Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY. NEW YORK.

NEW YORK, SATURDAY, SEPTEMBER 26, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1082

For the Week Ending September 26, 1896.

Price 10 cents. For sale by all newsdealers

THE SECRETS OF GERMANY'S INDUSTRIAL SUCCESS.

Perhaps the most notable fact in the industrial world just now is the commanding position which is being won by the German manufacturers and the rapid encroachments which they are making upon the foreign trade of other nations, and particularly upon that of Great Britain. In taking note of this development we must remember that it is nothing new, that it is not the result of a sudden outburst of energy. It is merely the larger development, the coming of age, of a system which has been steadily at work in Germany for many years. Her industrial triumph, which has come as a surprise to the world at large, and with a rude, awakening shock to Great Britain in particular, is no surprise to the German people themselves. In school and college, in workshop and factory, by carefully planned organizations at home and abroad, they have set in motion a system of industrial forces which are now working out the desired results with mechanical regularity and precision.

The German mind is essentially scientific and methodical. It was these qualities that contributed largely to the signal triumph of the German arms in the memorable war of 1870. During the quarter of a century that has intervened since the close of the struggle and the consolidation of the empire, Germany has been applying the same scientific methods to the arts of peace; and with such success that it begins to look as though her industrial armies were going to occupy the broad fields of international commerce with the same resistless energy with which her battalions marched from Saarbruck to Sedan a quarter of a century ago.

Germany owes her industrial success to her system of scientific training in schools and colleges, to the close fellowship which exists between her factories and her schools, and to her elaborate organizations for the control and development of commerce.

That the scientific course in German schools was thorough and effective has always been well understood; but it has been reserved for a private letter, written by Prof. Ostwald, the distinguished German chemist, to his English friend Prof. Ramsay, to open the eyes of the world, and particularly of the English people, who are most nearly affected, to the practical use to which the scientific researches of their specialists are put by the German people. It appears from this letter that there is a close alliance between the German manufacturers and the universities and high grade technical schools. In the chemical industry, for instance, it seems that splendid inducements are offered to the graduates of technical colleges to enter the laboratories which form part of the equipment of the factories. These young men are engaged, not for the executive work of the establishment, but for purely experimental work in the laboratory. They form a brigade of skilled inventors, who devote themselves to the discovery of improved processes and methods of manufacture.

Speaking of this system, Prof. Ostwald says:

"The research laboratory in such a work is only different from one in a university by its being more splendidly and sumptuously fitted than the latter. I have heard from the business managers of such works that they have not unfrequently men who have worked for four years without practical success; but if they know them to possess ability, they keep them notwithstanding, and in most cases with ultimate success sufficient to pay the expenses of the former resultless years."

When we bear in mind that "there are often more than one hundred Ph.D.'s in a single manufactory," and that this little army of qualified scientists is occupied solely in "making inventions," we begin to understand why it is that Germany is already pre-eminent in certain markets of the world, and it is likely to become so in others before long. Invention is no longer left to the unaided efforts of the well meaning, but often uninstructed, individual. In the special laboratory there will be no long hours of fruitless search for an object whose supposed existence is based upon ignorance of the first principles of physics or mechanics. In this admirable combination of the skilled theorist and the trained mechanic there is little left to chance; and the development of an art is carried on by the sure and logical process of experiment, invention, and design.

Of scarcely less importance in German industrial economy is her elaborate system for the fostering and extension of trade. This includes the founding, in certain industrial centers, of chambers of commerce. These institutions are intended to deal with questions of home and foreign trade in the broadest possible manner.

"There is no question connected with the development of trade interests, of manufactures, credit capacity of foreign countries, advantages to be obtained by treaty stipulations, injuries resulting from measures adopted by other nations in restraint of trade, which is not thoroughly discussed and carefully considered by the many German chambers of commerce scattered over the country. These bodies report to the minister of commerce with regard to the influence and bearing of all such matters, as they are connected with the commercial interests of the various localities, and by petition or otherwise they often secure action through their minister and the minister of foreign affairs which is of great advantage to them."

