TRAVELING MILITARY TURRETS.

We have many times already pointed out to our readers the importance of the role of protected turrets in the work of the defense of strong places. It seems advisable now to make known to them an application of the properties of these metallic apparatus in the operations of the field of battle. We intend to speak of the "movable protected gun carriage" or "trench armoring," constructed at the Gruson works in Germany under the instructions of Major Schumann. It is said that an analogous system is perhaps to be studied in France also, and we are able to give a description of the apparatus such as they are now conceived. The idea, however, is certainly not new. Campaign turrets moved about on carts were in use in Persia in the remotest antiquity. Those that Cyrus had at the battle of Thymbra were about fifteen feet in length. Placed upon a platform drawn by eight yoke of oxen, each of them, says Xenophon (Cyropœdia, Lib. XI.), was occupied by a detachment of twenty picked archers.

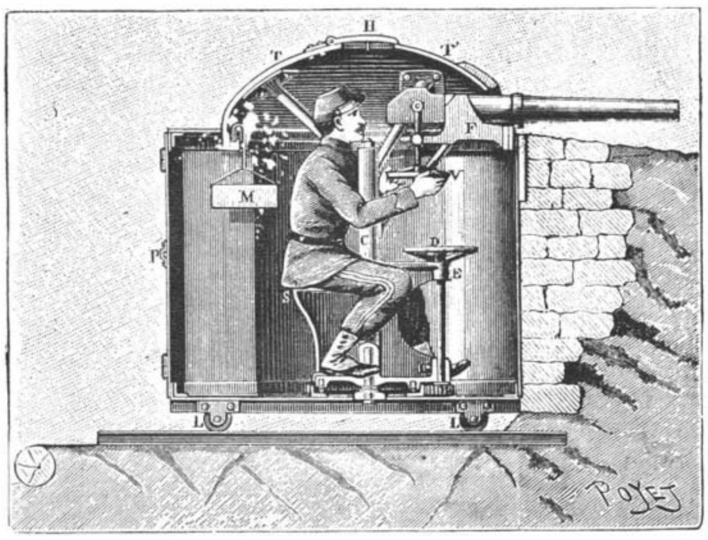

Fig. 1.—CAMPAIGN TURRET IN POSITION UPON THE TERRE-PLEIN OF TEMPORARY FORTIFICATION.

The ancients also made use of campaign turrets mounted upon the backs of elephants. These wooden works, fixed to the pack saddles of the great pachydermatous motors, were bordered with parapets covered with the hides of recently skinned oxen. But passing rapidly to modern times, let us see what there is in the economy of the Grusonwerk products. The Schumann campaign turret consists of an iron plate cylinder about four feet in internal diameter provided with a door, P, and closed at its base by a metallic floor and at its top by a convex cupola ten inches in thickness (Fig. 1). At its upper part the cylinder is strengthened by a ten inch thick forged iron ring. The roof, which is essentially movable, rests through the intermedium of three supporting branches upon a central column, C, whose lower extremity, in the form of a pivot, is capable of revolving in a step bearing fixed to the floor, and the circumference of which is toothed.

Under the cupola there is in battery a 1½ or 2 inch rapid fire gun served by two men, one of whom has charge of the ammunition, while the other, upon order, does the loading, pointing and firing.

The cheeks, F, in which rest the trunnions of the gun, are invariably connected with the roof, so that the recoil is completely suppressed. At the moment that the piece is fired, the cupola oscillates slightly, but, owing to the position occupied by the center of gravity, it immediately rights itself. The man charged with the maneuvering remains seated upon the chair, S. He points through the gun port formed in the cupola, and then, after the port has been secured against the danger of a reply by the enemy through a revolution of 180 degrees, he can survey the field through a sight hole, H, provided with a shutter.

In order to point in direction, the gunner causes the cupola to revolve by maneuvering the hand wheel, D, upon the axis of which is mounted a pinion that engages with the teeth of the step bearing. This axis, which traverses the arms, E and G, keyed upon the column, C, can be rendered immovable when occasion requires it.

The apparatus for upward pointing consists simply of a screw that the seated gunner maneuvers by means of the hand wheel, V. The amplitude of the angle of firing may be varied by ten degrees above to five degrees below the horizon. In the interior of the cylindrical turret there are ammunition chests, M, suspended from a circular rail along which they can be made to slide. The gunner brings them within his reach in measure as the exigencies of the firing require it. As soon as one of the chests is empty he unhooks it and passes it to the assistant, who replaces it by a full chest.

