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THE GREAT MUSEUM OF THE MACHINE AGE

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TIME and time again Henry Ford has publicly stated that he is opposed in principle to endowments, charity or philanthropy in any form. They are demoralizing. If this defective world were properly organized there would be no need of charity or philanthropy. To be sure he supports a fine trade school for boys, but with half an eye to the requirements of his own automobile works. His public hospital in Detroit is said to pay for itself. And now, it is announced, much to the astonishment of those who know him, he departs from a principle to which he has clung tenaciously by giving 1,000,000 marks to the Deutsches Museum of Munich.

It is clear that powerful influences must have affected Henry Ford. Any one who has ever seen the Deutsches Museum or talked with Dr. Oskar von Miller, its founder and director, will understand what they are. The truth is that both the Deutsches Museum and Dr. von Miller are irresistible. The heads of German steel, chemical, shipping, mining and machinery trusts, municipalities, emperors, kings and dukes—all have succumbed.

As a result the Deutsches Museum is at present the most remarkable institution of its kind in the world, a monument to its creator and its benefactors and a convincing demonstration of what can be done to bring the fundamentals of science, engineering and industry to the people.

"Deutsches Museum" is but part of the name of the institution that stands on an island in the Isar on the outskirts of Munich. In legal documents and on ceremonial occasions it is referred to as the "German Museum of Masterpieces of Natural Science and Technology." What we see in Munich, then, is a technical museum in which the evolution of the major branches of science, engineering and industry is traced by means of historically important instruments and machines or by replicas if originals are not obtainable.

What the art museum does for painting and sculpture the Deutsches Museum does for science and invention. It is more than a storehouse of relics systematically arranged. Under the direction of von Miller it has become by far the most successful experiment in visual education ever made, and this in a field especially difficult to popularize.

The difference between the Deutsches Museum and most other museums is the difference between a zoo with roaring lions and blinking elephants and a collection of stuffed animals with glass eyes. Many of the hundreds of machines in the Deutsches Museum are in operation. And where, because of the very nature of an exhibit (a geological formation, for example), motion is impossible, a dramatic setting catches the eye and holds the attention.

The idea of thus animating a technical museum was not first conceived by von Miller. In the Science Museum of South Kensington, London, a few models had begun to move before the Deutsches Museum was opened. Moreover there had always been operative machines in international expositions. But von Miller applied the principle on a scale that had never been tried before and, what is more, applied it for a definite cultural purpose.

To carry out his principle of reaching technically untrained minds, von Miller decided on an innovation that made Germans gasp. Where they are not absolutely indispensable in protecting delicate objects from dust—the riggings and sails of ship models, for example—glass cases are abandoned. Nothing is "verboten." No "Hands Off" signs.

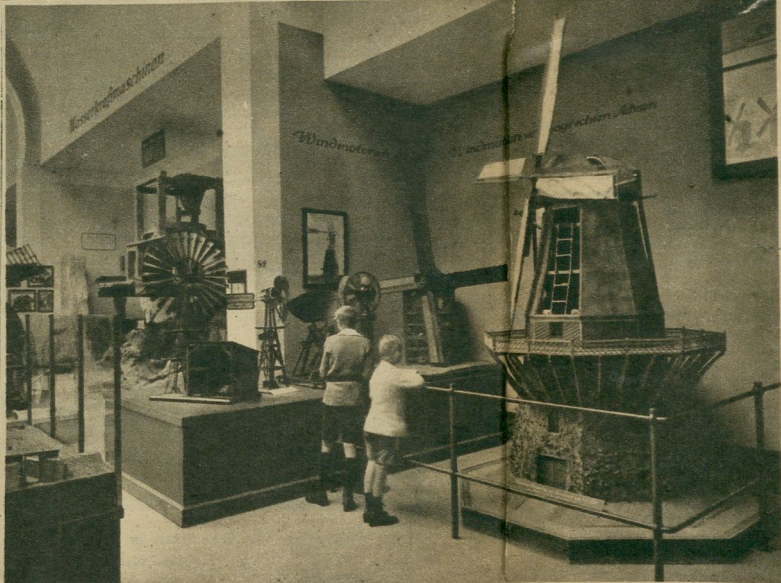
NOT only this, but everywhere there are push-buttons and levers. Push the buttons and pull the levers to your heart's content. Let the wheels spin around. See for yourself that after you have exhausted the air from a bell-jar the ticking of a watch within can no longer be heard. After that you will never forget that without air you cannot hear.

