Correspondence.

More Light on the Smokeless Powder Question.

To the Editor of the Scientific American:

The Scientific American of May 6 contains a letter from E. J. Ryves, of London, England, relative to the recent wrecking of a 10-inch gun at Sandy Hook. The tenor of this communication is to the effect that this deplorable accident is directly chargeable to inherent faults of multi-perforated powder. This attack upon a brilliant solution of the smokeless powder problem involves insinuations and charges that I cannot allow to pass by in silence. Those who are acquainted with the relations of the Maxim brothers have already read between the lines of Hiram Maxim's—I should say Mr. Ryves'—letter. But the vast majority of your readers are ignorant of this fraternal warfare, and I crave your permission to place before them in the columns of your paper some facts that may convince them that our ordnance officers, though unprogressive, are not yet fit subjects for the attention of alienists, and that all knowledge did not desert this country when the plans of a certain machine gun crossed the Atlantic.

My claims for consideration in this matter rest with the fact that I acted as assistant in the experiments of Dr. Schüpphaus and Hudson Maxim and as superintendent of the company formed for the commercial utilization of the results of those experiments, which covered very fully the field of smokeless powder. As the inference from the letter in question and an article in the Scientific American Supplement for May 6 inspired by Hiram Maxim is that the Schüpphaus-Maxim powder was founded upon the early work of that gentleman, it will be necessary to add some more secret history. Hudson Maxim had undertaken to develop a smokeless powder torpedo gun system. Mr. Maxim associated with himself Dr. Robert C. Schüpphaus. To produce a progressive powder, Mr. Maxim had in view a tubular powder, with a thin non-combustible or slowly burning cover. Practical difficulties made us discard the idea. Recalling Capt. Rodman's work with multi-perforated cakes of black powder, multi-perforated grains without covering were adopted, since mathematics showed that such grains could be made to approximate the theoretical advantages of a covered tubular powder with regard to an increasing burning surface.

But no smokeless powder formula of the day was suitable for the production of a satisfactory multi-perforated powder. New lines entirely had to be pursued. While Mr. Maxim gave his attention to dies and torpedo guns, Dr. Schüpphaus busied himself with this problem with the most happy results, discovering a suitable formula, capable of wide variations to meet all intelligent views, and a process for manufacturing commercially that formula into a perfect multi-perforated grain. Later I brought out the "segmental grain," relating to the most advantageous shape of the perforations, for which patents have been granted me in the United States and Germany. This history will dispose of the implication that the Schüpphaus-Maxim powder may be traced to Hiram Maxim through Hudson Maxim's early connections with his brother. If Hiram Maxim would but publish the retraction he made to Mr. Vickers of his firm concerning this point, his understudies might be more guarded in their statements. A word in regard to Dr. Schüpphaus will not be out of place, for he is a pioneer in the American smokeless powder field. When smokeless powders began to make a stir in America, his investigations were turned in that direction, with the result that in 1890 he submitted several powders to the United States government. For the 0·30 caliber gun, then in its experimental stage, two forms of guncotton powders were offered, representing ideas that have not been improved upon to this day. But the ignition of these with the primers in use proving very unsatisfactory, and the cry being for the high ballistics inherent in the nitroglycerin powders, he produced such a powder that gave superior results in the 0·30 caliber rifle. He then took the ordnance office by surprise in presenting samples of this powder for the 8-inch rifle. Satisfactory results were obtained, but to no avail.

Rip Van Winkle of the Ordnance Department turned in for another sleep, with the result that utter consternation ruled throughout the department when the adoption of the Krag-Jorgensen rifle brought the realization that they had no American powder even in sight for it, since the early inventors had retired permanently in disgust from the field of small-arms powder.

It was certainly premature upon the part of Dr. Schüpphaus to poke Rip Van Winkle, of the Ordnance Department, in the ribs five years ahead of any other American inventor and say, "Wake up, old man, and try to catch up with Europe; here is some smokeless powder for a large rifle."