The cartridges used are metallic. The charge of powder is inclosed in a brass cylinder fixed to the base of the projectile. The supply is 160 shots for the 1½ inch caliber and 130 for the 2 inch. The turret that has just been briefly described is essentially transportable. To this effect, it is mounted upon a two-wheeled vehicle of special construction, drawn by six horses (Figs. 2 and 3).

The axle is bent twice at right angles so as to diminish the height of the carriage. To this axle and to the frame of the vehicle are fixed two rails about six feet in length upon which the turret rests through the intermedium of four wheels, L L (Figs. 1 and 2).

From the carriage are suspended two other lengths of rail that are laid upon the ground in the prolongation of the others at the spot that the turret is to occupy after being removed from its carriage. Upon reaching its destination, the turret is set into the earthwork of the parapet that it is to arm. There then emerges from this earthwork nothing but the cupola of the turret and the chase of the gun (Fig. 4), ready to fire from 30 to 40 shots a minute. In default of receptacles prepared in advance, the turrets may be placed against the interior talus of the parapet. The cupola is proof against balls and fragments of shells, but not against direct shots; yet, since it offers to the enemy's artillery a target of but limited dimensions, it runs little risk of being struck directly. It is estimated, moreover, that it would suffice to give the steel cupola, TT, a thickness of 1¼ inches, and the forged iron ring, A, 2 inches in order to have the armor resist the action of campaign shells perfectly.

The weight of the turret, inclusive of the gun, is 3,300 lb. for the 1½ inch caliber and 4,400 for the 2 inch. As the vehicles weigh respectively 1,188 and 1,520 lb., the total weights to be considered are 4,488 and 5,920 lb.

Fig. 3.—CAMPAIGN TURRET, WITH ITS DRAUGHT HORSES.

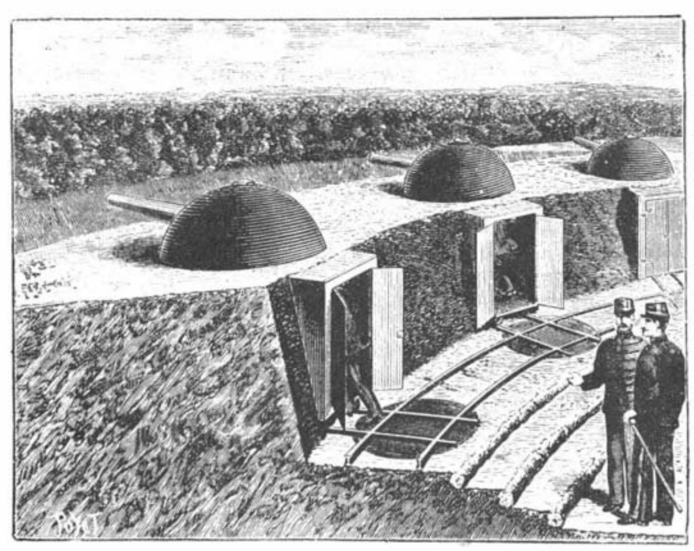

Fig. 4.—GROUP OF TURRETS IN POSITION IN THE EARTHWORK OF THE PARAPET OF A TEMPORARY FORTIFICATION.

It will be understood that the putting in battery of a campaign turret requires the combined efforts of quite a large number of men, and that the performance of this operation takes a certain amount of time. Apropos of this, it is well to observe that it is possible, in case of need, to work the turret without dismounting it from its carriage.

The German General Von Sauer, in accord with Majors Schumann and Scheibert, estimates that the use of campaign turrets may, in certain cases, exert a decisive action upon the operations of war. Such was not, it must be said, the opinion of Marshal Moltke, who treated these movable armorings as playthings, as masterpieces of clockwork that almost anything puts out of order and that cannot be made use f for any length of time. But the marshal is no longer of this world, and, consequently, the authority of his opinion has lost somewhat of the prestige of yore. The Germans think that it is expedient to have recourse to the use of these "movable protected gun carriages," as they call them, for improvising centers of resistance designed to serve as supporting points for bodies of troops in action; and that, too, not only upon a field of battle properly so called, but also in the zone of the defensive positions of a stronghold.

In this order of ideas they ar making studies of turrets capable of receiving rapid fire guns of a caliber greater than that of those put in service up to the present, and have already submitted to experiment a type of protective armor for a 2¼ inch gun. Our government cannot delay following them in this direction, and so we have put French uniforms upon the persons who give life to our explanatory figures.

