

### THE HOW AND WHY OF THE MODERN KEYBOARD.—I. BY THE REV. F. W. GALPIN, M.A., F.L.S.

In the wide range of musical instruments none are more popular or more practical than those provided with a keyboard; and although, as was shown in a recent paper on the Roman water organ, the modern keyboard is a comparatively recent invention, yet more than seven centuries have rolled by since its first introduction, or rather its reintroduction in mediæval times. We purpose to describe in brief the how and why of this adjunct to our music-making, and we begin with the organ, for it was to this instrument the keyboard was first applied. The illustrations accompanying this article represent types to be found in the splendid educational collection donated by Mrs. J. Crosby Brown to the Metropolitan Museum of Art—which has been so scientifically arranged that it is one of the finest of its kind.

For the loss of the knowledge of the keys of the hydraulus or water organ with their tones and semitones and their light "touch" we have already suggested some possible reasons. When the organ re-appears as an aid to purer worship it is a pneumatic and not a hydraulic instrument. Keyboard there is none; but the player pulls a perforated slider called in the old manuscripts a "lingua" or tongue, which is placed under each pipe or set of pipes and marked with the names of the notes represented. An organ of the eleventh century thus constructed is shown in Fig. 1, taken from an old version of the Scriptures. In the monastic church of Winchester, England, such an organ was erected toward the close of the tenth century, and in a Latin poem written to celebrate this great work we are told that "two brethren of concordant spirit sit together at the instrument and each controls his own alphabet," an allusion to the lettered sliders.

At the beginning of the twelfth century, however, we begin to hear of keys—small levers which when depressed push in the wooden sliders and when released were restored to their original position by means of a horn spring; in fact they were very similar to the key-levers described by Hero of Alexandria some fourteen hundred years before. The flat "touches" of the levers, called "lamina," were now marked with the letter of the note to which they corresponded and hence arose the name "key" (*clavis*) because the letter gave the "clue" or "key" to the particular sound required. This practice of lettering the keys was long continued, appearing even in the spinet and virginals of the sixteenth and early seventeenth centuries. The use, however, of levers and sliders as organs grew in size was found exceedingly cumbersome, and it soon yielded to an invention which was destined not only to survive to our own day, but to revolutionize the keyboard and bring it to its present effective form.

Organs of diminutive size, called "portatives" because they could be carried by the performer and played as he went, had in early times been constructed, and these were furnished with valves (technically called "pallets") for admitting the wind to the pipes instead of with sliders. At first a small T-shaped button, somewhat like those of the concertina, when pressed by the finger opened a hinged valve placed directly below it and kept in place by a little

spring; this allowed the wind to pass through a small channel to the pipe standing just behind the button. Such a rudimentary keyboard is shown in a painting by Mellozzo da Forti (c. 1450) in the National Gallery, London, a survival, doubtless, of an older day. For

between the bellows and keyboard. The other instrument is the folding or Bible regal invented by G. Voll in 1575. The principle is the same and the ends of the little pipes are distinctly visible, but the whole of the pipes and keyboard mechanism can be packed away

inside the bellows-case, which, when closed, was often designed to give the appearance of a large book. Another and later form of book organ is shown in Fig. 5. An old positive organ is represented in Fig. 7. This name was