When Dr. Schüpphaus took up the powder question some years later with Hudson Maxim, the erosive qualities of high grade nitroglycerin powders had been recognized, and the demand was for guncotton powders, with higher ballistic properties than they then possessed.

Mr. Ryves' discovery that multi-perforating is not advantageous, but dangerous, is novel. The Ordnance Department of the United States Army has never been accused of jumping to conclusions. After three years' experience it announced very firmly that multi-perforated powder was to be credited with all the advantages that had been claimed for it. Powder was supplied for all the guns of the United States Army, and duplicated in part of them many times. What excited particular comment, outside of the powder's high ballistic and low erosive value, was its remarkable reliability and regularity. However, Mr. Ryves has made tests. The trouble with those experiments is that they were comparative ones. The experienced engineer will always go shy of such tests. The comparative test deals with relatives, and generally omits some essential condition. It had been attempted to manufacture multi-perforated cordite, with no success at all. There was a quasi-peace between the Maxim brothers then, and they were working together for the introduction of multi-perforated powder into England. Hiram proposed, however, that some credit should go to him, and so walked the cordite formula onto the scene. But flat failure followed. Whatever is added, vaseline or castor oil, is put in for the simple purpose of keeping the larger rods from warping and checking badly. It does not succeed any too well with plain rods and is utterly out of the question with the intricate forms of multi-perforated grains. Then transversely perforated rods were tried. Cordite being too brittle for being punched into, some rods of Chilworth powder were secured and perforated transversely, it having a rubbery consistency. Theoretically, I cannot figure out any particular advantage in transversely perforating the usual long solid rods to which the process must be applied. The rod of circular section employed in England was a very poor form additionally for the purpose. It is probable that the Chilworth powder was just right for the gun. This was perforated with sapient wisdom in a manner that rendered it a quicker powder for that gun, and that meant a lowering of ballistics obtainable with it. That the perforated powder gave equal ballistics with the unperforated is explainable by the fact that the perforations were such as but to quicken the powder to a degree that the slight advantages of transverse perforations could counterbalance. Furthermore there could exist doubts as to the action of such transversely perforated rods in a gun where experience and theory both dictated that the short longitudinally perforated grain offered especial advantages for regularity of action. Mr. Ryves' witnessed some loosely conducted experiments of a system never tried before, and would damn something else by it. He may have fired more rounds of ammunition than most men alive, but inhalation of powder gases has never been classified by the medicinal profession as a brain tonic.

No powder was sent to England at that time on account of troubles in the company. But it had been distinctly understood that we would not guarantee our powder to pass the English heat test. While the United States was conning its smokeless powder primer, prudence did not dictate the building of a costly guncotton plant, and that article was purchased in the American market. It was the best to be had, but not up to the English standard, and it is manifest that a powder cannot be more stable than its ingredients. The implication that the process hurt the stability of the ingredients is best answered by the fact that the Schüpphaus-Maxim powder led American powders in that regard and contributed largely to the raising of the American heat test that then existed.

Then again the powder is damned because it contains di-nitrocellulose. There must be many fools in the business, then, since the Russian, German, French, and American powders for large rifles contain that article by intention. Even cordite has some that is always produced in the manufacture of military guncotton. The only powder that made use of military guncotton from which the soluble cotton had been specially extracted has a nice headstone in the powder graveyard. The truth of the matter is that di-nitrocellulose is a generic term comprising a large number of varieties of nitrocellulose, many of which are eminently suitable for use in smokeless powders.

Basing an opinion upon experience derived by my connection with the development and manufacture of multi-perforated smokeless powder, and upon such information concerning the trend of commercial production of powder in this country during the last year or so that has reached me, I do not hold with any explanations that have been publicly advanced. That placing it upon the multi-perforated feature seems to me to border upon the nonsensical, for it is reason that an inherent defect should have put itself in evidence during three years of trials. The same thing was alleged of brown prismatic powder with its central hole to account for abnormal pressures occasionally encountered. But Vieille showed that such pressures arose from wave action in the powder gases induced by certain conditions of loading. When these conditions were avoided in practice, abnormal pressures disappeared. My opinion would involve responsibilities that I do not care to assume in absence of direct proof of any cause. In addition, I know that a most eminent authority in Europe, with a wide experience in powder matters covering many years, has stated firmly that any smokeless powder may detonate in a gun under certain conditions. What those circumstances are I do not know, since the man in question vouchsafed only the general statement. The report of the board investigating the accident will be a basis for the advancement of ideas by those who may not agree with the conclusions.

