

THE WELLCOME TROPICAL RESEARCH LABORATORIES.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

It is only ten years since the whole of the Sudan was a closed book to the outside world, being under the sway of ruthless barbaric Mahdism. To-day it is a country of increasing prosperity, and at the ancient capital of the Dervishes has been erected a magnificent pile of educational buildings, the Khartum College, a portion of which comprises an extensive and elaborately equipped tropical research laboratory. When the country was finally subdued, it was realized that the peculiar conditions prevailing, both climatic and geographical, rendered the territory a difficult one for the residence of the white man. It was the home of innumerable and mysterious diseases and infectious maladies, which rendered it untenable to the white man, and were also destructive among the ranks of the natives. Moreover, these maladies were peculiarly endemic to the country, and it was realized that the only possible method of reclaiming it for civilization was the investigation and solving of these problems upon the spot, by the most up-to-date scientific methods possible.

Scarcely had the last shots in the campaign been fired, when a movement was started for the foundation of an educational college on the site of the Mahdi's stronghold. Here it was decided to study the questions upon a small scale at first. Owing to the generous munificence of a well-known Englishman, Mr. Henry S. Wellcome, however, it was found possible to establish an extensive institution for tropical research. The donor, in connection with his gift to the Sudanese government, offered to equip the laboratories with all the latest appliances that might be desired, so that the investigations could be carried out upon the most comprehensive lines. These laboratories are unique, inasmuch as they are the only ones of their character upon the African continent, which is unanimously held to be the greatest seat of all those peculiar natural conditions inimical to the white man which have appreciably retarded the development of the country in the past. But through the efforts of this institution invaluable work has been accomplished in reclaiming the northern part of the country, which, in conjunction with that of the Liverpool and London Tropical Schools of Medicine, has assisted in the hygienic betterment of the continent at large.

The work of the Wellcome Tropical Research Laboratories is broadly divided into six ramifications, as follows: (1) The promotion of technical education; (2) the bacteriological and physiological study of tropical disorders, more especially the infectious diseases of both man and beast peculiar to the Sudan, and to extend assistance to the officers of health and to the clinics of the civil and military hospitals; (3) to assist experimental investigations in poisoning cases, by the detection and experimental determination of toxic

agents, particularly the obscure potent substances employed by the natives; (4) chemical and bacteriological tests in connection with water, food-stuffs, and such sanitary matters as may be found desirable; (5) the promotion of the study of disorders and pests which attack food and textile producing and other economic plant life in the Sudan; (6) to undertake the testing and assaying of agricultural, mineral, and other substances of practical interest in the industrial development of the Sudan.

The work upon these diverse subjects is under the

cently the work of the Institution has been extended to the sciences of ethnology, ethnography, and anthropology.

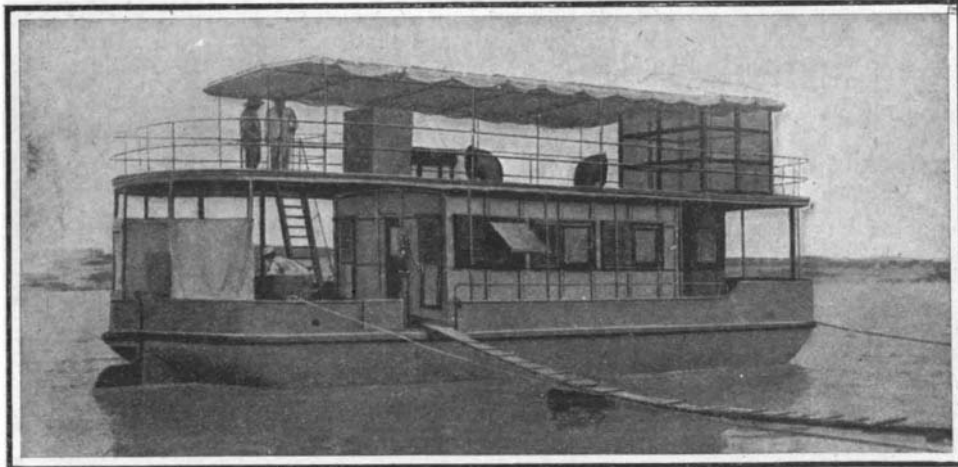
Tropical medicine comprises researches in the trypanosomiasis of animals, chiefly cattle and camels—fortunately the dreaded scourge of sleeping sickness among humans has not extended to the Sudan. Piroplasmiasis, spirochaetosis of Sudan fowls, and studies of the many fell diseases such as kala-azar, mycetoma, and dengue fever, which cripple human life in the tropics, constitute the most prominent of the purely pathological and bacteriological work. Then again the sanitary organization of Khartum and Omdurman has been taken in hand, involving the destruction of mosquitoes and the introduction of sanitary laws and a conservancy service. Dr. Balfour, the director, is the medical officer of health of the towns, and, with the adequate laboratory resources at his disposal, has been able to revolutionize completely the conditions of life in a few years, and has practically exterminated malaria at Khartum.

