SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXV.—No. 1.] ESTABLISHED 1845. NEW YORK, JULY 4, 1896. [$3.00 A YEAR. WEEKLY.

OIL ENGINE SIGNALING PLANT ON UNITED STATES LIGHTSHIP NO. 42.

The United States Lighthouse Board have just completed a signaling plant upon their lightship No. 42, which, when on her station, lies in Vineyard Sound, off Cape Cod. The installation is the second of the kind, and is in many respects novel, and an advance upon anything hitherto accomplished in that line. The duties of a lightship such as No. 42 are twofold, as both visual and auditory signals are to be maintained. The first or visual signals are provided by gratings at her mastheads in the daytime, and at night by fixed white lights, each consisting of a circle of lamps placed in a large reflecting lantern, which are hoisted up to the mastheads every evening. The audible signals may take the form of a bell or of some type of steam or air whistle. On the ship we now speak of a powerful compressed air whistle is employed, and oil engines are provided to compress the air.

Hitherto it has been the custom to have the whistle on this lightship blown by steam. This necessitated the use of coal, which involved much expense and trouble. Often great delay would be experienced in the transfer of coal from the tender to the lightship. An efficiency exceeding four or five pounds of coal to the horse power hour could not well be looked for. If a fog was seen approaching or forming, the boilers would have to be fired in anticipation, and before they were well started the fog might cease. This and similar conditions of the service involved in the course of a year many hours of idle steaming and many tons waste of coal.

The new plant with oil engines avoids to a great extent these troubles. The consumption of oil per horse power hour is only one pound. To the great economy directly due to this fact is superadded the feature that no idle steaming is needed. The engine can be started in fifteen minutes, and the oil consumption ceases the instant the engine stops. A quantity of oil very much less than the weight of coal requisite for corresponding service is required.

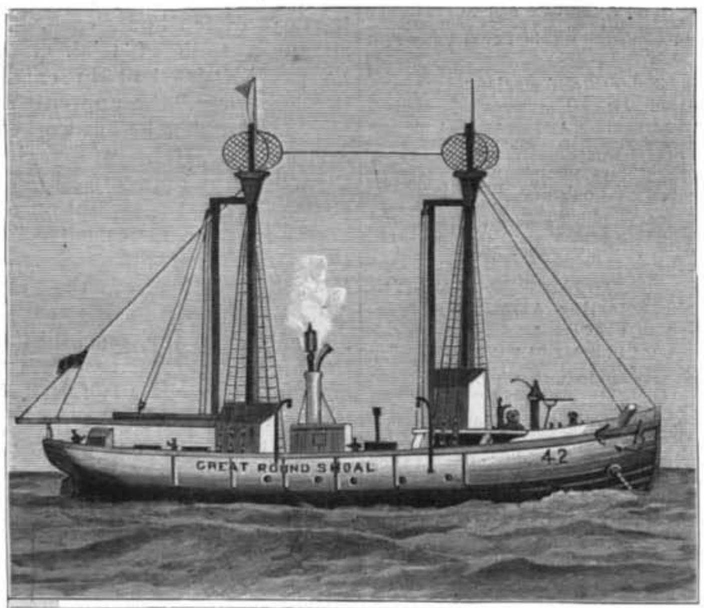
The plant is a development of one already in successful use on another United States lightship. In the hull of the vessel are installed two 25 horse power Hornsby-Akroyd oil engines. These are explosion compression engines whose most distinctive peculiarity is the method of ignition of the charge. Back of the cylinder is a vessel forming a sort of continuation of it and acting as a retort. To start the engine, a powerful oil burner is lighted beneath the retort. In ten or fifteen minutes, for a 25 horse power engine, the machine can be started. Oil is admitted to the now hot retort. It is at once vaporized, mixes with the air, and, as the engine is started, explodes, giving an impulse to the piston. The regular cycle of the compression gas engine is followed. The retort keeps hot by the heat of the explosions, the lamps being only used to start the engine, and it may even rise to redness; its direct heat effects the ignition. There is no battery and spark coil and no troublesome ignition tube. It is calculated that 15 horse power can be developed for twelve cents an hour. This power is that approved of by the engineers for lightship signaling.

