

## I

“Now, Messieurs, if we cast a retrospective glance over the twenty years that have just gone by, we will feel a legitimate satisfaction at the sight of the results obtained and the progress realized during that period. The metallurgical establishments of the entire world, once our rivals, have been obliged to cease their competition before the crushing superiority of our cannon-metal. Many of them have been ruined by fruitless research attempting to penetrate our secret or to discover an analogous product that might permit them to continue the struggle. All of them are presently reduced to manufacturing objects of a distinctly secondary importance, such as steam engines, railway equipment and other metallic constructions for which the old steel can still suffice.

“In the not-very-distant future we shall also take away those last and feeble resources, but we can already say today that our laborious efforts have assured us the most brilliant and the most envied of monopolies, that of artillery. We have not only given cannons a perfection in lightness and resistance that has astonished connoisseurs; our projectiles possess such powers of explosion that their prodigious effect on troops has aroused general enthusiasm every time they have been called upon to resolve the grave questions that sometimes divide peoples.

“Thanks to the intelligent and indefatigable zeal of our agents in all parts of the world, the negroes of Africa, the inhabitants of South America, and even the islanders of Polynesia have no hesitation in imposing the heaviest sacrifices upon themselves in order to procure our products, and are now indebted to us for the same benefits as the European powers.

“Thus provided, they too have been able to constitute those superb armies that are the glory of the century, by means of which their fragmented territories will soon be covered by vast and powerful empires. Better than the Spekes, the Burkes and the Livingstones, our commercial travelers have been able to bring these young peoples nearer to old Europe by giving birth among them to the fecund sentiment of national grandeur, and initiating them into the latest discoveries of modern industry.

“We have thus contributed, in large measure, to the acceleration of the march of civilization. A few more efforts, and the world, disrupted so many times by revolutions, drawn into the path of progress by the impulsion that we have been able to impart to it, will surely move in the direction of utilitarian reform, and end up finding the equilibrium and the stability that philosophies and religions have been impotent thus far to bring about.

“However, above that brilliant horizon, I can see the threat of tempest surging forth. A black dot today, it will perhaps be a cloud tomorrow capable of obscuring with its giant shadow the gleam of our success.

“I fear that our riches, so legitimately acquired, might attract the attention of our neighbors, particularly that of the great empire that surrounds us. There, jealous eyes are following the progress of our influence, which is increasing incessantly, to the detriment of some, it is true, but assuredly to the profit of the greatest number. Dazzled by its power, that State seems to have forgotten that it owes its most efficacious means of action to us. Although the ingrate is scornful of us because of the limited extent of our territory, and hates us for our treasures, we shall nevertheless pursue the goal to which we aspire!

“But our security must not be compromised; our duty is to seek to adopt at great haste measures against the unfortunate eventualities that might be produced. I believe, in addition, that I have already found them, and I propose to reveal them to you in an imminent session.”

Such is the essence of the remarkable speech of 1 February 1923 in which the eminent engineer Lichtmann, the President of the Cooperative State of Canonenstadt, had revealed to the Government Council the brilliant industrial situation of the country, and also the anxieties inspired in him by external politics.

An extraordinary engineer and an accomplished economist, the man in question combined with his many virtues and many faults an audacity capable of any enterprise and an energy capable of carrying it through. Still young, he had fathomed the abyss in the depths of which terrible social questions stirred,

lifted up like black smoke by the irresistible current of our old civilization toward luxury and pleasures. As active as he was indefatigable, he had confronted those somber problems resolutely, analyzed them coldly and recognized fearfully the impossibility of opposing a dam to the ever-increasing overflow of human misery.

But from the violent impact of an elite intelligence against a reef in which so many strong wills had already broken, a powerful idea sprang forth one day, a spark that was to illuminate those depths and serve as a beacon light to society in the sheer paths that it was necessary to climb in order to arrive at the serene heights of universal peace. He set to work without delay and founded, in the final years of the 19th century, in the midst of Europe, a free and respected State, armed to the teeth, whose surface area was less than that of a medium-sized French département.

All the causes of inequality, and hence of jealousy, between the citizens were carefully set aside there by the wisest of institutions. Thus, the constitution dictated by the engineer gave rise to the admiration of other peoples, who would all have liked to be ruled by it. For reformers, it was a model that it would be necessary, sooner or later, to imitate.

