

THE 10,000-TON SUCTION DREDGER "LEVIATHAN" FOR USE ON THE MERSEY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Owing to the increasing draft and tonnage of steamers frequenting the port of Liverpool, the maintenance of an open channel in the estuary is one of vital urgency. Dredging upon a vast scale has to be maintained continuously to remove the sand, which threatens to silt up the navigable channel; and in order to carry out this work most efficiently the Mersey Docks and Harbor Board found it necessary to undertake the construction of a special type of dredger. The task of evolving such a craft was intrusted to their engineer-in-chief, Mr. Anthony G. Lyster, M. I. C. E., who is familiar with the peculiar conditions prevailing at this port, and who designed the sand pump dredger "Coronation," which, built in 1903, was at that time the largest and most powerful dredger of its type afloat. This latter vessel, 332 feet long by 53 feet beam and 20.4 feet deep, with a gross tonnage of 3,943 tons and capable of dredging to a depth of 65 feet with a pump capacity of 4,500 tons per hour, proved eminently successful, and he decided to design a new craft upon the same broad lines.

The new vessel, the "Leviathan," has now been placed in service, and ranks as the largest and most powerful dredger that has yet been placed in operation in any part of the world. It has an over-all length of 487 feet, a beam of 69 feet, and a depth of 30 feet 7 inches, these large dimensions being necessary to afford the requisite capacity and strength to carry the designed enormous load of 10,000 tons of sand. It is of the twin-screw, self-propelling, sand-pump, hopper-dredger type, provided with twelve hop-

indicated horse-power of 2,800, coupled direct to four independent sets of centrifugal suction pumps connected to their respective suction tubes, two on each side of the vessel, with hydraulic sluice valves on the inboard side. Each tube has an internal diameter of 42 inches, is 90 feet long, and is bolted to a heavy cast-steel swivel bend at the upper end and a strong nozzle of special design at the lower extremity. These nozzles are provided with a cast-steel grid, so as to exclude material of such a size as would foul the pump. The swivel bends work in vertical slide frames riveted to the vessel's side, with trunnions to permit the suction pipes to hinge about its center, and thus permit raising or lowering to conform with the state of the tide during dredging.

The suction pipes have an inclination of 45 degrees when dredging to their lowest limit of 70 feet below sea level. Each tube is lifted and lowered by two strongly built derricks of steel, one at each end of the tube, and stopped on seats at the upper deck complete with blocks and flexible steel wire ropes led on to drums of its respective hoisting winch.

Fitted over each side frame are deck slides supported by strongly built seats on deck, to enable the suction pipes with swivel bend to be stowed inboard when not dredging. Each deck slide has a heavy cast-iron frame of the same section as the slide frame, and can be moved inboard or outboard by means of worm gear, the same being carefully adjusted so that it comes exactly in the same vertical plane as the slide frame when at its extreme outboard position, to permit the suction pipe to be lowered to its working position below the water level.