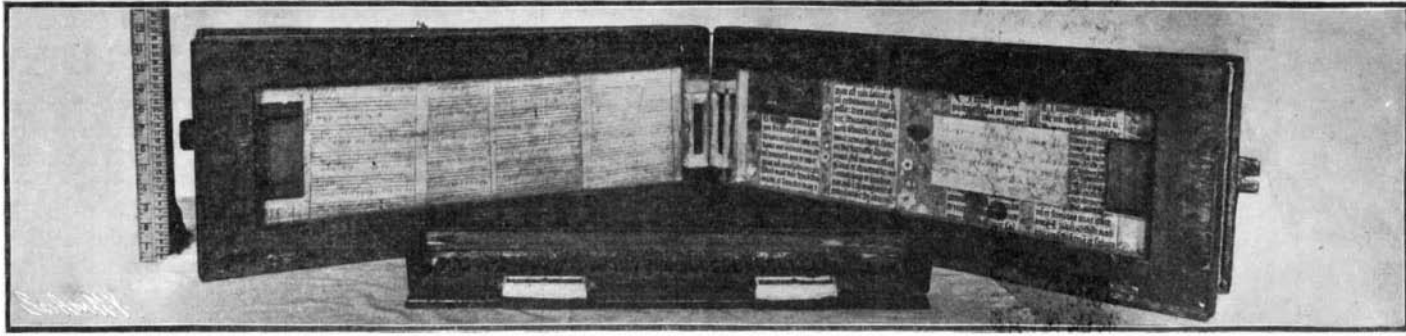


Fig. 4.—A Folding Regal of the Sixteenth Century.

before this the little buttons had been covered with thin slips of wood hinged at the further end and forming the keyboard which is found in all the smaller organs of the sixteenth and seventeenth centuries. Turning to the interesting and valuable collection of Mrs. J. Crosby Brown in the Metropolitan Museum of Art we find among numerous specimens there great many serve to illustrate in hand-portative organ and it will be the pipes rows immediately behind the is still more in Figs. 3 give two rare instruments as the *regal*. In the first instance we have the ordinary form with large bellows worked alternately to supply the wind to the small "reed" pipes, the ends of which are seen projecting in a double row in the space



Fig. 1.—Organ with Sliders. (Eleventh Century.)

given to the larger form of the small organs because it had to be placed in position before it could be played on. It was in a certain sense portable, and the reader will observe the iron bands through which the carrying poles were put; here, too, the little pins which opened the valves of the earlier organs are lengthened into long wooden "stickers" communicating the action of the key to the valves placed at the bottom of the case. The two straps projecting from the right-hand side are for raising the bellows.

Now the application of the valve or pallet to the larger organs probably took place during the early part of the thirteenth century. The mechanism, however, required some alteration, as owing to the absence of any means of silencing the various rows of pipes, such as the later ventils and the stop sliders, it was necessary that every pipe should be furnished with a valve. A stout rod of wood, therefore, was placed beneath the pipes in each row which were to be sounded together and the pallets were attached by cords to it. As the rod was hinged at the further end, on depressing the nearer end the cords pulled the pallets open, and, when it was released, strong springs closed them again. So great was the force required to open the pallets that the ends of the rods were struck with the closed fist and the performer

was aptly called "the organ-beater." In Praetorius's "Organographia" (plate xxv.) we find an illustration of such keyboards attached to the old organ at Halberstadt, erected in 1361, and in the light of later developments it is interesting to observe that it possessed three manuals for the hands and a small pedal-board for the feet. In these old organs the keys varied from 2½ to nearly 6 inches in breadth because the lower key had to represent the diameter of the largest pipe which stood immediately behind it and the size of this key regulated that of the rest. In the fourteenth century, however, an important improvement was made—wooden rollers were used to transmit the action of the key in any direction right or left; the size of the keys, therefore, was no longer dependent on the size of the pipes, for the latter could be placed on either side of the organ so long as they could be reached by the rollers and their "pulldowns" or "trackers." Owing to this invention we find that in the organ built for the church of S. Aegidius, Brunswick, in 1456, the keys were so reduced in size that a fifth could be struck with the thumb and little finger, and in 1499 an organ was constructed for the same city with a keyboard whose octave was only one note longer than at present. In the following century the width was further reduced and became identical with the