That man of genius had nothing particular about his appearance, which greatly astonished his contemporaries. His description was easy to make. He was not one of those men whose cerebral development or profundity of gaze causes people to say, on seeing them: "There goes an intellectual!" No, he could only be judged by his actions, and the examination of his skull would not have revealed any particular protrusion.

It was probably that perfect balance of all the elements of his personality and faculties that had permitted him to assimilate all human knowledge and master the most dissimilar sciences. That universality, which made him simultaneously the greatest chemist, the greatest technologist and the greatest philosopher of the era, had allowed him to discover the true path of progress, which so many others had only glimpsed.

Essentially practical, he had not allowed himself to be dazzled, while studying the religions and philosophies of all eras, by theories that are admittedly seductive, but solely for the usage of educated minds. No system had, in his opinion, preoccupied itself sufficiently with the material interests of the multitude. The liberty that some people thought they had achieved and which others envied was only a deceptive lure, a shadow always on the brink of vanishing, for the turbulent and hungry crowds always dreamed of other destinies and became more irritated every day with the obstacles raised by the constitutions and laws in place. Experience began to demonstrate their insufficiency and even their complete lack of utility. Liberty had been painted by the popular imagination in attractive colors, but with disillusionment had come lofty demands in favor of the absolute equality that, by suppressing unhealthy comparison, was the only means of suppressing completely any seed of revolt.

Lichtmann resolved to give satisfaction to the masses; labor, the source of all wealth, the conqueror of the spirit of independence as well as oppression and tyranny, would unite in the same momentum all the classes of society, and in that leveling of conditions and fortunes, humans would find the remedy for their ills and the pledge of a boundless felicity.

Thus distinguishing the goal with a marvelous lucidity, he had immediately thought about the means of attaining it. We should say, in his praise, that he did not think for a moment of having recourse to the polemics of the press or the podium, the results of which could only be uncertain, and the effects very slow. Those instruments had, moreover, the inconvenience of being in the hands of malevolent wills and paltry interests, which would certainly join up in opposition to him. That century of money and weapons had to furnish him with a more rapid and more reliable means.

In his view, suspicions and hatreds between neighbors, carefully maintained and envenomed, were being aroused by governments at bay in order to deflect attention away from burning questions. For love of peace, peoples were ruining themselves with the expenses of war, and those great deployments of force, that redoubtable military power, hid a fundamental and complete exhaustion. The regime of excessive armaments further exaggerated the evil by opposing a better utilization of human effort.

He therefore promised himself to exploit it, to push it to extreme exaggeration by demanding of it the resources that he lacked in order to arrive at the realization of his ideas. To do that, it would simply be

sufficient to bring to the apparatus of war improvements, sufficiently considerable and repeated, to make it absolutely obligatory for the nations that were ready to cut one another's throats to renew frequently their armaments by recourse to him. In that fashion, the greater part of the heavy budgets of war would pass into his coffers, bringing him the omnipotence that he wanted to acquire.

In 1892 he entered as an engineer into the Krupp organization, so celebrated for the quantity, if not the quality, of the cannons that it manufactured. Although still very young, he was bound to attract attention by virtue of his exceptional ability, but in the beginning he had to contend with the attentions and jealousies of his colleagues. His unknown origin gave rise to the most slanderous suppositions and the most extravagant rumors. He was concealing his real name, whispered his detractors; born in Russia, he had prudently quit his native land after having been involved in several nihilist conspiracies. For those absurd rumors, inflated by public gossip, one would have searched in vain for any other foundation than a profound knowledge of explosive materials; but merit is always twisted when a stupid person denigrates it.

His voluminous correspondence with unknown individuals in the most distant countries was also interpreted as being suspicious. It was, however, nothing but the result of connections he had made with a number of enlightened individuals during his numerous voyages, and which he maintained carefully in order always to be up to date with the principal discoveries and the movement of ideas throughout the surface of the globe.

Finally, the malevolence gradually wearied, his modesty and his politeness disarming the most obstinate; everyone was obliged to bow down before his indisputable superiority and the unlimited confidence to which the owner of the factory testified in his regard. The latter, on his death a few years later, could not have made a better choice in designating him as his successor.

At that moment, the prosperity of the establishment was beginning to decrease. It was competing without any marked advantage against foreign competition, especially against Armstrong & Co.,<sup>1</sup> in England and Creusot in France.<sup>2</sup>

Was that not a marvelous opportunity to deploy the extraordinary talents that had earned our hero the first place among so many men remarkable for their knowledge and business intelligence? His fortune was assured, but his ambition was left unfulfilled. The honor of the company to restore, a great reputation to justify, a noble enterprise to pursue—such were still his tasks, and he did not fail in them.

