifting lever. Two men and a boy can operate the machine. One man spreads the mortar, the second feeds the machine, and the third operates it. Mr. Knight informs us that anyone can operate the machine. He claims for it an ability to lay 500 to 600 bricks per hour.

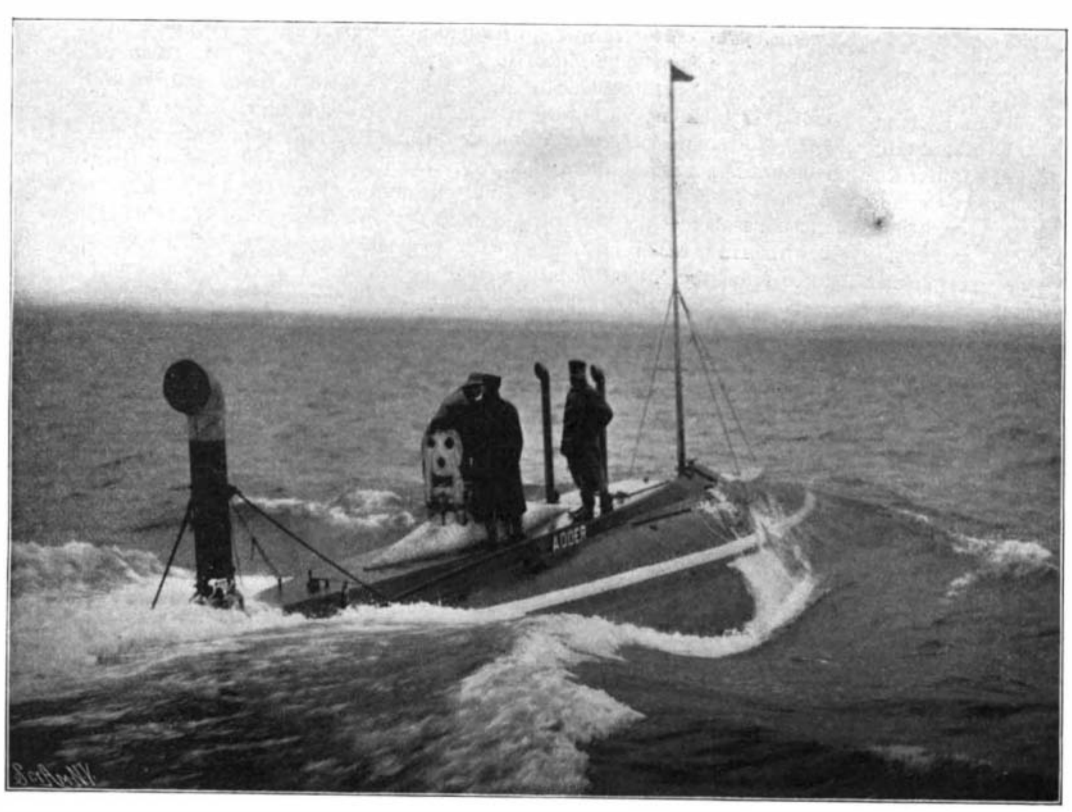
OFFICIAL TRIALS OF OUR SUBMARINE BOATS.