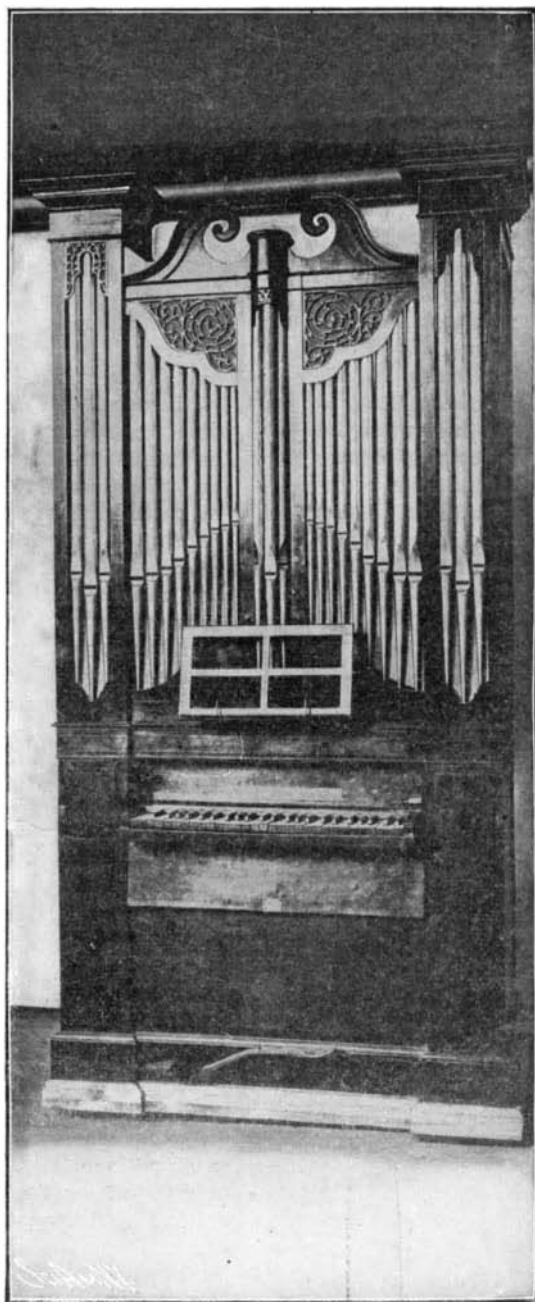


Fig. 5.—An Eighteenth Century Organ.

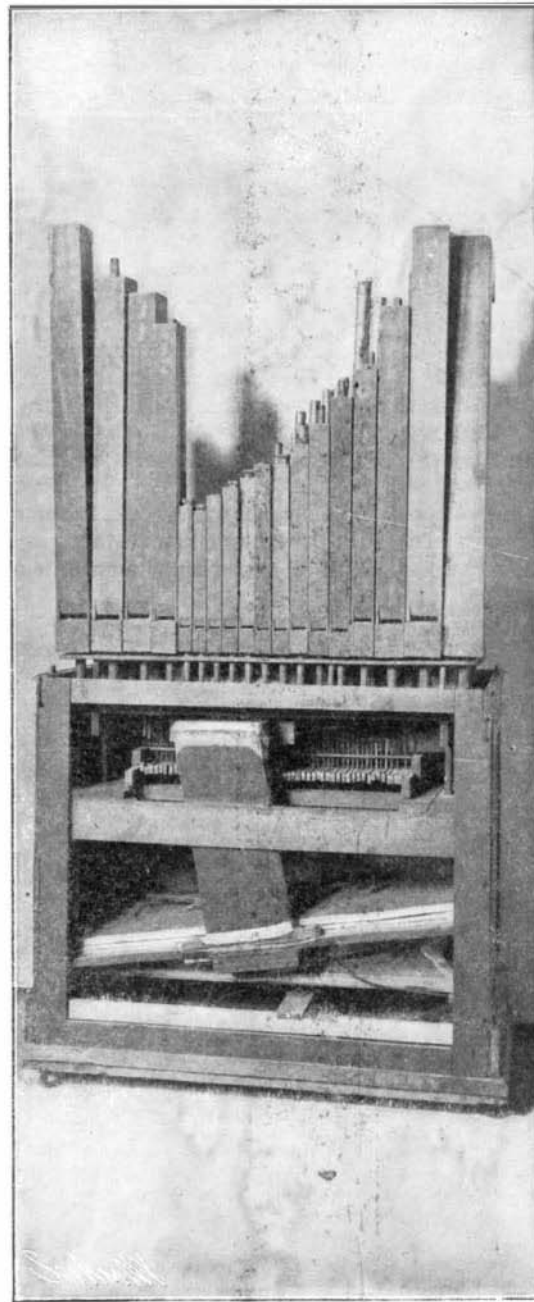


Fig. 6.—Eighteenth Century Organ, Showing Roller-Board.