As the necessary counterpart of this organization at home, the Germans are about to establish a system of commercial attachés, whose agents shall be specially trained for the service and shall form a recognized part of the national representation in foreign countries. The work of the attaché will be similar to that which is now embodied by our own consuls in their "consular reports," many of which, be it said, are admirable documents and worthy of a wider circulation. He will furnish to the home government a statement in detail of the particular commodities which are required in his district, and will keep it informed of the volume and nature of the trade done there by competitors; and, indeed, he will report any facts which might be of service for dissemination among the various local boards of trade above mentioned.

Visitors to the Columbian Exposition at Chicago will remember the truly magnificent display that was made by Germany, and particularly the collection which figured so prominently in the Liberal Arts building. It was a special effort, carefully planned and effectively carried out, and German foreign trade is feeling the stimulus of that costly display at the present moment.

Our brief consideration of this subject suggests that, while it more immediately concerns the commercial supremacy of Great Britain, it has also a practical interest for the United States. In our future commercial development and expansion we shall certainly enter into a most active competition with the two nations above mentioned. It is a question which we shall do well to ask ourselves, whether our native inventiveness and mechanical skill should not be stimulated and rendered more efficient by such a triple alliance of science, industry, and organization as is now carrying Germany to the front by leaps and bounds.

The Serum Treatment of Leprosy.

In the New York Medical Journal for January 18 was mentioned a communication that had been made to the National Academy of Medicine of Bogota by Dr. Juan de Dois Carrasquilla in which he reported cases of leprosy that had been cured or much ameliorated by the use of an antileprous serum prepared by him. It was his second paper on the subject, and was presented before the academy on the 22d of last November; the first had been laid before the same learned body on the 30th of August, 1895. By the courtesy of the academy's permanent secretary, Dr. Pablo Garcia Medina, the same journal has now received a copy of Dr. Carrasquilla's third communication, made on the 24th of June, 1896. In it the author describes in detail his method of obtaining the antileprous serum and his mode of employing it. These we can indicate only in outline. He first bleeds a leper, choosing an adult whose general condition is fairly good. The blood drawn varies in amount from a hundred to two hundred and fifty cubic centimeters. It is received into a sterilized vessel and carefully covered, kept away from the light, and, above all, kept perfectly quiet. In from twelve to twenty-four hours the superficial layer of serum, that only which is perfectly limpid, is removed with a pipette. If it has to be kept for some time before it is to be used, it is passed through a layer of powdered camphor contained between two layers of cotton, to preserve it, and it is kept away from light and heat.

Thus prepared, the serum is injected into an animal that is refractory to leprosy, preferably a healthy young horse in good condition. Roux's method of procedure is employed. In regard to this operation, says Dr. Carrasquilla, there are two points that are of the greatest importance and at the same time difficult to determine—the amount of serum to be injected at one time and the interval that should be allowed to elapse between the injections. His experience leads him to think that forty-five cubic centimeters is the proper medium dose, given at intervals of ten days. The horse is bled in from five to ten days after the last injection, preferably from the jugular vein. The Nocard-Roux process is followed for obtaining aseptic horse serum, and it is treated in exactly the same way as the human serum.

The dose of the serum for use on the human subject is from one to five cubic centimeters, according to the strength of the serum, the constitution, age, and other circumstances of the patient, the period of the disease, etc., given subcutaneously. The locality to be preferred for the injection is that bounded by the iliac crest and a transverse line passing just beneath the trochanteric fossa, or, better still, just to the outer side of the trochanter major. Great care must be taken to make sure that the serum has not undergone any septic change. A full day should intervene between the injections. Febrile reaction follows in all cases, and the injection should not be repeated until this has subsided. Dr. Carrasquilla gives many other details, which we have not space to mention, and promises to publish further reports of results.

The Death of Lilienthal.

The following letter appears in Nature of recent date:

C. RUNGE.

Dear Sir: You are right in presuming that I can give you details referring to Otto Lilienthal's death, authentic as far as they can be obtained.

As early as the beginning of last spring, Lilienthal's experiments had taken a new departure. He had gradually come to the conclusion that the surfaces employed by him were not sufficient.