Shut away day and night in a laboratory, where only a few disciples had the privilege of accompanying him, he interrogated with an anxious eye the heated crucibles in which unknown mixtures agitated in horrible reactions. Thus, on the eve of battle, the ancient diviners sought in the entrails of victims the prophetic signs of events to come and the fate of human beings. But antiquity only had haruspices, the Middle Ages astrologers and sorcerers; the nineteenth century possessed true chemists, and although Lichtmann, like Basile Valentin, Raymond Lull and many others, did not find the philosopher's stone, a new substance emerged from his scientific research, an alloy of copper, steel and aluminum.

That metal, by virtue of its resistance in limited thickness, left far behind its analogues thus far employed in the construction of cannons. In order to found it he invented a furnace whose temperature was unattainable in rival factories. In a short time, those two well-guarded secrets were to ensure him the preference for the supply of cannons to the military powers.

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<sup>1</sup> The Tyneside operation in question was actually Armstrong, Mitchell & Co. after 1882, when its original armaments manufacturing company merged with Charles Mitchell's shipbuilding company, and before it became Armstrong Whitworth in 1897 after merging with Joseph Whitworth's engineering company, when it also began to produce cars, trucks and, eventually, aircraft.

<sup>2</sup> The armaments factory based in Le Creusot was actually Schneider et Cie, sometimes known as Schneider-Creusot.

## II

In 1896, having established a new model of campaign cannon, Lichtmann invited the competent artillery experts of all nations to witness the trials; they responded to his summons with enthusiasm.

They examined the gun barrel with interest, which was elliptical in section and whose principal axis was horizontal. By virtue of its restricted thickness, it was reminiscent of a flattened stove pipe. Underneath, a cylinder a few centimeters in diameter, founded along with the first, gave the section of the ensemble the form of an inverted figure 8. The inferior cavity was designed to hold the cartridge, the other a lenticular projectile.

The cartridge was a long cylinder of compressed powder with a varnished surface; it was ignited at the rear via the breech and burned in successive stages as the shell was displaced within the cannon. The internal pressure of the gases and, in consequence, the acceleration imparted to the projectile, being thus continuously rendered, meant that the barrel did not have to support too great a stress, even though the muzzle velocity was about fifteen hundred meters per second.

On the left-hand generator of the elliptical cylinder, the cavity had a series of teeth. These projections, engaging with a copper crown surrounding the shell, forced the latter to adopt an axial rotation, whose circumferential speed was consequentially equal to that of the forward motion—which is to say, thirty times that acquired in an ordinary canon. That would have been unrealizable with a metal less resistant than the new compressed alloy, because the enormous centrifugal force would certainly have caused the projectile to explode, if not within the barrel, at least on its emergence. But that was precisely what would ensure its unique explosion and procure for it an enormous useful effect. Those advantages were explained by the inventor himself to the elite artillerists he had assembled.

“My shell,” he said, “weighing about forty kilograms, can be projected as far as twenty kilometers. That range might seem to you to be exaggerated, and would be, in fact, with your present systems, since one cannot perceive the enemy at that distance and therefore does not know where to direct one’s fire. Henceforth, however, it will be sufficient to know their approximate position, and accuracy will only play a secondary role, for the projectile covers two square kilometers with shrapnel, which skims the ground less than one meter fifty from its surface.

“To obtain the latter result, an inferior stopper is unscrewed by inertia in mid-air during the first moments of the trajectory. One then sees emerge, impelled by a spring, a thin stalk about a meter and a half long, which is folded up in the interior like the units of a collapsible telescope. When, at the end of its course, the shell arrives at that distance from the ground and touches it with the extremity of the stalk, the latter transmits the shock to a fulminating capsule, which ignites the interior charge and determines the explosion.

“Now you know, Messieurs, that in the air, speeds of rotation are conserved almost integrally. It will, therefore, be with an average speed of fifteen hundred meters per second, augmented in a forward direction by the residual velocity—still a thousand meters per second at a range of ten kilometers—and diminished from whence it came, that the fragments will be projected in all directions. They will travel horizontally above ground for distances varying from five hundred meters to fifteen hundred meters from the point of explosion, over a breadth of a kilometer. That gives the surface area indicated. The fragments, about two thousand in number and with an average weight of twenty grams, are disposed in the projectile in horizontal layers subdivided into sectors.

