SCIENTIFIC AMERICAN

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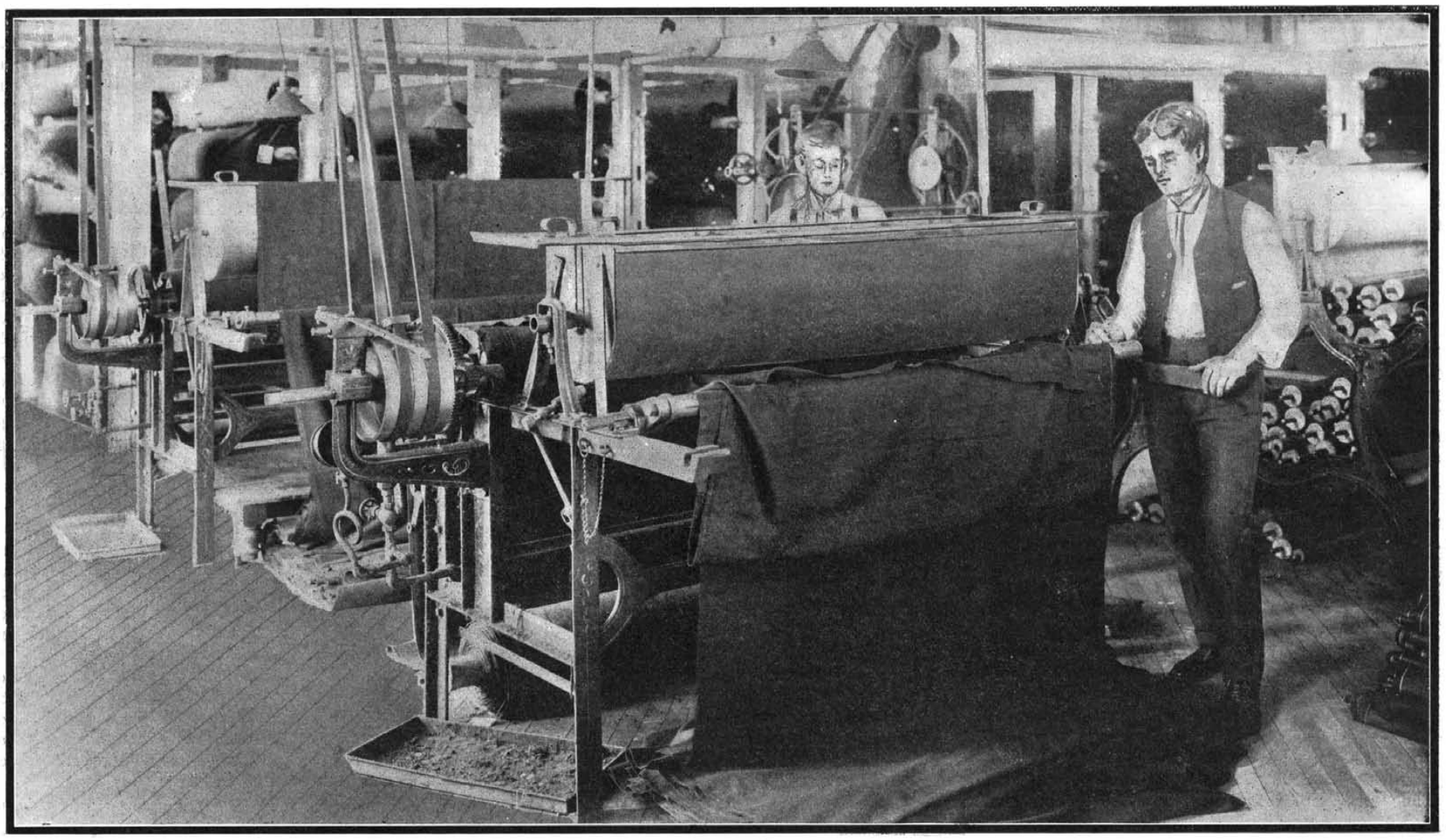
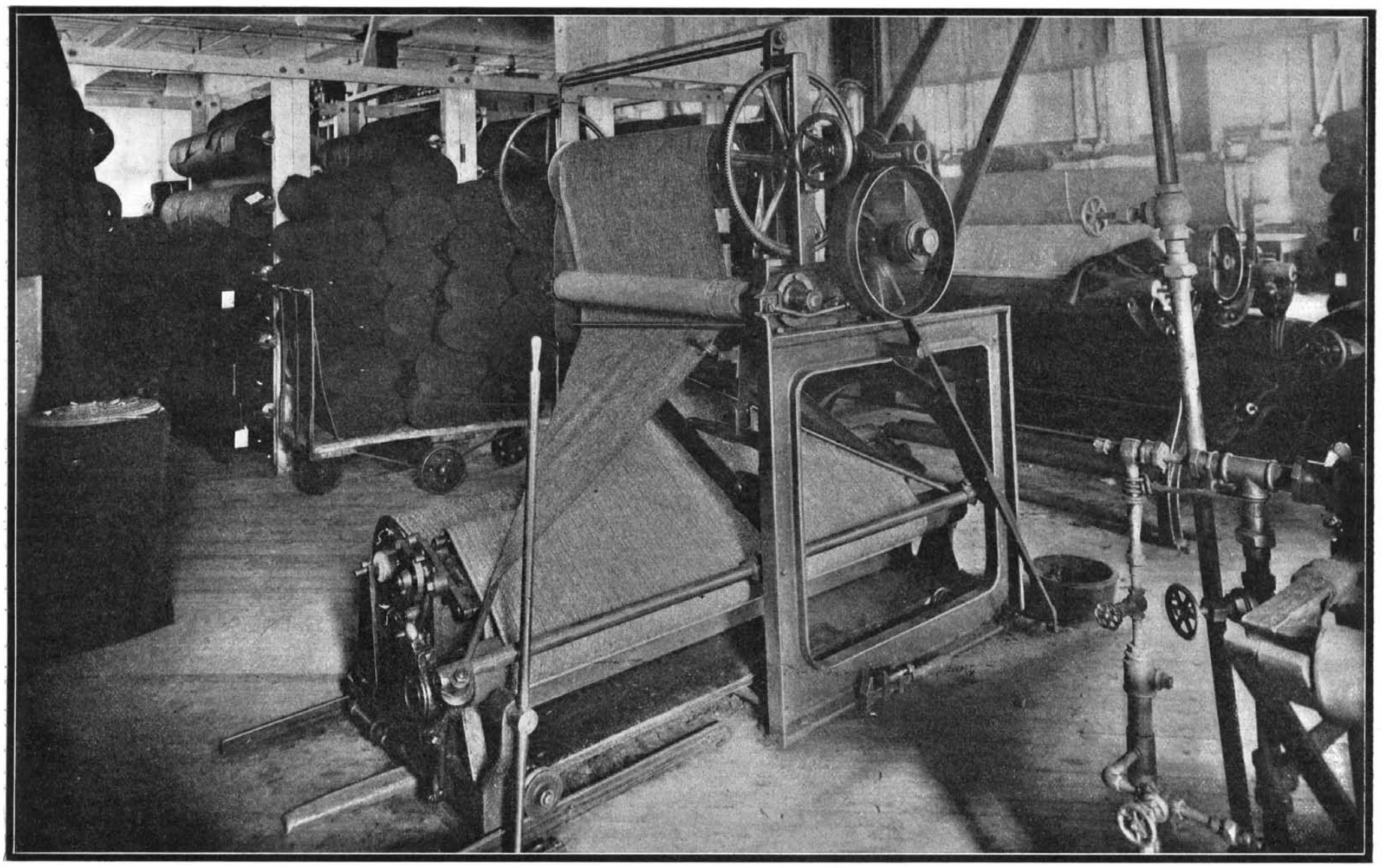


Cloth "Sponging" or Shrinking by the Aid of Live Steam.



Cloth-Folding Machine for Doubling the Cloth.

THE MANUFACTURE OF CLOTHING AS CONDUCTED ON A VERY LARGE SCALE.—[See page 404.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, MAY 21, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

REAR COLLISIONS ON CITY RAPID TRANSIT SYSTEMS.

The recent rear collisions on the elevated railroads of New York and Brooklyn are a forcible illustration of the increased risks, which are inseparable from the higher speed of travel and the greater frequency of trains resulting from the introduction of electric traction. Most of the collisions of the past twelve months have occurred on the Brooklyn lines, where the operation is notoriously careless. On the Manhattan elevated lines, considering their far heavier traffic, there has been a remarkable and most commendable freedom from accident—remarkable, because we doubt if there is any railroad system in the world, where trains, with a running speed between stations that rises at times to 30 miles an hour, are run under a headway so close, that in the rush hours there will be sometimes not over a car's length between two trains at the stations. The trains are not merely faster, but heavier; and were it not for the wonderful efficiency of the Westinghouse air brake, which was installed at the same time that the elevated railroads were electrically equipped, rear collisions would be a frequent occurrence. Tribute also is due to the motormen, most of whom are engineers carried over from the days of steam service; for it is evident that under a service so swift and crowded, a few moments' hesitation or neglect would precipitate a disaster.

The recent accident at Fifty-ninth Street, on the Third Avenue line, resulted in the telescoping of two cars, and the death of the motorman. That a score of people were not killed and wounded is due to the fortunate circumstance that the collision occurred at an hour when traffic was light. The immediate cause of the collision is a mystery; for it seems that after the accident the controller and the air brakes were found to be in good order. An eyewitness claims that just before the collision occurred, he saw the engineer of the second train gesticulating wildly, as if to warn people in the train ahead; but why he did not apply his brakes or turn off his controller is a question that is puzzling the authorities. In spite of the remarkable immunity from accident of the electrically-operated elevated lines, we are of the opinion that the trains should be operated by some system of block signals of an automatic character, which, while it would allow two trains to be between the same two stations at the same time, would still automatically serve to shut off the current and apply the brakes should the trains approach within less than say three train lengths of each other. To introduce a block signal system in which the blocks occupy the full length between stations, would be to cripple the capacity of the line, and indeed blocks of this length would not be necessary. At the speed at which the local trains are operated, it would be sufficient to divide the space between the nearer stations into two blocks, and that between the more distant stations into three blocks. To render the system fully effective, there should be a trip provided at the danger signal, to automatically apply the Westinghouse brake, should a train run past the signal. It is gratifying to know that the Subway trains are to be operated strictly on the block signal system; and the experience obtained by the company after a few months' operation of the Subway should render it a simple matter for them to install an automatic block signal adapted to the conditions that obtain on the elevated roads.

ECONOMY OF NARROW-GAGE RAILROADS.

We have recently received from a correspondent in the West Indies a letter asking for advice regarding the proposed construction of a branch railway to extend through a somewhat hilly country into a region of plantations, the particular point upon which information was sought being the old question of the broad versus the narrow gage railroad. It seems that our correspondent was desirous of having a narrow-gage road constructed, being under the impression that a great economy would be realized thereby over a road of the standard gage of four feet eight and a half inches. The engineers, who had reported in favor of a standard gage road, stated that the cost would be but little greater, and that with a road of standard gage, it would be possible to have an interchange of cars with the main line, and freight could be shipped through from the plantations to the docks without any intermediate handling. This and other advantages were supposed to more than outweigh the very slight reduction in cost obtained by building the road of narrow gage. Our correspondent could not understand that the narrow gage could cost so little less per mile than standard gage, as to render the saving entirely wiped out by the many limitations and disadvantages of the system.

Now, the railroad engineers of the United States have had considerable experience, especially in Colorado, with narrow-gage roads, which have been tested for both freight and passenger, slow and high speed service, with the result that after a certain number of years of operation, it has been established that the cost of construction and the cost of operation are so slightly increased for a standard gage road, as to render it good policy, where there is any prospect of a reasonable amount of traffic, to build on the standard gage system. As regards construction, the mere saving of eighteen inches of width throughout the whole length of the line cannot be taken by a rough-and-ready method of calculation as insuring that the road can be built for one-third less cost. As compared with the standard-gage road, the cost of location will be the same; the amount of contractor's plant which must be transported to the scene of the work will be about the same; there will be the same number of rails to the mile; the same number of rail joints, bolts, and spikes; and the same number of ties, although the latter, it is true, will be some eighteen inches shorter; there will be the same amount of equipment in the way of switches, signals, telegraph lines, etc., and the section gangs for the maintenance of the line must be approximately of the same strength. It may be taken for granted that, except under very special conditions, it will be found advisable to build to standard gage.

On the other hand, there is undoubtedly a great field open for the construction of light railways that are not intended to handle traffic of the amount, or at the speed, aimed at in the narrow-gage railroad; and we believe that as soon as some well-thought-out system of single-rail track and equipment is placed upon the market, and given practical demonstration under normal working conditions, we shall see a great development of this form of railway.

RESULTS OF THE GERMAN ANTARCTIC EXPEDITION.

An interesting lecture was recently delivered before the Royal Geographical Society of Great Britain by Dr. von Drygalski, of the German Antarctic Exploration, narrating some of the most important results achieved by that expedition.

The German South Polar Expedition was absent altogether twenty-eight months, of which fourteen months were passed in the South Polar ice, ten months with operations in the South Atlantic and South Indian oceans, and four months with work and residence in the islands of the Indian and Atlantic oceans and at the Cape. The vessel "Gauss," although not a fast sailer, had proved a remarkably strong and seaworthy ship, her lines being well suited to the conditions of polar work.

Dr. von Drygalski explained the researches of the expedition in the vicinity of Kerguelen and Heard, on both of which the glacier development was discovered to be considerable. In the former region they stayed a month. A branch station was here established, for the purpose of carrying out terrestrial, magnetic, and meteorological observations while they remained in the Antarctic waters. After leaving these places, the great unknown lay before them, and they had to seek out the right course, which, in the almost complete lack of previous experiences, was practically a question of pure luck. He chose the Kerguelen route, for south of that part, between 60 deg. and 100 deg. east of Greenwich, there lay before them an Antarctic region, where hitherto no serious advance had been attempted, and where were consequently concealed many debatable problems. They found a seaboard trending east and west just a little south of the Antarctic Circle, and consequently forming a bar to further progress southward. For a portion of the unknown space between Knox Land and Kemp's Land —a stretch of over six hundred miles—a land connection was definitely established.

Pushing southward, they came in view of land never before beheld, never before set foot on. All was ice-clad. The coast itself was a high vertical wall of ice, too steep to be approached, in whatever direction they turned their eyes. A landing on this icy barrier was out of the question, and the explorers accordingly resumed such operations as, in the absence of ice-free tracts, might lead to some conclusions regarding the substratum of the ice-cap—that was, the character of the land itself.

The expedition now followed the coast westward in the direction of Kemp's Land, in order to see in what way was filled in the unknown gap between Knox and Kemp's lands. The ship soon became icebound, and remained fast for the rest of the twelvemonth. On the hummocks surrounding them, however, the expedition was able to carry out even the most delicate observations without disturbances of the level. Frequent storms and gales raged, the ship feeling the shocks, and constantly heaving over under the fearful strain. Numerous expeditions on sleighs were made from this central point, which occupied altogether five months. Records were taken of the phenomena of motion presented by the inland ice; stones were collected, lichens and mosses were also found; the nesting places discovered of one of the two species of stormy petrel in the Austral glacial sea. Many interesting facts were brought to light, amply rewarding the great expenditure of five months' time and efforts.

Suddenly, in January, 1903, the icebergs which had closely encompassed the "Gauss" began to drift northward, and on February 8 the ship was liberated by the ice suddenly breaking.

The results of the expedition, Dr. Drygalski pointed out, could not be comprehensively surveyed until the whole material and copious collections, all of which had been brought in good condition, were classified and made accessible. It might, however, be already affirmed that the "Gauss" expedition achieved everything in the region assigned to it that it was possible to accomplish in the time available. It had discovered a new land, and thereby cleared up an old contested question regarding the nature and extent of the Antarctic continent for over ten degrees of longitude, certainly for about half of the debated region between Knox and Kemp's Lands, and perhaps for the whole. At least for the actual determination of the westerly tract, observations were now at hand by which light might be shed on the specified question. An important factor was the steep fall of the land down to a deep sea discovered by the explorers; important also was the structure of the land, which consists of old crystalline rocks; lastly, it was important to find that this margin of the continent was occupied by a volcanic formation, whose lavas contain molten gneisses, which had been forced up with them from the bedrock. The inland ice covering the continent presented a picture of our former Ice Age, and was undoubtedly the vastest glacial area now existing.

THE CATALPA TREE.

How a forest of extremely valuable timber may be grown in a score of years, and made a source of profit within six to eight years, will be demonstrated in an interesting exhibit at the World's Fair.

This exhibit will be made under the auspices of the International Society of Arboriculture. John P. Brown, secretary and treasurer of the association, has consulted with the chiefs of departments at the World's Fair and has made all arrangements.

That particular variety of the catalpa tree known as Speciosa will be the basis for this exhibit, and the great value and adaptability of this wood will be shown in all forms. The catalpa is indigenous to the Wabash bottom lands in Illinois and Indiana, but may be grown in any section of the United States. The tree is known nearly everywhere, but its great value is just beginning to be understood. Nearly every boy knows the tree because of the long and slender seed pod, which when dried burns much like tobacco, and is often known as the "lady cigars."

It is the worth of the timber, and its marvelously quick growth, that is destined to solve the problem of future railroad building, and furnish a supply of lumber for all purposes.

In the World's Fair exhibit a section of railroad will be built showing the adaptability of catalpa timber for ties. Old ties, that have been in use for thirty-two years, and not yet showing any signs of decay, will be shown. When it is shown that the average life of an oak tie is seven years, the catalpa's value on this line is demonstrated. There will be telegraph and telephone poles that have been in use as long, and fence posts will be exhibited that can be proven to have been in use for one hundred years.

Not alone for these purposes is the wood of the catalpa valuable. A prominent Dayton, O., car-building plant will exhibit a section of a palace car, all of the timbers of which, inside and out, are of catalpa wood. The timber possesses all of the requirements for such work, being strong and susceptible to a fine finish. After it has been placed in the finish of a palace car, it is often mistaken for oak, chestnut, or cherry. Furniture factories will also exhibit fine chairs, desks, and other furniture made from this wood.

The Arboriculture Society's exhibit will not stop with showing the varied uses to which the lumber from the catalpa tree may be put, but it will show how the catalpa forests may be grown anywhere within a very

few years. The seed are planted in good, rich garden soil, and in a short while they spring up. The young shoots should be transplanted within a year, for the roots reach out in every direction, and the best results are obtained from early transplanting. The trees should be set out in spaces of eight feet in either direction. The growth is exceedingly rapid, being uniformly one inch in diameter for each year. At the end of the sixth year the trees have attained a diameter of six inches. Then it is best for the trees to thin them out, cutting down each alternate row, and then each alternate tree in the rows that remain. This leaves the trees standing sixteen feet apart.

The trees that are cut may be used for posts and ties, and then the forest yields a fair return during the thinning process. "Pole ties" from oak trees are practically valueless, because of the sap in the latter years' growth of the tree. The wood that contains the sap soon decays, and this contaminates the rest of the timber. There is practically no sap in the catalpa, and "pole ties" from this wood last an indefinite number of years.

After the thinning-out process, the growth of the tree continues at the uniform rate of one inch in diameter each year, and catalpa trees at eighteen years old often reach as high as one hundred feet, thus yielding a large return of splendid lumber.

Among the large railroad systems to recognize the importance of tree planting in order to guarantee a supply of ties for the future is the Illinois Central. At a point near Du Quoin, Ill., two hundred thousand catalpa trees were planted three years ago, when President Stuyvesant Fish became interested in the work of the Arboriculture Society. These trees are thriving now, and in a few years, when the thinning-out process begins, many of the ties in the Illinois Central Railroad will be cut from this forest created in the heart of the vast Illinois prairie. The same road is planting similar forests in Mississippi, and contemplates the establishment of others.

ILLUMINATION OF THE WORLD'S FAIR.

BY ROBERTUS LOVE.

It was a rare occasion when first the bud of electric illumination at the World's Fair burst into blossom; and since that first night of informal rehearsal, every time that the lights have been turned on has been a rare occasion to those privileged to be present. Now that the public may enjoy this illumination each evening, the long-anticipated delight of the spectacle is being realized.

It is best to see the illumination at first from a considerable distance. One should get his first glimpse of this magnified fairyland from the outside of the grounds, or at any rate from a point a mile or so away from the "main picture," which is the center of illuminative features. The night should be dark, with neither moon nor stars visible, but free from clouds, so that the lights be not dimmed by the misty haze.

Riding around a curve on a trolley car, or topping the brow of a hill, one suddenly becomes aware of something wonderful in the distance, a mighty bouquet of light blossoming out of the darkness. For half a mile the flowers of light sparkle in the murk—clear, clean-cut, golden. The distance not only lends enchantment to the view, but mellows the lights to a soft glow soothing to the eyes. One beholds, glowing through the darkness, long lines of little lights, broken here and there into fantastic designs. Now a huge star breaks out, made of many lights. Yonder is circle after circle of gleaming brilliancies, far up in the sky. Still higher up is outlined a skeleton framework of lights, and you know that it is the illumination of a tower, though you see nothing whatever of the tower itself.

Lower down are parallel rows of lamps, in parallelogram form, leading hundreds of yards horizontally and sixty or seventy feet perpendicularly, the perpendiculars crossing the other lines at frequent intervals, and ending in circles and diamonds and squares and crosses. You know that this is the outline of one of the mighty exhibition palaces, but you see nothing of the building itself. A glorious archway in electric lights marks a main entrance, and overhead a curious arrangement of lamps suggests a gigantic statue or a mighty pediment of reclining figures, though there is nothing visible of the statuary staff.