Emergency gear is fitted to each suction tube, so

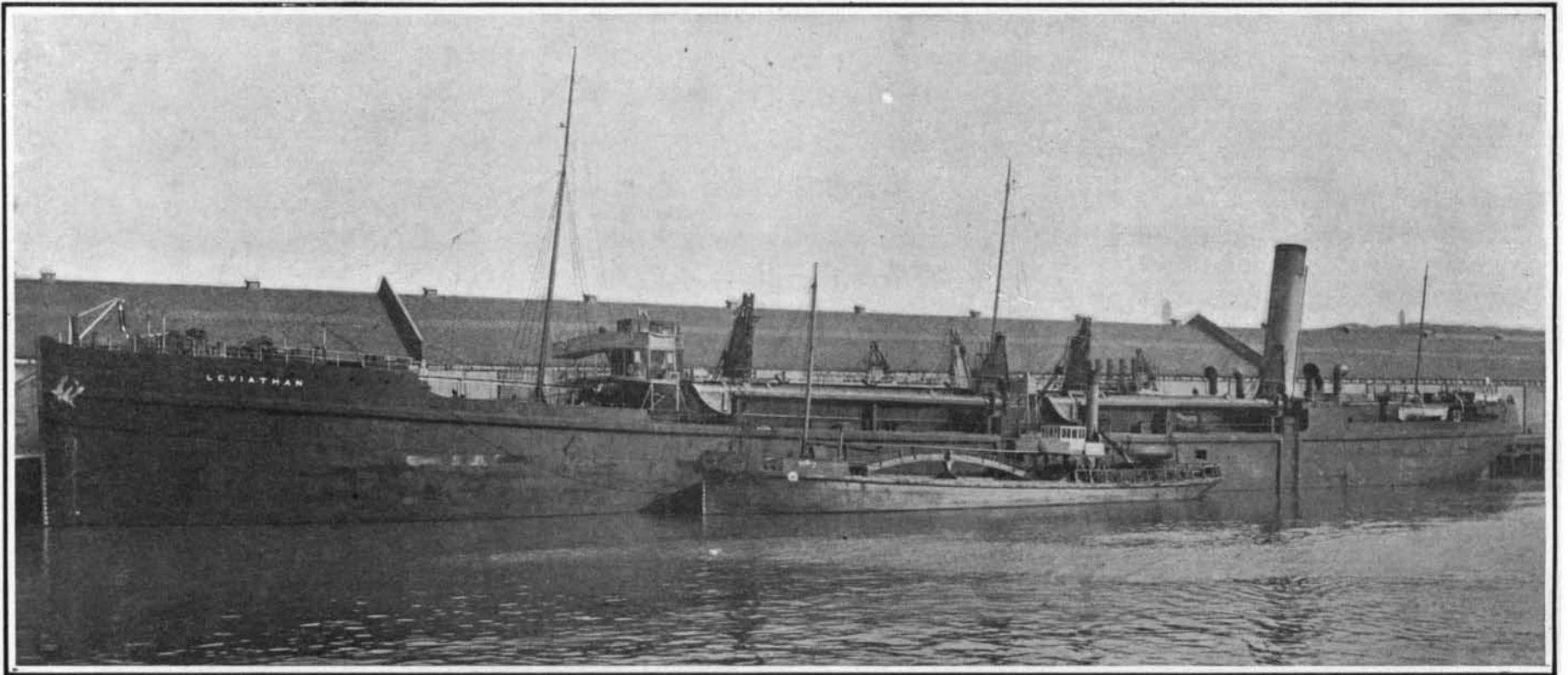
SOME CURIOSITIES OF INVENTION.

From time to time we have collected in these columns instances of perverse mechanical ingenuity as well as misdirected efforts on the part of inventors, partly for the purpose of amusing the more sober-minded, and partly as an instructive object lesson. On the opposite page will be found a number of such mechanical curiosities, some of them without any excuse whatever for their existence, others not without merit. We are indebted to the Illustrated London News for these examples.

The man who invented the padded chair and traveling carrier to prevent serious street-car accidents was evidently as much concerned with the comfort of the person to be saved, after collision, as with the mere act of saving. He has provided a fender which consists of a traveling belt and which serves the kindly purpose of conveying its human freight to a comfortable chair. It would seem from the illustration that the man to be saved is expected to be picked up in a sitting position facing forward so that he may be conveniently lodged in the padded seat. If he were picked up prostrate, he is presumably either dead or unable to sit, for not otherwise can we account for the chair.

The umbrella cap which emanates from the mind of another inventor certainly ought to serve its purpose of shielding the wearer from rain and sun if one may judge from the illustration. It is assuredly no uglier than the headgear in which civilized man now disports himself.

The method illustrated for arresting a runaway horse is certainly one of the wildest fancies which we have ever seen. The plan is nothing more or less than



THE 10,000-TON DREDGER "LEVIATHAN," WITH A 500-TON SAND PUMP DREDGER ALONGSIDE.

pers having a net total capacity of 180,000 cubic feet, and is fitted with pumps capable of dredging and filling itself with this load of clean Mersey sand in 50 minutes from a maximum depth of 70 feet, while the propelling machinery is sufficient to enable her to drive this load of 10,000 tons in her normal steaming trim, with coal bunkers and water tanks full, at the rate of 10 knots under ordinary working conditions, and to discharge this load very rapidly. The gross tonnage is about 8,000 tons, and the full load is carried on a mean draft of 23 feet. The fulfillment of these conditions insures the boat's possessing three times the power and capacity of any of the Harbor Board's existing dredgers, including the "Coronation," which is the next largest craft of this description in operation at Liverpool.

The vessel, constructed by Messrs. Cammel, Laird & Co., the well-known British armament manufacturers and naval shipbuilders, at their Birkenhead works, is built of steel to class 100 A 1 at Lloyds. It has a complete steel upper deck sheathed with wood, and is divided transversely by thirteen watertight bulkheads extending from keel to deck. There is a longitudinal center line bulkhead dividing the hoppers, pump rooms, and boiler rooms, as well as No. 2 buoyancy spaces on either side of the vessel. These subdivisions, taken in conjunction with the watertight hopper side bulkheads, divide the vessel into about thirty separate watertight compartments. The steel structure has been arranged to give special strength to the vessel, in view of the great strains developed in loading and unloading the hoppers.