The headquarters of the laboratories are at the Gordon College; and here within a period of seven years innumerable experiments and investigations were carried to a successful issue, and a mass of unique information collected which is of inestimable value in connection with the subjects treated. It was found, however, that the conditions under which the researches were made were not quite perfect, on account of the possibility of change in or damage to bacteriological and other specimens in their transmission from remote districts to Khartum. It was therefore decided to carry the war into the enemy's camp, and to carry out the investigations on the spot under conditions very similar to those at the Gordon College. For this purpose a floating laboratory was established, and the work accomplished therewith has been of far-reaching value. The southern Sudan is a country criss-crossed by waterways, on the banks of which are clustered native villages, wherein all manner of rare and interesting pathological conditions are to be found. Flies and mosquitoes abound; the birds, reptiles, and fish harbor strange parasites; men die from

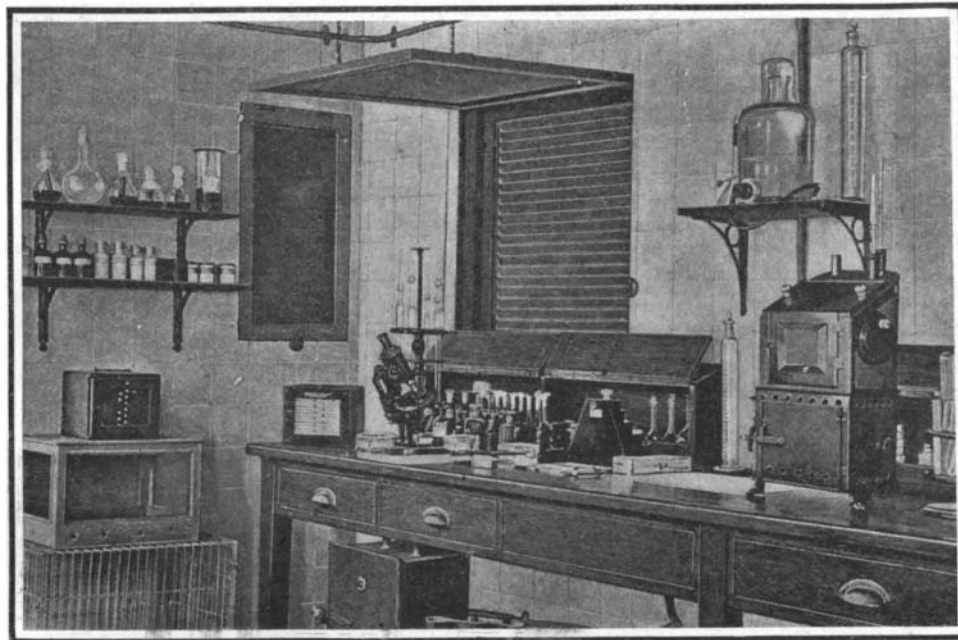
curious diseases, and there is a vast field for the study of tropical medicine. Before the days of the floating laboratory, material occasionally reached Khartum from these distant territories, but too often it was in a badly damaged condition. Blood slides were dirty and spoiled, insects broken, and notes incomplete. On the whole, it was recognized that the proper study of conditions must be conducted on the spot, and then many valuable data could be gathered.