If you are familiar with the shapes of the buildings, you can distinguish one from another by these lights. The classic pillars on the colonnades of the Palace of Varied Industries flash themselves into fiery outline. The massive plyons at each end of the Palace of Transportation are heralded in the living language of the lamps. The Palace of Electricity is a gleaming telltale ghost of its own glories of architecture.

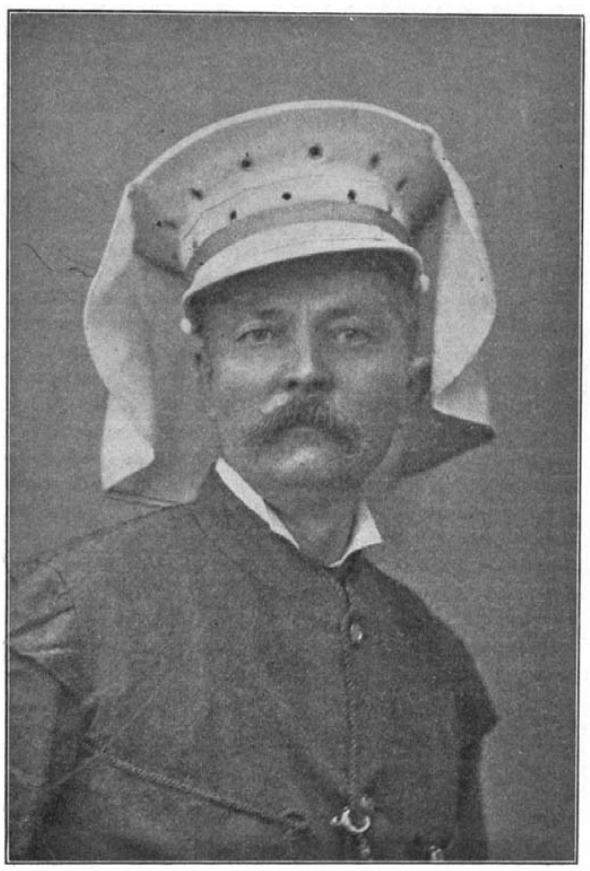
Yonder, high up on Art Hill, rises in lines of lights converging to a common center, the illumination that marks Festival Hall and its wonderful dome, and just below are the great fountains and the Cascades, leading down to the Grand Basin and the lagoons, which are spanned by bridges outlined in electric glow. At each side on the hilltop lights lead the vision along the Colonnade of States to the towering twin pavilions with their lesser domes flanking Festival Hall.

Away down in the center of the bouquet of brilliance you behold a single flower rising above the rest, and you know that the name of this slender stalk is the Louisiana Purchase Monument. It is time now that you come nearer to the picture. As you approach, the darkness gradually melts from the vicinity of the little lamps, and you perceive the ivory-tinted exteriors of the huge buildings, glowing in the light of thousands of lamps. Stepping into the edges of the main picture, you are entranced by the scene. Lagoons and plazas and broad thoroughfares for promenade are made as bright as day. Thousands of people pass along the promenades, stand upon the bridges, or float in the many gondolas.

DEATH OF HENRY M. STANLEY.

Word has been received from England of the death on May 10 of that great African explorer and colonizer, Henry Morton Stanley. Following the lead of Livingstone, in relieving whom he first started to explore the "dark continent" in 1871, Stanley spent the best years of his life traveling through tropical jungles and tracing out lakes and rivers in the very heart of Africa, and to him is due the credit for solving her most puzzling geographical problems.

Stanley's life history reads like a romance. Born of Welsh parentage in 1841, his father, John Rowlands, dying when he was but two years old, the lad took to the sea at the age of sixteen, and worked his passage on a sailing vessel to New Orleans. Here he obtained employment from a merchant named Stanley,



THE LATE SIR HENRY MORTON STANLEY.

who befriended him, and whose name young Rowlands assumed in recognition of many benefactions. When the civil war occurred, he enlisted in the Confederate army, and he was taken prisoner at the battle of Shiloh. He escaped, however, and returned to his Welsh home. The next year (1863) he returned to America, and joined the Federal navy. He served on the flagship "Ticonderoga," soon attaining the position of secretary to the admiral, and afterward, on account of great gallantry in swimming 500 yards under fire and fixing a line to a Confederate steamer, he was made an officer. After the war he left the navy, and engaged in work as a newspaper correspondent. In 1868 he accompanied the British expedition to Abyssinia under Sir Robert Napier, acting as correspondent of the New York Herald. The following year the same newspaper sent Stanley on a trip through various countries of the East, and in February, 1871, he left Zanzibar with two hundred men in search of Livingstone. On November 10 of that same year, he found Livingstone at Ujiji, on Lake Tanganyika, in an almost helpless condition. After nursing him back to health, and making some explorations with him around the northern end of the lake, Stanley returned to Europe the following year. In 1873 he went to West Africa, to report the campaign against the Ashantis.

The death of Livingstone in Africa on May 1, 1873, and the interment of his remains in Westminster Abbey in April of the following year, made Stanley once more eager to attack the problems of the "dark continent." He was again sent out by the New York Herald and the London Daily Telegraph, and he left Bagamoyo, near Zanzibar, with 356 men (including three white men) on November 12, 1874. The first great work he accomplished was a boat survey of the shores of the Victoria Nyanza. Following this he discovered Lake Albert Edward, and found it to be one of the head reservoirs of the Nile. He also found the Kagera, or Alexandra Nile, to be the main source of supply of Victoria Nyanza. In 1876 he sought in vain the outlet of Lake Tanganyika, as the level of this lake was then too low for water to flow through its outlet, the Lukuga, into the Congo. Although the expedition was greatly depleted by fever and smallpox, the intrepid Stanley traveled westward to Nyangwe on the Lualaba, which Livingstone and Cameron had visited before, and then he determined to follow the river to its mouth. Fighting his way westward through tribes of ferocious cannibals, he succeeded in making the 1,500-mile trip on the river which, upon his arrival at Boma, August 9, 1877, he found to be the Congo. This was Stanley's greatest discovery, for he proved that the Lualaba and the Congo were one. The journey cost him his three white companions and 170 porters, and he was exactly 999 days from the time he left Bagamoyo until he reached Boma.

Early in 1879 Stanley again went to Africa, this time for the purpose of founding the Congo Free State, making treaties with the natives, and planting stations on the Congo from Vivi to Stanley Falls, about 1,300 miles up the river.

Stanley remained five years in Africa this time, in order to accomplish his mission. He made treaties with 450 native chiefs, and in order to reach the upper part of the river, his native porters had to carry all his supplies and steamboats in sections for 235 miles around the rapids.

The great explorer made his final crossing of Africa during the two years from 1887 to 1889. This time he conducted an expedition in aid of Emin Pasha, the Governor of the Egyptian Soudan, who had been cut off by uprisings of the natives from communication with the civilized world. Ascending the Congo as far as its tributary, the Aruwimi, Stanley followed this river to its source, and then cut his way for months through well-nigh interminable tropical forests to the Albert Nyanza, which he finally reached December 13, nine months from the time he started. So hard had been the journey, that 215 out of 389 natives that began it with Stanley, perished on the way, while the 174 that were left were mere skeletons. In April, 1898, Emin Pasha appeared at Stanley's camp on the shore of Albert Nyanza. The explorer then retraced his steps through the great forest, in order to bring back from the head of navigation of the Aruwimi, a detachment of men which he had left there. Taking with him the few he found alive, he fought his way through the 250 miles of jungles for the third time, and again joined Emin Pasha in January, 1889, and conducted him to Zanzibar. In this expedition Stanley made his second journey across the continent, and, besides discovering the extent of the great forest, the water connection between Lake Albert Edward and Albert Nyanza, and the snow-capped Ruwenzori mountain chain that separates them, he accomplished the main purpose of his expedition—the finding of Emin Pasha.

Stanley's success with the natives in Africa was largely due to his patience, kindness, and tact. On account of these qualities, he was able to inspire confidence and win friendships readily. His planting of colonies on the Congo, and opening of this great highway to trade, was one of his greatest achievements, while the previous tracing of this great river from its scurces to its mouth—which is graphically described in "Through the Dark Continent"—was undoubtedly his greatest. The finding of Emin Pasha terminated his life of exploration. After returning to England, of which country he became a naturalized citizen in 1892, he was made a Knight, and he devoted his time to writing of his travels. "In Darkest Africa," "My Dark Companions," and "Through South Africa" are the titles of some of his best-known later works. Sir Henry married Miss Dorothy Tennant, the artist, in 1890.

A movement is on foot to inter the body of the great explorer beside that of Livingstone in Westminster Abbey, and it seems to us that no more fitting place could be found than one beside that first great African missionary and explorer, whose work Stanley so largely completed.

The industrial development of Brazil is likely to be greatly enhanced by the recent discovery of coal measures in that country. The monthly bulletin of the International Bureau of the American Republics for last September reports that there has been discovered in Brazil, at a place called Cedro, in the township of Imbituba, State of Parana, a great deposit of coal. The coal-bearing area extends over 3,000 hectares (7,000 acres), and the samples taken from the upper strata were classified as "fat pit coal." These coal fields run through the center of Parana due north and south, and seem to be the continuation of the veins that traverse the States of Rio Grande do Sul and Santa Catharina.

THE DISTILLATION OF SEA WATER AT SUAKIM.

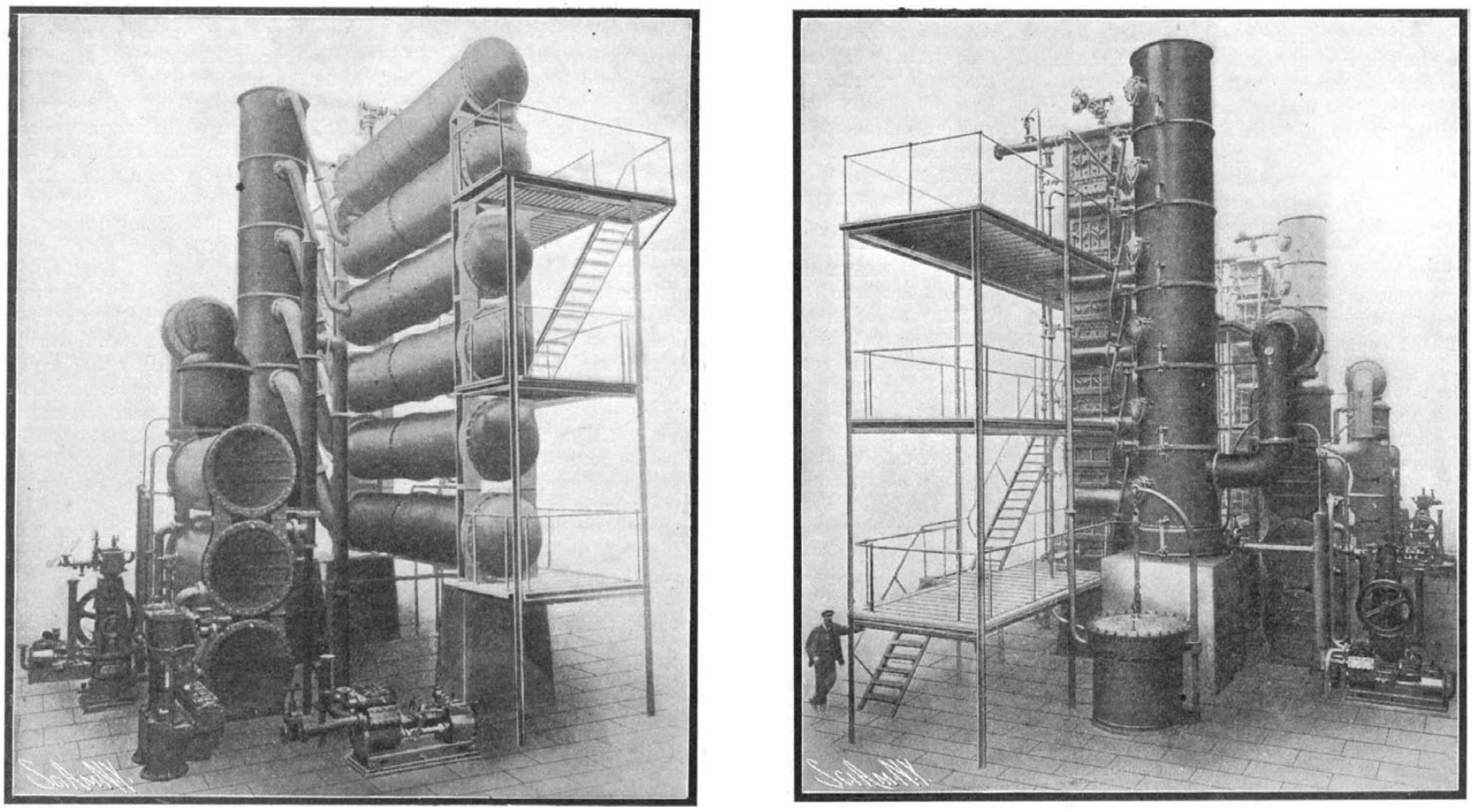
BY OUR BELGIAN CORRESPONDENT.

The Egyptian government has recently installed at Suakim, on the shore of the Red Sea, two very large plants, one for the distillation of sea water and the other for the distribution of fresh water, not only for individual consumption, but also for the supplying of locomotives and steam generators. The plants were installed by the Mirrlees Watson Company, of Glasgow, which had already done work of the same character at Kossier, Camaran, Mombassa, and elsewhere. Each of the two installations is designed for the daily furnishing of 350 tons of pure water. Each pound of coal burned should produce 45 pounds of pure water.

The distilling apparatus are of the well-known Yaryan multiple evaporation type. There are two sextuple-acting distillers, besides auxiliary and air pumps, surface condensers, and feed-water heaters. Each apparatus is warranted to give a daily discharge of 350 tons of potable water. The steam produced in the first part of the apparatus serves for partially heating the second, and so on. The pressures are 40 pounds to the square inch in the first reservoir and 27 inches of vacuum in the last. Each apparatus is provided with an independent battery of boilers, a mechanical salt water filter, and a series of filters for aerating the distilled water before it is sent to the storage tanks.

The salt water is drawn from the sea by the circulation pump. During its passage through the tubes of the condenser, it is slightly heated and is then sent to a reservoir, whence it is forced into the first and second heaters. In the first it is heated by the steam coming from the sixth, and flowing to the condenser. In the second it is heated by the hot distilled water of the sixth, which also goes to the condenser. The feed water then passes into a heating coil arranged upon the bottom of the last part of the apparatus, and afterward ascends through analogous coils into the successive receptacles, becoming gradually heated until it reaches the last, where it is exposed to the heat given off by the steam of the boilers. It passes thence into a special apparatus called a "lime catcher," which is heated directly by a coil coming from the boilers. All the impurities that have not been eliminated by cold filtration, deposit in the "lime catcher" upon a carbon filter. The water is now at its point of ebullition, and in this state it passes through the evaporating coils of the first-acting part of the apparatus.

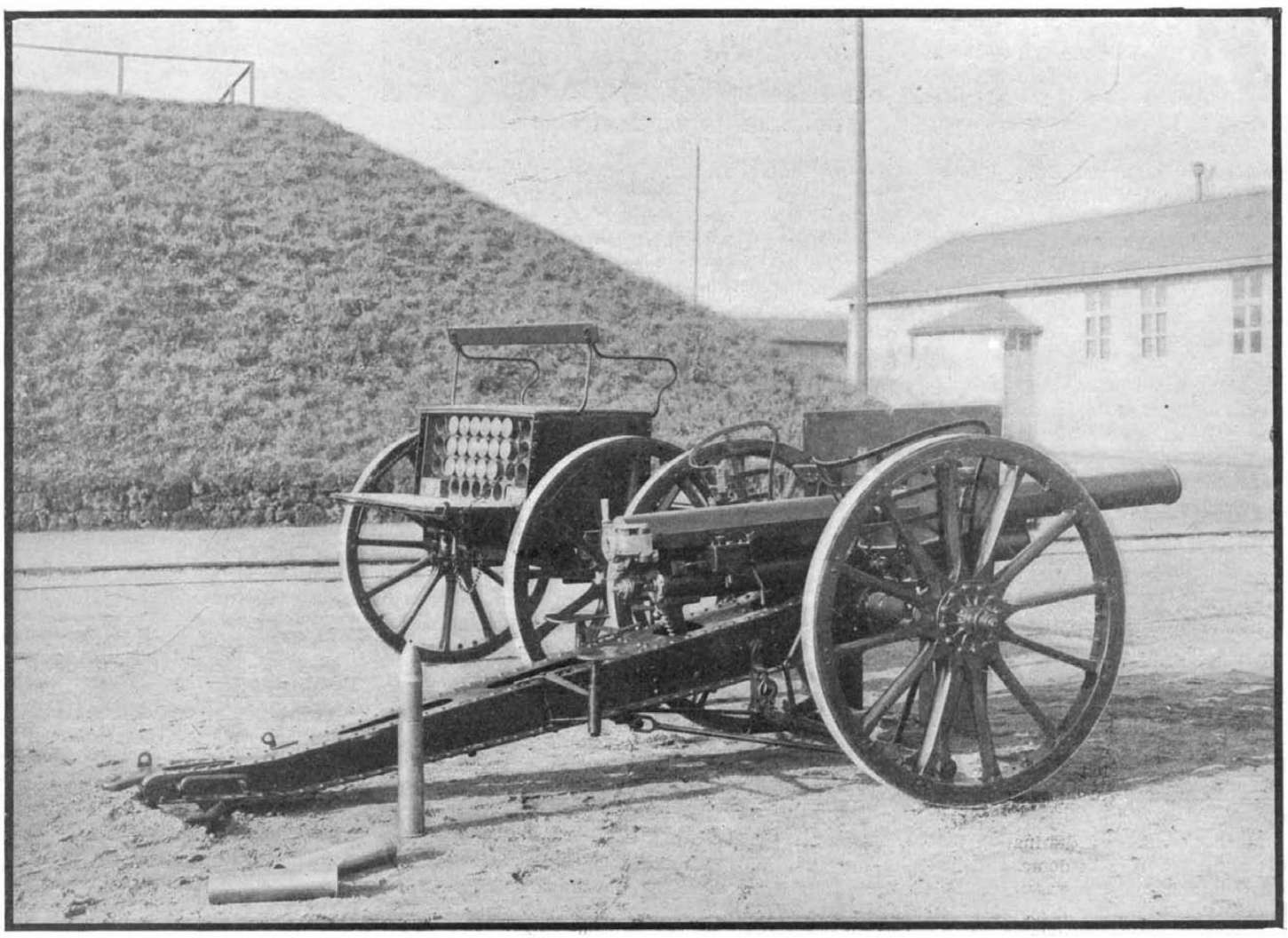
The hot water and the steam then enter the separator. The steam that is produced therein goes to the jacket of the second-acting part of the apparatus, where it is employed anew for evaporating the water taken from the first separator. The same thing occurs with the following acting-parts of the apparatus up to the sixth. What then remains—about 25 per cent of the original volume—is removed by special pump. A large number of cocks and valves permit of regulating the flow of the feed water into the various receptacles, so as to make the system as automatic as possible. A scaffolding is so arranged as to allow of easy access to all the parts and permit of the cleaning of the tubes of the receptacles. These latter are 3 feet in diameter and are provided with bronze tubes 3 inches in external diameter, and 17½ feet in length. The distillation, it seems, may be employed conjointly with machines for the production of pure ice.



TWO VIEWS OF A SEXTUPLE SEA-WATER DISTILLING APPARATUS USED AT SUAKIM.

THE RUSSIAN ARMY AND ITS GUNS.

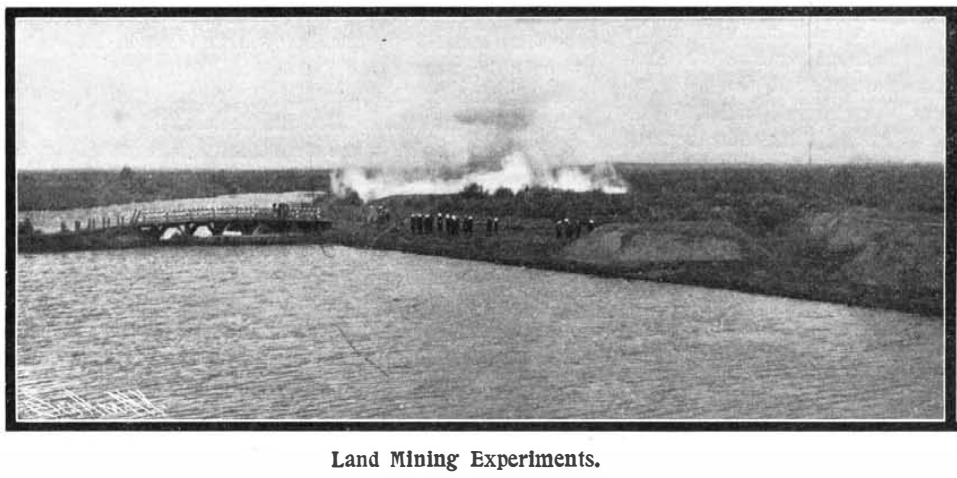
Every year about 850,000 Russian youths reach the age of twenty-one, when they are liable to service either in the Czar's army or his navy. For twenty-two years thereafter they are either under military or naval training, or are subject to a call to arms. The government, however, is quite lenient, and for one reason or another a large number of men are exempted from service. No clergymen, doctors, or teachers need serve. About 220,000 men are annually taken into the navy or the active army, while the remainder form a vast reserve. The term of service varies in different parts of the empire. In European Russia the period of active service is five years; in Caucasia, three years; and in Asia, seven years. The reserve is formed of two divisions, the first being composed mainly of those who have received



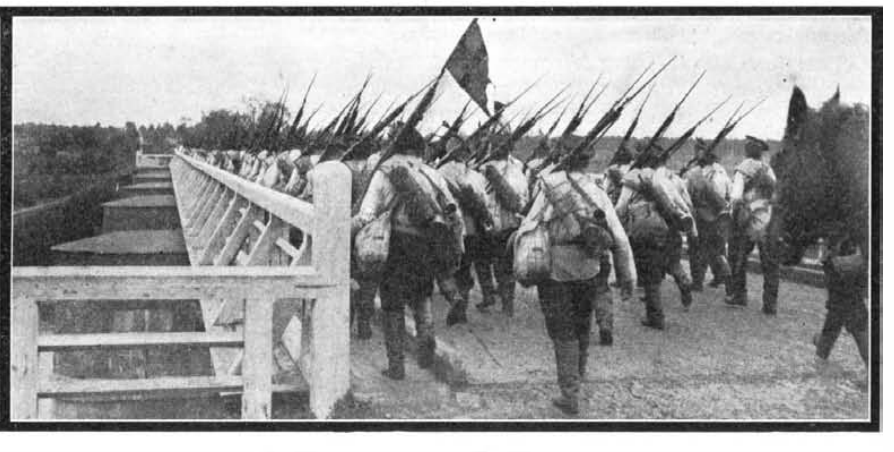
THE SCHNEIDER-CANET 3-INCH, RAPID-FIRE FIELD GUN, UPON WHICH THE LATEST RUSSIAN FIELD GUN IS MODELED.