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Japanese Clock.

To the Editor of the Scientific American:

In your issue of May 6 is an illustrated article about a Japanese clock in which mention might be made of some interesting facts pertaining to Japanese horology.

The Japanese divide the twenty-four hours into twelve periods of time, of which six belong to the night, and six to the day, their day beginning at sunrise and ending at sunset. Whether the day or night be long or short, there are always six periods in each. To attain this the characters or numerals on the scale are adjustable, two of them are set, one to agree with sunrise, the other with sunset, and the four characters between them divide the space into equal portions. Thus, when the period of daylight is longer than the night, the day hours will be proportionately longer than those of night. Another peculiarity in their scale is, that they only use six characters, those from four to nine, and these read backward. The scale on your clock is numbered consecutively or

$$\begin{matrix} 6, 5, 4, 9, 8, 7, & 6, 5, 4, 9, 8, 7, \\ & 7 \end{matrix}$$

Why these are so arranged from top to bottom I should like to know.

The United States National Museum has a clock like the one you illustrate. It also has a Chinese watch with adjustable figures on the dial that are placed in the same order as those on the clock scale.

E. H. Hawley.

Smithsonian Institution, United States National Museum.

The Speed of Warships.

To the Editor of the Scientific American:

I have read with much interest the several articles on the various foreign navies, and note the widespread popularity which they, as well as the Naval and Coast Defense Supplements, have gained. A discussion of the various navies, also of the different types of vessels contained therein, proves to be an unusually interesting subject at the present time, and I am pleased to note that the Scientific American is aiming to keep its readers thoroughly informed on naval matters. One fact impresses itself very forcibly on the reader's mind, namely, the superiority both in number and excellence of the British vessels over those of the Continental navies. A very important advantage, and one which is somewhat overlooked in the comments on the British navy, is that the rated speed of their vessels is based on natural draught instead of forced as in all other navies, and as a result a 21-knot vessel of the "Cressy" class would be able, under forced draught, to easily overtake a 22-knot vessel of other navies should it come to a chase on the open sea, as she could make over 22 knots under forced draught, a very important advantage not to be lost sight of in speed comparisons. While the British vessels as a rule do not carry as heavy armaments as some others of the same or even less displacement, the additional weight will always be found to be well accounted for in the more powerful boilers and engines required to give them their excellent high speed under natural draught, and in the additional ammunition and stores carried. British ships were they rated at forced draught would be found to be the fastest vessels afloat for their class by a large margin, a very important advantage. A British vessel to-day, in case of hostilities, would be able to accept or refuse battle from hostile ships of equal or superior power for this reason, to say nothing of being able to maintain her most advantageous fighting range should she choose to risk an engagement with a more powerful foe. A comparison of the run from Southampton to New York of our "Columbia" (22·8 knots trial speed) when she averaged 18·41 knots per hour with the British cruiser "Diadem" (20·5 knots rated speed), from Gibraltar to the Nore, when she averaged 19·27 knots per hour, both runs being made under natural draught, proves the above beyond any question. It is with no little humiliation that all admirers of our navy note the following facts in a speed comparison of our ships with England's. Our "Kearsarge" and "Alabama" classes, which are not yet in commission (nor will the last named class be for another year), have the low speed of 16 knots (equal to 14½ or 15 in service), and are several knots slower than ships of the same date in foreign navies. Of course the "Maine" class are a great improvement over the last named of our navy, and the fact that the Senate effectually blocked the