The "Adder" and the "Moccasin," two of the six submarine boats which are being constructed for the navy, have recently been undergoing their trials, with results that have been very gratifying both to the builders and to the Naval Board of Inspection, for whose benefit the trials have been carried on. The vessels are the "Adder," "Grampus," "Moccasin," "Pike," "Porpoise" and "Shark." They are all identical in size, construction, and equipment. They were designed to be an improvement upon the "Holland," which was the first torpedo boat owned by the navy, and in them is incorporated the valuable experience which has been gained in a long series of experiments with the pioneer vessel. The "Holland" is 53 feet 11 inches long, 10 feet 3 inches extreme diameter, and displaces 74 tons. As her armament she carries a torpedo tube and a so-called dynamite gun. The improved "Hollands," of which the "Adder," herewith illustrated, is one, were authorized on June 7, 1900. They are 63 feet 4 inches in length, 11 feet 9 inches in diameter, and they displace, when submerged, 120 tons. When running on the surface they are driven by a single-screw, four-cylinder gasoline engine of 160 horse power. They also carry a 70 horse power generator, which may be driven by the gasoline engine for the purpose of charging the batteries when the boat is at the surface, and when the boat is submerged it can be connected with the batteries and used as a motor for driving the propeller. Like all vessels of her class, the "Adder" is constructed with a double bottom and two transverse bulkheads, dividing her into three watertight compartments. The gasoline tank, the expulsion tube and the air flasks for the torpedoes are carried in the forward compartment; the center compartment holds the main ballast tanks, the cellular structure of the double bottom being used for the latter purpose, while above the ballast tanks are carried the storage batteries, the torpedoes and the air flasks, in which fresh air for living purposes is stored at a pressure of 2,000 pounds to the square inch. The third compartment, in the stern of the boat, contains the gasoline engine, the motor and the steering gear. To submerge the vessel, water is admitted to the trimming tanks, and a pair of horizontal rudders at the stern are inclined so as to depress the nose of the boat and cause her to descend. The vessel is controlled from the conning tower, which will be noticed above the working platform. It is protected from the rapid-fire guns of the enemy by the four inches of Krupp steel with which the conning tower is clothed.

In the recent official trials by the government Board of Inspection and Survey, the "Moccasin" and the "Adder" both achieved speed results considerably above those called for by the contract. The "Adder" made an average speed on the surface of 8.5 knots an hour when running in the light condition, that is with all her submersion tanks empty. In the awash condition she made an average speed of 8 knots an hour, and when totally submerged her speed was 7.5 knots, and thereby she exceeded her contract speeds by half a knot on the surface, by one knot when awash and by one-half a knot when completely submerged. In her trial on November 18, the "Adder," after taking position on the course and getting under way, ran for a mile submerged, then turned and returned to the starting point and fired her torpedo at a predetermined mark. The turn was made when she was completely submerged, and in the home run only two observations, lasting 30 seconds each, were taken, one of them soon after the turn, and the other between the half and the quarter mile flags. After the second observation she remained invisible, with no indication of her whereabouts, except when she fired her torpedo, the course of the torpedo being indicated, as it always is, by the trail of bubbles of compressed air from her engine rising to the surface. The torpedo went a few feet wide of the mark, although it was claimed that the divergence was due to the swerving of the torpedo and not to faulty aiming from the "Adder." The whole run submerged occupied a period of three hours, and according to press reports, Naval Constructor Woodward, one of the officers of the Inspection Board, stated that the air, excepting during the last twenty minutes of the run, was perfectly fresh, and even in the latter period it was as fresh as the air on the berth deck of a battleship. Subsequently the engines were tested satisfactorily on a continuous run of 12 hours duration. There is no question that the results achieved in these trials have done much to advance the submarine boat in the opinion of army and navy men. It is considered in army circles that the possession of a few of these boats would greatly strengthen the defenses of any important harbor or shipping port. That increased attention has been directed to the submarine is shown by the presence of a specially constituted Army Board to observe the trials and report upon them to the War Department.



BROADSIDE VIEW OF THE "ADDER," SHOWING WAVE FORMATION.



THE SUBMARINE "ADDER" MAKING HER OFFICIAL SURFACE RUN AT 8.5 KNOTS AN HOUR.

To make a small cork fit a large bottle, and *vice versa*, it is common practice to trim the sides of a cork when it is too large for a bottle. Generally the knife is dull, and the cut irregular. A simpler way is to cut a wedge-shaped piece out of the cork at its lower end. If the cork is very large, cut out an additional wedge at right angles to the first. This will make a perfect non-spilling stopper.

Vice Versa, if the cork is too small, cut off a transverse section from its lower end, make a deep vertical slit in the top of the cork, and wedge in the disk without trimming. The cork will now fit tightly in a bottle otherwise much too large, and may be properly trimmed. The thickness of the disk is proportionate to the difference between the diameters of the cork and mouth of the bottle.—W. Lawrence Stevenson, M.D.