The floating laboratory is a commodious vessel well adapted to service upon the waters of the South. The main working room is completely mosquito proof, and is adequately fitted out for proto-zoological and entomological work. Its maiden voyage was carried out

(Continued on page 381.)

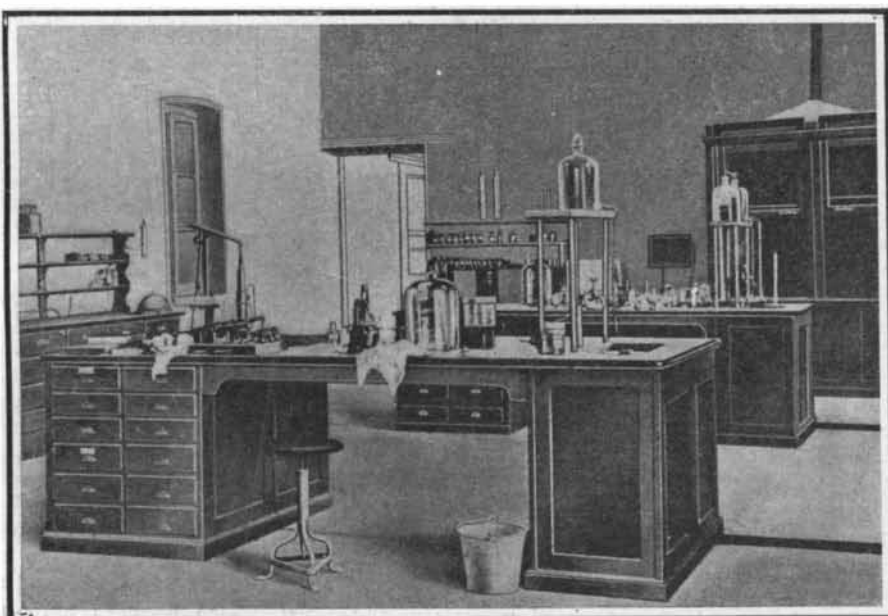


The floating laboratory on the Nile, auxiliary to the Wellcome Research Laboratories.

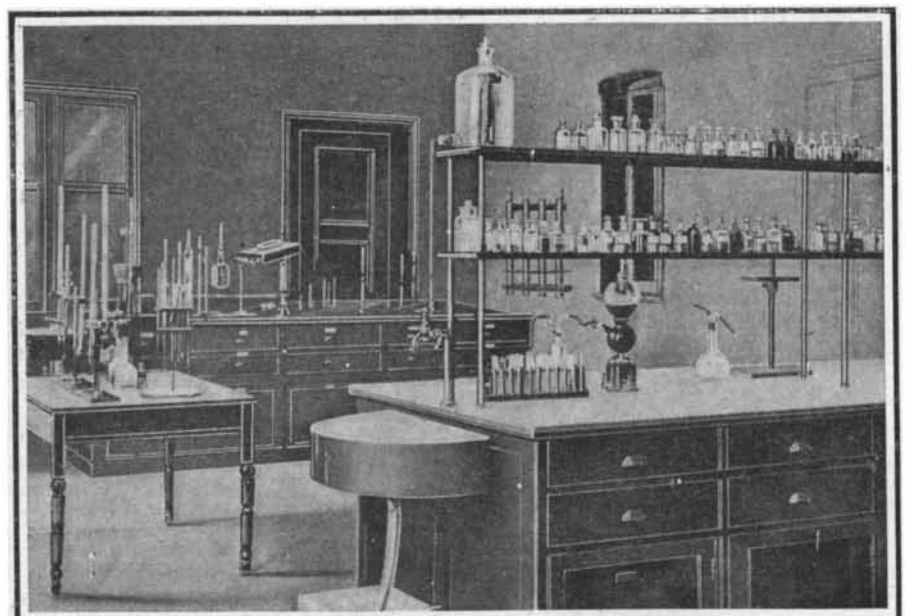


Part of bacteriological section of floating laboratory.

direction of Dr. Andrew Balfour, B.Sc., D.P.H., F.R.C.P., and he is gladly assisted by the various other departments of the government which are interested in one or more of the avowed objects of the Institution, such as the Egyptian Army Medical and Veterinary services; indeed, the co-operation of outside workers in the same field is much appreciated and fostered, so that there may be an indisputable conclusiveness concerning the results achieved. Within the first year of its foundation the laboratories became fully occupied in all their departments, and then Dr. Andrew Balfour gradually and carefully selected the best fields of work, and concentrated the attention of his staff thereon. Chemistry and entomology have received almost as much attention as tropical medicine, and re-



Bacteriological room.