construction of our 13,500-ton battleships and 12,000-ton armored cruisers until next year, while greatly to be deplored, would be fortunate should the Bureau of Construction see fit to take advantage of the fact and increase the speed of the battleships and armored cruisers to 19 and 23 knots respectively; in which case they would be more up-to-date vessels at the time of their completion. It is likely that Congress would have to be asked for an additional appropriation to cover the increased cost, also the displacement would probably have to be increased; but according to the exact wording of the naval bill this would be feasible. There is no plausible reason why the United States should not have ships the equal of any afloat or under construction. England has set the speed of her new battleships and armored cruisers of the "Duncan" and "Drake" classes at 19 and 23 knots respectively and they will be completed and in commission sometime before our new vessels. It is difficult to understand why, in view of the all-important lessons taught by the late war, the naval authorities do not replace the 1 and 6-pounder guns on the plans of the "Maine" class, also the proposed new vessels, with 12 and 3-pounders. It was clearly demonstrated that the 1-pounder gun has no place on armorclads where the fighting range is from 1,500 to 3,000 yards. The 12 and 3-pounders are conceded by nearly all naval authorities to be the ideal light rapid-fire guns for both battleships and cruisers.

The construction of six unprotected cruisers of about 2,500 tons trial displacement, of the low speed of 16 knots per hour, which seems to have been decided upon according to the clipping I inclose, if true, seems to be only one step removed from the absurd act of Congress, over a year ago, when it inserted a clause in the naval bill providing for the four obsolete monitors now under construction. It has lately been discovered that the six small cruisers can be raised to about 3,200 tons displacement, and still be constructed within the amount appropriated, $1,140,000 each. Why not build six protected cruisers of a little less displacement, and about the speed of the "New Orleans," or six improved "Raleighs," and arm them with two 6-inch and ten 5-inch rapid-firers, or ten rapid-fire 6-inch.

It is reasonably certain that vessels of the above type could be built for the amount appropriated, and would not be a comparatively useless waste of the people's money, as will be the case if the present plans are persisted in. It would be fortunate if Secretary Long would withhold his approval of the plans for such extremely slow vessels. An expression of opinion from the editor as to the value of the proposed slow vessels in time of war would be interesting. If they were attached to a squadron they would be of no value, and would keep down its speed to about 14½ knots. If they ventured out to sea, and encountered a hostile ship or fleet, they would probably have to surrender, or fight a more powerful antagonist, as they would have no choice of battle on account of very low speed. Of course they could be used for police duty in times of peace, but warships are supposed to be built to fight also, and these vessels seem to be wofully deficient in two of the most important requirements, speed and protection.

The proposed large coal supply of the small cruisers is unusually heavy, and is important, but good speed, protection and armament will win a vastly greater number of battles than a hundred or so tons of coal. It is sincerely to be hoped that the plans as outlined in the inclosed clipping will not be the ones finally adopted, and it does not seem possible that the Bureau of Construction would commit itself to vessels of the unheard-of speed of 16 knots in this advanced period of warship construction. A SUBSCRIBER.

Billings, Montana, April 26, 1899.

[The question of speed in warships is treated at some length in our editorial columns. In comparing the speed of our new battleships and cruisers with that of the new 19-knot battleships and 23-knot cruisers of the British navy, our correspondent overlooks the fact that our ships will be more heavily armed. We are willing to sacrifice a knot of speed for a preponderance in armament. The six new vessels referred to by our correspondent have been designed to meet the new conditions imposed by our possessions in the Pacific and the West Indies. They are intended for service on distant stations, to reach which, it is necessary to make long unbroken trips, or on stations more or less remote where docking facilities are wanting.

With a view to this they are to be sheathed and coppered (the weight of which covering reduces the speed by from a quarter to half a knot) and they are to have an unusually large coal supply, sufficient to carry them 8,000 miles without recoaling.

The comparatively low speed is in agreement with a growing belief among naval men all over the world, that while higher speed is desirable in the battleships and large cruisers, it is not so essential in the smaller cruisers which do police duty on distant stations.—ED.]

PLANS are being made for the projected canal between Berlin and Stettin by which vessels of heavy tonnage will be able to reach Berlin.

Mr. Eddy's Later Experiments.

