

The Saving Grace of War

Some of the Vicious Industrial Habits Which We Are Abandoning Under the Pressure of Military Necessity

By John Walker Harrington

BLACK stumps where late proud forests grew; streams oozing putrid through once fair and sunlit fields; the air oft tainted by gases which poison and slay—this is what war is in the embattled lands beyond the seas. But in America it checks the defilement of streams by unsightly sludge and scum; it halts the dumping of refuse on the earth; it pens and uses the noxious vapors which not long since were turned loose to stifle man and beast and to blight the garden and the farm.

Before the war, everybody knew that trade had no right to cast away its slime and sludge and stench. The manufacturer knew it better than the rest of us, but he pleaded that the cost of saving his unwelcome wastes equalled, if it did not exceed, the prices which he could get for them. Then came the great increases in the costs of raw materials, making it possible to wring wealth from filth and to pay for expensive recovery apparatus out of the salvage of a single year. Once the factory and mill owners are set on the way toward keeping the refuse which formerly they spurned, the endless chain of the by-products begins to unwind. Already the plaint that, when there are no more war prices, the saving of noxious wastes will no longer pay is almost silenced; groups of new substances are being found which in days of peace bid fair to meet all the costs of manipulation.

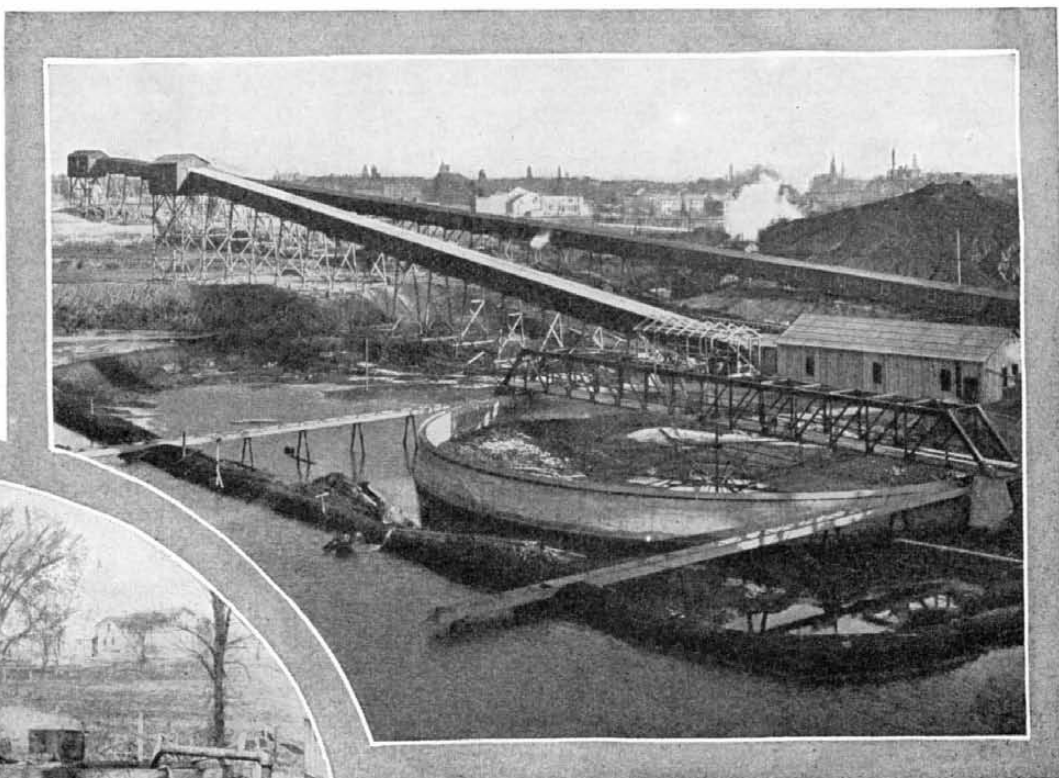
Thanks to the conditions brought about by the shortage of materials, much has already been done to make this a

and rob of their selling value; it means cities, fit places in which to dwell; it means better and cheaper food; last but not least, and quite as a social by-product, it makes for unsullied nature and the keener enjoyment of life itself. If then any man or corporation insists that he must deprive the community of its birthrights of air and land and stream, let him be led up to the counter of Mars & Co., forthwith and learn that pests may be changed to profits and that he can grow rich by giving his fellow beings a chance to live in health and peace.