General chemical laboratory.

| | |
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| Internal combustion engine, W. M. Appleton | 939,376 |
| Internal combustion engine, A. J. West | 939,459 |
| Iron oxid scale, electrolytically removing, Danforth & Jones | 939,223 |
| Key fastener, W. A. Loveland | 939,607 |
| Kinetscope, A. C. Roebuck | 939,634 |
| Kinetscopic apparatus, J. E. Lagergren | 939,274 |
| Kitchen utensil, F. H. Hamblin | 939,251 |
| Kitchen utensil, J. Saul | 939,329 |
| Knife blade, detachable, M. H. Sterling | 939,346 |
| Knitting machines, lace pattern mechanism for straight, Salzer & Walther | 939,328 |
| Lacing tips and the like and composition for the same, fabric for, G. W. Prentice | 939,313 |
| Lamp, carriage, H. Blau | 939,385 |
| Lamp, gas or vapor electric, P. C. Hewitt | 939,912 |
| Lamp, mercury and other vapor electric, Kent & Lacell | 939,708 |
| Lamp, miner's electric, H. Remane | 939,630 |
| Lantern, J. H. Pence | 939,542 |
| Lantern and heater, combination, O. H. Armington | 939,377 |
| Last, locking collapsible, C. F. Pym | 939,860 |
| Last, shoe, A. J. Buch | 939,212 |
| Lathe tool post, C. L. Libby | 939,722 |
| Lawn rake, rotary, C. Waite | 939,765 |
| Lead joint runner, W. Vanderman | 939,356 |
| Lens carrier, lantern, F. D. Spear | 939,754 |
| Lens grinding machine, automatic prescription, E. O. Mattern | 939,845 |
| Leveler, automatic, E. Woodward | 939,372 |
| Lever, J. R. Weatherly | 939,574 |
| Lifting jack, F. M. Allerton | 939,374 |
| Lighting and extinguishing device, automatic, A. J. Bedford | 939,790 |
| Line casting machine, J. McNamara | 939,291 |
| Line casting machines, keyboard mechanism for, J. R. Rogers | 939,325 |
| Lino slug trimming machine, S. R. Carter | 939,800 |
| Linotype machine, F. Johannesen | 939,262 |
| Liquid as power, power method and means of utilizing, B. Taylor | 939,757 |
| Liquid cooling and dispensing apparatus, G. W. & W. H. Fulper | 939,954 |
| Liquid dropper, E. K. Scott | 939,556 |
| Liquid fuel burner, B. Moore | 939,613 |
| Liquid fuel lighting system, A. Burton | 939,799 |
| Lock bolt, L. & D. Moeller | 939,921 |
| Lock key, I. C. Freud | 939,679 |
| Locks, seal attachment for, C. H. Johnson | 939,699 |
| Loom filling detector mechanism, G. F. Hutchins | 939,696 |
| Loom filling detector mechanism, web replenishing, E. H. Ryon | 939,954 |
| Loom pattern mechanism, Owen & Pratt | 939,299 |
| Loom picker stick mechanism, L. P. Sherman | 939,560 |
| Loom shuttle, Cunniff & Rafferty | 939,892 |
| Loom, web replenishing, E. H. Ryon | 939,326 |
| Looms, filling thread cutting device for web replenishing, B. F. McGuinness | 939,433 |
| Looms for weaving, beating up mechanism of, W. Hollas | 939,503 |
| Loss preventing device, M. T. Fish | 939,487 |
| Lubricant, J. W. Watkins | 939,646 |
| Lubricating device, F. R. Paine | 939,301 |
| Magneto generator, R. H. Hassler | 939,910 |
| Mail bag deliverer, S. B. Colbert | 939,806 |
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| Match box, automatic, J. G. Hanna | 939,252 |
| Match holder or safe, E. M. King | 939,710 |
| Match machine, W. R. Swick | 939,348 |
| Match safe, pocket, J. F. Beatty | 939,657 |
| Matrices, dovetail notch chamfering machine for, H. A. Reynolds | 939,632 |
| Matrix channelling machine, H. A. Reynolds | 939,631 |
| Matrix combination punching machine, H. A. Reynolds | 939,633 |