Mr. W. A. Eddy, of Bayonne, N. J., has been continuing his experiments of sending up a hot air balloon carrying a thermometer, to which we have already referred. The balloon was held captive at a height of 400 feet. The earth temperature when the balloon first ascended was 69° above zero. Five minutes later when it was hauled down the thermometer registered 66°. At the second ascension, when the height of 600 feet was reached, there was a difference of 3°. The balloon is 12 feet in diameter and exerts a lift of 4 pounds. The thermometer weighs 3 ounces and is arranged to give the readings of the extreme heat and extreme cold. It was impossible to use kites because the wind was so light that they would not remain aloft. The expenses of the experiment are borne by the Hodgkins Fund of the Smithsonian Institution.

A BEDSTEAD FOR INVALIDS.

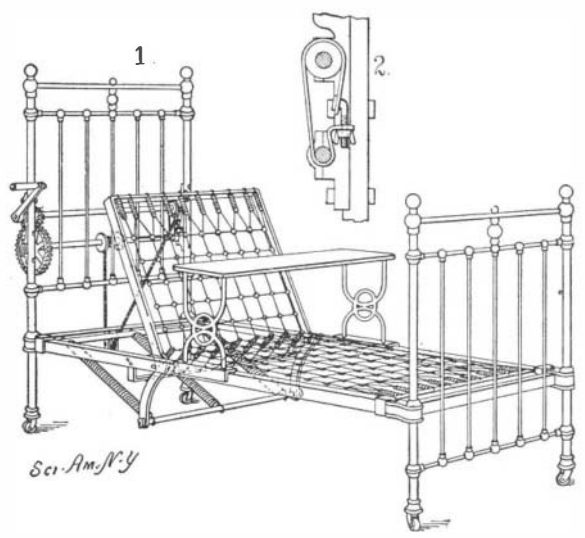
We illustrate herewith a bedstead for invalids, which has a head portion arranged to be raised and held yieldingly in an inclined position by springs.

Fig. 1 is a perspective view of the bedstead. Fig. 2 shows a brake employed for the purpose of preventing too quick a movement of the head-portion under the action of the springs.

The movable head portion of the bed bottom is pivoted to the side rails of the bedstead. Arms extend downwardly from the sides of the head-portion and are connected at their lower ends by a cross rod. To these cross rods and to another cross rod secured to the side rail springs are secured which serve to swing the head portion into an inclined position.

In the head-posts of the beadstead, a power-shaft and a drum-shaft are journaled, connected by gear-wheels, and operated by a crank. Around the drum-shaft a rope is wound which is connected with the movable head-portion.

By releasing a dog which controls one of the gear-



COUGHLIN'S BEDSTEAD.

wheels, the spring secured to the cross rod connecting the downwardly-extending arms of the head-portion will swing the head-portion upward, the springs being of sufficient strength to raise the patient lying upon the bed. In order to prevent too violent a movement of the head-portion, a brake-strap engaging the power-shaft and the drum-shafts as shown in Fig. 2 is employed.

As indicated in Fig. 1, a table may be placed upon the side-rails, the table being so mounted that it can be pushed lengthwise but not sidewise.

The beadsteadis the invention of William Coughlin, 252 East Fifty-second Street, Manhattan, New York city.

American Bridges for Burma.

The Burma Railways Company invited six English and two American firms to make a tender for the Goktick viaduct in Burma. Four of the English firms responded, and the most favorable English tender required three years for completion of the work, and the cost was to be $590,000. The American tender proposed to complete the work in one year at a cost of $300,000. It is needless to say that the Burma Railways Company accepted the tender of the American company.

Our Losses in Two Wars Compared.

The War Department has prepared a memorandum which compares the losses in the Spanish War with those in the first year of the Civil War. The aggregate strength of the troops employed in the war with Spain was approximately 267,000, covering a period from May, 1898, to April, 1899, inclusive. During this time deaths from all causes amounted to 6,190, or 2¼ per cent. The mean strength for the first year of the Civil War was 276,371, and the aggregate loss by deaths from all causes was 19,159, a percentage of 6·8.