THE NEW BEACHY HEAD LIGHTHOUSE.

The new lighthouse off Beachy Head, on the English Channel, is now completed. It has been erected by the Corporation of Trinity House, the body responsible for the lighting of English waterways. It has been built at a cost of $100,000, and represents the latest example of the sea-builder's skill, as the engineers who build these structures are called.

As the undertaking has already been described in the SCIENTIFIC AMERICAN of November 9, 1901, anything like a detailed reference to the new light is unnecessary. It is situated on the foreshore, some 550 feet from the toe of the great cliffs. At high tide the surrounding site is covered to a considerable depth, which naturally made the work difficult and progress slow, particularly during the winter months. Indeed, work was commenced on the site so far back as July, 1899. The foundation is laid to a depth of 10 feet in the hard chalk. As no blasting was allowed, the foundation had to be dug out by pick and ax. This work had often to be suspended for days at a time through rough weather. Fortunately, no serious accidents have occurred, considering the nature of the enterprise, one man having lost a toe while endeavoring to place a stone in position. Several tools were washed away, though the majority were eventually recovered.

At the base the structure has a diameter of 47 feet and is perfectly solid for a height of about 48 feet, with the exception of a space reserved for the storage of water. It is built of granite, which came from the Hard Stone Firms' quarries at De Lank, Cornwall. Altogether, some 3,660 tons of granite were used in its construction. The tower boasts of seventy-six courses. Up to the twenty-sixth course they have a depth of 4 feet 10 inches, many of the stones weighing 4½ to 5 tons. To the top of the masonry the new tower measures 123½ feet, while to the top of the lantern it has a total height of about 153 feet.

The lighthouse has eight rooms. They commence at course No. 26, termed the entrance-room. Then come the oil-room, crane-room, store-room, living-room, bedrooms and service-room. The lantern is equipped with a dioptric apparatus, giving flashes of about 83,000 candle power intensity every fifteen seconds. The illuminant is mineral oil converted into vapor passed through a Bunsen burner. The flashes are controlled by clockwork, which is wound by hand, the weight rising and falling in a tube in the center of the tower. The apparatus rotates in a mercury trough.

The new light is almost double the power of the one it displaces on the famous promontory above the shore. There were two reasons why the erection of a new lighthouse at this spot became necessary. In the first place, the old light, which stood 400 feet above the level of the sea, was frequently capped by fog, while the encroachments of the sea rendered it unsafe. There have been several large "falls" at Beachy Head during the last decade. It is estimated that in 1893 some 85,000 tons of earth and cliffs were dislodged, while a similar catastrophe in 1896 brought down a mass calculated to weigh 89,000 tons.

The English Pacific Cable.

The much-talked-of, much-obstructed and long-delayed Anglo-Pacific cable has at last been actually opened for the transmission of messages. Congratulations were exchanged on October 31 between Canada and Australia over the new line. The London Times in commenting editorially on this new enterprise states that its history is the history of every great undertaking, the history of patient effort by a few energetic and farseeing men fighting the obstacles of official dullness, public apathy and vested interests.

This new cable brings the Australasian colonies ten thousand miles nearer to Canada than they were before, and at the same time opens up possibilities of other substantial improvements in imperial communications. Across the Pacific, from Vancouver to Queensland, the cable touches only British territory; and now there is completed a telegraph girdle of the world which touches foreign territory only at Madeira and St. Vincent, in the Cape Verde Islands, both belonging to an old ally, Portugal. Thus the empire is bound together by what is all but an all-British line, giving an alternative means of communication free from the grave dangers which at critical moments would threaten connection with the colonies by the previously existing route. The new route will have a further great advantage in speed, since it has only three transmissions across the Pacific, all on British soil, in place of over a dozen belonging to various nationalities. Its tariff will be less than half that of the other route prior to reductions which are directly due to its competition. There is no reason to doubt that it will be fully employed, nor any reason to fear that it will do any harm to established companies. The reductions in their rates which nothing else would have induced them to make have been balanced by an increase of business, and further reductions would undoubtedly lead in the present conditions of the world to a yet greater increase of public patronage. The commercial use of the long-distance cables has been terribly hampered by almost prohibitive rates, and the social use of them can hardly be said to exist. There is indefinite expansion to be looked for in both directions, proportioned to the facilities that can be obtained at reasonable charges.