| Measurer, liquid, C. C. Allen | 939,198 |
| Metal box, Klenk & Fink, reissue | 13,038 |
| Metal shears, G. Potstada | 939,627 |
| Metallic tie, T. B. Bradford | 939,794 |
| Micrometer, H. Spahn | 939,562 |
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| Milk heater, H. C. Root | 939,936 |
| Miter gage, Erikson & Wikander | 939,405 |
| Mold, J. N. Erixon | 939,819 |
| Molding flask, J. D. Millar | 939,849 |
| Molding mechanism, W. Zimmerman | 939,581 |
| Mop, Wichmann & Rich | 939,883 |
| Mower trimming attachment, lawn, H. Smith | 939,926 |
| Music turner, W. & B. Mark | 939,525 |
| Musical instrument strings, holder and protector for, O. J. Muller | 939,734 |
| Musical instrument tracker mechanism, T. P. Brown | 939,387 |
| Net frame, landing, G. M. Barnes | 939,381 |
| Nut lock, W. Atkins | 939,654 |
| Oil and grease gun, combined, F. J. Ball | 939,465 |
| Oil burner, C. Eckland | 939,816 |
| Oil cake forming machine, A. W. French | 939,492 |
| Oiling device for gas meter diaphragms, automatic, J. R. Daly | 939,675 |
| Ore separator, magnetic, W. D. Ludwick | 939,523 |
| Oven, bake, E. A. Geurink | 939,410 |
| Packaging machine, B. W. Tucker | 939,353 |
| Packing and display receptacle, W. E. Collins | 939,807 |
| Painting machine, wheel, J. Heinz | 939,416 |
| Paper box blank machine, J. R. Van Wormer | 939,571 |
| Paper cutter and printer, automatic roll, G. V. A. Pincus | 939,545 |
| Paper fish-making machine, I. Bertin | 939,888 |
| Paper feeder, automatic, J. Hren | 939,260 |
| Paper shells, machine for making, J. Chesney | 939,948 |
| Pedal and panel mechanism, T. P. Brown | 939,386 |
| Pen, fountain, H. J. Upton | 939,456 |
| Pen holder, R. J. Cox | 939,810 |
| Pendant, A. Jacques | 939,510 |
| Percolator, J. B. Livingston | 939,281 |
| Perforator, casing, Lapp & Harrison | 939,917 |
| Permutation lock, O. Anderson | 939,887 |
| Phonograph, F. E. Holman | 939,692 |
| Piano violin, J. Bajda | 939,736 |
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| Picture machines and phonographs, synchronizing device for, P. Seiler | 939,337 |
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| Pipe cleaning apparatus, G. A. Lutz | 939,608 |
| Pipe coupling, F. C. Pablow | 93-739 |
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| Planter and harrow, combined, J. M. Tucker | 939,761 |
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| Planter, corn, L. E. McQuitty | 939,853 |
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| Plow, reversible, W. Koehler | 939,271 |
| Plow, reversible, J. J. Nall | 939,617 |
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| Pot and kettle cover, I. Chapman | 939,802 |
| Powder cutting machine, C. Dobbs | 939,895 |
| Powder distributor, enameling, W. Lindsay | 939,918 |
| Press, L. H. Conner | 939,475 |
| Press, H. G. Miller | 939,732 |
| Press button, R. Scheewe | 939,446 |
| Pressure control, automatic, J. H. Smith | 939,752 |
| Pressure generating and applying device, hydraulic, T. W. Nelson | 939,535 |
| Pressure generating, hydraulic, and applying apparatus, T. W. Nelson | 939,737 |
| Printer's galley, A. S. Orchard | 939,620 |
| Printing and issuing machine, ticket, R. North | 939,297 |
| Printing and issuing tickets and registering fares, machine for, R. North | 939,295 |
| Printing machines, sheet inverting apparatus for use in connection with, T. R. G. Parker | 939,541 |