Spin this gyroscope and then try to force the wheel out of its plane of rotation and note that, even if you succeed, the wheel comes back as long as it spins. Press a button and see how water, as it flows from one lock to another, enables a canal boat to rise step by step over a mountain range. Here is a model of an eighteenth-century hot-air balloon. Light the gas flame beneath (it stands for the old fire), watch the balloon swell and then rise on a guide wire to the ceiling, only to descend after its air has cooled. You learn that hot air expands and that, as it expands, it acquires lifting power. Walk over to yonder cabin and step inside.

Hold up your hand to a fluoroscopic screen and throw a switch. The attendant will show you how if you have any misgivings. An X-ray tube glows. You see the bones of your hand just as a physician sees them in a hospital.

Only von Miller could have conceived so far-reaching a plan and only von Miller could have carried it out. He was not a professional director of museums but an electrical engineer of international reputation. There is hardly an important electrical enterprise in Germany with which he has not been connected as a consultant. He organized the first electrical exposition that Germany ever held. His solid engineering achievements had made him an international figure. Fate has so decreed that these should be eclipsed by his extraordinary success as a museum director. Even in his own country he is Oskar von Miller "of the Deutsches Museum" and not Oskar von Miller the international consulting electrical engineer who made waterfalls and coal generate electricity.

It is not only the engineer but the democrat and the imaginative crea-



There Are Few Glass Cases and No "Hands Off" Signs in the Museum.

tor in von Miller that have given the Deutsches Museum a character all its own. Although scholars find much to interest them in the collections of old apparatus and machines, this museum is an institution that deliberately makes its appeal to the common people. Von Miller has the instincts of a first-class showman and of a great popularizer of science and engineering. P. T. Barnum would have been delighted with the Deutsches Museum. Even staid German professors of science, to whom anything that smacks of extreme popularity is anathema, pass through the halls of the Deutsches Museum as fascinated as any Bavarian peasant in leather breeches and bare knees.

Like the editor of any good newspaper or magazine of wide circulation, von Miller never permits himself or his staff to forget that the visitors to his Deutsches Museum know nothing about magnetism, induction, Hertzian waves, and electrons. Science, engineering and industry must be made as exciting and attention-arresting as any motion picture film.

Von Miller slices a locomotive Science Is Alive in Deutsches Museum— Its Ideas Are Adopted Here

through the middle, jacks it up a few inches, and drives it electrically by concealed motors. An attendant climbs into the cab and pulls the throttle. Pistons move back and forth in their cylinders, and slide valves open and close. In five minutes you learn more about the principles of locomotive design and operation than if you were to spend two weeks over textbooks and blueprints.

OVER there stands Puffing Billy, a replica of the original locomotive in London, but a replica so exact that even the rust spots and hammer dents in the smokestack are reproduced. Puffing Billy ran in England in 1813. William Hedley, who designed the engine, would accept von Miller's reproduction as his own creation. The boiler and cylinders are not cut open, simply because the mechanism is simple enough in itself. Instead of electricity, compressed air drives the pistons and wheels—a perfect substitute for steam. The clatter and din take one back to the early days of British railroading when Parliament was petitioned to check the introduction of frightful mechanical substitutes for the horse.

Von Miller is imbued with so strong a sense of what is dramatically interesting that he was not content with teaching astronomy by means of the usual orrery—a model in which a central ball stands for the sun and around which smaller balls are mounted to represent the planets. He wanted something deceptively like the real heavens, with thousands of stars among which the planets would wander.

The Deutsches Museum was in course of construction when the idea flashed on him. He changed the entire top story, over the indignant protest of the architect, and provided a domed space in which the wonders of the heavens were to be seen. Then he went to the famous Zeiss works and laid his idea before Dr. Bauerfeld, the technical director. It took many weary months of research and experimenting, but at last the first planetarium was designed and built for the Deutsches Museum. Now there are about twenty such instru-

ments in the world, one of them in Chicago.

An ordinary old-fashioned model of the solar system is passed by. In a planetarium 500 people take their seats and listen to a lecture lasting half an hour as they behold the glory of the heavens unfolded with a realism that makes them accept the dome of the planetarium as the welkin itself. And what a welkin! It can be manipulated. Years can be compressed into minutes, so that the sun and the planets race across the sky. The constellations can be hurried and located where they will appear 50,000 years hence; or the hands of the celestial clock can be turned back and the heavens made to appear as the prophets of the Bible saw them.

Not all of the models can move. Von Miller resorts to all the devices of a theatrical producer to make them interesting. Between two sections of his museum there was a forty-foot passageway, a non-committal stretch that offended him. He converted it into the promenade deck of an ocean liner. On one side is the ship's bulkhead with its portholes. There are deck chairs with blankets, and even a little table set for tea. Sit down, if you like, and gaze out at the ocean. To be sure it is a painted ocean, but done by a panoramic artist who knew his business.