Science Notes.

The Belgian consul at Manila states that money for the construction of the projected railway connecting the north and south portions of the island of Luzon with Manila has already been subscribed in Belgium.

Prof. Campanile and E. Stromei explain that phosphorescence in Geissler tubes is due to gradual charging and extremely rapid discharging of the walls of the tube at the part covered externally by the anodic tin foil, the phosphorescence being set up on the opposite wall during the extremely rapid discharge.

A railway company of Brooklyn has a special car fitted with a hydraulic jack by which the car can be lifted off the rails of the crossings and put on another track having no connection by switches. They also have a special tower car with an adjustable platform on the roof enabling repairs to be effected on the "up" trolley wire while the tower car is on the "down" line. This car is very useful in stringing trolley wires.

Dr. Koeppe notes that distilled water is decidedly deleterious to protoplasm, absorbing from the same saline constituents and swelling its tissue even to the extent of destroying the vitality of the cells. Distilled water has a similar action on the cells of the stomach, producing in some cases vomiting and catarrhal troubles. He concludes that the toxic property of certain glacier and spring water is due to its absolute purity, which also explains why the sucking of ice and drinking of glacier water sometimes causes stomach derangement.

A German inventor has devised a curious display apparatus which consists of a mirror having its rear face silvered to such a degree as to render it capable of reflecting objects. A picture is secured in the rear of the mirror and under ordinary conditions it is indistinguishable through it. An electric light is mounted in the recess at the rear of the mirror, which can be lighted and extinguished at will. When the current is turned on, the picture on the back is brought into view, and, as the light may be flashed intermittently, a curious effect is produced.

Sir W. B. Richmond is pursuing his campaign against the smoke of London. The Coal Smoke Abatement Society, over which he presides, is attracting leaders of artistic and scientific circles of the metropolis and now seeks to enlist as well the skill of those in the mechanical world. At a recent meeting of the committee it was decided to give gold, silver, and bronze medals to the three best exhibits in the coal smoke abatement section of the forthcoming Building Trades Exhibition at Agricultural Hall, London. Sir W. B. Richmond has promised to design the medals.

The "Ernest Bazin" will shortly be sold at auction at Liverpool. According to the announcement of the auctioneers, "this fine model of engineering skill," which cost nearly $100,000 to build, will be offered for sale. Great attention is directed to the suitability of this boat as an attractive novelty show steamer and advertising medium for the great coast pleasure resorts, and it will doubtless prove of more interest and importance to those in this class of business than it ever will be to navigators. It has also been suggested that the rollers may be used for gas buoys or caissons.

An Italian medical journal calls attention to the fact that a Brussels bank disinfects all its soiled notes and commends the practice which is followed by the Bank of England of destroying all its notes that come back to the bank. Our own government would be very wise in following such a course. Where the notes are very old they are destroyed, it is true, but every note ought to be as soon as it gets in the hands of the government. Infection by paper currency is probably not very frequent, but, at the same time, there are cases on record which can be directly attributed to this cause.

According to a decision of the Court of Errors and Appeals of the State of New Jersey, property owners need not permit telegraph poles, telephone poles, and electric light poles to be placed on the highways in front of their property without due compensation. Corporations cannot set their poles in the night time or at any other time when they can take property owners unawares and thus secure a right of way. They must obtain the consent and agree with the property owners as to the rate of compensation, or, if they cannot agree, they must go to court and have the issue adjudicated there.

In Sweden the food given to reindeer is "reindeer moss," a lichen highly prized by the Lapps, and which grows abundantly in the Arctic regions, almost as luxuriantly on bare rocks as in the soil. It covers extensive tracts in Lapland, making the summer landscape look like a field of snow. The domesticated reindeer are never as large as the wild ones. The domesticated Siberian reindeer are larger than those of Lapland. No care at all is taken of the deer. They thrive best by being permitted to roam in droves and obtain their own sustenance. The moss can be used as human food, the taste being slightly acrid. Attempts have been made to feed hay, roots, grain, etc., to the reindeer, but they have not succeeded.