The dredging plant, of the Gwynne type, comprises four sets of inverted vertical, triple-expansion, surface-condensing, direct-acting engines having a total

that in the event of an accident the suction tubes may be lifted by block and tackle led to the deck winches. Two of these winches are placed under the fore-castle deck, and two on the poop deck. The four hoisting winches are inclosed in steel houses fitted with glass fronts, so that the winchman within has a clear and uninterrupted view of the derrick lifting and lowering gear. Each hoisting winch has four drums arranged in pairs, two for raising and lowering the suction pipes, and the other two for derricking in or outboard. These powerful winches are actuated by double-cylinder reversing steam engines.

The four dredging pumps are arranged to deliver the excavated material along pipes passing up through the deck into two landers, and at the point where they joint, hydraulic sluice valves are fitted. The landers are placed side by side with a center division, and run the full length of the hoppers. The lander valves worked by worm gear are placed over each hopper on the bottom of the landers, so that the discharge to any hopper can be controlled as desired. By these means the valves with control gear are also arranged in the steel division separating the two landers. The discharge of sand and water from any, or all, of the pumps can be controlled so as to trim the vessel as necessary.

The hoppers placed forward of the pumping-engine room are built in twelve separate compartments, six on each side of the center line bulkhead. Each is fitted with Lyster's patent valves, having an opening 5 feet 6 inches in diameter through the bottom of the vessel. The hopper bottom plating has a steel slope in the four directions down to the edges of the valve seat bottom casting for quick discharge of the sand.

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simply to lift the runaway horse bodily by using a derrick. Presumably the driver is to manipulate the derrick boom. Surely only a Titan could succeed in raising even the half-starved animal that is harnessed to the average tradesman's wagon.

The inventor of the horse velocipede pictured was concerned chiefly with the preservation of roads and horses' shoes. He places his horse upon a kind of treadmill which is operatively connected by crank mechanism with the road wheels. Presumably this wheeled horse is to be used as a kind of locomotive to draw the car.

The many disasters at sea have, no doubt, inspired the inventor of the combined waterproof coat and life raft which is illustrated. A central hollow structure is connected with a waterproof coat into which the passenger crawls and thus makes himself literally part of the life raft. Inasmuch as a hollow mast is provided to supply air to the interior of the life raft and water and inasmuch as provisions are there stored, the man in the rubber coat must have access to the interior. A counter-weight is provided to enable him to keep the raft in proper trim.

The inventor of the cigar holder for hats, which is also to be numbered among these curiosities, seems to have been dismayed by the waste space in an ordinary "bowler" hat, for he has devised a means of utilizing the unoccupied space in a way which leaves one to infer that he never heard of pocket cigar cases.

We believe that something like the sporting dress here shown has actually been used, but certainly not equipped with the hand-operated screw propellers. As shown in the detailed view, separate airtight chambers *a a* are employed, which are protected

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Table listing various mechanical and scientific items with prices, including Lamp bracket, Lamp shade, Lamp socket, etc.

'Star' Lathe advertisement featuring an illustration of the lathe and text: 'Foot and Power Screw Cutting', 'Automatic Cross Feed', 'FOR FINE, ACCURATE WORK'.

Engine and Foot Lathes advertisement: 'MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE'.

Incorporate Your PATENTS and BUSINESS in ARIZONA advertisement: 'Laws the most liberal. Expense the least. Hold meetings, transact business anywhere.'.

SENSITIVE LABORATORY BALANCE advertisement: 'By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp.'.

Veeder Counters advertisement with an illustration of a counter showing '99728' and text: 'to register reciprocating movements or revolutions. Cut full size. Booklet Free.'.

WORK SHOPS advertisement: 'of Wood and Metal Workers, without steam power, equipped with BARNES' FOOT POWER MACHINERY'.

How to Construct An Independent Interrupter advertisement: 'In SCIENTIFIC AMERICAN SUPPLEMENT 1615. A. Frederick Collins describes fully and clearly with the help of good drawings how an independent multiple interrupter may be constructed for a large induction coil.'.

Two Good Books for Steel Workers Hardening, Tempering, Annealing and Forging of Steel advertisement: 'By JOSEPH V. WOODWORTH. Size 6 1/4 x 9 1/2 inches. 288 pages. 201 illustrations. Price \$2.50 postpaid'.

The American Steel Worker advertisement: 'By E. R. MARKHAM. Size 5 1/2 x 8 inches. 367 pages. 163 illustrations. Price \$2.50 postpaid'.