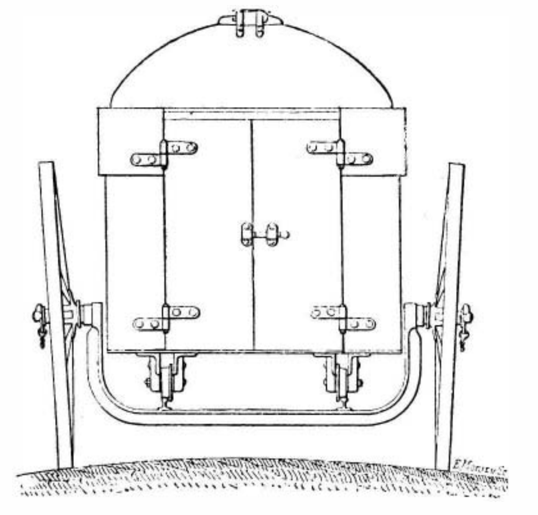

Fig. 2.—THE TURRET MOUNTED UPON ITS CARRIAGE.

We have stated above that six horses must be harnessed to the carriage of the turret designed for the reception of 1½ and 2 inch rapid fire guns. Now the increase in caliber and in the thickness of the armor will necessarily correspond to an increase of the total weight of the apparatus. How can a load be moved that could not be pulled by six collars together? The solution of the problem seems to be plainly indicated. It is necessary to have recourse to som mode of traction without horses, and, in this regard, to make an appeal to the ingenuity of the laureates of the competition recently opened by the Petit Journal.—La Nature.

Light from Water Power.

An American traveler in the Tyrol and other Alpine countries gives an interesting account of the manner in which the Alpine torrents are being utilized in the Swiss villages. Until the past year these villages were lighted at night only by an occasional swinging horn lantern. Now the streets in many cases are as brilliantly lighted as Broadway. There are clusters of incandescent lights strung across the streets every few yards. The little inns and the scattered shops are also lighted up brightly inside and out. The same change is spreading everywhere. It is probable that extensive manufacturing interests will soon spring up and the mountain torrents will turn saws and spindles as well as dynamos. There is the greatest abundance of power going to waste on every side which may easily be made to run machinery.

IT takes a snail exactly fourteen days and five hours to travel a mile.

The Atmosphere of Mars.

Though the evidence is as yet insufficient to prove the existence of cloud or mist on Mars, of water vapor as such present in his atmosphere there is practically no doubt whatever. It is through the air that the water liberated every year from about the pole must return to form the next winter's snows. Furthermore, the spectroscope has been thought to show the lines of water vapor in the spectrum of Mars, but the observation is of extreme faintness and the result proportionately doubtful. But another argument from the behavior of the polar snows can be drawn with some cogency. From the manner and extent of their melting, the climate of Mars seems peculiarly mild, whereas the thin air and the distance of the planet from the sun would necessitate an unpleasantly frigid one, something almost perpetually below the freezing point. Now, as Flammarion points out, the presence of sufficient water vapor in the air would suffice to produce the observed convenient amelioration.

To sum up, then, our present knowledge of the atmosphere of Mars, we may say that we have proof of its existence and reason to believe that it is at the surface of the planet about half as thin as ours is on the summits of the Himalayas; that in constitution it is probably similar to our own, except that it is more heavily charged with water vapor; that it is nearly, if not quite cloudless, and that rain or snow are almost unknown phenomena on Mars, dew or hoar frost ill supplying their place. For precipitation would be actually too precipitate for anything else. Finally that in the day time, at least, it is almost perpetually fine weather on Mars.

One deduction from the extreme rarity of the air we must, however, be careful not to make: that because it is thin, it is incapable of supporting intelligent life. That beings physically constituted like us could not exist there with any comfort to themselves is more than likely. But lungs are not inseparably linked to logical powers, as we are sometimes shown in other ways, and there is nothing in the world or beyond it that we know of to hint that a being with gills might not be a superior person notwithstanding. Doubtless a fish who had had no experience of man would conclude life out of water to be impossible. In the same way to argue intelligent life beyond the pale of possibility because of less air to breathe than that to which we are, locally, accustomed is, as Flammarion happily puts it, to argue not as a philosopher, but as a fish.—Percival Lowell in Popular Astronomy.

The Law of Invention.*

BY HORACE PETTIT.

Where a mere doubt exists at the time of application regarding the novelty and patentability of an invention, it is generally resolved, as it should be, in favor of the applicant, and the courts, when subsequently called upon to pass upon such patent, will, as they should, be considerably guided, where such a doubt as to patentability still exists, by the fact that the invention in question has proved commercially successful.