Perhaps the reader has never heard of a garbage barrage.

and often goes to 20. Its recovery, despite the fact that there has been complaint about the odors from the New York plant, can be conducted without unpleasant smells.

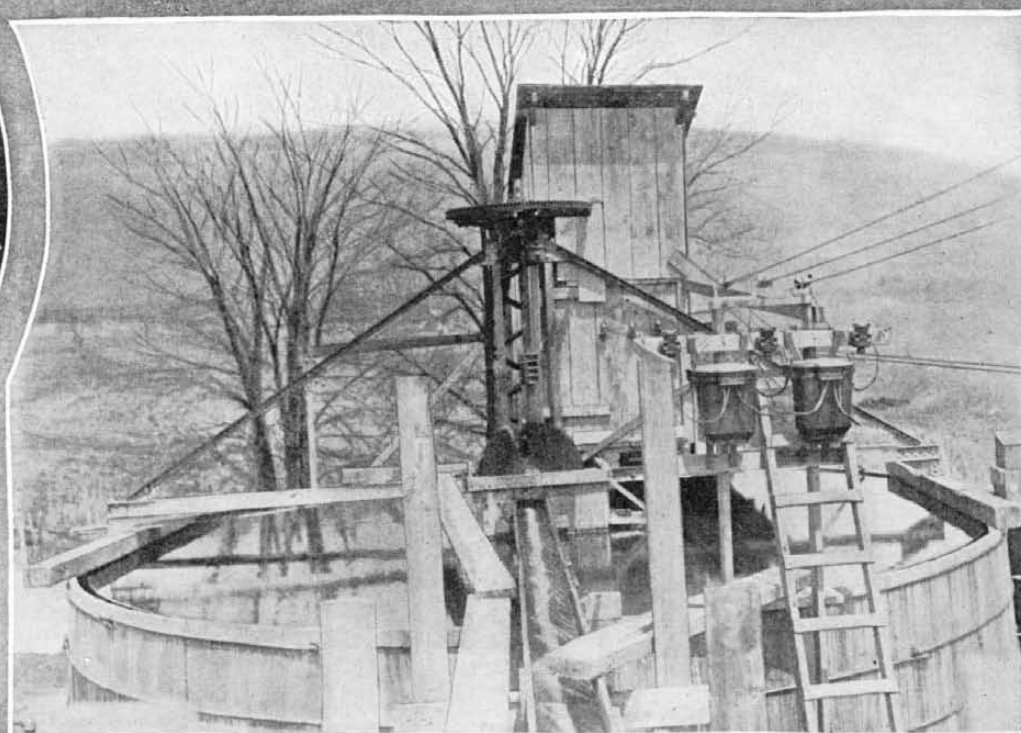
The story of garbage is no epic. It is a plain tale of offal turned to account; and yet every housewife and every landlord should know how much good can come from properly attending to these wastes. They contain elements from which powerful chemicals can be drawn,



The Dorr thickener for treating waste waters from tanneries. The material held in suspension is precipitated to the bottom of a tank. Here it is agitated by plow blades attached to radial arms that are carried on the lower end of the central vertical shaft shown in the cut below. Through the rotation of these blades, which are set at an angle, the settled material is moved to a discharge opening at the center of the tank. By this continuous removal of the settled material, the formation of gases in the sedimentation basin is prevented. Above, a general view of the apparatus, including the troughs that deliver the water to the thickener; at left, the open-air beds where the sludge from the machine is filtered and dried; below, a close view of the precipitating tank, showing the agitating and discharging mechanism.



The Androscoggin River directly below a mill-race at Berlin, N. H., showing the volume of sulphite waste formerly allowed to flow away unutilized from a single paper mill. This liquid, a nuisance to the paper-makers, is now found to be a valuable source of explosive bases, and yields in addition grain alcohol, leather and rubber fillers, and a binder for fuel briquettes.