WALK on and you come to the chart house of a liner. You see the magnetic and the gyroscopic compasses. On a table lie a chart and the instruments for plotting the course made good and locating the vessel's position. The wheel occupies the commanding position. It is clearly connected with the steering engine. Behind you are the engine telegraphs. They work, too. Ask an attendant to turn their handles and you hear the clanging of gongs, just as they are heard in an engine room. Before you is a painted harbor. The ship is manifestly at anchor. It cost \$20,000 to set the scene thus realistically, and a great steamship company paid the bill. What a difference between this dramatic setting and a collection of mariner's instruments in a glass case!

Walk on still further and you pass through a succession of ship's quarters of different periods. "Interiors" they are called in museum parlance. You study the accommodations with which steerage pas-

sengers of sailing-packet days had to content themselves and contrast them with the scarcely more luxurious quarters of the rich who had cabins. Then comes the dining saloon of an early transatlantic steamer, with the mast running straight through the dining table. On either side are cabins, just as on the steamers of 1870.

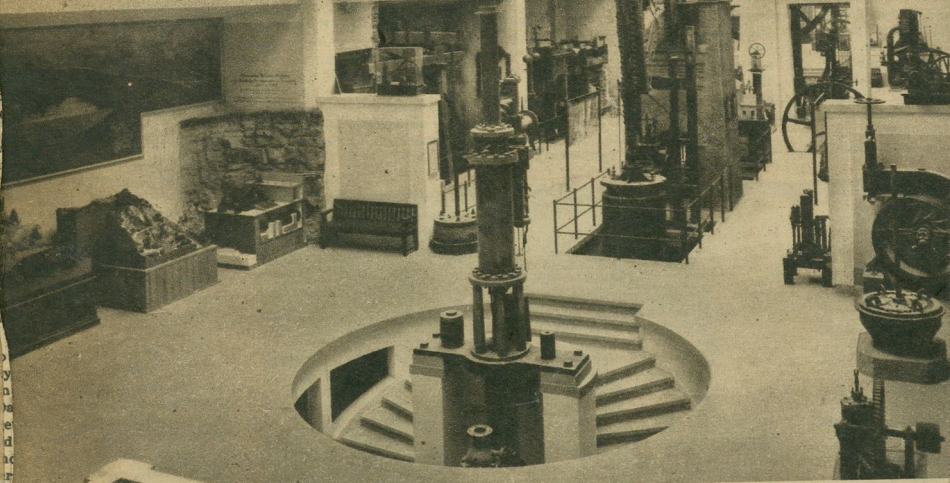
Von Miller, like other museum directors, believes in the "interior." He has reproduced the homes of Swiss lake dwellers, alchemical laboratories, an eighteenth century apothecary (with dried toads, assefetida and other medicinal horrors in the drawers and jars), an old Swiss watchmaker's shop, kitchens of different periods, engine rooms of ships. There are dioramas, too—little stages on which machines are realistically mounted. Thus he manages to pack into a few cubic feet of space facts about mining in the days before there were explosives, power houses, gas-making, bridges and waterways.

Von Miller is not content with telling you that hundreds of perfumes can be derived from coal-tar. You must smell them. He arranges beneath a horizontal screen (even orderly Germany has its hoodlums) about twenty open bottles in which synthetic perfumes are contained. Flowers that emit corresponding natural odors are placed in the bottles. You sniff one scent after the other.

So it is with optical instruments. You look through microscopes that cannot possibly be stolen and see for yourself such wonders as the tongue of a fly, the kit of lances and pumps carried by a mosquito, the structure of some deadly germ. There are models of the eye before which you stand and from which you can learn whether you are near-sighted or far-sighted.

The masterpiece of the museum is perhaps its coal mine. A real coal mine in a museum! No hard cement floor, but dirt of the kind found in a mine, dirt that yields to the feet. On the walls not painted coal, but real coal in rock cut from a mine in the Ruhr district. Wax figures of miners in cramped postures tell the story of mining underground. You emerge again into the light. Before you are drills old and new for piercing rock. An attendant operates them. There is the ear-splitting tapping of the bit against a block of real granite. No institution in the world was

Wasserkraftanlagen



In the Hall of Prime Movers at the Deutsches Museum, Showing Water and Steam Power Machinery.

er called into being quite as this was. Von Miller knew that it would require millions to carry out his ideas. He appealed to industry only von Miller can appeal. He announced that he would not accept a salary as director of the museum. With his own example of denial, he became Europe's most magnificent beggar. He begged machines, instruments, money—begged so persuasively, so persistently that no one could resist him. He even begged much of the material of which the Deutsches Museum is constructed and begged the government to transport it to the spot free of charge. He begged electric power from the Bavarian central stations and got it. But his most triumphant piece of begging was his appeal to the workers who were building the museum. Would they work for nothing on Sundays and holidays? And this in Germany where labor unions reign supreme. The miracle happened. Europe's most daring and imaginative beggar had his way.