As a usual rule, however, in the class of cases just referred to, it will be found that where an invention has proved successful commercially, there is some inherent reason for it residing in the invention itself. This may be illustrated, for instance, by the celebrated telephone cases, where a mass of alleged anticipatory testimony, some of it very strong, was produced. It is true that the credibility of some of the testimony was very much doubted by the court, but Mr. Bell had in his favor throughout the whole proceedings the fact that he had described a successful operative means of transferring to, or impressing upon, an undulatory current of electricity, the vibration of air produced by the human voice in articulate speech, in such a way that the speech was carried to and received by a listener at a distance on the line of the current. Never before had such an invention been given to the public. It was one of the greatest inventions of the age, and naturally it would have taken very strong evidence of anticipation to have defeated his patent. (American Bell telephone cases, 126 U. S., 863.)

The Bell company rested its entire case upon the fifth claim of the Bell patent, which is as follows: "The method of, and apparatus for transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

It is interesting to note that when Bell applied for his patent he had never actually transmitted telegraphically spoken words so that they could be distinctly heard and understood at the receiving end of his line; but, as stated by Mr. Chief Justice Waite, in delivering the opinion of the court: "In his specification he did describe accurately, and with admirable clearness, his process; that is to say, the exact electrical condition that must be created to accomplish his purpose; and he also described with sufficient precision to enable one of ordinary skill in such matters to make it, a form of apparatus which, if used in the way pointed out, would produce the required effect, receive the words, and carry them to and deliver them at the appointed place. The particular instrument which he had and which he used in his experiments did not, under the circumstances in which it was tried, reproduce the words spoken so that they could clearly be understood; but the proof is abundant, and of the most convincing character, that other instruments, carefully constructed and made exactly in accordance with the specification, without any additions whatever, have operated and will operate successfully."

It will thus be seen that although Bell did not give to the public at the date of his application for a patent a commercially operative device, and never up to that time had constructed one himself, he did, nevertheless, describe and claim such a device in his application as would enable others skilled in the art to make a successful operative commercial device. Perhaps it may be safely said that at the date of Bell's application he had not been as successful in his actual experiments as some of those who had experimented before him, but they had never completed, either in an actual device, or upon paper, the invention to the extent to which Bell had perfected it.

Mr. Chief Justice Waite said inter alia: "Some witnesses have testified that they were unable to do it (construct an apparatus from Bell's patent); this shows that they, with the particular apparatus which they had, and the skill they employed in its use, were not successful, not that others, with another apparatus, perhaps more carefully constructed, or more skillfully applied, would necessarily fail. As was said in Webster Loom Company vs. Higgins (105 U. S., 580, 586), 'when the question is whether a thing can be done or not, it is always easy to find persons ready to show how not to do;' if one succeeds that is enough, no matter how many others fail. . . . The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way to put it into operation. This Bell did."

* Abstract of lecture delivered before the Franklin Institute, Philadelphia.

Arc Lamps in Cotton Mills.

The use of arc lamps in cotton mills, upon what is known as the "inverted arc system" of lighting, is slowly but surely making headway in England, according to the London Electrical Review. Owing to the murky atmosphere which prevails in English manufacturing districts, where cotton mills most do congregate and where the sun is rarely seen, there is need for artificial light during greater portion of the working hours, hence the question of lighting is a very important one, not only for mill owners, but also for mill hands. Gas at its best is a poor substitute for daylight, and is further objectionable on sanitary grounds. The advent of incandescent electric lighting was a great improvement, no doubt, both as regards safety and health, but it still left much to be desired as a light for mill purposes. Arc lighting, as then known, was found unsuitable on account of the hard shadows cast, and furthermore was regarded as unsafe, and consequently practically prohibited by the fire offices.

The first attempt at mill lighting by arc lamps upon a rational system emanated, if we mistake not, in France. This simply consisted in suspending an inverted cone reflector below the arc, thus throwing the light first upon the whitened ceiling above, and thence upon the work below. By thus doubly reflecting the light, and at the same time shielding the eye from the direct rays, the effect was most pleasing, the perfect diffusion thus attained practically destroying all shadow. The next advance was to invert the arc itself by placing the crater carbon below, and in this form we have what is known as the "inverted arc" system of lighting. So much is the new light appreciated—rivaling daylight itself—that mill owners readily pay the extra tax imposed by the fire offices rather than be without it. At the same time it must be admitted that great care is needed when introducing arc lamps in the presence of such highly inflammable material as cotton, and upon this score we venture to offer a few remarks.