Russian General and Staff.

Russian Infantry, Showing the Serviceable High Boots and Method of Carrying the Kit.

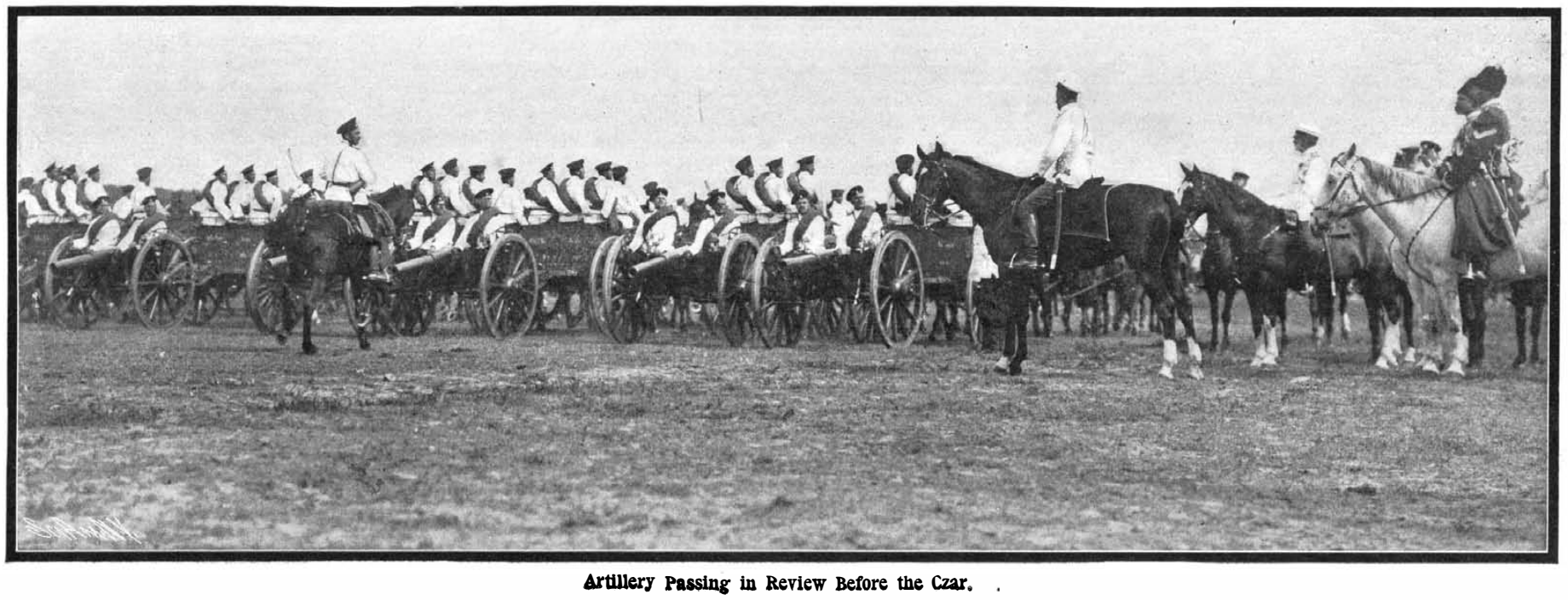


Land Mining Experiments.



Russian Infantry in Marching Order.

Russian Cavalry Off-Saddled.



Artillery Passing in Review Before the Czar.

RUSSIAN ARMY VIEWS.

training in the active army, as well as all able-bodied men who have not received such training. These could be called upon for active service in time of war. The second division comprises all the able-bodied men who have served their term in the first division, and all others who, on account of ill-health, or the like, are exempted from active service. Special conditions exist in the case of the Cossacks. These fierce, war-like people are born fighters. From their very childhood they are trained to deeds of daring, and the whole people are looked upon by the government as a portion of the military organization. At the age of seventeen, military service begins at the Cossack post, and three years later this is followed by field service, which continues for from twenty to twenty-five years. The Cossacks are divided into three classes: First, the active soldiers; second, those on furlough with their arms and horses; and third, those on furlough without their arms and horses. The Cossacks are organized into eleven separate "voiskos," or corps, each "voisko" being obliged to clothe and arm its soldiers.

Russia is divided into fourteen military districts. The army on a peace footing is estimated at 42,000 officers and 1,000,000 men, and in war at 75,000 officers and 4,500,000 men, with half a million horses. There are 21 army corps, 213 infantry regiments, 114 regiments of cavalry, and 511 batteries of artillery. In time of peace it is estimated that the infantry numbers 710,000 men, cavalry 130,000 men, artillery 150,000 men, engineers 42,000 men, besides 40,000 others in army service. The infantry is composed of 52 infantry divisions, 24 rifle brigades, 25 separate infantry brigades, 2 separate rifle battalions, 8 separate infantry battalions, 21 fortress regiments, and 12 fortress battalions. Each infantry division is composed of two brigades, each brigade of two regiments, each regiment of four battalions and each battalion of four companies. An infantry regiment is usually composed, in time of peace, of 70 officers and 1,867 men; in time of war, the officers number 79, and the men 3,945. The cavalry is made up of 24 divisions, 5 brigades, 7 separate regiments, and 3 double squadrons; 2 divisions of guards, 17 divisions and 2 brigades of dragoons, and 6 divisions of Cossacks. The cavalry is divided into four- and six-squadron regiments, the former comprising 32 officers and 779 men in time of peace, and 30 officers and 673 men in time of war. The six-squadron regiments comprise 38 officers and 1,071 men in peace, and 36 officers and 948 men in time of war. The artillery is composed of field, horse, guard, grenadier, and line brigades. In time of peace each field battery has four guns, and in war eight guns. Each horse battery has six guns both in peace and in war. Each mortar battery has six guns. The engineers consist of 29 sapper battalions and 8 pontoon battalions.

The Russian people are composed of the aristocracy and the common class; there seems to be no middle class. In no other European country is there such a gulf between the high and low classes of society. The officers are almost exclusively taken from the upper class, and the common soldiers from the lower class. The latter are a very slow, stolid, and ignorant lot, but they possess the merits of explicit obedience to their superiors and indifference to danger or death. Aside from this, owing to their splendid physique, they can endure great hardships, and are admirably adapted for long and difficult campaigns.

In the last issue of the SCIENTIFIC AMERICAN we fully described the Russian small arms. We now devote some space to a description of their artillery.

As a result of the experiments made between 1898 and 1900 with different rapid-fire guns, the Czar has adopted the 3-inch rapid-fire gun of the type of 1900, devised by Gen. Engelhardt and constructed by the Pontilov establishment. The manufacture of this material, however, has been submitted to some delays, so that, up to the present, but three batteries of it have been constructed.

The gun is provided with a rapid-closing breech-block of the screw type which operates in a single motion. It is mounted upon a small cradle, which, after a shot has been fired, recoils about 36 inches upon the slides of the carriage. The live power of the recoil is absorbed by a hydraulic brake and a recuperator formed of a series of rubber buffers. The recoil of the carriage is prevented by a rigid trail-spade. The carriage is capable of sliding upon the axle, and thus permits of direct pointing when the spade is inverted in the ground. The Russian gun fires about fifteen shots a minute.

The shrapnel of this gun weighs 14.4 pounds, contains 260 balls of 160.5 grains each, and is provided with an aluminium double-acting fuse of 9 ounces. It forms a cartridge with the charge of smokeless powder and is fired with an initial velocity of 1,928 feet. The weight of the carriage is 4,145 pounds. In battery, the caissons are arranged alongside of the guns, as in the French artillery.

In addition to the three rapid-fire batteries, of which we have just spoken, the Russian campaign artillery comprises: (1) Light horse batteries of 3.4-inch guns; (2) heavy horse batteries of 4-inch guns; and (3) mortar batteries of 6-inch guns. There are also mountain guns.

The 3.4-inch accelerated fire gun is of steel and has its origin in the slow-fire gun of the types of 1877 (Krupp) and 1879 (Oboukov). The improvements introduced in 1895 by Gen. Engelhardt have made of it an accelerated-fire gun, capable of firing from 5 to 6 shots a minute. The barrel, properly so called, is identical in both the light and horse batteries, except that, in the latter, it is a little shorter. It has a movable chamber consisting of a thin tube driven into and secured in the barrel in a cold state. It was originally constructed with the Krupp wedge breech mechanism, but has since been provided with the Bange screw arrangement.

In 1895, the pointing devices (rack breech-sight and Broca muzzle-sight) were placed in front and upon the side of the barrel. The object of this arrangement was to expose the breech during the loading, and consequently to increase the rapidity of firing by permitting of pointing during the loading.

The carriage (Engelhardt type of 1895), upon which the barrel is mounted, permits of checking the recoil without undue strain on the parts through a trail-spade provided with an elastic joint. This spade, which is jointed to the trail through the intermedium of two rods, is connected with the stock by a combination of two jointed rods. Upon the posterior rod are strong rubber buffers separated by thin metallic disks. These buffers are held at the rear by a plate screwed to the end of the rod and bearing in front against the back face of the shoe. When the shot is fired, the piece recoils, the trail-spade enters the ground, and the carriage continues its recoil in causing the spade to pivot around its bearing point. During this rotation, the spade compresses the buffers, which, expanding after the recoil, bring the gun back to battery. In order that the carriage may not be submitted to an excessive strain through the recoil, rubber buffers are interposed between the axle and the body. Besides, in order to permit of pointing in direction when the stock is rendered immovable by the spade, there is added to the carriage an arrangement that permits of displacing the latter upon the axle. What especially prevents this gun from being a rapid-fire one is the rising of the piece during the firing. Such rising, however, has been notably reduced in the new 3-inch gun.

The 3.4-inch gun fires 15-pound projectiles with a charge of smokeless powder and an initial velocity bordering upon 1,410 feet, such projectiles being a shrapnel with rear charge, a case-shot and an explosive shell. The fuses are double acting and graduated for time. The weight of the carriage is 4,160 pounds.

The 4-inch heavy gun is destined to disappear as soon as the rapid-fire gun is put in definitive service. It is very heavy (4,840 pounds), and would, at the most, be adapted only for the heavy artillery of the army. The gun is of steel of the 1877 type (Krupp) or of the 1879 (Oboukov), these two types differing only in the arrangement of the jacket that covers the tube. It is provided with a wedge breech-block of the Krupp type and is mounted upon an elastic carriage of the Engelhardt type of 1877. At the moment of firing, the carriage displaces itself 2 inches with respect to the axle, by compressing rubber buffers that deaden the shock. This arrangement has permitted of the addition of a trail-spade for checking the recoil without excessive strain on the carriage.

The initial velocity is 1,225 feet, and the 26-pound projectiles fired are a double-walled shell with percussion fuse, a shrapnel with a rear charge and a case-shot with double-acting fuse.

The 6-inch mortar used for high-angle firing was adopted in 1886, as the result of ideas that were materialized after the Turko-Russian war of 1877-78. It is the first of the short army pieces that the majority of the powers have constructed. The barrel, which is of steel, is of the Oboukov type, with wedge breech mechanism. The carriage is original. Between its body and the axle there are two rubber buffers as in the 3.4-inch gun. These buffers, which stand almost vertically *en route*, serve as suspension springs during a march and of elastic bands in firing. Under the body of the carriage are suspended two ground-brakes connected by a cross-piece. Each of these consists of an upper part forming a piston and of a lower one forming a pump chamber, and of intermediate rubber buffers. When the shot is fired, the carriage recoils upon the axle by compressing the axle buffers. The brakes, descending with the carriage, rest upon the ground, and their pistons compress the corresponding buffers. These parts then, in the absence of trail-spades, support the entire stress of the recoil.

Despite its caliber, this weapon, which is thin-walled, is not heavy, the weight being 1,800 pounds in the piece in battery, and 4,300 in the horse-drawn piece. But its range (10,495 feet) is short as compared with the ranges at present obtained. With a maximum initial velocity of 720 feet, it throws a 68-pound shrapnel, a 62-pound fougade shell containing 13 pounds of melinite, and an "illuminating shell." This latter, due to Capt. Nilus, is adapted to illuminate the sites of the enemy at night long enough to permit of pointing.

The mountain gun is old, and presents no interest. The same is the case with almost all mountain guns, the various powers having begun the transformation with campaign guns. The piece is of a caliber of 2.5 inches and weighs 214 pounds. It is mounted upon a carriage weighing 334 pounds. There are both mounted and horse-drawn mountain batteries.

Eight batteries of four Maxim machine guns of 0.275 inch (the caliber of the Russian gun) were, in 1900, formed in Siberia. Each of these comprises 1 captain, 2 lieutenants, 7 non-commissioned officers, 50 men and 22 horses, and an ammunition supply for 5,850 shots per gun. The machine guns are drawn by mountain artillery fire-carriages, and each of them carries 1,350 cartridges upon loading-bands. The supply of ammunition is contained in four two-wheeled carriages, with 4,500 cartridges to each. In addition, the battery is provided with six two-wheeled service carriages. Some of these batteries of machine guns participated in the operations in China, particularly in the engagements at Tien-Tsin. Since then, five companies of machine guns have been created by a ukase of March 23, 1901, and apportioned to four divisions of infantry of Europe and to one brigade of chasseurs of Siberia.

Engineering Notes.

The huge one-span arched steel bridge which is to carry the Cape to Cairo Railroad across the waters of the Zambesi River, just below the Victoria Falls, will shortly be swung into position. This bridge will be the highest in the world, with a main span of 500 feet. The materials used in the construction of the bridge are to be transported from one bank to the other across the gorge by an ingenious method devised by the engineers of the scheme, Sir Douglas Fox and Partners. About 40,000 tons of plant will be carried across the river at a point where the banks are over 600 feet apart, and this will be effected by means of an electric cableway. There will be little manual labor required, merely a few men for driving the electrical machinery, which will do all the hauling. The plant was built at Darlington, in England, and, after a thorough test at the maker's works, was shipped to South Africa.

The Aeronautical Institute of Great Britain proposes to carry out in the latter part of this year a series of trials with screw propellers designed for aeronautical purposes. The trials are to be held in London, in some convenient building of suitable size so as to secure immunity from interference by variations in the force and direction of air currents. The method of testing the propellers is to attach them to a motor provided with a carriage of known weight, which will be driven by the propellers along wires or rails. The run will be as long as possible, and it is hoped in this way to secure valuable kuowledge of the action of propellers, which cannot be gained by any other than a straightaway test such as this. It is proposed at first to test only rotary propellers and those up to about four feet in diameter. For this purpose, the Aeronautical Institute will provide a motor of from one-quarter to one-third horse-power, together with all the other necessary apparatus except the actual propellers, which will be supplied by those desirous of participating in the tests. Silver and bronze medals are to be awarded to the successful competitors.

While the longest ropes are used for haulage purposes, some of the most interesting data in connection with wire ropes are obtained in connection with their use for hoisting purposes. Hundreds of thousands of lives are literally each day hung by a small wire thread as the men are lowered into, and hoisted from, the bowels of the earth, and in many cases the only means of communication between the surface and the underground workings, which are from a few feet to a mile in depth, is by a comparatively small hoisting rope. Think of hanging from the end of a cable only a few inches in diameter and a mile long and being hoisted at a rate which is faster than that of the average railroad train, and some idea of the hoisting problem can be gained. To the honor of the wire-rope manufacturers it must be said that very few shaft accidents are due to the breaking of the rope, excepting where the cage is overwound and unwarranted demands are made upon the rope, or which are traceable to false economy on the part of the users of wire rope. No part of a mining plant is more carefully inspected and watched than the hoisting rope, and very few mine managers will take any unnecessary risks in the hoisting of men. The skill of the wire-rope maker is taxed to the utmost to provide ropes for hoisting from great depths. To make a rope of practicable size that will be sufficiently flexible and that will bear even its own weight, is no mean problem, for in such cases the weight of the rope is often much more than the material lifted. Hence we have taper rope intended to give a varying section dependent on the amount of rope off the drum or reel.—Mines and Minerals.

Correspondence.

Cause and Treatment of Consumption.

To the Editor of the SCIENTIFIC AMERICAN:

Medical science claims that the presence of the tubercle bacillus in the lungs is the fundamental cause of phthisis, or consumption.

After several generations of study and experiment, the medical profession of the entire world have finally come to the conclusion that this disease is not amenable to drug treatment; they seem to have directed their attention to discovering some means of destroying the life of the germ in the lungs, in place of removing certain fundamental causes which make it possible for the germ to exist there. The fact that so little progress has been made in the treatment of the disease, would indicate that some of the important conditions of causation have hitherto been overlooked. Some modern medical writers claim that malnutrition is the cause of phthisis, but people suffer from malnutrition, in a severe form, and yet do not have phthisis; in fact, they could not have it unless they had some unhealthy lung tissue especially suited to the development of this germ.

The tubercle bacillus requires an unhealthy tissue and a certain amount of moisture to favor its development, and the lungs are most frequently infected because they are seldom fully developed. This is due to the fact that the apex or top of the lung is seldom filled with air, and consequently the tissue in that part of the lung becomes weak and unhealthy—usually the result of improper breathing. When this microscopic vegetable germ becomes established in the unhealthy or diseased tissue of the lungs, no drug has yet been discovered which will stop its rapid growth. Unhealthy tissue is absolutely necessary for its development. A person with active, healthy lungs can inhale these germs, and will experience no harm from them. The facts herein described explain the leading and fundamental causes, which become operative when other concomitant and requisite conditions are present.

It is not the germs which make *all* the trouble (they are only an accidental condition—merely like a scavenger that lives on diseased tissue); they are only active because of a weak condition of the tissues, resulting from various causes. Of course, phthisis could not exist without the germ; neither could the germ exist without the unhealthy tissue to favor its development. The unhealthy tissue in the lungs could not exist unless there was a cause for it, which condition usually results from an undeveloped state of the lungs, although the same condition could be caused by an attack of pneumonia, or grippe, and from other causes. Even if the germ has the unhealthy tissue favorable for its development, the disease can progress but little, unless the vital force of the patient has been greatly impaired, as a result of mental or nervous strain. Therefore, *the disease cannot be caused by the germs, unless the necessary accompanying conditions are present.* The germ, therefore, is only *one factor* in the cause; the leading fundamental cause being the condition of the mind, which made it possible for the patient's vital force to become so reduced. It is this phase, or condition of causation, which has hitherto been overlooked; and accounts for the unsatisfactory results experienced in the treatment of this disease.

I do not claim that the condition of the mind represents the direct cause of phthisis, but it is, without any doubt, the fundamental and most important condition to be considered in the *treatment* of this disease.

Phthisis is made possible on account of the weakness of the motor and other nerves of the lungs; also of the heart, stomach, and any other internal organs which have to do with the proper digestion and assimilation of food. As all the motor and other nerves are controlled entirely by the mind, we must look there for the leading fundamental trouble. If anything goes wrong with the engine or motor power of a large manufactory, so that it does not run in perfect smoothness, or rhythm, the uneven motion is transmitted to every machine in the entire establishment; and if the motor is allowed to continue running out of balance, it will soon be worn out and ruined. Now, the mind is infinitely more sensitive and powerful than any machine motor, and if it has full control of all the nerves in the body, then when it becomes overstrained or excited through worry, fear, or irritation of any kind—either from physical or mental causes—it will be thrown out of perfect balance, or rhythm, and this disturbance will extend through the entire nervous system. If this strain, or irritation, is continued for some time, the mind becomes correspondingly weakened and loses its power over the body, and subsequently all the nerves become similarly affected, and are unable to perform their normal functions.

When the mind is depressed or excited, the action of the heart is correspondingly changed, and the stomach and other digestive organs are affected in the same way; thus preventing the proper digestion and assimilation of food, producing, in time, malnutrition, which accounts for the emaciation which usually accompanies this disease. The motor nerves of the lungs also become weakened, and make it impossible for them to expel the tuberculous matter which has already collected, and which continues to collect with great rapidity for the same reason. With a weak heart, which cannot keep up a proper circulation of the blood, and a weak stomach and digestive organs, which cannot digest and assimilate the food properly, and weak lungs, which have not sufficient power to expel the tuberculous matter, it is no wonder that the pus collects there and the germs multiply, and the patient has an increased pulse and temperature.

