THE ELECTRIC ORGAN IN THE M'EWAN HALL.

THE University of Edinburgh is not only enriched by the munificence of Mr William M'Ewan, M.P., with a splendid hall, but in the decoration of that hall, and the provision of an organ surpassed by none, Mr M'Ewan has done far more than originally intended. The result is that Edinburgh will shortly enjoy the finished work of the highest skill of architect and organ-builder. When an organ was decided upon, the greatest difficulties had to be faced, and it is safe to say that but for the most novel and ingenious inventions and devices of Mr Hope-Jones, the electric organ inventor, only a very inadequate instrument could have been erected. At first sight the only space available seemed to be a shallow one in the centre panel of the wall at the back of the musicians' gallery, behind the seats of the Senatus, but Mr Hope-Jones saw that by certain structural alterations a very large organ could be built, though a great part of it would be in the worst possible positions for giving fair play to the sound.

The flat side of the M'Ewan Hall has in the middle what may be called a platform alcove or recess, in the front part of which, and slightly raised above the floor, are the seats for the Chancellor, Vice-Chancellor, Lord Rector, Principal, and Senatus. At the back there is a carved oak screen, on the top of which is a shallow gallery. In this gallery has been placed a handsome carved oak organ case, of very elaborate work, richly coloured and gilt, occupying the centre panel of the wall (15 feet long but only 5½ feet in depth), in which is the choir organ, with the large metal 16-feet pipes of the pedal organ showing in front, and having on the top the tuba mirabilis of the solo organ. Below this case, on the level of the floor of the hall, and concealed behind the screen, are the large pipes of the pedal open; and in like manner the light stops and the heavy stops of the great organ are grouped left and right respectively, behind this screen, and below the floor of the gallery. On the left side of the platform recess there is a series of rooms—one above the other—and by appropriating the two upper ones, and

making a large opening through their walls into the recess, organ chambers are formed, in the lower of which are placed the swell and solo organs, while above are the 32-feet diaphones of the pedal organ. On the opposite side is a staircase which has been robbed of part of a landing to form a chamber to contain the 16-feet diaphone and bourdon pipes of the pedal organ. The openings of these chambers into the platform recess are concealed on each side by finely-carved organ cases, with ornamental pipes, matching the large central one, and which project on brackets at a height of 30 feet from the floor. At any time an organ chamber is a bad arrangement, but in this case, where there are very low ceilings, and openings like small windows, the pipes neither have proper room (*i.e.*, their own length) to speak in, nor the sound a way to get out. Yet the effect of the full-voiced pipes which Mr Hope-Jones has invented is so clear and sonorous that they seem to be speaking quite in the open. The room where the swell and solo organs are placed is so low in the ceiling that many of the larger pipes are fixed on the back wall horizontally, one above the other, and in the attic above the great 32-feet pipes of the pedal organ are actually lying on the floor, in the shape of a huge fan, with all their mouths collected close to the small grilled opening, only 9 feet by 2½ feet, through which they speak into the hall. Ordinarily the pipes of the different organs (swell, pedal, &c.) which make up the instrument are each grouped on one soundboard, but here they are scattered—the pedal organ, for instance, being partly in the centre case, partly behind the screen, partly in the chamber on the right, and the rest in the upper chamber on the left. Yet so instantaneously do the electric connections work and the pipes speak, that with the eyes shut one would judge the organ to be compacted in one case.

The console or keyboard resembles a large American organ, and can be moved about to any part of the hall, being connected to the organ by a large cable which, though only 2 inches in diameter, contains

1700 separate wires. There are four manuals, viz., choir, great, swell, and solo, each having 61 keys; and there are 30 pedals. The touch of the keys is lighter than a piano, a mere brush of the sleeve causing the notes to sound; but the repetition is far faster than any piano, and when Dr Peace, organist of Glasgow Cathedral and the City of Liverpool, tested it, he reported that it gave 60 repetitions a second, or 3600 a minute, and this from a pipe (if required) 300 feet or more from the console. Three of the manuals have a wonderful arrangement called "double touch," by which the player can, by pressing the key further down, give louder expression to individual parts, or produce sforzando effects on single notes or chords, effects hitherto unobtainable.