“You can see that by this method, none of them will be, as in your present apparatus, launched into the air uselessly to fall back devoid of force, while others will be immediately buried, devoid of useful effect. Instead, they will all furnish a kind of blast footprint. It is easy to calculate, and the trial will demonstrate, that approximately five pieces of shrapnel will pass over each square meter of surface. In such conditions, any troop that is within several hundred meters of the location of the explosion will be literally scythed down.

“These remarkable properties of a unique projectile will permit a small number to be transported on campaign, and, in consequence, a considerable reduction in weight, which has caused serious difficulties in the past.

“I shall only tell you briefly about the gun carriage, which, like the gun, only weighs two hundred kilograms. Thanks to its metal and mode of construction, it supports without fatigue the enormous effort of the shock transmitted to it. Cupel springs that link it to the cannon diminish the recoil, and can even deaden it completely if one supports the butt against any obstacle, without there being any risk of the rupture of any component. That’s another advantage that you’ll doubtless appreciate.

“In a few days, I shall introduce you to another kind of gun designed to attack fortifications and the armor of ships. In that case, accuracy is absolutely necessary, since one cannot have recourse to the fragmentation of the missile. Thanks to an enormous initial velocity, I’ve succeeded in achieving a perfect regularity of fire. The weight launched is scarcely fifty kilograms, and yet the projectile, whose anterior part is made of a mixture of molten quartz and steel, a substance of extreme hardness and tenacity, will pierce the thickest armor plating as easily as a needle penetrates into a soft material.

“One can therefore consider as finished the already-old contest of projectiles and armor, for no State will be able to bear the expense necessary to fortify big ships or bunkers with the quartz-metal compound.”

In the following days, the engineer carried out before his guests a series of trials designed to convince them that he had not overstated the capacities of his invention.

To render the results more tangible, he disposed a veritable army of mannequins depicting squadrons and battalions grouped in accordance with the principles of modern strategy. After a few cannon shots, those phantom soldiers, without exception, had been afflicted with wounds that would almost all have been mortal.

It was a surprise and a phenomenon before which all the prophets of contemporary artillery bowed down. Oh, illustrious ignoramuses, you all believed that you had made some contribution to the art of destruction during the last thirty years! What were your ridiculous conceptions and innocent ballistic dreams worth by comparison with that gigantic hecatomb, that marvelous butchery!

So, the members of the audience congratulated Lichtmann warmly, proclaiming him their master. When the enthusiasm had died down somewhat, they began to reflect on the new consequences that were about to flow from the introduction of such materiel into armies. They looked at one another suspiciously, wondering who would be the first to take advantage of the discovery. Torn between the desire to get ahead of their competitors and the desire to conceal their intentions, they strove to dissimulate with great care the impressions that their patriotism and the awareness of their responsibility aroused within them.

Colonel von Holzenkopf of the German foot artillery had made a rapid decision. He was already calculating whether the indemnity once paid by France would be sufficient for the acquisition of the large number of the new cannons necessary to endow the subjects of His Imperial Majesty with such precious instruments of labor as soon as possible.

The French envoy, General Rognard, had requested immediate instructions. In the meantime, he was astonished not to have discovered such a simple system a long time ago. As for the others, they were deeply plunged in their reflections and seemed very perplexed, but they kept the thoughts that were agitating them secret.

Only Major Fumistello, the head of the Italian mission, was unable to hide his disquiet on the subject of the projectile designed to pierce the hulls of ships. It was necessary to admit that there was good cause for apprehension, for such a weapon would render useless the gigantic, ponderous and heavily armored vessels that were the pride of the young peninsular navy, likely by virtue of their cost. An immense sadness invaded him at the thought that their inadequacy had been demonstrated even before they had encountered an opportunity to do battle. He therefore awaited with anguish the moment when he could be assured of the reality of the famous projectile’s effects, striving to hope that the engineer was mistaken.

He was obliged to remain in uncertainty, for the date of the trials had not yet been fixed when the delegates learned that European diplomatic relations, already compromised when they departed, had deteriorated completely. They all received orders to rejoin their respective armies as soon as possible. The

great war anticipated for several years was about to break out before the new cannons could be called upon to take part in it.