Recent tests have demonstrated the fact that when the real causes are corrected, and the action of the heart is increased by a proper massage treatment, the pulse and temperature are very quickly reduced to normal, and will continue to remain so, notwithstanding the fact that the lungs continue to retain large quantities of tuberculous matter for some time afterward. The pulse and temperature will seldom rise again, unless caused to do so by some mental worry or disturbance. Nature will afterward take care of the tuberculous matter remaining in the lungs, just as soon as the motor nerves and tissues of the lungs have acquired sufficient strength to expel it.

The *treatment* of phthisis is, of course, the most important subject to consider. The environment, and conditions of the disease in different patients, are so variable, that no single treatment can be specified for all. The following suggestions will answer for most cases, and are especially recommended for patients suffering from the disease in an advanced stage.

It has always been truly stated that this disease was incurable, on account of the patient not having sufficient vital force or nervous energy to resist it. Such being the case, the matter of first importance is to retain all the nervous strength the patient now possesses, and cut off every influence which could possibly reduce it. Every person understands that if he spends more money than his income, financial distress will surely follow; but most people waste their nervous energies with the utmost extravagance, and then seem surprised that they should experience any nervous weakness as a result.

When a motor machine does not run properly, the first thing to be done is to put every part of it in perfect balance, so that it will run smoothly. The same rule applies to the human body. When the mind, through mental irritations, is thrown out of balance, then the whole body is correspondingly affected, and the first thing to do is to restore it to a rhythmic condition. To do this, the patient must be taught how to think, breathe, and act in a rhythmic manner.

Some physicians have met with most pronounced success in treating incipient cases of phthisis by deep, rhythmic breathing. This favorable result is not due entirely to the fact of opening the air cells and introducing fresh air into the lungs, but to the additional fact that the patient, in breathing rhythmically, acquires the habit, more or less, of thinking and acting in a rhythmical manner, which gives great rest to the mind and all the nerves of the body. If the patient is suffering from the disease in an advanced stage, he should be given a large, sunny room, and the windows should be kept wide open, both day and night. He should be carefully instructed as to the real cause of his condition, and it should be impressed fully on his mind that his recovery will depend largely on his own individual efforts to control his thoughts and mind, so as to eliminate the elements of worry, fear, anxiety, or anything which will irritate the mind or waste his nervous energy. He should be taught how to practise slow, deep, rhythmic breathing. He should not commence by counting slowly six or eight for each inhalation or exhalation, because he may not at first be strong enough to do so; but instruct him to count as many as he can and breathe with perfect ease, and then continue to increase the number as his increased lung capacity and strength will permit.

Members of the family should not ask him how he feels; and if he coughs, should make no remarks about it whatever—if he wants to cough, let him do so peacefully; it is a necessity, and he cannot help it. Do not allow well-meaning but ill-advised people to tell him about their own troubles, or those of their friends—he has troubles enough of his own to consider. Exclude all visitors who would be liable to excite or irritate him in any way. Do not urge him to take a walk on some fine, sunny day—let him have the fresh air and sunshine without active exercise; it will be time enough for him to take a walk when he has recuperated his physical and nervous strength sufficiently to do so without experiencing any reactionary weakness afterward. Massage treatment will make up for lack of exercise. Save his physical and nervous strength in every way possible. Many patients are kept in a continual state of worry about their pulse and temperature, and therefore it is best to ignore that condition as much as possible, especially when in the presence of the patient.

In addition to these suggestions, the proper kind of massage treatment will be found of great value in assisting the heart to do its work, and in promoting the proper circulation of the blood.

Limited space will not allow an extended description of massage treatments especially suited for this disease, but, in all cases, the massage manipulation should be given firmly and in perfect rhythm, but very slowly; no strokes should be given on any part of the body more rapidly than the normal pulse rate. If strokes, with a heavy pressure, are made more rapidly than the normal pulse rate, then an abnormal pressure is produced on the walls of the veins and arteries, which will cause additional congestion, and consequent irritation of any inflamed parts of the body. In order to cure phthisis, it is of the utmost importance that the mind be relieved of all irritations. In some cases, even a painful tooth is sufficient to irritate the mind and cause it to be out of rhythm, not that any single irritation will do so much harm, but the combination of a number of mental or physical irritations is sufficient to cause the condition which makes phthisis possible, and also prevents its cure.

Always remember that what the patient needs most is perfect quiet and rest for the mind until it can recover its normal strength and be able to fulfill its natural functions.

If the medical profession will direct their skill and energies to the treatment of this disease, on the lines herein described, their efforts will soon result in the discovery of new truths and new treatments; and in a comparatively short time, consumption will be controlled and cured as easily as any other disease.

New York, May 12, 1904. CYRUS L. TOPLIFF.

A Radium Clock.

A radium clock, which will keep time indefinitely, has been constructed by Mr. Harrison Martindale, of England. The principle of this apparatus is simplicity itself, the registration of time being made in two-minute beats, while its function is to exhibit the dissipation of negatively-charged alpha and beta rays by radium. The clock comprises a small tube, in which is placed a minute quantity of radium supported in an exhausted glass vessel by a quartz rod. To the lower end of the tube, which is colored violet by the action of the radium, an electroscope formed of two long leaves or strips of silver is attached. A charge of electricity in which there are no beta rays is transmitted through the activity of the radium into the leaves, and the latter thereby expand until they touch the sides of the vessel, connected to earth by wires, which instantly conduct the electric charge, and the leaves fall together. This simple operation is repeated incessantly every two minutes until the radium is exhausted, which in this instance it is computed will occupy thirty thousand years.

Death of Prof. Maxwell Sommerville.

Prof. Maxwell Sommerville, of Pennsylvania University, died recently in Paris at the age of seventy-five years. He was a well-known glyptologist.

He spent forty-eight years wandering about the earth and trafficking with the inhabitants of the most out-of-the-way places in his quest for rare gems, cameos, intaglios, and specimens of lapidaries' art of historical value. His collection in the archæological museum of the University of Pennsylvania is considered the largest and finest in the world. He also created and installed in the museum the Indian Hindoo museum and Buddhist temple, of which a description will shortly be published in the SCIENTIFIC AMERICAN.

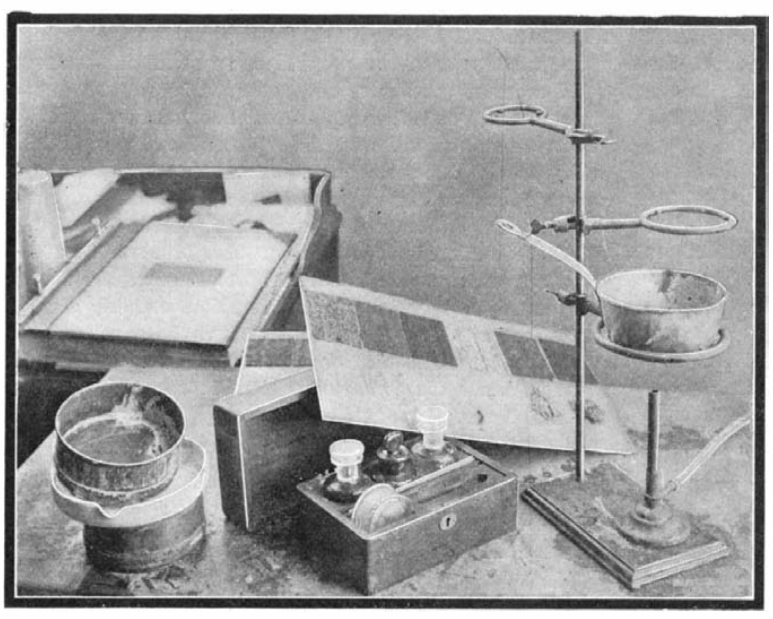
The Current Supplement.

Striking pictures and a well-written, authoritative account of the Ogden-Lucin cut-off of the Southern Pacific Railway open the current SUPPLEMENT, No. 1481. The engineering work described is one of the most important feats in railway engineering to which the West can point. A combined gasoline motor and electric generator for railroad traction is a railway novelty described by the English correspondent of the SCIENTIFIC AMERICAN. Submarine navigation is the title of an article which briefly reviews a most important development in modern naval warfare. "The Soldering of Metals and the Preparation of Solders and Soldering Agents," is the title of an exhaustive discussion. Emile Guarini writes an instructive review of some interesting experiments with the mercury arc. Dr. Gustav Eisen writes on the fig and its history.

Recently Dr. Macdonald, of Mombasa, East Africa, encountered a puff adder, which is one of the most deadly snakes. He discharged his rifle at it and killed it. He took the body to the hospital verandah, and, finding it to be a male, returned to the spot to search for the female, but without success. A few nights later, however, while sitting on his verandah, the doctor espied the snake he had been seeking, and fired at her. Afterward no fewer than ninety-one young adders were found scattered on the ground, and had all been killed by the shot fired at the mother.

THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

That Thomas Carlyle should have used "clothes" as a peg on which to hang the inimitable essays in "Sartor Resartus," dignified what otherwise might be considered as a rather dull and dry subject. He says:



The Acid Test for Wool.

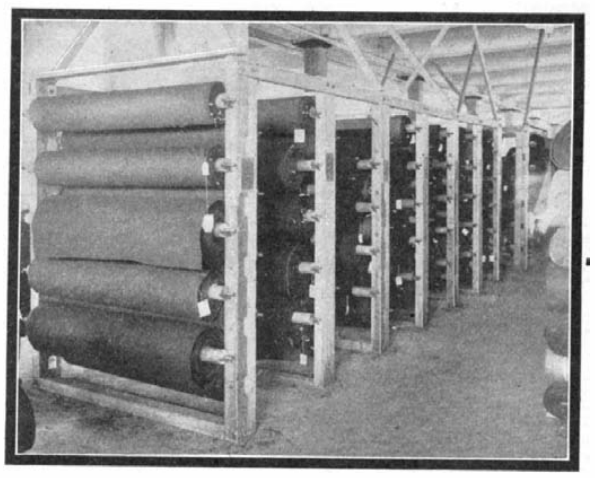
"The hand is ever guided on by mysterious operations of the mind. In all his Modes and habilatory endeavors, an Architectural Idea will be found lurking. His body and the cloth are the site and materials whereon and whereby his beautiful edifice of a person is to be built." With all Carlyle's alleged wisdom concerning clothing, we doubt very much if his researches ever produced so much real knowledge as can be gained by a morning spent in a great clothing manufactory. It will be news to most readers to know that some clothes are designed by a technologist, that the anatomy of a coat is most complex, that the weight of articles carried in the pocket is carried from the shoulder by a sustaining member, that a suit passes through one hundred and forty hands in course of manufacture, and other things equally interesting. Ready-to-wear vs. custom-made clothing has been the subject of millions of debates.

It is the object of the present article to show how a ready-to-wear garment can be designed and "built" with thousands of others, and still continue to have in a marked degree those distinctions which go to make up the garments tailored by the custom merchant. We have selected for the purpose of illustration the plant of A. B. Kirschbaum & Co., of Philadelphia, which offers peculiar advantages as being the largest in the world. This factory is also interesting on account of the peculiar construction of the building, whereby the health and safety of the wage-earners are conserved. The building is located on Broad Street, opposite the Ridgway Library, and is entirely isolated on all sides, so as to give the best of light, which is so essential in this industry—no artificial light being necessary under normal conditions. The building is four hundred feet long and is six stories in height, with a basement having a ceiling seven feet above the street level. Natural light is secured through hundreds of windows of ribbed prismatic glass. Goods are received and goods are shipped with the aid of a private railway switch. Every sanitary precaution has been taken to safeguard the health and comfort of the workers. For example, weekly fire drills are held, and the protection against fire is of the best possible description. In case of a conflagration on any floor, the fusible plugs would burn out and fire doors would close automatically, protecting the elevator shafts. The staircases which lead from floor to floor are entirely outside the building, which would prevent any draft in case of fire. The fire escapes are in a separate tower with walls ten inches thick, readily accessible from any floor. Automatic sprinklers are provided at every portion of the plant, and the number of standpipes is unusual.

The workers are dismissed at the noon hour in two shifts, so that the lunch room may not be unduly crowded at one time. If this department pays its expenses, the company is satisfied. All workers on entering the establishment leave their hats and outside garments in lockers. On the whole, it would be difficult to see how any branch of manufacture could be carried on on more wholesome lines.

The manufacture of ready-to-wear clothing is of comparatively recent date. The industry started in 1835. At first almost all the clothing was made to supply the trade in the South and West. Gradually the wholesale houses began to manufacture better grades of ready-to-wear clothing. From this obscure beginning has grown the present enormous industry. Such a growth was rendered possible only by the introduction of labor-saving machinery; notably the sewing machine and the cloth-cutting machine. Many factories simply cut the cloth and give out the goods and trimmings in bulk to workers who labor in unsanitary workshops often located in tenements. It stands to reason that clothing made in light, airy rooms will be less susceptible to contamination. In the Kirschbaum plant the clothing never leaves the building, and is therefore subject to inspection at all times.

A designer in a wholesale clothing house is what we almost might term a "general." He is responsible for style, fit, and finish. All the creations or modifications in garments are made or passed upon by him. No one city or master-designer can set the fashions, but a combination of them can. Style and the subsequent developments as to sizes are in his hands. He is a creator, his minute touches may make or unmake a style, it may be only the turn of a collar or the cut of a lapel.

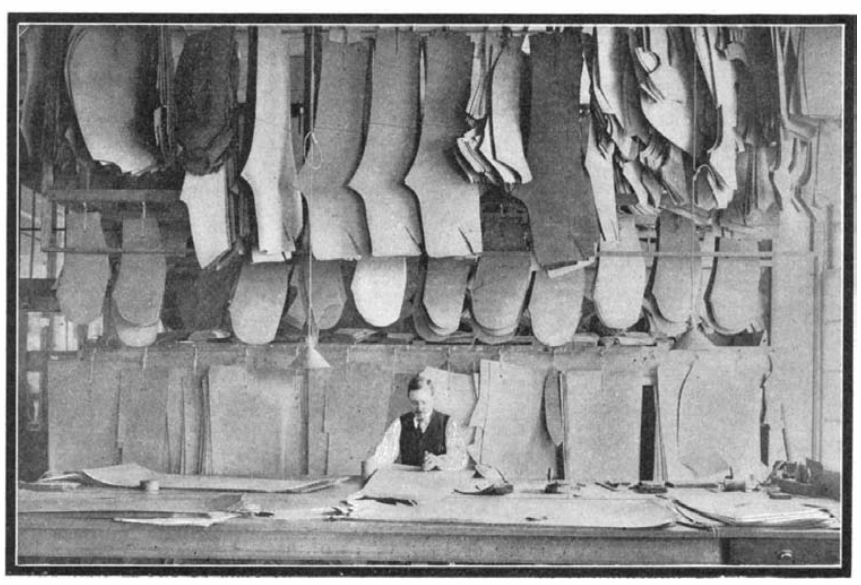


Cooling the Cloth.

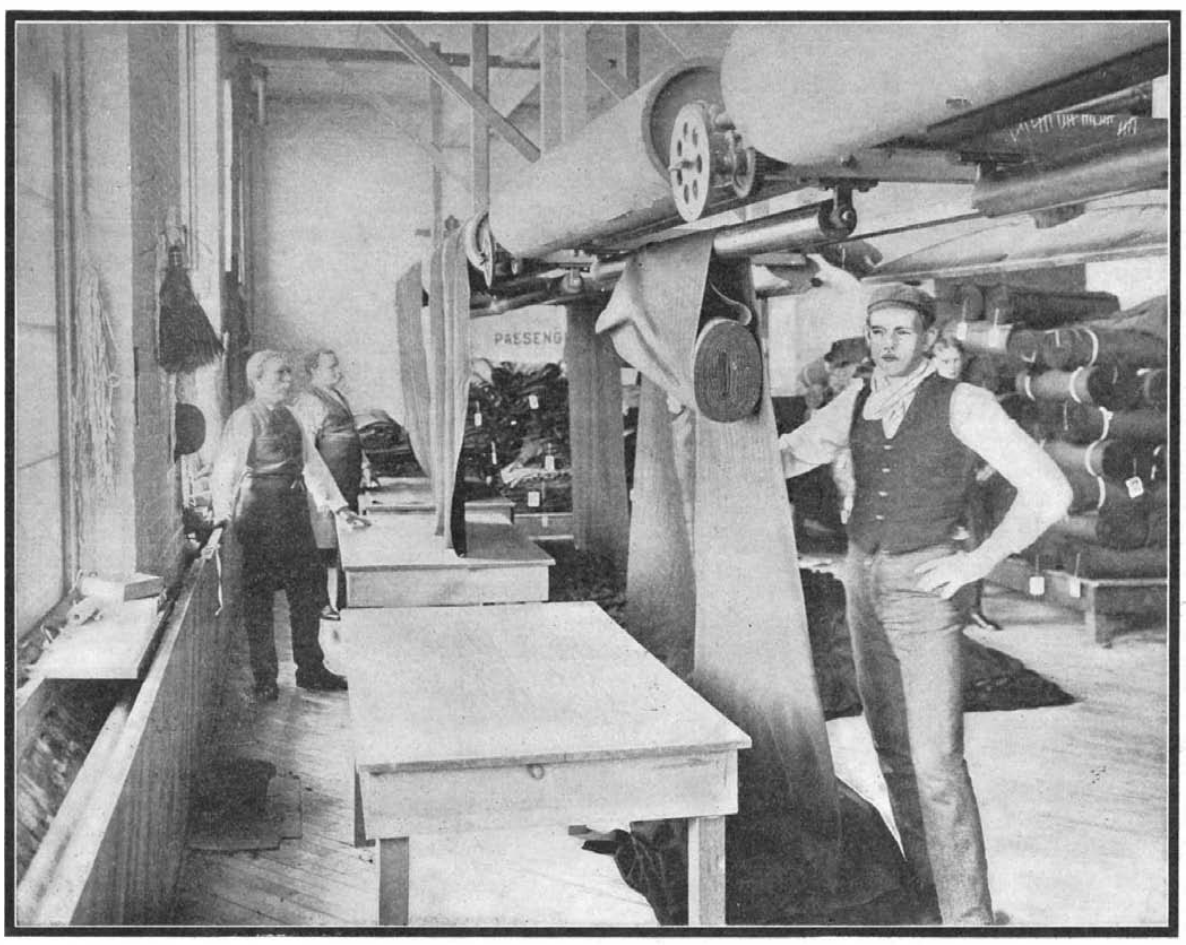
The sartorial artist is not bound by hard-and-fast rules, but by his careful assimilation of exact information he is able to forecast the styles. In the plant which we are describing, the head-designer works in a "studio," and his approximations to the human figure are based on living models at his disposal. His systems are really based upon those relating to engineering. He obtains a base line, and from this develops the various sizes mathematically. This results in economy both as to labor and material. His workroom is one of the most confidential in the establishment, and is naturally one which is usually closed to visitors.

The cloth is bought from samples, and when the goods are received they are not only compared with the sample, but each piece is submitted to physical and chemical tests. A small sample is taken from the bolt, and is inserted into a pair of jaws, which can be tightened so that a firm grip is maintained at both the top and bottom of the sample which is being tested. Means are provided for separating the jaws until the cloth breaks—a dial indicates the breaking strain, which varies according to the weight and quality of the fabric. Cloth which cannot endure a tensile strength test of thirty pounds to the square inch is almost useless in clothing manufacture; it is nothing unusual to find even a flannel which will not be ruptured until the one-hundred-pound limit is reached. The sample is then submitted to the "wool-test," in order to find out if there is an admixture of cotton. It is subjected to a hot solution of caustic potash. The animal matter, or the wool, boils out, leaving the cotton, or vegetable matter, as a residue. The acid tests are used for determining the quality and permanence of the dye; sulphuric, nitric, and hydrochloric acids are employed. Samples are also dated, numbered, and exposed to light and air for months. It is owing to such thorough tests that the integrity of the future garment can be guaranteed.

A special balance scale is used, which shows the exact weight of every yard in the bolt, and the weights are computed in "ounces to the yard." There is hardly a piece of cloth that has no imperfection, and it must

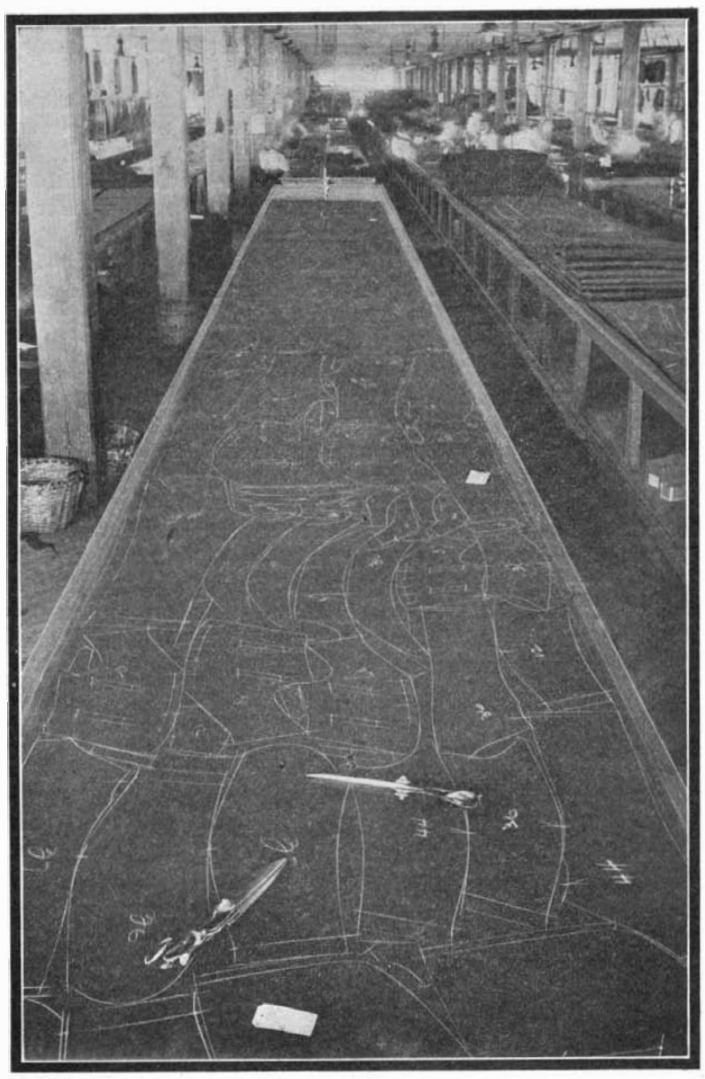


Making the Patterns.