There are two cases on record of serious fires in cotton mills traceable to arc lighting. In the first case the usual netted glass globe had alone been relied upon for protection, and owing to some imperfect construction, or, what is more likely, the neglect of the trimmer to replace an injured globe, a particle of heated carbon escaped from the lamp on to the material below, immediately setting fire to the cotton, and resulting in the destruction of the mill. The second case was in connection with the use of an inverted cone reflector suspended below the arc by means of chains, made detachable to admit of trimming. The lamp had just been retrimmed, when the cone reflector was seen to tilt violently on one side, dislodging a large particle of the crater carbon onto the mule beneath, setting fire to the cotton, with the same disastrous result to the mill as in the case above quoted.

Here again the trimmer either failed to properly reconnect the chain, or else some part of the suspension gear gave way. Now there is a lesson to be learned from these two fires. It is evident that glass, or any other such brittle material, should not alone be relied upon as a guard against the escape of heated material from the arc. The necessity for retrimming every six or eight hours during the running of the mill, and frequently under trying circumstances, leads to breakages, which are not always attended to in time; and the bungling or neglect of the trimmer is the one factor most to be feared, as well as the most difficult to provide for. Glass of any kind is therefore better dispensed with. It absorbs much light, particularly when coated with dust, and casts unpleasant shadows.

The supposition that there is danger in a naked arc burning in an atmosphere charged with fine cotton flyings has been proved groundless, and experiments also show that the dust which collects within the reflector is impotent to do harm. In fact, it appears that the one and only danger to be apprehended is the possibility of a considerable particle of the incandescent carbon coming in contact with the material itself. We believe it possible to give all the protection necessary by a well designed and ample metal inverted cone reflector, without the addition of a globe, provided it be permanently and rigidly attached to the body of the lamp. Indeed, it should be a sine qua non in all arc lamps for cotton mill lighting that no essential guard or any part of the suspension gear needs detaching for purposes of adjusting or renewing carbons.

Next in importance is the suspension gear, for should a lamp fall when in use the result would probably be fatal. Usually the lamp is suspended by a cord or chain, with counterweights, over a couple of small pulley wheels, with considerable wear and tear upon the cord. This, therefore, should be strong, preferably of steel, with well made connections; and as an additional precaution, an independent guard chain is recommended to prevent the lamp falling beyond a certain distance in the event of any portion of the suspension gear giving way.

The use of arc lamps in the spinning and carding rooms of cotton and flax mills must always be attended with more or less danger, and only by carefully attending to such details of construction as we have here briefly alluded to can that danger be reduced to a minimum.

The Transit of Mercury, November 9-10, 1894, as seen at the Lick Observatory.

BY E. E. BARNARD.

A more superb day than Saturday, November 10, could not have happened for the transit of Mercury. Though a slight northerly wind was blowing, it did not materially affect the observations. The air was warm and balmy and was unusually steady for a Mount Hamilton day.

My observations of the transit were confined to the 12-inch, with which all four contacts were observed. and fifty-three independent measures of the right ascension and declination diameters made. Forty-eight measures of the position f Mercury on the sun's disk were also obtained.

The unusually good conditions prevailing gave an opportunity to look for evidences of an atmosphere to Mercury and for any unequal shading of his disk.

Neither at contacts nor while on the sun's disk could any luminous ring be detected. The disk was uniformly dark, round and sharply defined during the intervals of best seeing.

The white spot reported at some previous transits as having been seen on the disk of Mercury was not visible, and has doubtless been an optical phenomenon, unless it was turned away from us at these observations.

It was noticeable that the disk of Mercury was not black—it seemed to be lighter than the sky about the sun. A micrometer wire placed over the planet was apparently more in contrast than when against the sky outside the sun's disk. The wire seemed to be about twice as black as Mercury, while on the sky there was but little contrast. This illumination of the disk could scarcely have been due to earth light, and I therefore assume that it must have been purely optical.

An attempt was made to see the planet before its entrance onto the sun, but nothing could be seen of it. Nor was that portion of it visible which was not yet on the sun, during the interval between first and second contacts.

At the first internal contact the black drop formed but the geometrical contact could be easily decided. This black drop—which was only slight—lasted for about nine seconds after contact.

There was no black drop at the internal contact going off—definition then being excellent.

In the first half of the observations six inches aperture was used. This was reduced to five inches toward the last, as the heat became so great as to crack the sun cap.—Popular Astronomy.