Did von Miller hypnotize Henry Ford as he hypnotized German corporation presidents and laborers?

The Deutsches Museum has been criticized (but only by museum directors) as being too big and too confusing because it is big. Nine miles of exhibits! Sixty thousand things to see, if we include the pictures and charts on the walls! Nearly 400 separate rooms and halls! To walk rapidly through the vast collections, glancing only casually at the objects displayed, takes about four hours. To devote a half hour to each of the 400 groups means 200 hours. Granting that it is possible to spend five hours a day in the museum, it follows that it requires forty days to become acquainted with all that the Deutsches Museum displays.

THE answer to these statistical objections is easy. People come not once but over and over again. Munich is a city of 600,000 inhabitants, yet 1,000,000 people a year walk through the Deutsches Museum and stand spellbound in front of steam engines and electrical apparatus. Only the Hofbräuhaus and the motion-picture theatres of Munich can vie with the Deutsches Museum in popularity. No other museum can boast of visitors that annually outnumber the population of the town in which it is located. Von Miller is not in the least alarmed at the size of his institution. He dreamed in the very beginning of a whole group of museums, each devoted to a special phase of technology, convinced that if his method of presentation were simple and popular enough the crowds would come.

Despite his advanced age (he is 75), von Miller is constantly expanding his museum. Before the war he laid down plans for what he calls a "Studienbau," a building which is to be as large as the Deutsches Museum itself and which is to house an auditorium and a technical library of at least 1,000,000 volumes, drawings and blueprints of important engineering creations and inventions of the past, present and future and the documents that scientists, engineers and inventors may leave behind them. Here the student of technology will find precise information on any phase of technology.

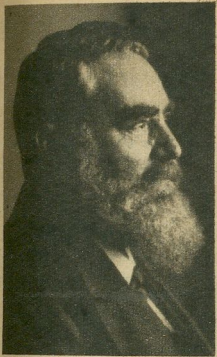
Von Miller had collected the money for this enterprise before the war ended. Germany's defeat brought ruin in its train. The millions that had been contributed were swept away when the mark fell to nearly zero. Undaunted, he renewed his solicitations. Although only half the sum needed has been collected again, the work of building the Studienbau is now in progress. In all probability Henry Ford's million marks is all that von Miller needs to carry the structure to completion.

The example of the Deutsches Museum has not been lost on America. Similar institutions are



A Tropical Scene. Native Workmen Ex

THE GREATEST MUSEUM OF THE MACHINE AGE



Dr. Oskar von Miller, Director of the Deutsches Museum.

Courtesy Museums of Peaceful Arts.

planned for Dearborn, Chicago, Philadelphia, New York and Los Angeles. The one at Dearborn is Mr. Ford's creation. It expresses its founder's admiration for Thomas A. Edison and for antiques. Mr. Ford has bought old engines, motors, furniture, spinning wheels, tools, baby carriages, automobiles, coaches, fire engines and clocks not singly but in lots. In an abandoned tractor plant covering five acres he has stored the greatest collection of antiques ever acquired by one man. These are to be appropriately mounted in a building covering 500,000 square feet, with a façade that is a reproduction of Philadelphia's Independence Hall.

Mr. Ford's museum constitutes part of what is called the Edison Institute. The rest is comprised by a trade school and an American village of the '50s in which are to be found an old country store, a tintype studio, a cobbler's shop, an old-fashioned country hotel, a boarding house, a town hall, a church, an amazingly accurate replica of Edison's historic Menlo Park laboratory fitted out as it was in the brave days when the electric incandescent lamp was invented.

WHAT we have in the Ford museum is an effort to breed a respect for the past, for its craftsmanship and for its ideals. The teaching of scientific and engineering principles, so far as the general public is concerned, is purely incidental. Mr. Ford's museum stands on his own land. It is his property. Like his factory and his hospital, and everything else that he owns, it must pay for itself. It will have moving machinery. It will be a fascinating place, but it will be animated by a spirit quite different from that which pervades the Deutsches Museum.