Cloth Examining and Measuring.

THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

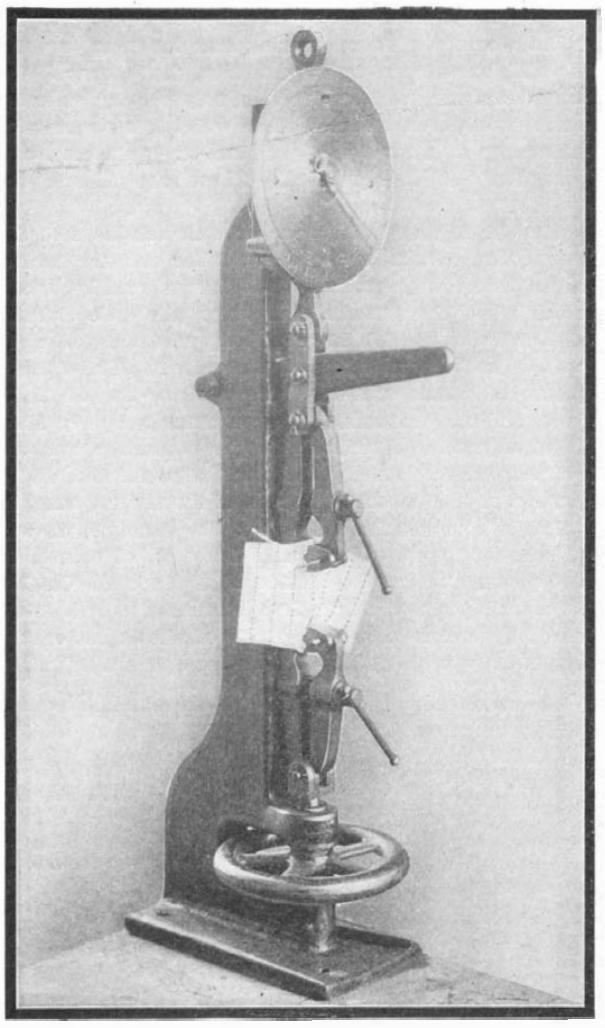


Patterns Removed, Showing the Layout.

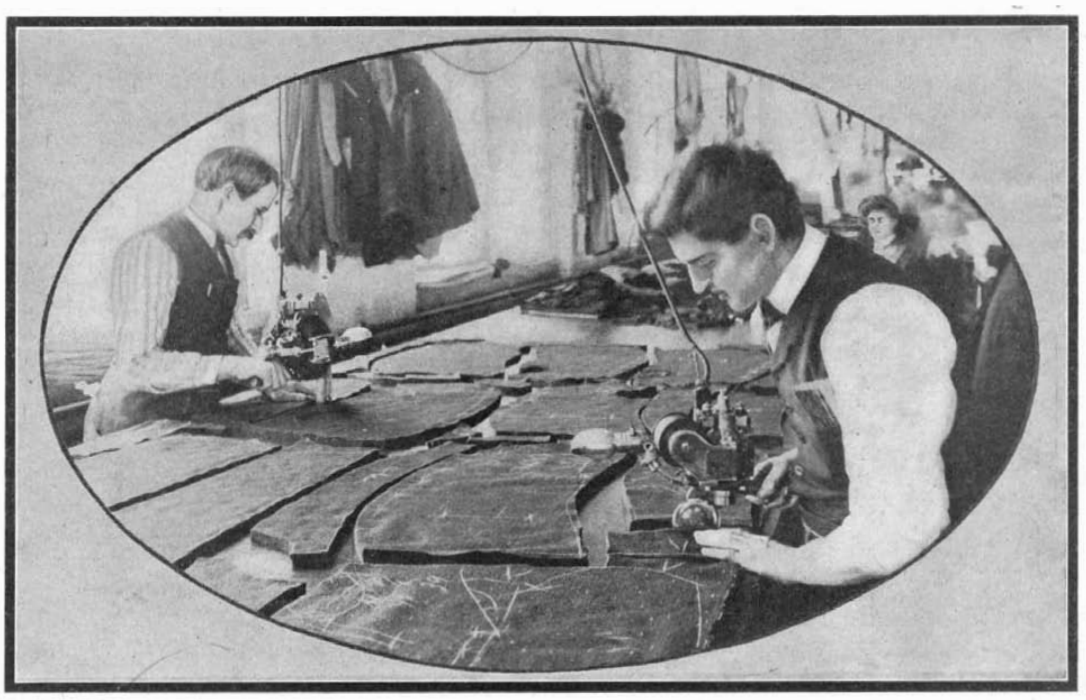
therefore be humored by the cutter. To the lay person these imperfections are hardly noticeable, but to the expert cloth examiner they are painfully real. The cloth is reeled from the bolt over rollers which are geared to a dial, which measures the length of a piece of goods. As the cloth passes down it is carefully inspected by the cloth examiner, who marks the imperfect places with tailor's chalk, and at the same time ties a piece of narrow tape in the selvage. This is a warning to the cutter that he must so impose his patterns that the uniform shading may be maintained; a hundred suits may be shipped to a customer, and each will be of exactly the same shade as the others.

The goods are now ready to be "sponged." This is really a misnomer, for it is practically a shrinking process. The machine consists of a steam box for the diffusion of steam. The cloth passes over the box as it is reeled, and is wound on a perforated cylinder, also filled with steam, which is allowed to permeate the roll of cloth. Every piece of woolen fabric shrinks from two to four yards in the sponging process. This removes the mill gloss, and serves to finish the material for a non-shrinkable garment. The warm and moist roll is then placed in a rack, and is allowed to cool for some twenty-four hours. The cloth is then folded and rolled by a special machine. We now have a double piece of cloth about 46 to 48 yards long and 28 inches wide. This folding is very essential, in order to insure a better match in the garment, and is especially necessary in blues and plaids. Before the goods go to the cutter, they are laid on tables in lots of two to one hundred pieces, and each piece is compared in shade, so as to give the customers uniform shading in every style, regardless of the quantity bought.

The cloth is now taken to the cutting floor, where it is unrolled on immense tables covered with linoleum. Only one piece of cloth may be unrolled at a time, or fifteen or sixteen pieces may be superimposed. The cutter now takes the pressboard patterns, and arranges them with such cunning that a uniform shading is attained and no cloth wasted. One of the immense tables covered with cloth on which the layout has been marked is a most interesting sight. All garments above three in number, which are to be cut at the same time from the same pattern mark, are cut by a machine, the first of which was introduced about 1870. The earliest of these had long knives operating perpendicularly like saws, and cutting through a number of thicknesses of cloth. These are still in use for certain classes of work, but circular disks rotated with a high rate of speed are now also very largely used. These cutters rest upon a flat bedplate, which is adapted to pass under the cloth. The knife is rotated at a high rate of speed by an electric motor, and an electric light forms part of the equipment of the machine, the latter being used when natural light fails. The various parts of the clothes bear a "lot" number, and all the pieces belonging to this lot are gathered up and sent to the distributing department on the floor below.

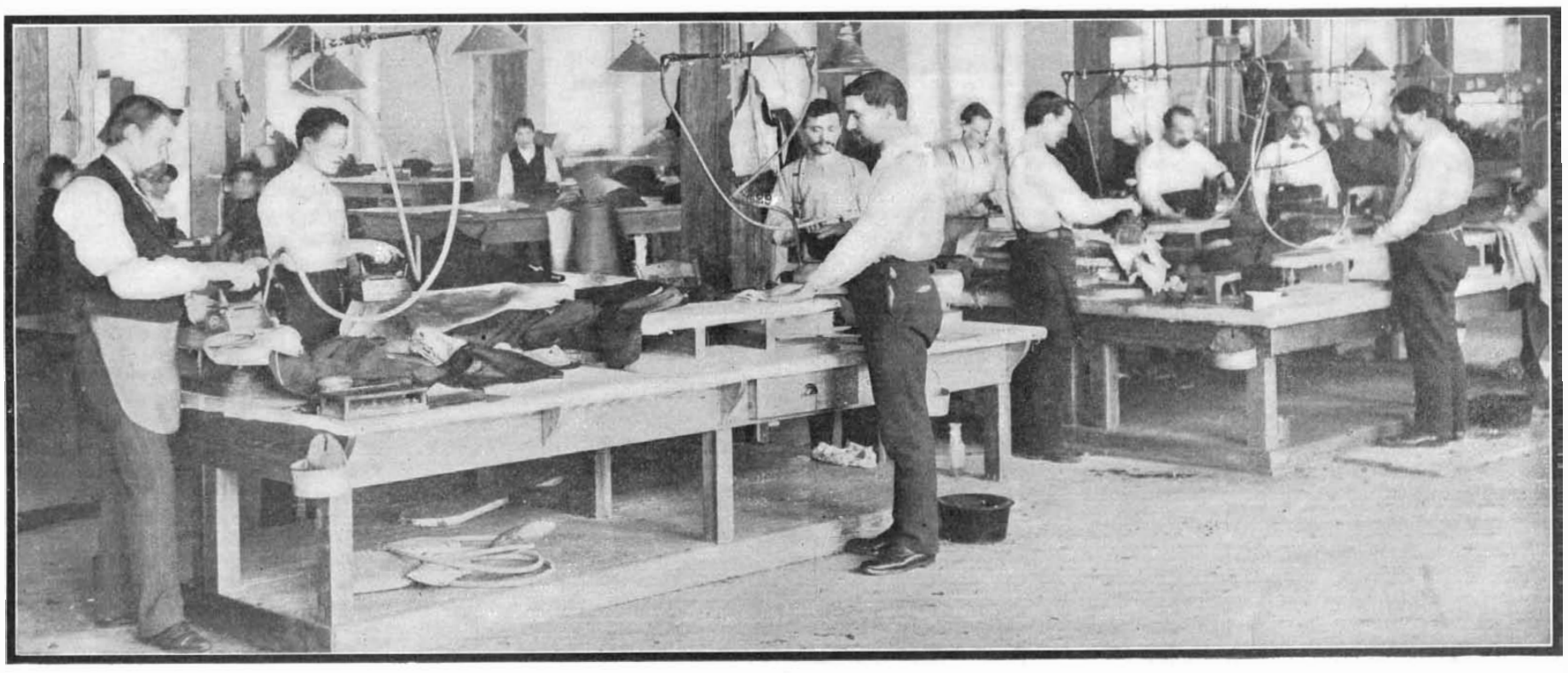


Cloth-Testing Machine.



Cutting Sixteen Thicknesses of Cloth by Electric Cutters.

Meantime the trimmings for the articles of clothing have been selected in the same quantity, great attention being given to a proper matching of these materials with the goods. The cloth and the trimmings are now combined in one bundle, which is ready for the tailor



Pressing With Irons Heated by Gas.

THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

shops on the floor below. But before passing to the room where the actual sewing and finishing is done, it will be interesting to consider, for example, the complex nature of a coat. This may contain as many as thirty different articles, all of which are structurally necessary to what we might term the "skeleton construction" of the garment. These are termed the "vitals."

How it is that a forty dollar suit can be sold for twenty-five dollars, or a twenty dollar suit for twelve, is an interesting problem; but this is readily understood when the systems of a large wholesale clothier are understood. We have already watched the cloth which has been tested, sponged, and cut. The various pieces of a suit consist of three parts—the coat, the vest, and the trousers. A large blank properly filled in gives specific directions for the trimmings and the finishing of the same. This blank is perforated, and a portion of it is attached to each of the three garments.

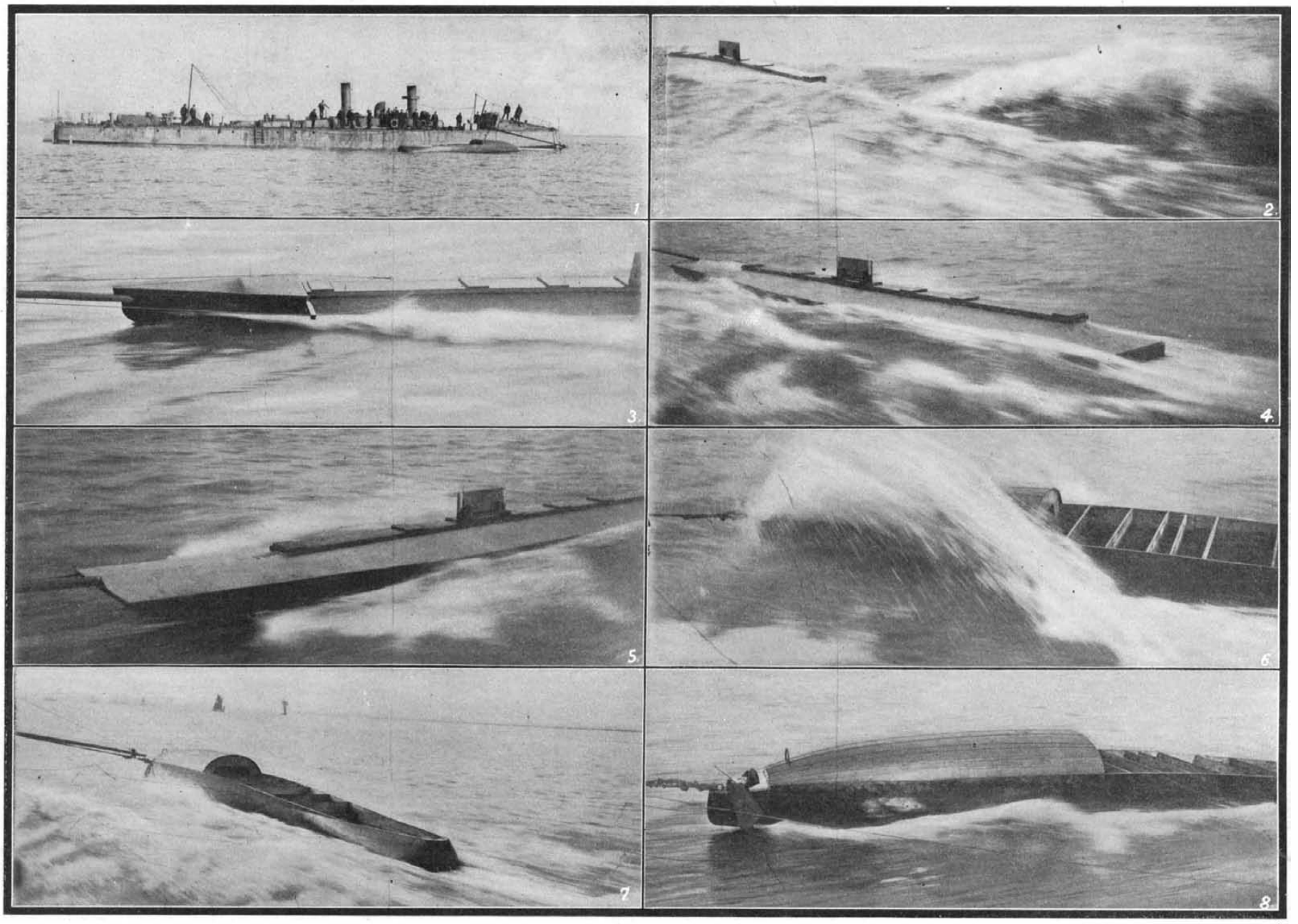
Let us consider the coat alone. For example, we will take a sack coat. The canvas front is, of course, in two pieces, and may be considered as the keel. On this is superimposed the hair-cloth stiffening, which is secured by means of narrow strips of silesia cut on the bias with a cross stitch; the padding is also attached to the hair cloth with a cross stitch. The button stay, which is also of silesia, starts at the bottom of the lapel and extends to the lowest button. Every coat has a shoulder-pad of various thicknesses made of wadding. It may be ten-ply in the center and grade down to nothing at the end. In conjunction with the shoulder pad there is an arm pad, which is attached to the shoulder pad and extends toward the elbows. The pockets are stayed by imposted two-inch linen strips, which extend from the fore part of the coat across the lower pockets, if any. Strips of the same material cut one inch wide run from the top of the pockets up into the arm hole. This is a suspension stay, and is intended to help sustain the contents of the pocket. There is a body lining which covers the vital trimmings. There are also sleeve linings, buttons, a hanger, besides a ticket to show the name of the maker. The trimmings vary with the cost of the suit.

From the trimming-stock room complete bundled trimmings in lots of from two to four hundred meet the cut cloth at the distribution department, whence the assembled semi-finished materials go to the tailoring shops. Sizes are compared, and the coat is put together by tailors; in reality we might say "parts of tailors," for each man knows his own particular branch of the tailoring business much better than the average tailor can ever expect to. This naturally increases the individual capacity for work, and decreases the cost to the consumer, whereas the quality is enhanced. Hand and machine sewing are both used, the higher-priced garments being sewed by hand. Button holes are made both by hand and by machine.

The pressing is done by large irons heated internally and uniformly by gas, the Bunsen flame being used. Powerful foot-power irons heated in the same manner are also used to press certain kinds of clothing. A person weighing one hundred pounds can exert by his weight a pressure of 2,500 pounds.

Vests, trousers, overcoats, rain coats, and other garments are made along similar lines. The finished suits or garments are kept on a stock floor, or if made for an order they are taken to the "lay-out" floor. Here are long aisles of platforms, and the goods of three thousand customers may be assembled at one time. Each customer has a number, and the clothes are brought to a similarly numbered platform. As the pile rises, it is formed into a cube adapted to be placed in the lined cases. This prevents double handling, and possible creasing of the pressed clothing. This is only one of the many things which show that system, attention to detail, and economy of resources tend to effect success much more than we ordinarily suppose.

As a result of the modern method of clothes-making, thousands of men who once wore only custom-made are now buying ready-to-wear clothing.



1. Torpedo boat with boom for towing models. 2. The bad stern wave of 1903 model. 3. Good bow wave, bad stern wave from this model. 4. Model good for smooth, poor for rough water. 5. Same as No. 4, showing water indicator for keeping boat on even keel. 6. A bad failure, heavy wash from bow. 7. The accepted model, small bow wave, clear run. 8. Accepted model at 25 knots. Very slight bow wave.

FULL-SIZE MODEL TESTS BY TOWING FROM TORPEDO BOAT.

INTERESTING EXPERIMENTS TO DETERMINE THE CORRECT LINES FOR GASOLINE MOTOR BOATS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A prolonged series of exacting experiments, to discover the most suitable lines for a speedy motor-propelled boat or launch, has been carried out conjointly by Messrs. Yarrow & Company, Ltd., the eminent shipbuilding firm on the Thames, and S. F. Edge, Ltd., the manufacturers of the Napier gasoline motors. Hitherto the gasoline motor-propelled launch has been almost entirely devoted to pleasure purposes; but during the last twelve months considerable progress has been made in the utilization of this system for other marine purposes, and in view of the fact that they are exceptionally fast-running and reliable, the British Admiralty has been seriously contemplating the advisability of attaching this type of craft to battleships for certain purposes, such as dispatch boats, pinnaces, or even reconnoitering. In view of this awakened interest and progressive development, several naval constructing firms in Great Britain are conducting the most searching investigations and tests.

Yet although the reliability and efficiency of the gasoline motor have been established for marine purposes, the details of the design of the hull or boat itself have not been as scientifically developed as they should have been, in order to combine the maximum of efficiency of the boat with the maximum efficiency of the motor. When therefore it was decided to construct another Napier craft to defend the international cup presented for annual competition among gasoline motor-propelled boats, Messrs. Yarrow & Company suggested to the designers of the motor the inauguration of a series of trials with full-sized models, in order to obtain the best possible lines for the hull of the craft.

The suggestion was adopted, and for several months past these tests have been in progress. No restrictions were placed upon the Messrs. Yarrow, with the exception of the beam of the craft and its length, which was to be 40 feet. The stipulation as to the beam was essential, owing to the space having to be adequate to accommodate the gasoline motor. The draft and displacement were left to what the practical trials determined as the most perfect.

The question of the correct lines for the hull is most vital. It is essential that the bow wave should be reduced to the minimum, and that the bow of the boat should be kept down in the water when traveling at the maximum speed. To demonstrate the importance of this detail, it may be mentioned that the bow of the Napier boat which secured the international trophy last year, when traveling at full speed, was out of the water for almost half the entire length of the craft.