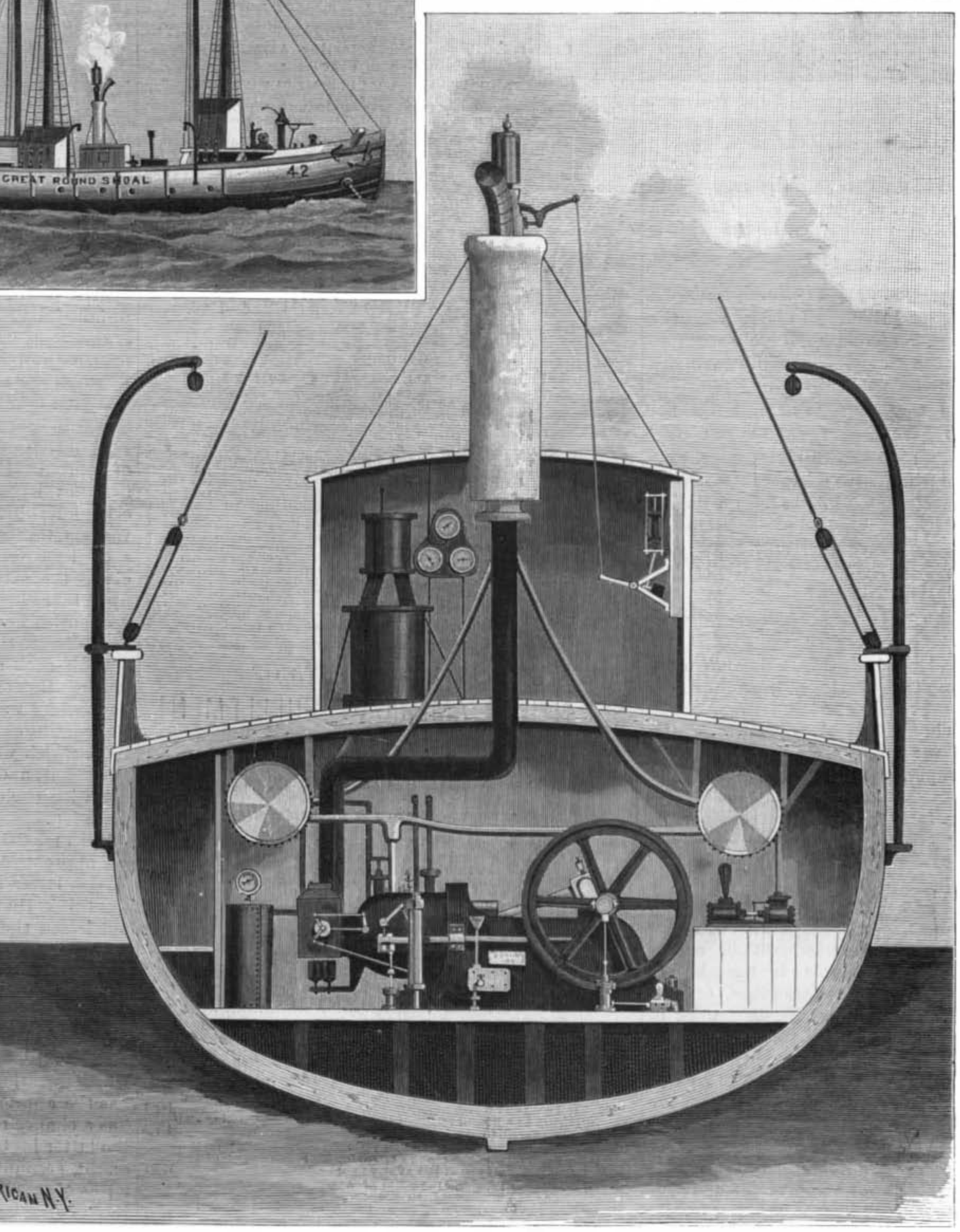
The cooling of the cylinder of the engine while running is effected in the usual way by water caused to circulate around it through passages in the metal. Fresh water is employed, as the danger of salt deposits precludes the use of sea water. To avoid waste, the same water is used over and over again, being cooled by a surface condenser supplied with a constantly changing supply of sea water.

To each engine is connected a single acting air compressor. The air can be used as fast as compressed to blow the whistle. To make provision for instant use of the whistle, as for a very sudden fog, two tanks of boiler iron, each one twenty feet long and three feet in diameter, are provided, which are charged with compressed air by the compressors. Ten cents' worth of oil will charge the tanks to their full capacity at 60 pounds to the square inch. The air contained is sufficient to keep the signal whistle in operation for twenty minutes. This period gives ample time to start the engine, so there should never be any delay in getting the whistle in operation.