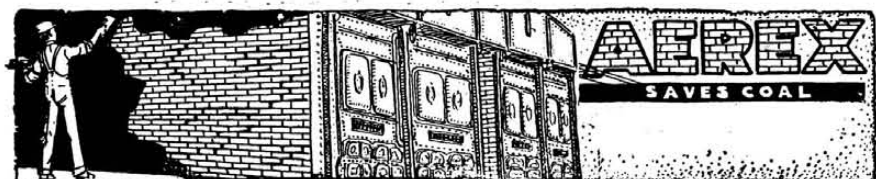
cleaner and a sweeter land. We should be able to breathe more freely, for the time was at hand when we would have been wearing gas masks on Riverside Drive and smoke protectors in Pittsburgh. We shall be able to go fishing in our rivers, to sail our bays in comfort, to rejoice in flowers no longer strewn of a morning with acrid, chemical dust. This is a state of affairs which will come home to every man, woman and child, for it means houses which fumes will not ravish of their paint

Out of every ton of household waste in our large cities can be got enough glycerine to load 14 shells for the French 75-millimeter guns. The glycerine, duly nitrated, becomes the nitroglycerine of war. It is taken in large quantities from the garbage of the city dumps, which may yield from three to five per cent of fat according to the season. Garbage grease in ante-bellum days brought only about $3\frac{1}{4}$ cents a pound and barely paid for the cost of rendering. It brings at least 15 cents now

for in them may be found toluol and an endless variety of valuable derivatives. And why dump tin cans into back lots to mar the outlook, when if detained, they furnish fuses, and later shrapnel?

From the industrial plants in the district of Pittsburg alone, 6,500 tons of free acids are discharged every day into such important rivers as the Monongahela, Allegheny and Ohio. These chemicals not only eat into

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The Current Supplement

ONE of the results of the war has been to prematurely advance the matter of an adequate supply of food to a position of not only pressing, but of permanent importance. Ordinary, old fashioned methods of agriculture cannot replace the lost crops from hundreds of thousands of untitled acres in Europe, untitled for years, and the excess consumption of the vast armies in the fields; and the only way to meet present and impending conditions is both to bring additional areas under cultivation, and to increase production by improved scientific methods. In connection with the latter phase of the problem, the weather holds an important position, and in an article on *The Relation of Weather to Agriculture*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2240, for December 7th, outlines some practical methods of procedure that should be productive of important results. *Destruction from the Sky* tells something of the airplane bombing expeditions that produced such efficient results during the last few months of the war. It is illustrated by several photographs. The paper on *Meteorology in Relation to Aeronautics* is concluded in this issue. Our American army hat has become so familiar of late that the short story on *Making Hats for Our Doughboys* will not be out of place, and the large number of excellent photographs that accompany the article tell a story of their own. *Ignition Magneto Construction* gives a great deal of valuable information how this familiar piece of apparatus is constructed, how it is tested, and how the magnets are magnetized. The article is illustrated by quite a number of drawings that make the explanations in the text quite clear. Other articles of importance in this issue are *The Treatment of Cases of Shell-Shock*, *The Wax Palm and Its Uses* and *The Shortage of the Supply of Non-Phosphoric Iron in Europe*.

The Saving Grace of War

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the hulls of steamboats, and injure all boilers into which any of the waters of the polluted streams are placed, but they do much harm to the submerged parts of Government locks and dams. Federal property is being injured to the amount of \$25,000 a year on the Monongahela and not less than \$32,000 on the Ohio. The presence, until recently, of the discharges from the acetic acid stills along the Hudson constituted a serious source of trouble to the war vessels of all nations which are constantly moored under the lee of the Palisades. And yet, when one company, at a cost of \$5,000,000, has built a plant for the proper fermentation of kelp taken from the Pacific in order to get acetone for its munitions work, why should another concern empty the content of its acetic stills into the Atlantic?

Many makers of chemicals are already aroused to the practical need of conserving the corrosive liquids which they had been squandering in days of peace. The fumes from a chemical factory in upper New York state, which makes hydrochloric acid, had become such a nuisance that the authorities ordered the owners either to close up the plant or dispose of the noxious vapors. It did not take long for the chemists to devise an apparatus by which the hydrochloric gases were passed over lime and thereby produced chloride of lime, or bleaching powder, which commands a high market price.