keyboard of the virginal and harpsichord, of which we propose to treat in a subsequent paper. The use of the tracker and roller-board in an organ of the eighteenth century is seen in Fig. 6. Here the pipes are no longer placed exactly behind their respective keys; and to the present day this mechanism is in general use for ordinary organs, though tubular-pneumatic and electric systems have dispensed with most of it in the larger instruments. Our present keyboard



Fig. 5.—Book Organ.

is chromatic, but as will be noticed in Fig. 1, the oldest organs were diatonic, though B $\flat$  was sometimes admitted for the sake of the Gregorian tonality. At Florence the writer was recently told by an organ-builder of a small organ which had come into his possession from a convent in which the keyboard had no sharps or flats; to his shame be it said that he had broken up this valuable relic of the olden days for firewood! The first accidental to be admitted after the B $\flat$  was the F $\sharp$ , then followed C $\sharp$  and E $\flat$  and lastly G $\sharp$ , but in the lowest part of the keyboard the sharps and flats were for a long time frequently omitted, and in Fig. 8 is represented an organ of the eighteenth century with the lowest C $\sharp$  wanting. Of the how and why of this we speak hereafter.

(To be continued.)

**Madame Curie's Youth.**

From the most recent accounts it would indeed seem that we are not a little indebted to the parsimony which the Minister of Public Instruction, in Russia, injected into the appropriations allotted to the experimental studies in the colleges, for the marvelous discovery of radium. Mr. Roussakov, a compatriot of Mme. Curie, gives, in the *Novosti* of St. Petersburg, some curious details of her youth, as well as interesting facts concerning her first initiation into the mysteries of her father's physical laboratory.

Mr. Roussakov was a pupil of Mr. Sklodovska, professor of physics at Warsaw in the Second College or "gymnasium" as the Russians call it, and it was in this building that the future Mme. Curie was born. Prof. Sklodovska was imbued with a passionate love for science; he was ready to make any sacrifices for its sake, he gave without stint his time, his energy, and his money to its cause. In spite of his strictness all of his pupils adored him, because they recognized in him a rare quality—at all events rare in Russia—

the desire to infuse into his classes the love which he cherished for the branch of science which he taught.

Prof. Sklodovska classed physics among the experimental sciences. With him theory occupied a secondary place. Literally, he never allowed a lesson to pass without improving the opportunity to perform some experiments before his pupils, and he constantly deplored the paucity of the resources at the disposition of the school laboratory. Even the most essential apparatus were wanting, not to mention the funds to procure the materials consumed.

The pupils themselves were constant witnesses of the disputes that raged between Prof. Sklodovska and Mr. Chmourlo, professor at the Lyceum or classical branch of the college.

Mr. Chmourlo was such a biased partisan of the study of the classics that he considered the experiments in physics but child's play, useless amusement, and deemed the meager sums allotted to the maintenance of the laboratory as more than sufficient.

The pupils of Prof. Sklodovska became all the more attached to him after they learned that their beloved master levied upon the very modest stipend that Russia allowed her professors, to obtain the wherewithal to cover the expense of the experiments and furnish his cherished laboratory. Every leisure moment was passed in his physical room; every mundane pleasure was strictly eschewed.

Where the proper implements were wanting it could hardly be expected that funds would be at command to pay an assistant, whose duty it should be to keep things in order, to do the drudgery, wash the tubes, retorts, and alembics after the experiments, and such unskilled labor. This thankless task was assumed by the little daughter of Prof. Sklodovska, who had evidently inherited the passionate fondness of her father for science. The paternal laboratory served her as a nursery, and the test tubes and ampullæ or flasks supplied the place of dolls. Of a serious turn and developed beyond her age, she passed entire days in the laboratory. Protected by a large apron and provided with towels, she hustled here and there, setting things in order and keeping them in the pink of neatness.