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SCRIBNER'S MAGAZINE 1910

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The articles already published have met every expectation with regard to their exceptional interest and value, and the extraordinarily large editions required to meet the demand have had to be increased with each number. Nothing he has ever written has better revealed his own attractive personality, his remarkable faculty for observation and appreciation of the picturesque and unusual in both humanity and nature. The *Boston Transcript* says:

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In the January number he will describe hunting experiences at,

Juja Farm:
Hippo and Leopard

These articles are not only fascinating narratives of adventure, they are also authoritative accounts of the natural history of many animals but little known to most readers. The illustrations by Kermit Roosevelt and other members of the expedition are especially interesting. To secure all of Mr. Roosevelt's articles subscriptions should begin with the October number.

THE WELCOME TROPICAL RESEARCH LABORATORIES AT KHARTUM.
 (Continued from page 375.)

under the direction of Dr. C. N. Wenyon, proto-zoologist to the London Tropical School of Medicine, and proved such a complete success that the work in this direction is being considerably developed.

Entomology is another very promising science that has claimed considerable attention in these laboratories. There is an immense field in the Sudan for an economic entomologist, and the scope and variety of the work done is almost bewildering. There are pests of every kind infesting every living being and plant, and the task of reducing these would at times seem almost hopeless. Every year taxes, aggregating large sums, have to be remitted owing to the ravages of *Aphis sorghi* and other pests. Fatalism, natural indolence, and improvidence often prevent the natives, unless supervised, from taking those active measures so necessary in cases of insect infestation of crops. These labors have also a direct bearing on tropical medicine, as results have abundantly testified.

In the field of anthropology very valuable work has been accomplished. The laboratories are recognized as a working place for fellows of the Carnegie Research Fund; and on the recommendation of the director, Dr. A. MacTier Pirrie was appointed anthropologist to the Institution. In addition to his medical qualifications, Dr. Pirrie held a special degree in anthropology, and was particularly well versed in physical work. Although he labored under the great disadvantage of not knowing the country, he undertook and successfully completed remarkable journeys into the totally unknown Burun country, which lies between the White Nile and Abyssinia. He lived and moved among the tribes inhabiting this territory, and his method of handling the natives was highly appreciated by the government. By his free movement among them he was able to acquire extensive data of their life, manners, and customs of the most highly prized character. Unfortunately, these expeditions proved fatal to the young, enthusiastic investigator. During one journey he contracted an indigenous disease propagated by the parasite of kala-azar. He was prostrated and invalided home to Scotland, but died six months later before he had the opportunity of setting out the results of his work. His notes and observations, as well as those of archaeological and ethnological aspect, were worked up by competent authorities, and have thrown much light upon a people and their country about which nothing has previously been known.

The chemistry section has received as much attention as tropical medicine, for it has an important bearing upon the commercial development of the country. The principal fields of investigation in this direction have been Sudan gums, food-stuffs, and seeds, as well as water supply from the Blue and the White Nile and wells. The study of gums has been particularly exhaustive. The Sudan has extensive forests of gum trees; in fact, such constitutes one of its staple products. Inquiry showed that comparatively little was known about gums, so that great attention was concentrated upon this subject. After some four years of labor, the laboratories have made some valuable additions to the chemistry of this commodity, and it is hoped that their labors may result in placing the Sudanese gum industry upon a sound basis.

Unfortunately, on May 11th, 1908, the laboratories suffered a heavy calamity in a fire, which breaking out in the photographic dark room, practically gutted the building, except the library, directors' room, and one or two other departments. Not only was a very large quantity of equipment destroyed, but all the trypanosomiasis specimens were lost, together with the records of two years' work on the subject. Nearly all the paraffin blocks prepared during the previous

(Concluded on page 383.)