The stops are actuated by a row of small ivory levers, called "stop keys," which are moved in either direction by a touch of the finger, as they are pivotted in the centre; they are placed in a semi-circle above the keyboard and below the music desk. Of these there are 13 on the pedal organ, 19 on the great organ, 19 on the swell organ, 10 on the choir organ, and 7 on the solo organ (as well as an "on" and "off" tremulant placed beside the swell keyboard), and for making certain combinations of these six composition pedals are provided, besides a centre sforzando (anglicè, "crash") pedal, which, so long as it is depressed, brings on the tuba mirabilis—a stop of immense power and volume. Besides the composition pedals, "composition keys" are placed on each keyboard at the back of the notes, so that the organist can, by pressing these while playing, get whatever stops or couplers he wishes into action, and of these there are 5 for the solo, 9 for the swell, 7 for the great, and 5 for the choir. Nor is this all, because these keys have three parts, the right one of which controls the stops of the manual, the left those of the pedals and couplers, and the central works both of these. Perhaps the most ingenious part of the whole mechanical arrangements is the "stop switch," by which the action of all the stops can be thrown out of use, so that the organist can prepare his second combinations beforehand, or get ready further ones while playing, and then, either by hand or by the special "stop switch" pedal, bring them into use. For instance, he can, before beginning, have certain stops ready on

the five organs (pedal, solo, &c.), then he can shut the stop switch and rearrange the whole stops and couplers as needed for a later part of the piece, and when the time comes he can bring them on by a touch of the finger or foot.

But it is not only in wonderful and manifold mechanical arrangements that this organ exhibits the skill and inventiveness of the designer, but it is, and will always be, famous as the first organ in which the new methods of tone production which have been invented by Mr Hope-Jones have been used, and which, in the view of the best-known organists, are bringing in a new era in organ pipes and tones. Hitherto organ tone has been produced by two methods—namely, by pipes called "flues" (having mouths like the common penny whistle), or others called "reeds" (having small vibrating tongues of brass.) The new method consists of a valve actuated by the wind moving a small bellows, which alternately opens and shuts off the flow of air, so as to divide a stream of air into a series of puffs or sound waves. This apparatus is placed at the base of a resonator, which controls the pitch of the note emitted. The result is the production of tones altogether surpassing in power and purity anything ever got from an ordinary organ pipe. This new tone producer is called the "diaphone," and the marvellous power, without roughness or blare, of the great 16 feet and 32 feet diaphones has to be heard to be appreciated, giving, as it does, a sonorous solidity to the tones produced by the full organ. Another quite novel stop is the "viol d'orchestre," the largest pipe of which is 9 feet long, while only 1 1-16 inch in diameter. The tuba mirabilis has two tongues, which are made to synchronise pneumatically, thus giving a tone of great power and brilliancy. Indeed, it may be said that in some way or another every stop in this organ has one or other of Mr Hope-Jones' inventions for improving the tone, but to the general public a brief description of one of the delicate scientific methods by which these results are attained will be more interesting than technical notes on the pipes.

When an organ pipe is sounded, not only does it give the note of its pitch, but it sets up a number of notes besides, both harmonic and discordant, called "upper partials," many of which give a jarring effect, and in order to get smoothness and dignity of tone Mr Hope-Jones set to work to get rid of them as far as possible. To test the effect of the various experiments he made in pipe construction, it was necessary to find some way of graphically recording these delicate variations in the tone. This he has done by inventing an instrument which virtually photographs the musical note. By looking at these photographs, he sees at once the amount and pitch of the upper partials, and so judges whether the form of his pipe is developing the tone he wants. To take these "sound photographs" a special chamber (free from noise, air currents, and shaking) has a tiny mirror, 1-16 of an inch in diameter, and weighing two grains, suspended in it by a single silk fibre (so delicate that it took two days to adjust.) On to this mirror an intense ray of light, only the thickness of a needle, from an arc lamp is thrown, and is reflected from it on to a screen 30 feet away, so that the slightest movement of the mirror makes the ray on the screen move a long way. The pipe under test is sounded about 8 feet from the mirror, which is moved by the sound waves, so that the beam on the screen gives in a perpendicular line an exaggerated copy of these movements. At the same time, a camera is moved rapidly backwards and forwards horizontally in front of the screen, thereby taking a photograph of the moving spot of light very like a horizontal flash of lightning, the curves of which give all the information of the kind of tones the pipe is producing. And so not only can Mr Hope-Jones experiment with pipes till he eliminates all upper partials and gets such wonderful smoothness, but in other cases he develops certain of the upper partials and produces novel stops like the quintaton, tierceaton, &c., which appear to sound notes far higher than their real pitch. It is by such truly harmonic means that this organ has been given a striking brilliancy without resource to the old-fashioned discordant jarring of mixture stops.