She seemed to know intuitively the proper place for each article, to feel, as it were, just what was needed for each experiment, and could even describe the various processes.

It was evident to the pupils visiting the classes that this little girl, with her precocious intelligence, exerted herself to penetrate into the hidden meaning of the ideas her father let fall as crumbs during the lecture. On the other hand, the professor adored his little daughter, but considered her work in the laboratory only as a pastime, an amusement, never suspecting that in this early taste for the management of a laboratory there could exist the germ of a future scientific career. Wiser than he were the almost idolatrous followers, for they dubbed the helpful little maid *professorowna*. The time came when Mlle. Sklodovska must go to school; nevertheless she did not give up her attentions to her dear laboratory. At the moment she became free from her lessons she rushed to the scenes of her chosen labors, where the tubes, retorts, alembics, flasks, pumps, and other implements lay around helter-skelter awaiting her arrival.

She soon had everything orderly, arranged in its proper place, and in the evening returned with her father to assist him in preparing everything that was

necessary for the experiments of the coming morrow.

It often happened on these occasions that she had an opportunity to hear the whole lecture, for her father had the habit of giving a *résumé* of the course.

Little by little the *professorowna* developed from the simple assistant without remuneration into an adequate aid to the professor, particularly when the father, beginning to feel the burdens of age, felt the need of some one to prepare the implements for the lecture.

Along with her regular studies at the "gymnasium" Mlle. Sklodovska continued her labors of love beside her father in the laboratory.

The pupils of the professor, even after they had passed their examinations and entered into real life, never forgot the youthful *professorowna*. It was no surprise to them to learn that she too had passed a brilliant examination and, sacrificing everything for her love of physical science, had left Warsaw for Paris, where she could better complete her studies. There can scarcely be a doubt that had the Russian government been more liberal toward the maintenance of the physical laboratories in its colleges, Prof. Sklodovska would never have taken the care and trouble to initiate his daughter into the secrets of science at so tender an age. What strikes us most in this short notice of the youth of Mme. Curie is that if the civil law permits the daughter, as it does her brother, to take

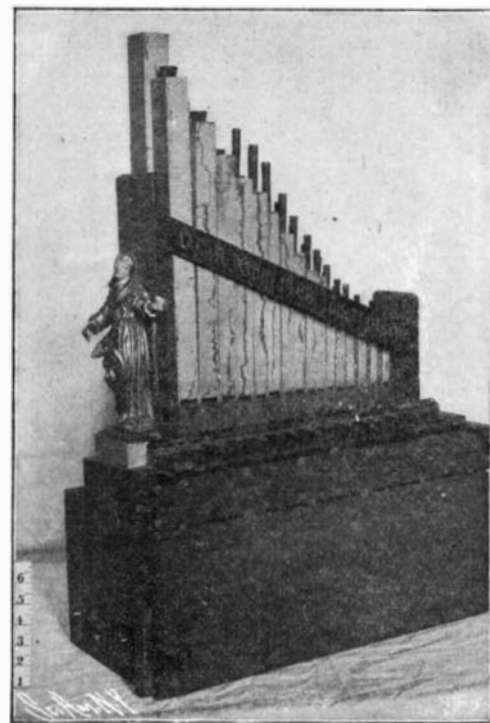


Fig. 2.—Portative Organ.

possession of the heritage of her father, the laws of nature endow her with the same rights regarding the intellectual heritage.

It is much to be regretted, however, that in most cases the fathers exclude the daughters from this portion of their succession, for which many times they are more fit than the sons. Fortunately Prof. Sklodovska was not of this caste, however, and by proceeding upon a path marked out rather by necessity than by choice he has given to the world the discoverer of radium.