The expansion of compressed air produces a lowering of temperature, which reduces the volume of the air. As the work done depends on the volume, the diminishing of it involves a loss in efficiency. The whistle, which is of the bell type, and which is placed about amidship over a deckhouse, has beneath it a reheater through which the air must pass. The exhaust from the engine passes through the same reheater, and so raises the temperature of the air and overcomes, to a greater or less extent, the cooling of the air due to its escape from compression. This feature not only is of economical value as utilizing the waste heat of the engine, but it tends to overcome another trouble. It has been found that an air whistle when the temperature fell to 18° F. would become clogged with ice. The heating of the air tends to prevent this. Moreover, the exhaust escapes into the air just forward of the whistle, and will do much to keep it warm and in condition to operate well.

Before reaching the whistle, the air passes through a reducing valve, then through the reheater and then through the whistle valve. The latter regulates the admission of air so as to produce the characteristic signal, and is operated by clockwork. The latter operates a small valve which admits air into a cylinder with piston, which opens the whistle valve. When released by the clockwork, it falls and closes the whistle valve. The clock carries a cam which, by its shape, produces the





The Lightship at Anchor. Cross Section Showing Distribution of Machinery.

OIL ENGINE SIGNALING PLANT ON UNITED STATES LIGHTSHIP NO. 42.

desired order of opening and closing the valve so as to give the signal. The officially designated fog signal for this ship has been a 12 inch steam whistle, with blasts of five seconds duration, followed by fifty-five seconds of silence. The air whistle is slightly modified, its annular opening for the escape of air being smaller than in the case of the steam whistle.

The engines' air compressors and storage tanks are exact duplicates of each other and are interconnected so as to allow the fullest possible degree of interconnection. It is quite improbable that any total breakdown should occur. The oil is stowed away as received in five gallon cans. The engine supply is taken from a tank below the engines, into which the cans are emptied by hand. The air does the auxiliary work of operating the bilge pump, and it may eventually be utilized to operate a power windlass.

The plant was built by the De la Vergne Refrigerating Machine Company at their works in One Hundred and Thirty-eighth Street, on the East River, in this city. The work was superintended by Mr. Wilfrid Sylven, superintending engineer United States lighthouse service. Our thanks are due to him and to Mr. George Richmond, of the De la Vergne Company, for courtesies extended in connection with this subject.

The plant is the second of its kind in the world and is in advance in every way on its predecessor, especially in power. The working unit in the new ship is taken at 15 horse power, in place of 3½ horse power in the first one.

One illustration shows the ship at anchor. The whistle is seen projecting from the reheater above the deckhouse. The other view shows the ship in cross section. One of the gas engines is shown, the other is by its side and parallel with it. The retort of the engine is cased within a hood shown to the left of the cylinder, and beneath it are the oil burners for starting it. To right and left, near the under side of the deck, are seen the compressed air tanks. Rising from the engine, the large exhaust pipe is shown entering the reheater to warm the air. On the right of the deckhouse is shown the cylinder and piston which operate the whistle valve.

An Ingenious Comparison.

Dr. Arnott has compared the human body with the steam engine, and the resemblance is very striking. Below is a copy of the comparison, as given in his "Treatise on Warmth and Ventilation":

THE STEAM ENGINE IN ACTION TAKES:	THE ANIMAL BODY IN LIFE TAKES:
1. Fuel – viz., coal and wood, both being old or dry vegetable matter, and both combustible.	1. Food — viz., recent or fresh vegetable matter and flesh, both being of kindred composition and combustible.
2. Water.	2. Drink (essentially water).
3. Air.	3. Breath (common air).
AND PRODUCES:	AND PRODUCES:
4. Steady boiling heat of 212° by quick combustion.	4. Steady animal heat of 98° by slow combustion.
5. Smoke from the chimney or air loaded with carbonic acid and vapor.	5. Foul breath from the windpipe, or air loaded with carbonic acid and vapor.
6. Ashes, part of the fuel which does not burn.	6. Animal refuse, part of the food which does not burn.
7. Motive force of simple alternative push and pull in the piston, which, acting through levers, joints, bands, etc., does work of endless variety.	7. Motive force of simple alternate contraction and expansion in the muscles, which, acting through the levers, joints, tendons, etc., of the limbs, does work of endless variety.
8. A deficiency of fuel, water or air first disturbs and then stops the motion.	8. A deficiency of food, drink or breath first disturbs and then stops the motion and the life.
9. Local hurt from violence in a machine is repaired by the maker.	9. Local hurt or disease in a living body is repaired or cured by the action of internal vital power.

Eggs in Therapeutics.

A mustard plaster made with the white of an egg will not leave a blister.

A raw egg taken immediately will carry down a fish bone that cannot be got up from the throat.