All free acids could thus be converted into channels of usefulness. The discharge from chemical and industrial plants represents lack of thrift. One of the most typical instances of the extravagant methods which had prevailed in American industry before 1914, was to be found along the Passaic River. That classic stream, famed in song and story for its beauty, has become a loathsome ditch surcharged with oils, greases, chemicals and costly dyestuffs mingled in the effluent of factories and mills. There is now under construction a trunk sewer 27 miles long which will defile the harbor of New York with these millions of gallons of filth each day unless the Supreme Court of the United States interferes. In view of the approaching decision, the captains of industry in the valley of the Passaic are finding that they can remove many of the objectionable constituents of the sewage and either re-use them or retain them for their own processes. The manufacturer of woollens is realizing that the grease from fleeces is the precious lanolin, a healing salve. The bed of the stream is lined with sulfur black and anilines which the dyers

are ceasing to cast upon waters from which they cannot return. The city of Paterson alone was flinging into the river 3,000 pounds of olive oil soap a day, of which 75 per cent could have been recovered.

The city of New York is no less an economic sinner than are her sisters across the Hudson. Year by year, despite the warnings of the War Department, she has been choking the fairway of the King of Rivers and the entrances to her piers with vast deposits of recoverable waste. How foul has become the bed of the Hudson could be seen only a few weeks ago when the Government was dredging the river off Riverside Drive preparatory to installing a repair yard for the Emergency Fleet. No one who did not witness the operation can have any conception of the filthiness of the matter brought to the surface nor of the odor of the gasses released. This mass of decay was composed of substances which not only can be rendered harmless but can be made to serve the nation's need. Even the portion which is of domestic origin is especially rich in nitrogen, an element upon which so much of the success of modern warfare depends that the War Department, in order to be ready for any emergency, is building enormous plants for the fixation of atmospheric nitrogen and is using every endeavor to get control of nitrogenous material.

Once there was an industry which poured a mixture shot with molten gold into the streams because it was black and ugly and seemingly useless. The fish died and were cast up to rot upon the banks. The herbage for miles around was killed. Even when the coke makers conceived the idea of pouring their coal tar waste into pits, it followed the strata and destroyed the grass and the trees and their very roots. Then came the war and the demand for the black liquid from which the Germans had been gaining explosives and dyes, for with them the dye factory becomes over night the ammunition mill. Out of the once discarded waste, when the appropriate by-product ovens were made to take the place of the wastrel bee-hive type, came benzol and toluol in plenty. Out of such liquids as these the magic of chemistry began fashioning weapons to the hands of the war god. Our American dye industry, thanks to the swift urge of war, is now ably taking the place of the vaunted color works of Germany.

Now comes the paper pulp industry, bringing toluol. It had stores of the base of T. N. T. all the time but did not give heed. The valuable constituent was hidden in the corroding waste liquor with which our lakes and streams were until recent months befouled. In order to have a paper devoid of spots and grease splotches, the makers boil out the resins and oils from the spruce chips. To the top there rises the spruce turpentine, known as cymene, a godsend to munition makers and a marplot to paper mills. The pulp manufacturers of the United States gladly undertook the patriotic duty of conserving their waste liquors, which yield cymene, from which ammunition is evolved, as well as the antiseptic, thymol, employed in dressing the wounds of our soldiers, and other by-products which are of high value to our troops abroad.

One company is distilling from this waste of the vats 500,000 gallons a day of alcohol, which is identical with that obtained from the best grain and which bears no resemblance to the ill smelling wood spirits. This product releases cereals for food and provides a valuable fuel for the arts of peace and war. This cooking liquor can also be condensed to the consistency of molasses. The light brown compound which results is much in request by the foundries, which just now are overwhelmed by Government contracts. They are paying from 13 to 15 cents a gallon for it to mix with the sand of their molds. Its adhesive qualities insure the firmness of the impression and lower the percentage of defective castings. As a binder in core making it is unexcelled.

The sulfite pitch, as the trade calls it, is also in much demand as a filler for leather. It is making its way into varied usefulness in the tanning industry, and the manufacturers of rubber goods are wondering how they ever got along without it. Its stickiness commends it to the makers of coal briquettes. It is incorporated with the slack, which it holds together firmly if not exposed to too much moisture. As it contains many resins it adds to the fuel value of the briquettes, from which most other binders detract.