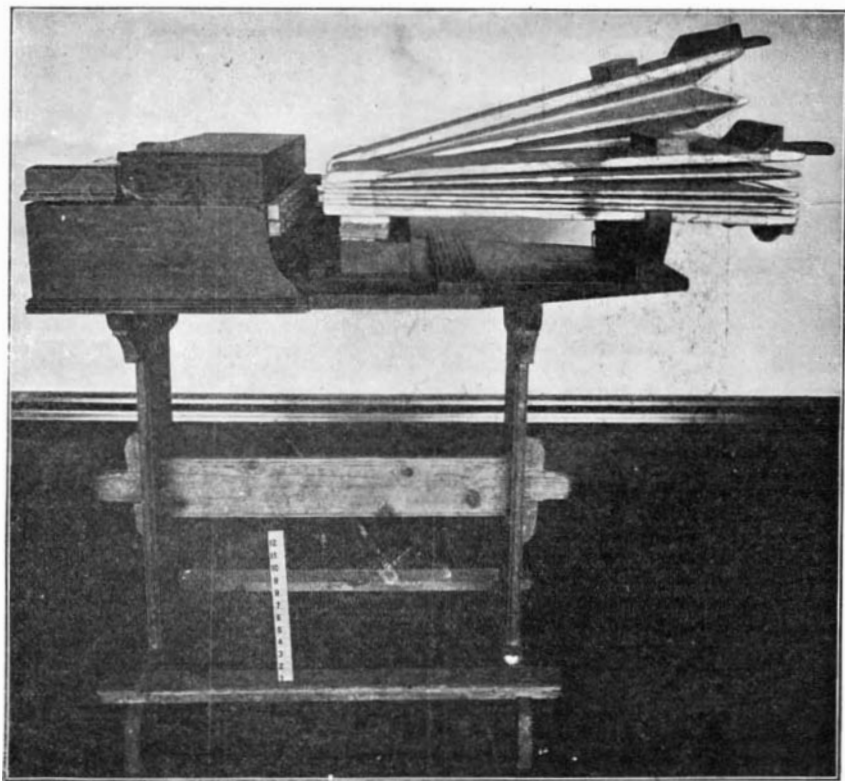


Fig. 3.—Large Regal (Seventeenth Century).

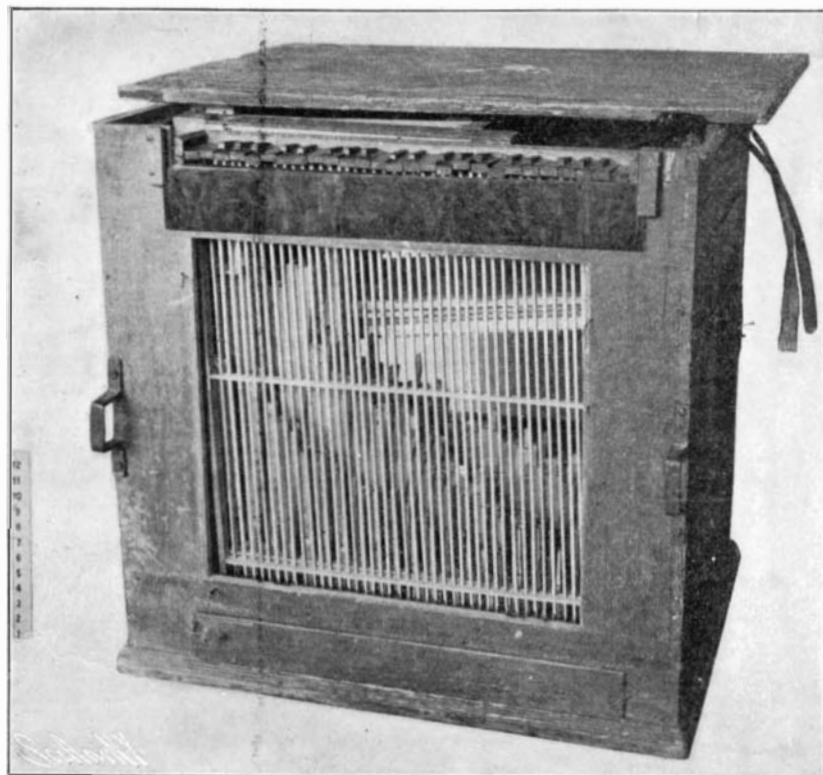


Fig. 7.—Portative Organ (Seventeenth Century).