For the purposes of these experiments, a number of full-sized model hulls were designed and constructed of wood, including one of the Napier which proved successful last year, and with which tangible results were obtained, thereby enabling some comparative data to be available. It was decided to carry out the trials in as practical a manner as possible. Tank experiments were discarded, as they do not furnish sufficiently reliable practical data, and accordingly the trials were carried out in the open water under actual and natural conditions. In order to impart as nearly as possible the same speed as would be available to propel the boats when the motors were installed within them, a turbine-propelled torpedo boat was requisitioned for the purpose of towing the models. Rear towing, however, was quite out of the question, as the stern wave from the

torpedo boat would upset the calculations, and for this purpose a specially-designed side-towing system was adopted (see Fig. 1). A special boom was projected from the side of the torpedo boat right forward, and of sufficient length to enable the model attached thereto to escape the bow wave of the torpedo boat itself. To the outward end of this boom the tow-rope and the dynamometer were attached, and the torpedo was run at speeds varying from 20 to 25 knots per hour, so that the results achieved were obtained under varying conditions.

Fig. 2 shows a photograph of the last year's boat at 25 knots, from which it will be seen that the disturbance of water was very great at the stern, and that the model was quite unsuitable for a 25-knot speed.

Fig. 3 shows a development in which a very perfect bow wave was got at 25 knots; but the stern wave was very bad, and the model had to be giveen up.

Fig. 4 shows a model which gave most excellent results so far as bow waves were concerned, and a clean run from the stern, but, unfortunately, while being very perfect in absolutely smooth water, as can be seen from the photograph, the model in the end was found quite hopeless in rough water. It would not steer properly and other defects became apparent.

Fig. 5 shows the same model. In the center will be noticed the water indicator for showing whether the boat kept a level keel or not.

Fig. 6 shows what Messrs. Edge thought was a fine model, until they got her at speed, and then it was found, although it took very little power to pull her (and all the pull was registered by a dynamometer, so that it was known exactly what each model took to move through the water), that the great arch of spray sent up by the bow made the boat useless, as it would have been very difficult to steer her, and exceedingly damp for the people steering. The methods adopted by Messrs. Yarrow & Company in the series of towing experiments are, we believe, entirely new, at least on the scale on which they were carried out. The construction of full-sized models and the towing of them at the actual speed aimed at, presents ideal conditions, and the results will be watched with close interest.

Success was attained with the next attempt, and the last two illustrations (Figs. 7 and 8) show the model that has been adopted for this year's competing craft. The bow wave is very slight, as is also the stern wave, and what little there is, is very clean. Curiously enough, the lines in this accepted model are somewhat coarser than in the preceding models, but they have proved far more successful. At 25 knots speed, which is equivalent to 28.788 miles per hour, she proved far more satisfactory. The bow wave became almost nonexistent, while an extraordinarily clean run from the stern was achieved.

The construction of the accepted model is now well advanced by Messrs. Yarrow, who have the contract in hand. The hull is being built of steel throughout. The craft will be propelled by a four-cylinder Napier motor, developing 80 nominal horse-power. One very important improvement will be incorporated this year in the Napier motor boat. In last year's contest the motors exhausted direct into the open air, and the noise was deafening. This year the gases will be exhausted into a special exhaust, carried under water at the stern of the boat. By this means almost complete silence will be obtained, while no noxious gases or smoke will be emitted into the air. It has been found that by means of the special exhaust principle that has been devised in this connection, the boats will be just as unimpeded in traveling as if the motors exhausted direct into the air.

LIFE-SAVING APPARATUS IN BRITISH SCHOOLS.

BY WILLIAM G. FITZ-GERALD.

Ever since the serious fire in one of the master's "houses" at the world-renowned college of Eton, near Windsor, there has been great activity among the principals of the leading British colleges, both for young men and young ladies, in the direction of providing the most efficient possible means of fighting fire and saving life. The principal of many a school, looking around him, may find that there is no more elaborate protection in the case of an outbreak than a few dusty old hand grenades, which may be worse than useless, or a little hand pump, which throws but the feeblest and thinnest of jets. This state of affairs has been radically improved of late.

The most favored type of fire escape in Great Britain at present is undoubtedly the canvas chute, of which thousands are in use in public buildings, theaters, hotels, warehouses, asylums, hospitals, private mansions, and schools. One of these is capable of emptying a school dormitory fifty feet from the ground, costs little more than $50, is exceedingly light, and may be kept just under the window-sill in an unobtrusive manner.

Other escapes in use at schools include the canvas sling, the canvas bucket (which is provided with any required length of the finest Manila rope), and a gun-metal brake, by which the person escaping from a burning building can control the speed of his descent at will.

A Type of Fire Escape Used in English Schools.

When once the installation is complete at the school—and very perfect fire-fighting and life-saving apparatus are now to be found at Eton, Harrow, Rugby, Winchester, and Stonyhurst—the work of organization is systematically begun.

Nor are the women's colleges behindhand; for at the Royal Holloway College at Egham, near Ascot, there is one of the most perfect amateur fire brigades in Great Britain, the young ladies being so expert as to be in request for outside fires at farmhouses and cottages in the rural districts round about.

Practice with the canvas chute fire-escape is taken very seriously by the young persons in schools, department stores, and other establishments, and praiseworthy attempts are made to make "records" in the way of emptying the supposed burning building against time.

The moment the alarm is given, it is arranged that the first person to slide down the chute shall be especially expert. This is because there is no one at the bottom to hold the chute out at an angle, and so break the fall. Therefore, the first person down uses his or her elbows and knees in such a way as to retard a too speedy descent; and arrived at the bottom, he or she promptly takes hold of the lower end and walks out a little way with it, so that the descent of the others may be a swift slide.

It is both curious and interesting to see a great school being emptied by a series of these canvas chutes, the boys dropping like so many divers at the upper end, and literally pouring out at the other end on to the lawn.

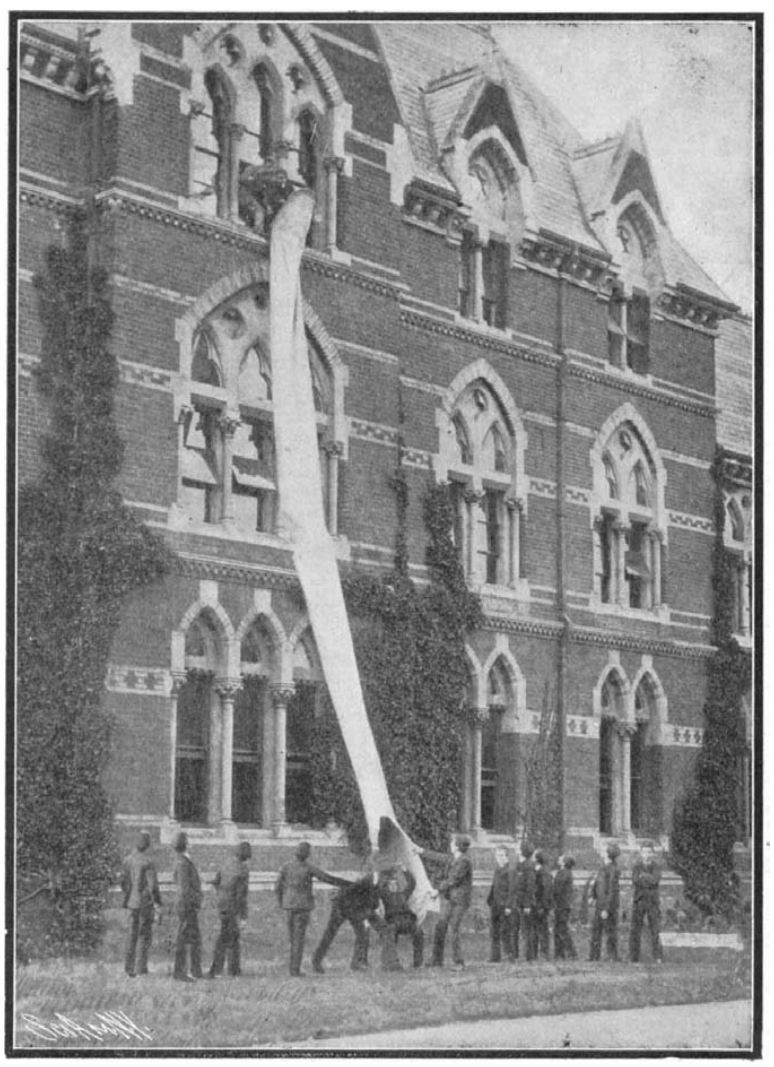
Naturally, to stand the strain, the canvas has to be especially strong. This reminds one that accidents have happened from such slight causes as a projecting nail in the shoe of one of the sliders, causing the canvas to rip and let the unfortunate slider through. As these canvas chutes are made up to one hundred feet in length, it will be seen that a fall through a hole in one of them might well mean certain death.

The same practice is gone through in the department stores; and it is no unusual sight to see a great crowd in the busy London streets watching the canvas chute escape practice of hundreds of young men and shop girls. It may be well to point out that in London all the young persons employed in the big stores sleep on the premises, so that some system of rapid escape in the event of fire is absolutely necessary.

The canvas belt or sling fire-escape is also much favored, and is, if anything, still simpler in its working than the canvas chute already described. It lies coiled up just inside the window; one end of the rope, which is carefully calculated to reach the ground, being made fast to steel staples in the wall just beneath the window.

In the event of an alarm, one rushes to the window and opens it, buckles in a moment the canvas sling or belt about the body, and then proceeds to lower one's self out of the window, regulating the speed of descent by means of the very simple brake which is also provided with the apparatus.

When the first person has reached the ground, it is only the work of a moment or two to draw the escape up again for the second person. Obviously, the canvas sling is not so fast in its operation as the chute, which provides for the escape of an unceasing stream of imperiled persons.



The Chute Fire Escape.

LIFE-SAVING APPARATUS IN BRITISH SCHOOLS.

A New Damask Jacquard Loom.

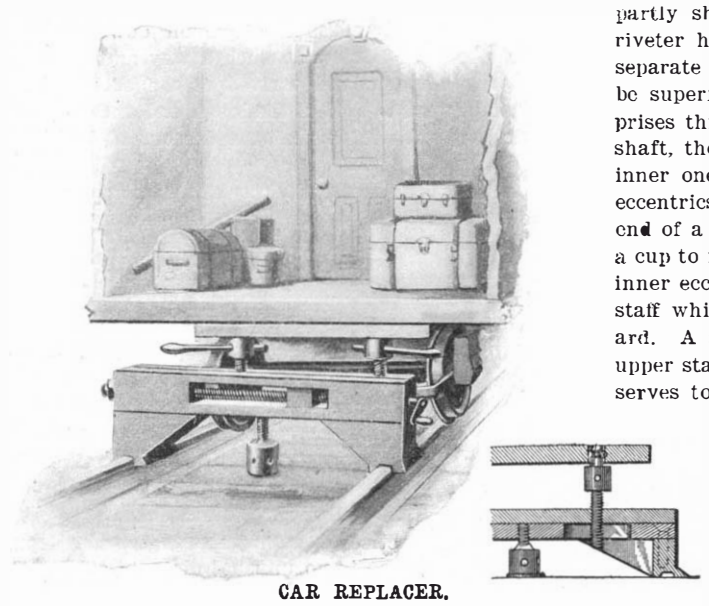
A Finnish inventor has designed a mechanical damask Jacquard loom effecting the same saving of pattern cards, pattern drawings, and work, without the employment of so-called "forward healds," as is obtained in the ordinary damask-weaving looms operated by hand. Another advantage claimed for this invention is the possibility of producing an almost unlimited number of large patterns. It consists in the arrangement of a number of wires or hooks for every needle corresponding with the number of threads desired in a warp unit. These wires or hooks are acted upon by lifting blades, the position of which is adjusted by cam grooves round a cylinder, the cam grooves being arranged in such relation to the speed of the cylinder that the required binding or combination is determined by the adjustment of the wires affected by the blades, so that those rows of wires which are to remain down are moved out, while others which are to be raised are not affected, and this whether the wires or hooks are pressed back by the pattern cards or not.

The United States Coast and Geodetic Survey is now making a survey of the coastline and harbors of the Philippine Islands. The extent of it is shown by the statement that the coast-line of the islands is over 11,400 miles, or double that of the United States. There is a mile of coastline to every square mile of area, while in the United States the proportion is 1:555. There are nearly 1,700 islands having names, and it is possible to count 3,000 islands and islets on the chart.

Patent Department

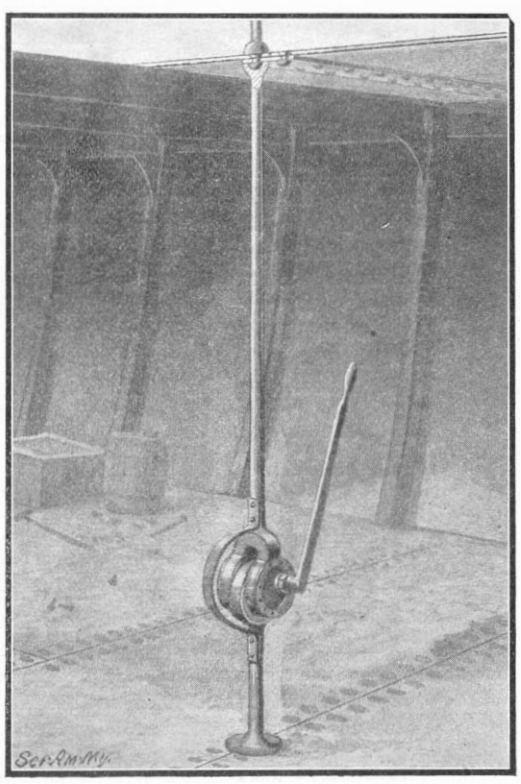
CAR REPLACER.

Street railways, owing to limits imposed by narrow and crooked streets, are apt to contain many sudden and sharp curves, and it is a very common occurrence for cars to jump off the tracks at such points, particularly in the case of a curve located at the bottom of a steep grade. These accidents are of such frequent



CAR REPLACER.

occurrence and result in so many delays, that a large demand has arisen for a simple device which can be readily applied and operated to quickly replace a car thus derailed. We illustrate herewith a device of this character invented by Mr. Christian A. Fischer, of 415½ DeMers Avenue, Grand Forks, North Dakota. This car replacer is applicable as well to replacing railway cars, and our engraving shows it lifting the wheels of a baggage car back in place on the track. It will be observed that the device is comprised of a frame which extends across the track and is provided at each end with sockets adapted to fit onto the rails. The frame is formed with a longitudinally-disposed guideway in which a carriage is adapted to slide. Lying parallel with this carriage and engaged by a nut thereon is a screw which may be operated by a crank at one end of the car replacer to draw the carriage to one side or the other. Two upright screw jacks are threaded into the carriage and carry at their upper ends a cross bar. They are secured to this bar by pins which fit into annular grooves in the upper ends of the screw jack. When the device is in use, the cross bar is placed under the car body and the screw jacks are operated to raise the car until the wheels clear the rails. It will be noticed the outer side must be lifted higher than the other, owing to the fact that the flange of the outer wheel must clear the top of the rail. When the car is lifted to proper height the feed screw is operated to move the car laterally until the wheels lie directly over the rails and then the jacks are operated to lower them on to the tracks. In order to strengthen the device a screw jack may be used under the center of the frame as a brace.



NEW RIVETER AND BRACE.

NEW RIVETER AND BRACE.

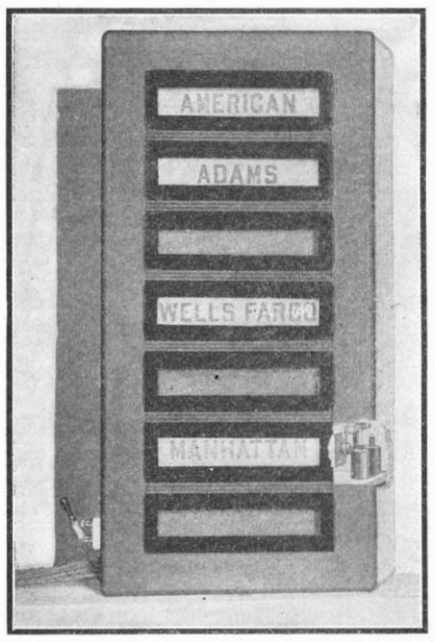
The pneumatic riveter has been found almost indispensable in all iron and steel construction work; but, nevertheless, it is not without certain objectionable features, such as the necessity of keeping the device constantly connected by hose and pipe lines with an air compressor. It is the purpose of the invention illustrated herewith to overcome this objection, by the use of an entirely mechanical riveter, one which is not operated by pneumatic pressure. Such a device, it will be seen, is entirely free from incumbering hose lines, so that it can be readily carried to any part of the work, and it does away with the expense of air-compressing machinery. Our illustration shows, in full, the device applied as a brace for a riveter which is only partly shown; but it should be understood that the riveter has the same construction as the brace, and a separate description and illustration of the same would be superfluous. The device, it will be observed, comprises three eccentrics, mounted and keyed to a single shaft, the outer eccentrics being set oppositely to the inner one. The straps which extend around the outer eccentrics are joined by a yoke attached to the lower end of a staff which at the upper end is provided with a cup to receive the head of the rivet. The strap of the inner eccentric is secured to the upper end of a similar staff which, at its lower end, is formed with a standard. A stiff, flat spring is riveted at one end to the upper staff, and at the other end to the lower staff, and serves to hold the device from buckling at the eccentrics, though permitting a limited amount of movement while the eccentrics are being operated. In operation, when the eccentrics are turned, the two staffs will be moved apart by a very powerful movement, sufficient, in the case of the riveting brace to hold the rivet in place and in the case of the riveter to flatten out the end of the rivet. This simple yet powerful device has already been put into operation, a model having been used with great success on the battleship "Connecticut," now building at the Brooklyn Navy Yard. Mr. Jacob L. Pearson, of 194 Sands Street, Brooklyn, N. Y., is the inventor of this improved device.

EXPRESS CALL FOR LARGE OFFICE BUILDINGS.

A very primitive system of express calls prevails in most of our modern skyscrapers. It is the custom for the tenants to inform the freight elevator boy when they desire to express any articles. That irresponsible individual must be trusted to set the street signal and inform the expressmen who stop in response to the signal at what rooms they are wanted. However, the elevator boy has other duties to attend to, and is too apt to delay and often entirely forget to set the signal; but even with the signals promptly set, the chances are that by the time an expressman arrives, the elevator boy will have confused the calls, and have forgotten at which of the hundreds of rooms in the building this particular expressman is wanted. The expressman must then waste valuable time in searching through the building for the express matter.

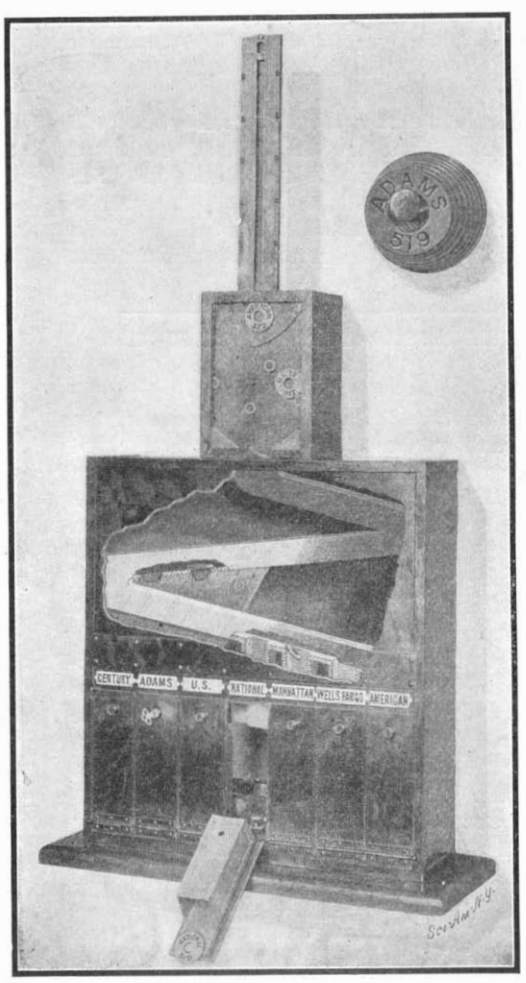
A remedy for these conditions has recently been found in an automatic call system, which we illustrate herewith. This system has been installed in a sixteen-story building in this city, and has given general satisfaction, both to the occupants of the building and to the express companies. Briefly stated, the system comprises a chute extending from the top to the bottom of the freight elevator shaft, with slot openings at each floor. Each room is provided with a set of flat steel rings or checks, on which the number of the room is inscribed, also the names of the various express companies. When it is desired to make a shipment by a certain express company, the check bearing that company's name is dropped into the chute, through which it falls to a distributer on the ground floor, and is thereby directed to a box bearing that company's name. When a check enters its box, it makes an electric contact, thereby setting a street signal bearing the name of the express company desired. A call driver for that company, on noting the signal set, enters the building and unlocks the box bearing his company's name. On opening this box a second electric contact is made, and the street signal is swung back to a blank. By glancing at the room numbers on the checks in the box, the expressman can tell at a glance where he is wanted, and can make his calls without the slightest delay, in each case returning the checks to the rooms where they belong.