THE 10,000-TON SUCTION DREDGER FOR USE ON THE MERSEY advertisement: 'Each valve is of tapered cylindrical form extending the full depth of the hopper, with open-bottomed valve at the lower edge, and has a lift of four feet.'.

There is an indicator fitted in the chart room which shows the draft of the ship, together with a complete system of repeating telegraphs and speaking tubes for transmitting orders to the pumping and propelling engine rooms, and to the different winchmen in their respective winch houses.

The hydraulic installation carried out by the builders of the ship comprises a set of three-cylinder inverted high-pressure direct-acting engines having three cranks and three single-acting ram pumps, driven direct from the piston-rod crossheads.

The propelling machinery is right aft, and consists of two sets of inverted, vertical, triple-expansion engines of the same type as the pumping engines, each having cylinders of 22 1/2 inches, 37 inches, and 61 inches diameter, respectively, by a stroke of 45 inches.

The side compartments adjacent to the hoppers, as well as the two forward holes, are buoyancy spaces rendered necessary for the vessel to support her weight of hull, plant, and load on the specified draft of water.

THE ENGINEERS AND OFFICERS are housed in the poop and the crew in the fore-castle, the master's cabin being placed in a large teak house on the navigating bridge, with the chart and wheel house above.

Home-Made Experimental Apparatus

In addition to the following articles, the Scientific American Supplement has published innumerable papers of immense practical value. If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

and connected by compound positive clutches at both crank and main shafts, are fitted on the forecastle head for working the anchors.

The steam steering is of the Caldwell combined steam and hand type, with control shafting to the steering standard on the navigating bridge, and is placed in the engine-room casing. Hastie's hand-screw steering is fitted aft immediately over the rudder head, for use in case the steam gear breaks down. On the starboard side a motor launch is carried under Welin bow davits, ready for immediate use for taking soundings or making observations.

SOME CURIOSITIES OF INVENTION.

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by cork bulwarks b. We wonder if the inventor really believes in the efficacy of the hand-operated screw propeller which he has provided.

The Society for the Prevention of Cruelty to Animals would undoubtedly interest itself in restraining the inventor who devised the arrangement here shown to enable a dog or cat to run a sewing machine. We once heard of a man who patented a contrivance for driving a coffee mill by means of a bicycle, so that by the simple contrivance of riding a bicycle it was possible to obtain not only a certain amount of exhilarating exercise, but also to provide enough ground coffee for breakfast. This patentee surely outdoes him. The dog is made to rotate a central shaft carrying a large gear wheel which meshes with a small bevel gear carried on the sewing machine driving wheel. It seems to us that after the dog had sewed one shirt he would be too dizzy to do much more; or perhaps when that occurs, the central shaft is to be driven in the opposite direction.

A grain of common sense is to be found in the trunk that becomes its own luggage trolley, for it must be confessed that the ordinary trunk when full is not the easiest thing in the world to handle. The inventor has provided a single wheel and a folding lever handle which serves the purpose of pushing the wheeled trunk along. He evidently was not concerned much with the problem of the amount of space consumed by the wheels and the handle when folded within the trunk.

The handle shown for carrying parcels used in carriages has been employed in European railways. The device consists simply of two straps and a rest board, with the whole easily detachable. Straps serve the purpose of binding the rest board and walking sticks and umbrellas together.

A boat driven by windmills is certainly a mechanical curiosity. Just why this complicated arrangement of bevel gears connecting the propeller shaft with the vertical windmill shaft should be better than canvas transcends our imagination.

There is a touch of the Yankee in the fishing device, the last of the inventions illustrated. Evidently the inventor was accustomed to fishing in streams where bites were few and far between, and where patience was ill rewarded. He has contrived a fishing pole with a swinging arm carrying a clapper which is made to ring a bell as soon as a fish bites and swings the arm down.

BIRDS OF PASSAGE.

(Continued from page 335.)

of the return of the same individuals. Some wonderful European records of the return of a species to a given nesting site are given by the late Prof. Alfred Newton. A common falcon, Falco peregrinus, a cosmopolitan bird commonly known as the duck hawk, in this country, had its eyrie at one point in Finland for 110 years; that is to say, there was at this same point an occupied nest of this species from 1736 to 1855. At Oxbridge, in one or the other of two earthen bottles placed for their use, a pair of blue titmice had their nest every year, with two (Concluded on page 342.)

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MUNN & COMPANY, Inc., Publishers, 361 Broadway, New York City

Table listing various mechanical and scientific items with their corresponding page numbers, including Regulator, Rock drilling machine, Retort charger, Rings from tubes, Rivet, Road machine, Roasting apparatus, etc.