(Concluded from page 381.)

eighteen months, and containing the imbedded organs of fowls dead of spirochaetosis, were lost, and thus a far-reaching investigation has been temporarily arrested, and it has not yet been possible to replace the material. Upon the receipt of the news of the catastrophe, Mr. Henry S. Wellcome, to whose munificence the Institution was due, immediately offered to replace the lost equipment; and through his generosity the laboratories were completely refitted and re-equipped with the most modern appliances, so that work could be resumed with the minimum delay. Consequently, so far as general usefulness goes, the Institution was only temporarily crippled.

Work is now again in full swing, and it should be pointed out that there is a very large field to be covered yet. If the various countries interested in the exploitation of the continent could establish similar laboratories to this in their respective territories, it would soon become a white man's land, and through concerted action the terrible maladies which at present arrest development would be completely subjugated.

ARTILLERY FOR AIRSHIP ATTACK.

(Concluded from page 373.)

is clamped tight against the axles. The third type of cannon is of a much heavier build than the two which precede, seeing that in this case it is designed to be mounted on shipboard, and hence the weight does not need to be reduced as in the other cases. It is of a considerably larger caliber, this being 10.5 centimeters (4.2 inches). In most of the details it is designed on the same lines as the second type. It is intended to be mounted generally upon torpedo boats or swift cruisers, and naturally the gun can be brought into service as an ordinary cannon in cases where it is needed. For the gun proper, the weight is 3,080 pounds, while the support weighs 3,520 pounds, giving a total weight of 6,600 pounds for this type. Like the former, the angle of elevation is 75 degrees at a maximum. The projectile, weighing 40 pounds, has an initial speed of 2,300 feet per second. A horizontal range of 44,500 feet is reached in this case, and we have the unusual height of 37,620 feet.

The present types of gun were given a series of tests by firing upon captive balloons, and two of our engravings illustrate this feature. In one case we observe the balloon, which has not been hit by the shot, and this can be clearly seen by the trail of smoke which shows the path of the projectile. In the second view is represented the effect which takes place when the projectile strikes the balloon, and we have the detonation of the grenade and at the same time the explosion of the gas and the destruction of the balloon.

Alcohol vs. Gasoline Engines.

Almost any engine with a well-designed carbureter will run as well with alcohol as with gasoline, except for a difference in ease of starting and in certainty of operation at low speeds. By using alcohol in an alcohol engine with a high degree of compression the fuel-consumption rate in gallons per horse-power hour can be made practically the same as for gasoline in a gasoline engine of the same size and speed. An alcohol engine with the maximum compression for alcohol will have 30 per cent more available horse-power than a gasoline engine of the same size, stroke, and speed, and the weight per horse-power may be less. Tests with mixtures of gasoline and alcohol showed no gain in efficiency over gasoline or alcohol alone. Diluting gasoline with water did not affect fuel economy.

With alcohol the case was different, but with dilutions up to 80 per cent alcohol the effect was so slight that 80 per cent alcohol is a cheaper fuel than 90 per cent if it can be had for 15 per cent less.

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The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

- I. The Chicago and Gulf Waterway.**—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.
- II. Chicago as a Railroad Center.**—Chicago is the greatest railroad center in the world.
- III. The Wonderful Grain Trade of Chicago.**—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.
- IV. Shipping on the Great Lakes.**—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.
- V. The Handling and Shipment of Iron Ore.**—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.
- VI. Freightage on the Mississippi.**—Freightage on the Mississippi is a more important industry than most of us may realize.
- VII. The Steel Industry.**—One of the greatest steel plants in the world is that which has been built at Gary.
- VIII. The Freight Subway System of Chicago.**—Chicago can boast of a rational system of handling freight by means of subways.
- IX. The Water Supply of Chicago.**—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.
- X. Reclaiming Arid Lands.**—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.
- XI. Harvesting the Grain of the Middle West.**—Farms that cover not acres but square miles, crops that aggregate not simply bushels but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

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