In our illustration the front of the distributing box is broken away to show details. It will be observed that two inclined channels are located in this box, and that openings of progressively greater width are formed in the bottoms of the channels. The checks also vary in diameter, to correspond with the openings in the channels, and as they slide down the channels, they will drop into their respective openings, each passing over the preceding narrower openings, until one of proper width to receive it is reached. From the distributer channels the checks drop into their respective boxes. The bottom of each box is formed of a plate having a limited vertical movement. Beneath the box is a spring-pressed button, which may occupy three positions, but is normally held at the middle position by the weight of the bottom plate. When a check falls in the box, the added weight further depresses the button. This movement is utilized to throw a switch completing the circuit to the street signal. The street signal comprises a number of hollow boxes of square cross section, which are revolubly mounted at their ends in brackets. Each box is provided with two opposite faces of ground glass



STREET EXPRESS SIGNAL.

on which, in black letters, the name of the express company is printed. The other two faces are opaque, and are left blank. At one end of each box a cord is secured, with its two ends respectively passing over pulleys to the iron cores of two solenoids. When the circuit to the signal box is completed, one of these solenoids is energized, its core drawn down, and the box turned so that the printed faces are presented to view through openings in the street signal case. In order that the sign may be visible at night, an electric lamp is placed within the hollow box. This lamp is connected with two metal segments, which on rotation of the box are brought into contact with the terminals of the lighting circuit, thus lighting the lamp. When the expressman opens the check box, the spring-pressed button above referred to, is relieved of the weight of the checks and of the movable plate as well, and is thus permitted to rise to its highest position, which movement is utilized to energize the second solenoid of the signal, and throw it back to blank. Directly above the distributer box in our illustration, we have shown a buffer box, which serves to break the fall of the checks and prevent them from injuring the distributer box.



DISTRIBUTER FOR THE EXPRESS CHECKS.

Legal Notes.

PATENTS FOR INOPERATIVE DEVICES AS ANTICIPATIONS AND THE HISTORY OF BARRELS.—A suit was brought against the Spruks Manufacturing Company by the Farmers' Manufacturing Company, assignee of John F. East, to restrain infringement of letters patent granted to East for an improvement in barrels. It was decided by the Circuit Court that the East patent was invalid, in that it did not involve anything more than ordinary mechanical skill in view of the extensive prior knowledge; and secondly, that there was no infringement by the defendants. From this decision an appeal was taken (127 Fed. Rep. 691) which resulted in a reversal of the lower court's decision.

The East patent contains four claims. Of these, only one and three, reading as follows, were in issue:

"(1) A barrel or receptacle having its sides composed of a sheet of veneer provided with parallel slits arranged lengthwise of the barrel, and terminating at a distance from the edges of the sheet, and leaving the edges of the veneer sheet continuous or integral, as shown and described."

"(3) A barrel or receptacle having its sides composed of a sheet of veneer provided with parallel slits arranged lengthwise of the barrel, and terminating at a distance from the edges of the sheet, and expanded in the middle to a greater diameter than at the ends, substantially as shown and described."

In his statement of invention, East says:

"I am aware that it is not new to make barrels of veneer, and that the ends of a veneer barrel have been drawn together by first slitting the edges of the veneer blank in order to get the bulge or curve to the barrel, and I do not claim any such construction."

His invention, as stated by him—

"Consists of a barrel composed of a veneer blank cut through its middle with a series of parallel slits extending transversely to the blank and longitudinally to the barrel, but not out to either edge of the blank, thus leaving the edges of the blank, which form the chines of the barrel, continuous or unsevered, while the middle cut portion is extended to get the bulge or curve to the barrel, and also to form ventilating openings."

The first patent for a barrel made of veneer was issued to Sheridan Roberts, May 14, 1861, and reissued as No. 6,044, September 8, 1874; and the opinion of the court below, so far as it adjudges East's patent invalid, seemed to hinge upon that. The invention relates to the formation of the body of the barrel in volute sheets cut or removed from the surface of solid cylinders, and forming the bulge of the barrel by forming notches or slots from the edges toward the center, or cutting out or removing gores or wedge-shaped pieces from each edge, so that, by bringing these cut surfaces into contact by means of hooping the body of the barrel, the barrel thus formed will have the desired bulge. An examination of this patent discloses that its design was to form a tight barrel, and a barrel shape, as contradistinguished from a mere cylinder, was obtained by cutting out gores or wedge-shaped pieces at the ends; and, by drawing in the veneer sheet at the joined ends, the gore spaces would be closed up. The vice of Roberts' patent was that it did not have that peculiar curvature at its sides, continuous from top to bottom and at every vertical line, which for ages has been known to be necessary for giving the greatest strength. It is this arch shape throughout, at every vertical line of its sides from top to bottom, that distinguishes a barrel from a cylinder. Roberts' patent would produce a package with a cylindrical central zone and two cone-like ends. What he refers to in his statement of invention as producing the "desired bulge," by the drawing together of the ends from which wedge-shaped pieces had been cut, would not be that bulge with uniform curvature from top to bottom so essential to a barrel-shaped barrel. The compressing the ends of the cylinder could have no other effect than to produce the semblance of a bulge, in that it was wider at the center than at the ends. It could have no bulging form of any spheroidal sort, and must remain simply a cylinder in the center, with the weakness characteristic of mere cylinders—of collapsing under pressure. Roberts' so-called barrel, therefore, is nothing more than a cylinder with a wider diameter and with cone-shaped ends, and lacks the curve or true bulge at the central zone, so essential to the strength of a barrel. Patent was granted to him in 1861, and renewed in 1874. It had been before the public for 29 years when East's application was before the Patent Office, and must have been thoroughly known to the commissioner when East's application was considered, and had proved to be inoperative and worthless. Roberts' barrel was not, and was not intended to be, a ventilating barrel. Considering this patent as an alleged limiting or anticipating document, what, asked the court, would a person skilled in the art of barrel making produce from inspecting the drawings of the patent and following it? Nothing but a tight, unventilated barrel, with a cylindrical center and cones at the ends. For nearly 30 years it had been on the public record without producing any effect on the art or trade of barrel making. It cannot be said that a patent for a device which fails to accomplish the desired end is an anticipation of one which successfully accomplishes it.

The other patent referred to in the court below was that of Elijah B. Georgia, No. 164,542, dated June 15, 1875. This invention, as stated in the application—

"Relates to means whereby fruits may be packed, transported, and kept without deterioration for a considerable period. The invention consists in having the staves or heads or both sawed or incised longitudinally, or in the direction of the grain, so as to get the necessary aeration without weakening materially the stave."

The appellate court doubted whether this Georgia patent had any real pertinency to the matter involved in the appellate court controversy, as this barrel was essentially different in structure from that involved in the patent in suit. This was an ordinary stave barrel with apertures or ventilators. East did not pretend to have been the first to make ventilators in a stave barrel. The essence of his invention and the characteristic thing about it, was that for the first time a ventilated barrel was made of veneer, and the central, outward, bulging bend at the central zone was secured by means of precisely arranged incisions or indentations in the veneer sheet, which thus relieved the fibers at the middle of the strain.

The need of a ventilated barrel for the shipment of vegetables had been greatly felt along the whole South Atlantic Coast by those engaged in truck farming, and, previously to East's invention, second-hand flour barrels, with holes chopped by hand, were commonly used for this purpose. These were found to be inconvenient, expensive, and sometimes unsanitary; and the testimony showed that, after East's invention, barrels were made of veneer from a gum tree which grows abundantly in that region, and put upon the market at a cost of about one-half of the old barrels, and that about a million of such barrels are now being annually made and sold for the shipment of potatoes alone, and that, except the recently produced barrel of the defendant, there was no other ventilated veneer barrel used in that region but that manufactured by the complainant company or its licensees; and there was also testimony that parties interested in the defendant company, including Mr. Canfield, its general manager, importuned the complainants for the right to manufacture their barrels, but were refused because they had already granted a license for the territory which he was endeavoring to secure. The testimony was abundant that the East barrel had gone into general use, that the public had attested its superior utility and value by adopting the same, and that it had superseded all other barrels previously used for like purposes. "The fact that prior devices, such as the Roberts and the Georgia barrel, had not been successful, and that the East barrel secured general acceptance and extensive use, and was a commercial success, creates a strong and almost conclusive presumption that the East barrel was the product of invention and had patentable merit, and that something more than mere application of mechanical skill was involved in its production. It is difficult to draw the line between mechanical skill and patentable invention, and now that East had succeeded in producing a barrel of great commercial use, out of simple and inexpensive material, by what seems to be but a trivial modification of previously known devices, it was easy to say that any mechanic skilled in the art, having before him the previous invention of Roberts, could readily have accomplished the same object by ordinary mechanical skill, but the fact remains that, notwithstanding the great demand and imperative need of the very thing that East produced, no other mechanic or barrel maker had ever produced such a barrel previously to East's patent." Simple as the device is, others failed to see it, or to estimate its value, or to bring it to the public notice. Ventilated barrels were known and used long before, but these were barrels made of staves, and ventilating holes were cut with hatchets or by mechanical means, such as are set forth in the Georgia patent. So, too, barrels made of veneer could be made in accordance with the Roberts patent, which would produce a tight, unventilated barrel, with cones at the ends, and a cylindrical center.

The next question was whether the defendant company had infringed this patent. The defendant's barrel was made from a sheet of veneer. The latter was cut to form two barrels; the central, dividing line showing the lines of cutting the sheet into two parts, from each of which two barrels are made. The blank for each barrel was a flat sheet, having at each end a series of gores between the end hoops, and the center bulge a series of parallel cuts partially through the wood.

Ventilation was supplied "near the head or chine ends, rather than altogether in the central portion of the barrel." It seemed clear to the court that, in the process of manufacturing its barrel, the defendant had adopted East's invention of cutting through the middle a series of parallel slits extending transversely to the blank and longitudinally to the barrel, and not out to either edge of the blank. "It is precisely these longitudinal parallel slits in the center of the barrel that is the essence of East's invention, for it is that that differentiates East's barrel from the Roberts barrel, with its smooth, continuous, uncut, imperforate central zone, which had proved to be impracticable and useless. Without these longitudinal incisions, the arch shape which distinguishes a barrel from a cylinder could not be attained."

"East has not discovered any new elementary material for the making of barrels, and the elementary principle upon which barrels are constructed is old; but he has adopted a new form, and discovered a new combination, a diversity of method and diversity of effect, a new modus operandi, whereby it has been practically demonstrated that cheaper and better results are obtained, which benefit the world; and therefore, under the principles and precedents, he has become entitled to that protection which the patent laws are intended to secure for 'any new and useful improvement on any art, machine, manufacture, or composition of matter.' Such combination, however simple and obvious, if entirely new, is patentable, and not the less so because up to a certain point he uses old methods and old materials. Having produced a new and better result by his invention, the law looks to that, and 'it is of no consequence,' says Justice Story, 'whether the thing be simple or complicated, whether it be by accident, or by long, laborious thought, or by an instantaneous flash of the mind, that it was first done.'"

The simplicity and apparently obvious nature of East's device were really the chief arguments against its patentability, but the books are full of cases where patents have been sustained for changes in methods which seem equally simple. The substitution of the hot blast for the cold in making iron; the use of a flame of gas to finish cloth, rather than the flame of oil; the substitution of pit coal for charcoal, and of anthracite coal for bituminous coal, in certain processes—are some of them.

While the question of patentable novelty in East's device might not be entirely free from doubt, the grant of a patent by the Patent Office created a presumption in its favor, which those who contest it must rebut by proofs; and when the proofs showed, as they did, that there was a wide and general demand for a new and cheaper barrel, that none of the alleged anticipatory devices had filled that want, and that East's barrel met instant public recognition, general acceptance, and extensive use, superseding all other devices, the presumption of novelty seems irrestistible; and the conclusion was that the patent should be upheld, and the defendants enjoined from infringing it by the making of the longitudinal slits in the central zone, which the testimony clearly showed that they did. In so far as it was claimed that they had improved upon East's invention, in providing additional ventilating apertures, the opinion, of course, did not affect such alleged improvement.

INFRINGEMENT OF A TRADE MARK INDICATING QUALITY.—The case of the Stevens Linen Works vs. William and John Don & Company (127 Fed. Rep. 950) discloses a state of facts doubtless common enough in business life. The uncontradicted evidence showed that the complainant, a manufacturer of linen crash, had adopted as a trade-mark the words "Stevens Crash," printed in a line diagonally across an ornamental square ground. By universal custom of trade, this trade-mark had been used to designate grade and quality, and not ownership; the complainant originally adopted them to indicate the different qualities of his goods. There was no evidence to support the charge of unfair competition, no evidence that anyone had ever been deluded by the use of the letters into the belief that he was buying complainant's goods instead of the defendant's. The bill was dismissed.

Infringement of a device for regulating the quantities of air and gas, respectively, admitted to the mixing chamber of a gas engine, is not avoided by so changing the mechanism that the quantity of air admitted remains the same, while the quantity of gas is variable.

Where defendant owns an infringing machine, and throughout the suit contests the validity of the patent, and asserts the right to use such machine, complainant is entitled to an injunction, although pending the suit defendant has refrained from actual infringement.

Two patents may be for the same invention, although the earlier is for a specific machine, while the later contains broader claims, which embrace both the prior specific machine and others as well.

A patentee cannot patent a structure, and by disclaimer withdraw the invention which makes the structure patentable.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

PROCESS OF GENERATING STEAM.—T. W. NEELY, Marshall, Ill. By this process, heat for converting water into steam is supplied internally in relation to the shell of the boiler by an electric arc or two electrodes juxtaposed in the relation of an arc and immersed in the water and introducing at one end of the electrodes hydrocarbon vapor or other gas unitable with the oxygen which may be set free by electrolysis of the water and be burned, and by the heat of the electric-arc or hydrocarbon flame to form a supplementary source of heat and pressure within the boiler.

ELECTRIC STEAM AND VAPOR GENERATOR.—T. W. NEELY, Marshall, Ill. The invention is in the nature of a form of steam-generator in which heat for converting water into steam is supplied internally in relation to the shell of the boiler by an electric arc or two electrodes juxtaposed in the relation of an arc and immersed in water. It comprehends means for introducing at one of the electrodes hydrocarbon vapor or other gases adapted to unite with oxygen freed by electrolysis of water and be burned by heat of the arc or hydrocarbon flame to form an auxiliary source of heat and pressure within the boiler.

ELECTRIC RAILWAY-SIGNAL.—W. S. JACKSON, Hoboken, N. J. One object this inventor has in view is the provision of a simple and reliable signaling system which is actuated automatically by a car on entering the siding or turnout constituting a "block" to display signals at "danger," and which is likewise actuated when the car leaves the block of the siding or turnout in order to restore the signals to their normal or safety positions.

SAFETY-TROLLEY.—W. M. GRUNER and W. C. FINK, Springdale, Pa. More definitely stated, the invention relates to a peculiar subtrolley adapted for catching the conductor-wire upon breakage of the main-trolley sheave or jumping thereof from the conductor-wire, the subtrolley being also adapted for holding the main trolley lowered or out of contacting position with the conductor-wire supports and at the same time through suitable circuit-closers recomplete the motor-circuit and the sounding of an alarm in a local circuit on the motor-car.

Lighting and Heating.

GAS-BURNER.—C. A. CAMPBELL, New York, N. Y. The prime object of the invention is to so control the circulation of air past the mantle as to produce the best possible results from gas consumed. The improvement lies in a cup which surrounds the burner-tube and is supported thereon, the contracted lower portion of the cup simply engaging the tube and the upper end of the tube flaring out toward the orifices. This cup incloses the lower end of the mantle and protects the burner-tube from the cooling air rising through the foraminated support. It also prevents the air from entering the space within the mantle.

COMBUSTION APPARATUS FOR FURNACES.—V. ZANETTI, Genoa, Italy. The practical results of this invention are to increase greatly the percentage of heat from the fuel used for steam-boilers and to diminish or eliminate the soot and smoke, almost completely burned by means of convenient regulation of the ratio introduced through the ash-box and air through the air-tubes, the smoke and soot being already heated up by the incandescing net, and as the velocity of their flight to the smoke-stack is diminished by the net the combustion of the gases and utilization of heat in the boiler are greatly promoted.

Machines and Mechanical Devices.

POWER-TRANSMITTER.—W. H. MERRITT and J. C. WALL, Genesee, New York. The object of this invention is to provide a transmitter which is simple and durable in construction, very effective in operation, and arranged for transmitting the power of a motor or the like to pumps or other machines in such a manner as to equalize the steam and to insure a uniform and easy running of the machine.

TYPE-WRITER.—E. RUNGE, Berlin, Germany. Type-carriers each carrying a number of types are so operated by means of type-disposing devices in this invention that always the required type in correspondence to the key depressed is brought into position for striking and printing. The inventor attains important advantages in respect to simplification of the apparatus for inspection of the parts, whereby the machine is made capable of doing more work, the types are caused to strike better in proportion to the force applied, and the striking force can be adjusted.

AUTOMATIC SHIFTING-WEIGHT SCALE.—C. SCHENCK, 3 Wendelstadtstrasse, Darmstadt, Germany. In this case the invention consists in a pressure which acts upon the beam of the scales, being relieved or taken off when the scales are balanced out, and in a kind of escapement being made to operate upon the further movement of the shifting weight beyond the point of equilibrium, the escapement retarding the movement of the shifting weight and allowing the gentle engagement of the ratchet-pawl.

Pertaining to Vehicles.

LUGGAGE-CARRIER.—F. DALES, Binghamton, N. Y. The object in this instance is to provide details of construction for a device which adapt it for an easy and secure attachment upon the bicycle-frame, afford a reliable bracket-frame for the support of a package or the like, and enable the secure retention of the luggage upon the bracket-frame by application of a single buckled strap or other available flexible connection.

Prime Movers and Their Accessories.

ROTARY ENGINE.—J. S. DAVIS, Montgomery, Ala. That class of rotary engines, that is provided with a piston adapted to travel in a circle around the shaft to which it is secured, is improved by this invention. The invention is more particularly an improvement in that class of rotary engines in which a sliding abutment is arranged radially between the steam inlet and outlet and is operated by a cam fixed on the rotary shaft.

Railway Accessory.

TRAIN-PIPE-TESTING DEVICE FOR AIR-BRAKES.—W. S. DECAMP, Chillicothe, Ohio. Mr. DeCamp's object is to enable the engineer to test the line of train-pipes and whistle-pipes and to know from his cab if all the intermediate angle-cocks of the train pipes are open and all the intermediate stop-cocks of the whistle-pipes are also open, and to do this means are provided that enable the engineer to ascertain if all the cocks are open and the air-brake train-pipe and whistle-pipe are in proper condition, for if any intermediate angle-cock of the train-pipe is closed or any intermediate stop-cock of the whistle-pipe, the whistle will not be blown.

Of General Interest.

SAFETY-FASTENER FOR ENVELOPES OR OTHER CONTAINERS.—J. NOSEWORTHY, St. Johns, Newfoundland. In this patent the invention refers to a fastening for envelopes and other packages or containers for the storage or transportation of valuables, although the fastening is especially useful in connection with envelopes for carrying money, valuable papers and communications by mail or express. It is effective in keeping the envelope or package in a securely-closed condition, which cannot be opened by the insertion of a wire or other implement, and is capable of being easily and quickly manipulated when it is desired to close and fasten the container.

OIL-PRESS MAT.—R. F. WERK, New Orleans, La. The subject-matter of the present invention as well as of the three other inventions noticed in this article, forms a division of a prior application for Letters Patent, filed by Mr. Werk. The present invention contemplates an oil-press mat or cloth consisting of warp-threads and weft-threads, the former being composed of hard, stiff, coarse, and long animal hair and the latter consisting of hard, stiff, coarse, and long animal hair mixed with soft, pliable, and long animal hair, the warp-threads being greatly in excess per square inch of the weft-threads and in such close proximity to each other as to cover and protect the weft-threads, the warp-threads forming the selvage of soft pliable hair. The purpose of Mr. Werk's next invention is to produce a hair mat or fabric durable in service owing to a combination of hair in different grades, and not liable to split or tear apart under the pressure of the seeds and the press-plates; nor will its threads or strands unravel, and it is capable of being folded lengthwise upon itself without breaking. Ends are secured by making warp-threads of soft pliable hair, while the weft-threads are made of coarse, stiff hair mixed with soft pliable hair. The next invention consists of an oil-press mat comprising warp and weft threads, both composed of long animal-hair, the warp-threads of hard, stiff, and coarse hair mixed with soft pliable hair and the weft-threads of soft, pliable hair, the warp-threads exceeding in number per square inch the weft-threads and disposed in close proximity to each other to conceal and protect the weft-thread, the warp-threads forming the selvage of soft hair and the weft-threads of soft hair being thicker than the warp-threads. The claim in the next patent defines the press-mat as consisting of warp-threads and weft-threads, each composed exclusively of long hair from animals' tails and manes, which hair is soft and pliable, the warp-hairs exceeding the weft-hairs in number per square inch, and the weft-threads thicker than the warp-threads.

FLUSHING-TANK.—B. WALKER, JR., Austin, Texas. The purpose of the invention is to construct a tank for flushing water-closets provided with means whereby the water-supply to the tank is automatically controlled without the use of a float, thus obviating corrosions and other well-known causes that tend to leakage whatever float-valves are used.

TOWEL-RACK.—S. A. A. STENBERG, San Francisco, Cal. The principal object in this instance is to provide means whereby a towel may be supported in position for use without utilizing any greater amount of space than ordinarily required for the accommodation of given lengths thereof, and also to provide means whereby soiled portions may be displaced and permanently taken up proportionately as clean portions thereof are caused to be drawn out by the user.

CLIP.—D. E. MAPOTHER, Louisville, Ky. The object in this improvement is to provide a clip or sealing device for envelopes, bags, and like articles which is easily applied, and arranged to close the mouth to prevent the contents from falling out and becoming lost in transit and on removal of the device from the bag to allow postal authorities or others to inspect the contents, the device being also capable of fastening covers to deeds and of being used for other purposes.