More frankly patterned after Munich are the technical museums projected for New York, Philadelphia and Chicago. Von Miller has personally acted as the mentor of their directors. Of these institutions that of New York was the first to be planned. It was the dream of the late Henry R. Towne, who left the sum of \$2,500,000 for the creation of "Museums of the Peaceful Arts in the City of New York." In accordance with the terms of the will, the Museums of the Peaceful Arts have already established themselves provisionally in an office building in New York City, the floor covering 35,000 square feet. Thus the citizens of New York may see a technical museum on a small scale.

By giving these periodical demonstrations of what a technical museum is and what it may accomplish in the field of visual education, the trustees of the Museums of the Peaceful Arts hope to interest philanthropists and through them receive endowments which will make it possible to carry out the provisions of Mr. Towne's will and give New York an institution comparable with the Deutsches Museum of Munich.

Philadelphia's museum is to constitute part of the Franklin Institute. It will especially stress the achievements of Benjamin Franklin as a scientist, inventor and printer. The Franklin Institute has received a plot of ground from the city at a rental of \$1 a year for ninety-nine years. Ground was broken last Summer. As in the case of New York, the Deutsches Museum will serve as a prototype.

Of all American technical museums the furthest advanced is that of Chicago. It owes its existence to Julius Rosenwald, who saw the Deutsches Museum some years ago and announced his willingness to donate \$3,000,000 toward establishing in Chicago a museum of science and industry that would be worthy of the city and the nation.

In Jackson Park stood the old Fine Arts Building, a disintegrating reminder of the World's Columbian Exposition of 1893. The South Park Commissioners were authorized to issue bonds to the value of \$5,000,000 to reconstruct the old building, in permanent fireproof form, of limestone, steel and cement, so that it could safely house collections which will ultimately be worth \$50,000,000. The building will probably cost \$6,500,000, and Mr. Rosenwald has agreed to pay the deficit. By the time the museum is opened in 1932 it will represent an investment of fully \$10,000,000 in preparatory scientific research, labor and materials. A staff of seventy-two is at present carrying out far-reaching plans. The exhibition area of some 400,000 square feet equals that of the Deutsches Museum.

THE Chicago museum is not to be a slavish imitation of Munich's splendid creation. Von Miller's principle is to be extended. Historic locomotives will pant as they panted a century ago to show how mechanical transportation began. Edison's first central station will be there. And so will the telegraphs, telephones, radio signaling devices, telescopes, plows, harvesters and the thousands of inventions without which modern civilization would seem empty. Their principles will be explained much after von Miller's manner. There will be buttons to push and levers to pull. Everywhere there will be the flashing of wheels, the crackling of electric discharges, the whir of motors.

What do these machines mean in our lives? It is this question that the Museum of Science and Industry of Chicago intends to answer as well as to explain science and industry popularly. For the first time the social phases and cultural aspects of science and technology will be interpreted in a technical museum, and this by the very machines that made this civilization possible.



The Masterpiece of the Museum Is Perhaps Its Coal Mine.



Here Is the Reproduction of the Laboratory of an Ancient Alchemist.

In Chicago the typewriter is displayed not only as a substitute for the pen but as a machine that put women into countless offices, where they were scarcely known before its invention. The Otis elevator will be shown not merely as a means of doing away with stairs, but as the creator of the skyscraper and with it of the cluster of many-storied hives which is Wall Street or Chicago's Loop. Electricity will be interpreted both as a technical force that drives trolley cars and lights streets and buildings and as energy freed from the limitations of the coal mine and the waterfall—energy that now makes it possible for a manufacturer to settle where land is cheap, the labor supply abundant and railways and waterways readily accessible—all to point the social moral that there is a steady migration of industry from the big to the small town.

The cotton gin of Eli Whitney will be there. It will pick seeds out of cotton—the purpose for which it was invented. But it will also become the principal actor in a social drama in which the whole character of the South is changed, in which slaves are imported by the shipload to pick cotton for the greedy gins and textile mills, in which a bloody Civil War eventually figures to settle the social problem created by the slave.

A reproduction of Watt's historic steam engine will rock its cumbrous beam, just as it does in Munich, and the technical significance of the separate condenser will be made clear. The steam engine also created the modern factory, and so Chicago will see what the world owes to Watt in the form of cheap clothes and shoes and lower manufacturing costs.

We see the same physical instruments that entrance thousands in Munich and we experiment with them in the same way. But they teach an additional lesson—the social lesson that with their aid man ceases to invoke the gods when lightning flashes or storms deluge the earth and studies the forces of nature objectively to the end that he learns to control them for his own advancement. Yet the firm, broad foundation that von Miller laid in Munich will always be visible. Upon his method of stripping mystery and a forbidding technical terminology from science, engineering and industry there can be no improvement.