The white skin that lines the shell of an egg is a useful application for a boil.

White of egg beaten with loaf sugar and lemon relieves hoarseness—a teaspoonful taken once every hour.

An egg added to the morning cup of coffee makes a good tonic.

A raw egg with the yolk unbroken taken in a glass of wine is beneficial for convalescents.—Medical Record.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.................$3 00
One copy, six months, for the U. S., Canada or Mexico............ 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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(Established 1878)

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MUNN & CO., Publishers, 361 Broadway, New York.

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NEW YORK, SATURDAY, JULY 4, 1896.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending July 4, 1896.

Price 10 cents. For sale by all newsdealers.

THE APPRENTICESHIP SYSTEM UNDER MODERN CONDITIONS.

On another page will be found a timely letter from a correspondent of Providence, Rhode Island, relative to the decadence of the apprenticeship system, of which subject we spoke editorially in our issue of May 23, and we are certainly "pleased to learn that the old system"—or, more strictly speaking, a judicious modification of it—"is still common in Providence," and that "apprentices are taken by almost every important machine shop and foundry" in that city.

Limitations of space prevent our giving more than an outline of the "terms of apprenticeship" of the Brown & Sharpe Company; but they appear to be just and reasonable, a conclusion which is warranted by the large number of boys (eighty-one) now serving in the shops, and by the fact that many former apprentices have remained after their apprenticeship had expired, and risen to become "foremen and heads of departments." Briefly stated, the "terms" are as follows: The apprenticeship lasts three years, each of which consists of two hundred and ninety-five working days of ten hours each. The first forty days constitute a term of trial, at the close of which, if he prove "deficient in capacity or unsatisfactory in deportment," the apprentice is paid four cents an hour for the time he has worked, and the contract becomes void. If he "prove industrious and of good capacity," the apprenticeship continues for the three years. Before the expiration of the time of trial the apprentice must "execute, together with some responsible surety, an agreement," by which the firm, in consideration of the sum of one hundred dollars, pledges itself "to faithfully instruct the apprentice in the machinist's art and trade." If the apprentice violate the terms of the contract, one hundred dollars is forfeited; but if the apprentice complies with the provisions of the contract for the three years, the sum of one hundred dollars is returned by the firm to the surety in consideration of the "faithful service on the part of said apprentice." The "terms" conclude with the statement that "the company reserves to itself the right in its sole discretion to terminate the agreement and discharge an apprentice from further service for any unfaithfulness, non-conformity with such rules and regulations, want of diligence, indifference to his business, or improper conduct in or out of the shop." During their apprenticeship the boys are paid for the first year four cents an hour, for the second year seven cents, and for the third year ten cents an hour.

While admitting that, as far as they go, the terms of apprenticeship outlined above are admirable, and that in the present case they have certainly given excellent results, we think that, for general use in the various trades, it would be advisable to add a clause specially covering the interests of the apprentice, and giving the surety the power to annul the contract, if, upon investigation, he should be convinced that the apprentice was not receiving "thorough instruction" according to the "prescribed routine."

With such a clause inserted, we think that this modification of the old apprenticeship system would be in every way adapted to modern industrial and social conditions. It is free from the old flavor of servitude, which would be obnoxious to modern ideas and sentiment, and the payment of a weekly wage, increasing with each year of service, is a step in the right direction.

With regard to the relation of the trade school to the apprenticeship system, although it was the decline of the latter that brought the schools into existence, we think that the revival of apprenticeship would not lessen the usefulness of the schools. They both have the same end in view—the systematic training of the mechanic and the abolition from the trades of the "botch" workmen. Each system of training has its strong points in which the other is relatively weak. The pupil in the trade school, for instance, has a larger opportunity to discover in which direction his tastes and aptitudes really lie than has the apprentice in the machine shop. The former has a chance to test himself in several different trades, the latter in but one. This fact to some degree, no doubt, accounts for the forty days' trial clause in the terms of apprenticeship. It frequently happens that the "fancy" of a boy for some particular trade is quickly killed when he makes its acquaintance; and many of the most successful men of our day have, in their early days, tried their hands at various trades before they fell into the particular line of work for which they were qualified by nature.

On the other hand, one cannot too strongly indorse the opinion of our correspondent that the apprenticeship system turns out a better practical mechanic than the trade school, for the reason that "greater skill is obtained under the system which gives the greater number of hours to actual shop practice, especially in the trade of a machinist." It is for this reason that the two systems should be regarded as complementary to one another: the school serving to direct the boy into his proper trade, and furnishing him with the rudiments of its theory and practice; the subsequent