GRAPPLE.—T. ALEXANDER, Brookhaven, Miss. The invention consists in pivoting the hooks of the grapple in recesses in the short levers to which the grapple-suspending ring is attached in the usual way and in providing a spring-detent for engaging the bent shanks of the hooks to hold the latter in normal position facing inward or toward each other; also in providing hooks with lateral projections that constitute handles for use in manipulating the hooks to engage them with or disengage them from a log.

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Inquiry No. 5525.—For the manufacturers of Grabler's pocket check protector.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5526.—For manufacturers of toys made from stamped sheet metal.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5527.—For makers of wooden blades for ceiling fans.

Manufacturers: We can satisfactorily represent and handle your account. Correspondence invited. Welhener-Patrick Company, Manufacturers' Agents, 172 Washington Street, Chicago.

Inquiry No. 5528.—For makers of tattooing machines, also supplies for tattooing.

Inquiry No. 5529.—For manufacturers of air pumps.

Inquiry No. 5530.—For makers of steam or autoboats, with steam or other power, not having clockwork.

Inquiry No. 5531.—For manufacturers of small ice machines.

Inquiry No. 5532.—For manufacturers of road graders, also of hand power drills for quarries.

Inquiry No. 5533.—For makers of gasoline or hot air engines of about ½ horse power.

Inquiry No. 5534.—For makers of elastic webbing, such as used in suspenders.

Inquiry No. 5535.—For parties desirous of putting a new article on the English market.

Inquiry No. 5536.—For addresses of manufacturers of hardware specialties.

Inquiry No. 5537.—For a cheap device for cutting paper 6 and 8 foot down to 2 foot pieces.

Inquiry No. 5538.—For manufacturers of paper box machines.

Inquiry No. 5539.—For manufacturers of peat machinery.

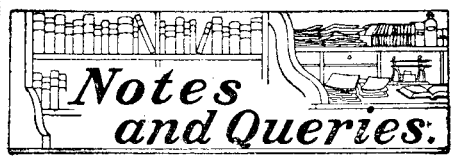
Inquiry No. 5540.—For makers of thermostats for dry kilns.

Inquiry No. 5541.—For manufacturers of sporting gun and ammunition.

Inquiry No. 5542.—For manufacturers of electric runabouts.

Inquiry No. 5543.—For manufacturers of self-registering turnstiles.

Inquiry No. 5544.—For makers of steam excavators or navvies, for trenching for sanitary work, about 4 feet wide by 16 feet deep.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9393) W. F. asks: Can you inform me what kind of colored glass or films, or what it is that is used to throw beams of different-colored light on actors and scenery on the stage of a theater? A. To throw colored lights upon an actor on the stage, it is usual to employ either a calcium or electric arc light with a reflector, and place in front of the light a gelatine film colored with an aniline dye of the desired color.

(9394) J. D. L. says: We have a 6-inch condensing lens with a 20-inch focus, and want to use a microscope objective with it in making a sun microscope. In order to get the necessary light, we have to place the objective nearly in the focus which, I understand, is too hot for the objective. Can we make a bath through which to pass the rays of light, thereby taking out the heat and still have the sun microscope work effectively? What should be used as a bath, and how often must it be changed? Could one get along without the bath, by using a single short lens for an objective? In that case, would there be danger of spoiling the microscope slides from the heat? If such a lens can be used, what length focus would it be advisable to get? A. In using the sunlight for projecting microscopic objects, it is necessary to protect the slide by a tank of water placed in the path of the beam, so that the light passes through the water before it reaches the object to be protected. This cuts off the heat to a sufficient degree. The construction of a tank with glass sides is not difficult. The details of the work can be found in Wright's "Optical Projection," which we can send you for $2.25. Two pieces of plate glass are fastened by clamps with a thick piece of rubber between them, so as to be water-tight. The water should be at least half an inch thick. Tanks are sold with metal sides, so that there is an inch or more water through which the light must pass. The lens for projecting the microscopic objects should not be of longer focus than 1½ inches, and a lens of as short a focus as ¼ inch may be used.

(9395) J. C. B. asks: 1. If vegetable oil, such as olive oil, etc., will harden in any degree in cold temperature. A. All oils harden more or less by cold; olive oil at 36 deg. Fahr., castor oil at about 34 deg. 2. Will ice sink if it is what is generally called rotten? A. Ice is said to be rotten when it separates into needle crystals and becomes saturated with water. It does not sink, but breaks up into floating needle crystals and is not seen as ice. 3. On what side of a curve does the most weight want to be, or which way will a wagon tip—to the outside or inside of the curve? A. A wagon should have most weight on the inside of the curve. 4. How do tinsmiths retin their soldering irons? A. Tinsmiths tin their coppers with pure tin and sal-ammoniac.

(9396) D. S. D. B. asks: Kindly tell me through the columns of the SCIENTIFIC AMERICAN how to lacquer polished brass. A. Brass articles to be lacquered should be first given the required finish and made perfectly clean. Then heat to about 160 deg. and quickly varnish with a thin lacquer of light-colored shellac, dissolved in methylic alcohol made thin like wine by settling and pouring off the clear lacquer. Use a broad camel's-hair brush.

(9397) O. D. S. asks: If a tree fell out on a field where there was no one that could hear it, would there be a noise? How can one prove that there would be a noise, if such the case may be? A. There are two senses to the word "sound" or "noise." The first is the definition given by the physiologist or psychologist: "Sound is a sensation produced in the brain by a disturbance or vibratory motion of matter, which can be perceived through the agency of the auditory nerve." The second definition of sound is that of the physicist: "Sound is a vibratory motion in some material substance, which if it strikes upon the ear of some living being would produce a sensation in the brain." The first definition is directed toward the sensation produced in the living being; the second is directed to the physical cause or action. Your question with reference to the falling of a tree

where no living being is present, or within reach of the physical disturbance, is answered in one way by the physiologist, and in the opposite way by the physicist. Physiologists say there is no sound where there is no auditory apparatus. Physicists say sound is independent of any auditory apparatus for its existence. You will then answer the question in either way according to your point of view.

NEW BOOKS, ETC.

HOISTING MACHINERY. By Joseph Horner, A.M.I.M.E. New York: J. B. Lippincott Co., 1903. 8vo.; pp. 252; 215 engravings. Price $3.

This book was written with the idea of showing the underlying principles, as well as the details, of crane construction, and illustrating the various types of hoisting apparatus in common use. As most of the manufacturers of such apparatus rely largely on experience for the correct proportioning of the parts, the author has omitted all formulas and theories pertaining thereto, and has made his book a handy technical reference work for all engineers and others desirous of knowledge on this subject.

DIZIONARIO TECNICO IN QUATTRO LINGUE. Tedesco. Italiano-Francese-Inglese. By Ing. Edoardo Webber. Milano: Ulrico Hoepli, 1904. 16mo.; pp. 611.

The only way in which to test the efficiency of a technical dictionary is to use it. That we have done. Although we have not always been able to find in this lexicon of Mr. Webber's the definition of every term that we have sought, still we have found his book, on the whole, an exceedingly helpful guide in translating. Most technical dictionaries are so far antiquated that the publication of the present volume is in many respects a welcome contribution from the Hoepli house.

OUTSTANDING ERRORS OF THE NAUTICAL ALMANAC. By Dodge P. Blackstone, A.M., C.E. Berlin, Wis.: George C. Hicks, 1903. 8vo.; pp. 55. Price, $1.50.

A correct nautical almanac is of equally great value to the astronomer and to the mariner. To the former it is essential for the correct determination of stellar parallax, while to the latter it is quite necessary for making correct observations. Mr. Blackstone's pamphlet gives a mathematical demonstration, and corrects the errors found to one ten-thousandth of a second. It treats of the moment of inertia, the precession of the equinoxes, the mass of the moon, the ellipticity of the earth, and the outstanding corrections due to elliptical orbit.

SIMPLE EXPERIMENTS IN STATIC ELECTRICITY. By Percival G. Bull, M.A.Oxon. London: Percival Marshall & Co., 1904. 12mo.; pp. 71. Price, 20 cents.

This small volume is intended for the use of many young students who know more or less about practical electrical instruments and machines, but who have had little or no experience in the fascinating field of static electricity. The book describes fully most all the interesting experiments that can be made with simple apparatus, and it can be used alone or in connection with a more elaborate text book.

ARCHITECTS' AND ENGINEERS' HAND BOOK OF REINFORCED CONCRETE CONSTRUCTIONS. By L. J. Mensch. Chicago: Cement and Engineering News, 1904. 12mo.; pp. 217. Price, $2.

Reinforced concrete, while considered to be the ideal building material of the future, is comparatively little used at present, owing to its not being well understood by even our most competent engineers and architects. This handbook was designed to convey to modern architects and engineers full information regarding the use of reinforced concrete constructions. It is copiously illustrated with photographs and drawings, and should prove of great value to the engineering fraternity.

X-RAYS SIMPLY EXPLAINED. A handbook on the theory and practice of radiography. By R. P. Howgrave-Graham. London: Percival Marshall & Co., 1904. 12mo.; pp. 93. Price, 20 cents.

This booklet for amateurs gives a clear and concise account, both historical and practical, of the experiments, discoveries, and improvements which have led up to the present knowledge of Roentgen rays and their application to pathology. Being intended for amateurs and students, it does not treat of the complicated and expensive apparatus, or of the latest developments in hospital methods. It gives, on the contrary, a thorough understanding with the elementary principles involved in X-ray work, and of the use and management of the essential pieces of apparatus employed, including the taking of radiographs and the construction of fluoroscent screens. It is well illustrated.

HIE EUROPA!—HIE AMERIKA! Aus dem Lande der krassen Utilität. Von Jul. H. West, Ingenieur. Verlag von Franz Siemenroth in Berlin. Price, 50 cents.

Despite its sensational title Mr. West has in this book presented a rather shrewd analysis of American industrial conditions. His work, like many another book of the same kind, is intended to bring home to the mass of German manufacturers the magnitude of the "American peril," of which the German press has had occasion more than once to speak within recent years. Americans have little to learn from the book. Germans, on the other hand, will find in it a bold, clear statement of the causes for American commercial success.

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Locomotive lighting system, E. T. Ford	759,511
Locomotive sander, G. W. Frazier	759,688
Log turner toothed bar, D. R. Edwards	759,685
Loom electrical warp stop motion, H. I. Harriman	759,436
Loom, filling replenishing, M. L. Stone	759,325
Loom reed, A. Saurer	759,317
Loom shuttle, A. R. Heritage	759,440
Loom warp stop motion, O. Reinhardt	759,309
Lubricants to wire or other ropes, apparatus for applying, Bone & Whitehead	759,801
Machinery, means for controlling velocity and decreasing shocks and recoil in, E. G. Shortt	759,481
Mail box, C. B. Harward	759,437
Marlinespike, F. Kappler, Jr	759,717
Massaging instrument, M. Doerr	759,505
Measure, angle tape, J. A. Roe	759,313
Measuring instrument, angle, C. Clark	759,239
Measuring machine, G. M. Bond	759,233
Measuring the revolutions of rotating shafts, H. Frahm	759,512
Measuring the revolutions of rotating shafts, apparatus for, H. Frahm	759,513
Mechanical movement, C. & J. Dietz	759,423
Mechanical movement, A. Wahle	759,648
Medicament vaporizer, M. Saenger	759,397
Mercurial regulator, R. J. Flinn	759,258
Metal fabric, P. J. Shrum	759,760
Metals for solutions, recovering, I. Anderson	759,493
Metals from their crushed ores, etc., apparatus for separating, W. N. Turner	759,775
Metallurgical furnace, E. C. Wills	759,791
Milling tool, adjustable hollow, A. Elmiger	759,425
Mine timber, D. W. Brunton	759,418
Miter box, D. F. Updegraff	759,647
Moistening machine, gummed strip, J. E. Colvin	759,675
Motion, device for varying reciprocating, C. F. Goddard, Jr.	759,265
Motor gear, J. Havluj	759,609
Music leaf turner, W. Pilot	759,829
Music sheet, mechanical, F. C. White	759,575
Musical instrument note striking mechanism, E. H. Klaber	759,532
Musical instruments, division indicator for mechanical, F. C. White	759,576
Nailing machine, W. J. Darling, et al	759,350
Net, fly, C. E. Rhinehart	759,470
Newsstand, S. J. Richardson	759,311
Nozzle, jet, L. Schutte	759,320
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Nut lock, F. J. Bloomqvist	759,232
Nut lock, S. M. Hopping	759,713
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Oil burner, G. G. Calkins	759,500
Oil burner, D. H. Mosteller	759,822
Oiler, wheel, W. D. Graves	759,699
Ordnance, smoke and gas ejector for, Boucher & McCloskey	759,803
Ore roasting furnace, rotary rabbled, T. D. Merton	759,730
Organ, pipe, F. Zebrowski	759,338
Packing, A. O. Van Dervort	759,330
Packing, piston and piston valve, J. T. Wilson	759,581, 759,582
Paddle wheel, E. Chaquette	759,238
Padlock, permutation, S. W. K. Miller	759,540
Paper fastener, E. L. Sibley	759,400
Paper feeding mechanism, J. S. Duncan	759,250
Paper watermarking device, E. R. & O. F. Behrend, reissue	12,218
Parer, fruit or vegetable, M. Glasser	759,264
Pea picking machine, S. E. Kierolf	759,381
Pen, writing, H. O. Reese	759,551
Penholder, C. C. Metheny	759,293
Pencil holder, H. H. Garson	759,691
Pencil holder, R. A. Nichols	759,739
Pencil sharpener, H. H. Brandes	759,499
Pessary, F. H. Brunig	759,342
Phonographs and kinematographs, apparatus for synchronously operating, L. Gaumont	759,693
Photographic objective, K. Martin	759,537
Photographic plate holders, exposure index for, H. G. Rosslow	759,314
Photographic printing apparatus, F. Rachel	759,469
Piano action, A. A. Barthelmes	759,655
Pick, miner's, M. Hardsocg	759,704
Picker. See Corn picker.	
Picture cover and frame, combined, J. C. Barcus	759,839
Picture, etc., frame, J. J. Sherman, Jr	759,561
Picture frame, L. Brand	759,840
Picture transferring composition, H. J. McKeel	759,301
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Pin joint, A. Pollard	759,548
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Piping fluids, Isaacs & Speed	759,374
Pistol grip, G. C. Bourne	759,415
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Plant weeding and thinning out device, B. J. Otto	759,393
Pliers, C. J. Carlsen	759,668
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Plow, disk, S. V. Weeks	759,489
Plow, sulky, J. E. Russell	759,754
Poke, animal, J. W. Seibert	759,758
Power transmission mechanism, B. J. Arnold	759,222, 759,223
Pressure mechanism, E. T. Wolf	759,793
Printing apparatus, wrapping paper, F. L. Mercer	759,292
Projectile for loading practice, P. A. Guye	759,516
Propeller shaft, screw, H. S. Maxim	759,726
Propeller shafts, stern tube for screw, J. Stephens	759,323
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Railway signal, E. J. Relph	759,310
Railway signal, J. W. Anderson, Jr	759,652
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Trunk strap, R. J. Nunn	759,305
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Turbine engine, W. Wyand	759,584
Turbine, steam, G. Code	759,420
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Twyers, cooling boxes, etc., lead detector for, A. C. Kloman	759,449
Typewriter escapement mechanism, F. X. Wagner	759,780
Typewriter key levers, tension device for, B. A. Brooks	759,807
Typewriter line spacing mechanism, J. H. W. Marriott	759,817
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Vending machine discriminator, J. J. Green 759,268
Vessel, navigable, C. A. Manker 759,536
Vessel sighting tube, S. Lake 759,622
Wagon body, B. F. Freeland 759,364
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Washing machine, P. Farnquist 759,254
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Washing machine, Cramer & Haak 759,678
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Water heater, J. Foster 759,303
Water heater, Hallas & McLaughlin 759,607
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Water tube boiler, S. C. Munoz 759,463
Water tube boiler, J. J. O'Brien 759,544
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Welding apparatus, T. F. Rowland 759,635
Well casings, means for sinking oil, E. J. Beane 759,412
Well digging apparatus, T. E. Law 759,723
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Whistle operating mechanism, automatic, O. C. Fisher 759,207
Willow, W. Francis 759,362
Winding machine, J. P. Cronin 759,595
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Window screen holding device, W. H. Fishburn 759,842
Window screen, roller, J. E. Buehler 759,664
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Wrench, C. D. Colley 759,674
Wrench, G. W. Jessup, Jr. 759,715
Wrench, M. F. Hudson 759,813
Wrench pipe attachment, S. J. Hinman 759,442

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Flour, wheat, B. S. Bull 42,586
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Oil, certain named, Chemische Fabrik Florsheim, Dr. H. Noerdlinger 42,593
Oil, cotton seed, Kentucky Refining Co., 42,591, 42,592
Oil, olive, Barton & Guestier 42,590
Ointments, Ray Oleopath Benevolent and Educational Institute and Club 42,574
Paints and painters' supplies, certain named, Standard Varnish Works 42,596
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Powder, talcum, Lord & Russell 42,573
Powders, shampoo, R. J. Pay 42,572
Razor strops, Kampfe Bros. 42,599, 42,600
Rubber, footwear composed wholly or in part of, J. J. Tallmadge 42,568
Scale beams, Peck, Stowe & Wilcox Co. 42,605
Shoes, leather, National Shoe Manufacturing Co. 42,567
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Tonic, Mount Eryx Co. 42,579
Trusses, I. M. Pease 42,571

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"Gardner's Pepsin Gum," for chewing gum, J. Gardner 11,051
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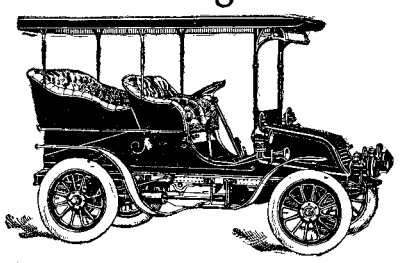

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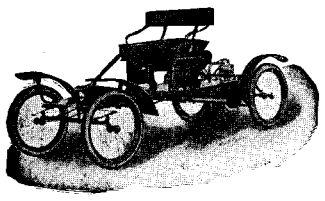

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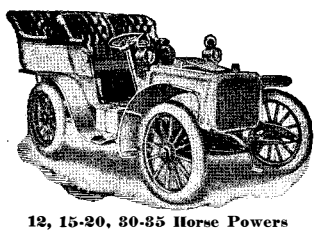

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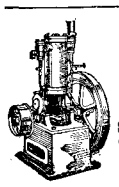

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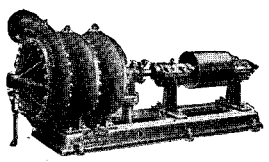

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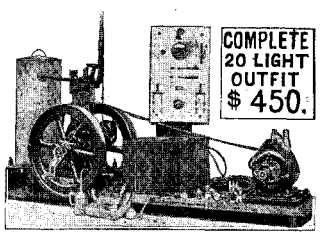

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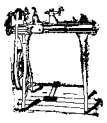

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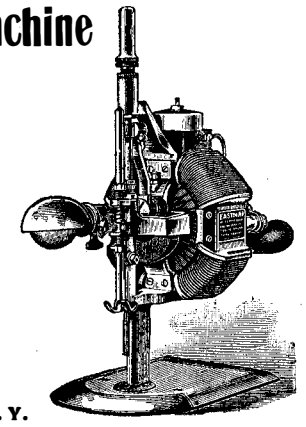

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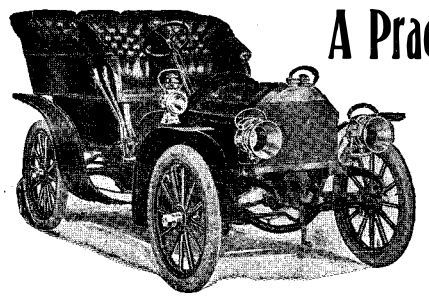

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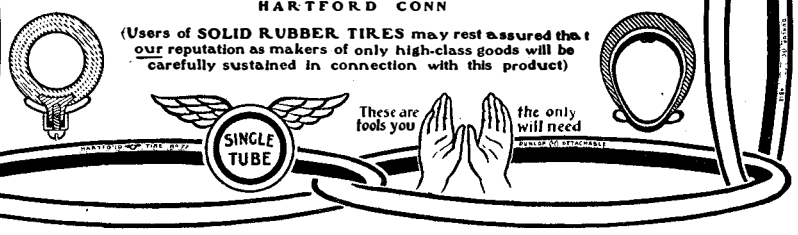

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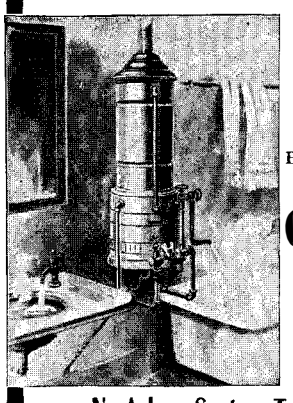

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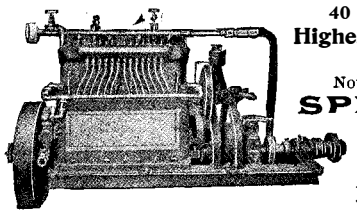

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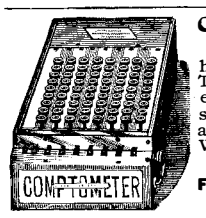

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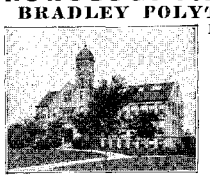

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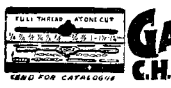

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