With a surface of twelve to fourteen square meters he could take sufficiently long flights to serve his purpose of observation and practice in strong, gusty wind, but he very rightly considered experimenting in a strong wind to be too dangerous, and with a light breeze about twenty square meters were found necessary. This enormous surface, however, could not be handled with the same certainty and exactness as the older wings, and as his system of steering consisted in shifting his weight within the surface upon which it was suspended, he had hit upon the simple expedient of placing two surfaces one above the other.

This system promised from the beginning to be a very marked advance. In former days Lilienthal had tried, over and over again, to make small paper models that would soar like birds, and had always been disappointed. Now this problem seemed to be solved. These two-story models, which resembled beetles rather than birds, soared in the most astonishing manner. He would let them off from the top of the artificial cone which he had erected at Lichterfelde, and they would take long and sometimes circuitous flights into the surrounding fields, and never showed the slightest tendency to take "headers"—a peculiarity very frequently hitherto observed in soaring models.

These experiments, therefore, seemed to prove that not only would a two-story surface be more easily steered, because a definite shifting of the center of gravity to one side would have a more marked effect (since the lateral extension of the whole structure was little more than half of that formerly used), but would also show a greater stability, a result all the more to be expected, as the center of gravity of the system was placed more than a meter below the upper surface.

Experiments, which were begun without loss of time, seemed to bear out this conclusion. Lilienthal appeared to have suddenly gained in power and in the faculty of shaping his motion at will. It seemed to be only a question of time or opportunity that the great step would succeed of describing a complete circle in the air (which always appeared to us to be the key to a definite, if not complete success), when the disastrous accident occurred which has cost the bold experimenter his life.

The following is, as nearly as I can remember it, the report of the mechanic who used to build Lilienthal's wings, and to help him with his experiments.

On Sunday, August 9, Lilienthal had gone out to the village Rhinow, where he used to practice on the bare sand hills in the neighborhood. Nobody was with him except his mechanic. The weather was exceptionally favorable, a light wind blowing from the east with a velocity of about 5—6 m. per second.

Lilienthal had selected one of these new two-story surfaces, which, in a considerable number of trials from the artificial cone in Lichterfelde, had shown itself to be especially successful. He took one flight, by way of warming to his work, and then prepared himself for a second, and gave the word to his man to look at his watch and note the duration of the flight. The man saw him soar down until he was nearly above the foot of the hill, then suddenly a gust of wind set in, lifted him up to a height of 30 m. above the ground—according to his man's estimate—and there he stood apparently motionless in the air.

This was a frequent occurrence, and gave no cause for alarm at first; but now the man saw how Lilienthal gradually lowered the fore edge of his wings more and more without obtaining the desired effect of getting way forward and downward. The man felt uneasy at this, pocketed his watch, and began to run toward the spot where his master was hanging suspended in midair. Suddenly he saw the apparatus heeling over forward still more, and then Lilienthal came down with it with great force head foremost, rolled over once or twice after striking the ground, and remained motionless.

When the man reached the spot, he found the apparatus much shattered, but Mr. Lilienthal apparently uninjured, though without consciousness. The local physician was instantly summoned and at first declared that nothing serious had happened. Lilienthal was brought to the neighboring inn, and within two hours recovered his senses. He seems to have felt no pain, because he immediately declared he would soon get up and continue practicing. However, his arms and legs were lamed. It appears that his spine was fractured.

The man left him to the care of the physician, and took the next train to town to fetch his brother. When the brother came he found that he had swooned again; and he did not recover his consciousness until death set in, which occurred the same night.

By publishing these lines the editor of Nature will, I think, fulfill a duty he owes the scientific world, as well as the memory of a man who, throughout his toilsome life, applied his rare energy, courage, and ability to the solving of a problem which has hitherto baffled the ingenuity of all modern engineering.

Lilienthal, who was a successful engineer and manufacturer, had not lived to see his forty-eighth birthday. He leaves a widow and three children.

Berlin, August 24 A. DU BOIS-REYMOND.