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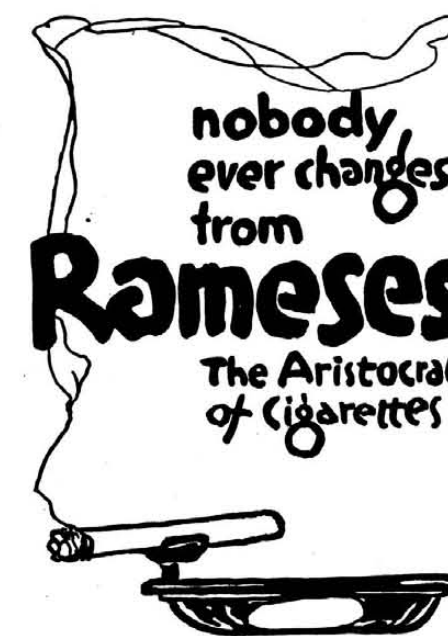
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stone and slag when they are laying the foundations for a highway. For keeping down the dust, it is superior to crude petroleum. Coal oil has an unpleasant odor which dulls the edge of the enjoyment of motoring, while sulfite pitch has the aromatic scent of the woods.

One enterprising manufacturer is getting sulfite yeast. Although he has been fairly successful in turning out the little, compressed cakes, he cannot be sure always whether they will come out pure white or sullen purple. Both shades possess good leavening qualities, but there seems to be a prejudice against violet rays, even in bread.

The problem of conserving tannery wastes had been considered from many angles by progressive men. The enhanced price of the product which goes into the making of harness, leggings and heavy shoes for millions of fighting men has encouraged the tanners to invest in substantial appliances for utilizing their refuse. The results have been most satisfactory. Much nitrogenous material can now be recovered, such as cuttings and scraps from hides and hair, which are quoted at a good price to manufacturers of ammonia and similar chemicals. There is probably in all industry no more offensive waste than those which come from the preparation of leather, nor any which could be made to yield a richer return, if properly treated. All trades have been prodigal in their use of water. If, before they discharged the aqueous waste from their factories, owners would observe due economy at the hydrant, the cost of separating the solid constituents from the liquid discard would be comparatively slight.

Results from a recorded test of four months at a tannery in Pennsylvania using the acid process, show the possibilities of conservation. Three million gallons in all were treated. For each side of leather, half a cowhide, 1.56 pounds of dry solids were recovered. The ammonia content of those solids averaged 6.47 per cent, after the sludge had been treated to render it soluble. According to the census report for 1914, the number of cow and horse hides tanned in the United States for the year was 20,867,620. The grand total of the hides and skins tanned for that period was 138,547,692. Based on these figures, the estimate is made that 60,000 tons of recoverable fertilizer, worth fully \$1,360,000 are annually dumped by the tanners into the streams of the United States. Yet were it not for war conditions, it is improbable that the tanning industry would be putting in even the simplest recovery apparatus.

Owing to the meat scarcity much attention has been given lately to increasing the fish supply, not only from the ocean, but from the inland streams. Mr. George D. Pratt, Conservation Commissioner of New York, has been especially successful in obtaining the cooperation of owners of industrial plants throughout the Empire State. One company which was manufacturing screen wire, was polluting the Tioughnioga River with washings of iron shale and oil. It installed precipitation tanks and thereby saved its iron and recovered its oil and also helped its employees reduce their cost of living; for the fish are returning there.

The late John Bigelow, who lived for years on the banks of the Hudson at Malden, once wrote that the money value of the shad caught from the metropolis to Albany exceeded the revenue of the farming communities bordering either side of the river. Not only could the shad be induced to return in large numbers to their old northern haunts, but there is no reason why the sturgeon, once so plentiful that hundreds of fishermen lived by taking them and thousands found them a favorite food, should not also teem again in the upper regions of the Hudson. There are men living today who recall that this fine fish was once so abundant that the capital of New York was called Sturgeon Town and the useful denizen of its adjacent waters was known as Albany Beef. The freeing of Lake Champlain from the sludge of the paper mills brought back that delectable fresh water smelt—the ice fish, which last winter furnished a substitute for meat to many inhabitants of that region and filled the purses of fortunate fishermen.