Having regard to the military and naval advantages obviously accruing from an alternative line of communication with distant portions of the empire, especially when that line is independent of all foreign territory, it is something of a satire upon British imperial professions that it has only now been secured through the colonies rather than through the home government. Even in the latest stages of the struggle for the Pacific cable, the haggling of the mother country about her share of responsibility for a possible deficit does not form a very inspiring chapter of history. It was only under considerable pressure from public opinion that England finally became responsible for five-eighteenths of the cost of the cable. To extend the benefit of an alternative and all-British route to India, where strategic considerations are surely important enough, it is still necessary to construct a line from the Cocos Islands to Ceylon. From the commercial point of view it is surely something of a scandal that, until the construction of the Pacific cable was assured, the rate between India and Great Britain was four shillings a word. It has been reduced to half a crown. but even that figure is much too high.

The Three Hundredth Anniversary of Otto von Guericke's Birth.

The 20th day of November, 1902, marked the three hundredth anniversary of the birth of Otto von Guericke, perhaps the most distinguished of the seventeenth century German experimental philosophers.

Guericke was the son of a Magdeburg councilor. When he was but fifteen years of age he matriculated at the University of Leipzig as a student of law. But the wars of the time put a summary end to his studies. Following his natural bent, he journeyed to Leyden and there studied physics and mathematics. During his student days (1620) Guericke's father died. Six years later, when he had hardly attained the age of twenty-four, Otto von Guericke was elected to a seat in the Council of the city of Magdeburg—such were his attainments even as a youth. Versed in engineering matters as he was, it was but natural that he was entrusted with the strengthening of the fortifications. The task thus allotted to him gave him much to do, especially at the time of the city's investment by Tilly. The terrible catastrophe which followed the storming of Magdeburg, May 10, 1631, almost cost the famous philosopher his life. Absolutely penniless, he managed to save himself with his young wife and his children. He was led into Tilly's camp and held a captive until the ransom which had been set upon his head had been paid. His reputation as a great scientist soon became known in the camp. After he had repaired a watch belonging to one of the imperial officers, his lot and that of his family became somewhat easier. The officer for whom he had acted as a watchmaker gave Guericke a ducat for his work. Long after, when he had attained a ripe age, Guericke used to recall this incident with pleasure. Finally, in January, 1632, the imperial army evacuated the city, and the inhabitants, among them Otto von Guericke, returned to their homes. At that time Guericke was perhaps the most respected and widely known personage of the town. He was overwhelmed with requests for assistance from the inhabitants, who had been compelled to impoverish themselves by quartering the imperial soldiers. In Guericke the inhabitants found an indefatigable friend. He saw to it that the new structures and fortifications that had been planned were carried out. We find him undertaking long and arduous journeys to Leipzig and Osnabrück, Münster and Regensburg, Prague and Vienna, for the purpose of interesting the great lords of those places in the welfare of the town of Magdeburg, to beg their protection and the withdrawal of the troops that had been quartered in the town for years. In order to win the protection of the Swedish General Torstenson, he made a most wonderful gilded celestial globe, which was turned by concealed clockwork. And this work of exquisite craftsmanship he presented to Torstenson, but without influencing the Swede the least in the city's favor. In recognition of his great services Magdeburg elected Guericke its Burgomaster in 1646. The city's condition having been considerably ameliorated and the inhabitants started on the road to prosperity, he could take up again the experiments which he had been compelled to abandon.