The Bids for the Three New Battleships.

There is matter for congratulation in the fact that there were five separate bidders for the construction of the three first-class battleships recently authorized by Congress; for it proves how rapidly the shipbuilding facilities of the United States are developing, compared with what they were when the reconstruction of the navy was first begun, now some thirteen years ago. The fact that a firm should put in a bid to build an 11,325 ton battleship is evidence that its shipbuilding plant must be thoroughly up to date and capable of turning out the heaviest and highest class of marine work.

It is noticeable that the bids approximate very closely, there being but $85,000 difference between the highest and lowest figures, as against a difference of $285,000 in bids for the Oregon class of battleship in 1890; which goes to prove that our leading firms have acquired familiarity with this difficult class of construction, and have no unforeseen contingencies to provide against. Another noteworthy fact is that the cost of building a first-class battleship is greatly reduced from what it was in 1890. This is shown in the case of the Cramp's Shipbuilding Company, which is now offering to build an 11,325 ton ship for about half a million less money than they asked for the construction of a 10,288 ton ship in 1890; the figures being $3,180,000 for the Indiana of 10,288 tons in 1890, and $2,650,000 for the new ship of 11,325 tons in 1896.

The contracts were awarded as follows: One to the Newport News Dry Dock and Shipbuilding Company for $2,595,000; one to the Union Iron Works, of San Francisco, for $2,674,950; and one to William Cramp & Sons Ship and Engine Building Company, Philadelphia, for $2,650,000. Other bidders were John H. Dialogue & Sons, Camden, N. J., $2,661,000, and the Bath Iron Works, Bath, Me., $2,680,000. The Union Iron Works secures one of the ships by virtue of an allowance of 4 per cent, which is made to cover the cost of transporting materials of construction across the continent.

The new warships will embody the best features of the three types of battleships already built or building for the navy, viz., the Indiana, the Iowa and the Kearsarge. They will have the heavy armor of the Indiana, the high freeboard and weatherly qualities of the Iowa and the powerful rapid fire battery of the Kearsarge. It will be noted that the 8 inch guns of the Indiana and Kearsarge type are wanting, but as an offset to this the new ships will carry a powerful battery of fourteen 6 inch rapid fire guns; and, while many admirers of our present ships will regret the absence of the 8 inch guns, it must be admitted that the change is in agreement with modern practice, and that it is warranted by the effective work done by the heavy rapid fire guns in the late Japanese war.

The general dimensions and principal features are: Length on loadwater line, 368 feet; beam, extreme, 72 feet 2·5; freeboard, forward, 19 feet 6·9; freeboard, aft, 13 feet 6; normal displacement, 11,325 tons; mean draught normal displacement, 23 feet 6; indicated horse power (estimated), 10,000; speed in knots an hour (estimated), 16 knots; normal coal supply, 800 tons; and total bunker capacity, 1,200 tons.

The main battery consists of 4 thirteen inch and 14 six inch rapid-firing breech-loading rifles, and the secondary battery of 17 six pounder and 4 one pounder rapid fire guns, 4 machine guns, and 1 field gun. Four above-water torpedo tubes are placed two on each broadside, amidships, and will fire through an arc of 60 degrees.

The main turrets for the 13 inch guns carry 15 inches of Harveyized armor, and the 6 inch battery, of which four guns are mounted on the upper deck and ten on the main deck, is protected by six inches of the same armor. The waterline belt of Harveyized steel will be 7½ feet deep and 16½ inches thick. The protective deck will be 2¾ inches thick and will be continuous from stem to stern. The engines will be of the usual triple expansion marine type, and steam at 180 pounds pressure will be supplied by eight large single-ended boilers.

There will be no speed premiums; but a penalty is imposed at the rate of $25,000 for each quarter knot that the ship falls below the contract speed of 16 knots an hour.

A MEDAL, called the Neumayer medal, will be conferred soon by the Berlin Geographical Society on persons who have distinguished themselves in geography or meteorology, in honor of the seventieth birthday of Prof. George Neumayer, who, after having been director of the Melbourne Observatory, has since 1870 been at the head of the Marine Observatory at Hamburg.