When the Government takes charge of industry, it stands not on the order of the day. War is a serious business which demands a full measure of efficiency from those who engage in it. Peace may destroy the value of millions of dollars worth of real estate on either side of beautiful and stately rivers and make citizens walking in the parks gasp like gassed soldiers. but



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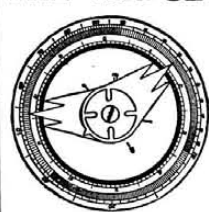
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The Liberty Motor

(Continued from page 455)

strengthen the crank case and reduce vibration. The cylinders are of 5 by 7 bore and stroke and have a cubic capacity of 905 inches. The motor has individual cylinder barrels and stamped steel water jackets. This construction permits of machining the barrels all over so as to have uniformity of section and a maximum of strength with a minimum of weight. The stamped steel jackets insure uniform water space and absence of steam pockets. The jackets are welded to flanges formed on the cylinder, the cross sectional area of the flanges being the same as that of the jackets so that both members can be brought to an equal degree of temperature, thus facilitating the welding operation. The valves in the head are set at an angle to insure the best shape of combustion chamber and the maximum possible valve size. To shorten the travel of the gases the inlet valves are on the inside, while the exhaust valves are on the outside and carry off the hot gases rapidly from the valves and motors. There is a single cam shaft for each set of cylinders which is mounted between the valve stems, providing a very simple and direct action. Double valve springs are used to minimize breakage from vibration. There are two duplex carburetors, each bore serving three cylinders so as to give the best distribution of gas and to permit of ready and accurate synchronization. Pressure lubrication is used on all plain bearings. The oil supplied to the connecting rod bearings and cylinders is controlled by metering conduits in the main and connecting rod bearings. The pistons are an aluminum alloy chosen for lightness and good heat-conducting properties. There are two spark plugs for each cylinder so as to halve the possibility of losing a cylinder due to spark plug trouble and in order to increase the rapidity of the flame propagation in the cylinders.

The future of the Liberty motor is a problem that is occupying a great deal of attention at the present time. It is not a power plant that can be used in automobiles or trucks. Its power is far greater than anything now required in such service. The motor might be used for racing motor boats, but it is distinctly an airplane engine built as an emergency measure for war purposes. No doubt a large stock of the motors now on hand will be retained by the Government for the development of the air service of the Army and Navy which will have to be maintained on a large scale as long as the possibilities of war confront us. Airplanes will also be used in rapidly increasing numbers for postal service and no doubt to a considerable extent for pleasure, because the vast army of young men who have learned to navigate the air will not be content to remain on the ground.

The Surrender of the German Fleet

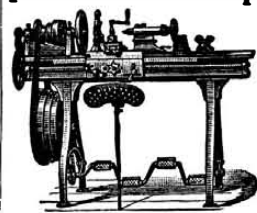
(Continued from page 459)

"Koenig," "Grosser Kurfuerst," Markgraf" and "Kronprinz Wilhelm." These are of about 26,000 tons displacement and 20.5 knots contract speed. They mount 10 12-inch, 45-calibre guns, 14 5.9-inch, 10 3.4-inch and two 14-pounder automatics. Like the "Bayern" they are driven by turbines operating three screws. On all of these ships the belt is just under 14 inches in thickness, the same thickness of armor being carried on the turrets, with 15 inches on the fore conning tower and 10 inches on the after conning tower. The main belt is 14 feet deep and the sides above the belt, between the forward and after barbettes, are protected by six inches of armor. The "Koenig," of this class, was to have been surrendered, but was in dry-dock at the time and could not be moved. These ships were completed in 1914 and 1915.

The next class consists of the five ships "Kaiser," "Friedrich der Grosse," "Kaiserin," "Prinz Regent Luitpold" and "Koenig Albert." The displacement is 24,500 tons, the horse-power 28,000 tons, and the contract speed 20.5 knots. It has been stated that these, in common with all the later battleships of the German navy, have made considerably more than 20.5 knots on trial. They are armed with 10 12-inch, 50-calibre guns, 14 5.9-inch and 12 3.4-inch and two 14-pounder anti-

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