About this time Torricelli had proved that air was by no means incorporeal and imponderable, but that it exerted a pressure upon all bodies. It was a matter of great scientific importance to produce a vacuum, in order to prove its effect upon bodies therein contained. Guericke began by experimenting with a pump on water placed in a barrel, but found that when the water was drawn off, the air permeated the wood. He then took a globe of copper fitted with a pump and stopcock, and discovered that he could pump out air as well as water. Thus it was that Guericke became the inventor of the air pump (1650). This important discovery was publicly explained before the Emperor Ferdinand III. at the Imperial Diet which assembled at Ratisbon in 1651. At the same time Guericke illustrated in a simple but effective way the force of atmospheric pressure. Placing side by side two hollow hemispheres of copper, he exhausted the air from between them by means of a pump and stopcock, and it is recorded that thirty horses, some say twenty-four, were unable to pull the hemispheres asunder. Before the Elector of Mayence, Johann Philip, Guericke later repeated the experiments, employing hemispheres having a diameter of four feet. On this occasion twenty-four horses, twelve back to back, were unable to tear the globe apart. This experiment earned for Guericke an international reputation. Guericke further demonstrated with the aid of the air pump that in a vacuum all bodies fall equally fast, and that animals cannot exist therein. He also invented the air balance and the anemoscope, a species of weathercock, by means of which instrument he is said to have foretold the terrible storm of 1660. After the death of its inventor this precious apparatus was sold for 800 thalers.

Guericke was one of the first of the great experimental electricians. With his famous sulphur globes he discovered the property of electro-repulsion. He also made successful researches in astronomy, predicting the periodicity of the return of comets.

In 1681 he gave up his office of Burgomaster of the city of Magdeburg. Five years later, May 11, 1686, he died at Hamburg, at the house of his son. He was buried in the city to whose municipal prosperity he had contributed so much. In commemoration of these services, and in commemoration of his scientific achievements, the city of Magdeburg officially celebrated his three hundredth birthday.

Oil Fuel on the Pacific.

The American-Hawaiian Line, which operates a fleet of steamers between New York and San Francisco and Honolulu, is one of the first freight lines to adopt oil as a fuel. The fleet consists of the "American," "Hawaiian," "Oregonian" and "Californian," of 8,000 tons each; "Alaskan," "Texan" and "Arizonian," 11,000 tons each; and the "Nevadan" and "Nebraskan," 6,500 tons each. These last two steamers are designed exclusively for the San Francisco-Honolulu trade. The entire fleet is completed with the exception of the "Arizonian," which will be finished in about two months. The "Nevadan" and "Nebraskan" have already been fitted with tanks for carrying oil. The other steamers will be equipped with the apparatus as fast as possible.

The "Nevadan" was recently described in the columns of the SCIENTIFIC AMERICAN. She has made three round trips between San Francisco and Honolulu, using oil as fuel. The distance covered was 12,500 miles. In the last trip of the "Nevadan" to Honolulu, which was begun at San Francisco on October 9 and terminated on October 16, the Superintending Engineer of the line gave out the following statement:

"The results were better than were expected. The boilers and engines were worked to their full capacity. Not a burner was stopped throughout the trip. The steam was kept at 200 pounds with no variation of more than a pound or two. Ordinarily there was not the least sign of smoke from the stack. The boilers developed 2,500 horse power. Only 1.22 pounds of oil were used per indicated horse power. The consumption was 3,006 pounds, or nine and one-fourth barrels of oil, an hour. The time of the trip was seven days and three hours, and the average hourly speed was 12.3 knots. Running with coal, we would have made one knot less speed. The advantage of oil over coal, as indicated by our experience, is that 20 per cent more power can be obtained from the same boilers. Not only this, but the pressure is manipulated at the same point. There is a reduction in the cost for labor in the fireroom. We save twelve men. Instead of nine firemen we use three, and are obliged to have no coal passers, of whom we should require six if using coal.

"On the return trip the engineer was directed to run at a speed of ten knots an hour as an experiment. The steamer left Honolulu on October 27 and arrived in San Francisco on November 4. The speed was 10.54 knots an hour. The burners worked with the same success as on the outward trip. The amount of oil burned was 1,390 barrels, or 7.2 per hour. This was 191 barrels less than on the outward trip. The horse power developed was 1,834. The amount of oil burned per indicated horse power was 1.27 pounds. While the difference in the quantity of oil used was 191 barrels,