How Roquefort Cheese is Made.

It is supposed that hundreds of years ago the south of France was disturbed by volcanic eruptions, which slit up the ancient granite rock, causing streams of lava to flow from them. The new surface consists of basaltic rock, which in its turn was fissured by eruptions and thrown up on a mountain range. The whole of the interior of a mountain was thus formed into caverns and caves, which belch forth hot sulphurous springs. It is here that the celebrated Roquefort cheeses are made.

The village of Roquefort is situated on the Mountain Larzac, which is about twenty-five miles in length and nearly 3,000 feet high. It consists chiefly of limestone, covered with sufficient pasture to feed the 300,000 sheep kept for their milk. The caves, being formed by the displacement of rocks, consist of an intricate labyrinth of open spaces and passages connected with each other and with a subterranean outlet. A cool current of air, therefore, always of the same humidity and temperature, flows in a never interrupted stream through the caves.

There is nothing in the milk or in the preparation of the cheeses that gives them that peculiar flavor and delicious mellowness for which they are so renowned. This is entirely effected by the method by which they are cured.

When the cheeses are ready for treatment they are taken to the caves, and after being allowed to cool are carried to the salting room. They are rubbed with salt on one face and then piled on the top of each other until the cave is full. After standing for twenty-four hours or so, the reversed side is salted, and once more they are piled up as before. The cheeses have to be frequently reversed, in order that the moisture may be even throughout, and to develop the fungus which has previously been sown in the curd.

In forty-eight hours the cheeses become viscous, and are rubbed with a coarse cloth. In the course of another two days the fungus will appear on the outside, in the form of a sticky paste. This is carefully scraped off with knives, together with a thin stratum of crust, and set aside for food.

The cheeses are now sorted out; the most solid ones placed on the floor. In eight days' time they become covered with a yellowish red mould, together with other minute vegetation, which is removed and given to the pigs. The scraping is continued until the character of the mould changes, showing that the curd has altered its condition, and announcing the completion of the cure. Then they are again carefully scraped and wiped, and wrapped in tinfoil, and are ready for the market.

Roquefort cheeses have been cured for centuries by this process, and stand as a triumph of uneducated art.—Commercial Gazette.

Protective Sounds and Colors.

In the July number of Natural Science, Mr. R. I. Pocock describes the stridulating organ in the Indian and African scorpions and argues that it is protective in character. He writes: "Since the organs that have been here described are equally well developed in both males and females, and appear in the young long before the attainment of maturity, there is no reason to suppose that they are of a sexual nature, serving, like the chirrup of the cricket or the call of the cuckoo, to inform the one sex of the whereabouts of the other. If this were the case we should expect to find, first, that the organs were exclusively confined to one sex, or, at all events, better developed in it than in the other; and, secondly, that they put in an appearance either just before or simultaneously with the reaching of the adult stage. Again, in spite of the opinion of many authorities, who maintain that the existence of a sound-producing organ implies of necessity the existence of an auditory apparatus in the same individual, we can only assert again that there is not a particle of evidence that either the large spiders or the scorpions can hear the sounds that their own stridulating organs emit. All the available evidence goes to show that in these groups of arachnids the organ is brought into use when its possessor is under the influence of irritation or fright, exactly as in the case of the rattlesnake's rattle. Like the snake too, both the scorpions and the spiders are furnished with highly developed poison glands, and it is a well known fact in natural history that animals so gifted are frequently rendered conspicuous by bright and staring colors, so that they may not be destroyed by carnivorous creatures in mistake for other harmless and edible species. Nature, in fact, for purposes of protection, has labeled them with her poison badge; and apparently with the same end in view, she has supplied the rattlesnake and the large spiders and scorpions with a sound-producing apparatus, which, when in action, serves as a danger signal to meddlesome intruders, warning them to beware of hostile interference."

On the other hand, it appears from experiments made by Mr. Frank Finn, says Science, that the lizard eats indiscriminately plain colored and bright colored butterflies, the supposed protective coloring not being of use in this case.