The organ contains 2424 speaking pipes, and is blown by a 10-horse power electric motor from the city electric mains, the bellows, which are very ample, being placed in the cellars below the platform. The organ was constructed by the Hope-Jones Electric Organ Company, of Birkenhead, from specifications by Mr Hope-Jones, member of the Institute of Electrical Engineers, the cases being designed by Rowand Anderson, LL.D., H.R.S.A., the architect of the University buildings.

SPECIFICATION OF THE ORGAN.

PEDAL.—COMPASS CCC to F (30 NO ..)

Diaphone	32	feet.
Quint	32	,,
(lowest octave acoustical)		
Diaphone	16	,,
Double	16	,,
Dulciana	16	,,
Open Diapason	16	,,
Ophecleide	16	,,
Flute	8	,,

Solo to Pedals.
Solo to Pedals (super.)
Great to Pedals.
Swell to Pedals.
Choir to Pedals.

10 Composition Keys, controlling Pedal, Stops, and Couplers.

GREAT.—COMPASS *CC* to *C* (61 *NOTES.*)

Contra Tibia Clausa (extra octave)	16	feet.
Tuba Profunda (extra octave)	16	,,
Diapason Phonon (extra octave)	8	,,
Tibia Pleua	8	,,
Open Diapason	8	,,
Tuba Sonora (extra octave)	8	,,
Hohl Flute	8	,,
Quintadena	4	,,
Harmonic Piccolo	2	,,

Sub-Octave (light wind stop.)
Sub-Octave (heavy wind stops.)
Solo to Great (sub.)
Solo to Great (unison) double touch.
Solo to Great (super.)
Swell to Great (sub.)
Swell to Great (unison), double touch.
Swell to Great (super.)
Choir to Great (sub.)
Choir to Great (unison.)
3 Compound Composition Keys, for Great Stops, Pedal Stops, and Couplers.
2 Compound Composition Keys for Great Couplers.
3 Composition Pedals.

SWELL.—COMPASS CC TO C (61 NOTES.)

Contra Viola	16 feet.
Double English Horn	16 ,,
Tibia Clausa	8 ,,
Horn Diapason	8 ,,
String Gamba	8 ,,
Quintation	8 ,,
Tierceaton	8 ,,
Cornopean	8 ,,
Oboe	8 ,,
Vox Humana	8 ,,
Violes Celestes (double touch)	8 ,,
(giving three beats of different periods)	
Gambette	4 ,,
Harmonic Flute	4 ,,
Clarion	4 ,,
Harmonic Piccolo	2 ,,

Sub-Octave.
Super-Octave.
Solo to Swell (double touch.)
Choir to Swell (double touch.)
Tremulant (on light wind stops.)
Swell Pedal.
4 Compound Composition Keys for Swell Stops and Pedal Stops, and Couplers.
2 Composition Keys for Swell Couplers.
1 Combination Key bringing on Swell Reeds.
1 Combination Key bringing on Swell Strings.
3 Composition Pedals.

CHOIR.—COMPASS CC to C (61 NOTES.)

Viol d'Orchestre	8 feet.
Lieblich Gedact	8 ,,
Dulciana	8 ,,
Flauto Traverso	4 ,,
Corno di Bassetto	8 ,,
Cor Anglais (free)	8 ,,

Super-Octave.
Swell to Choir (sub.)
Swell to Choir (unison), double touch.
Swell to Choir (super.)
3 Compound Composition Keys for Choir Stops, Pedal Stops and Couplers.
2 Compound Composition Keys for Choir Couplers.

SOLO.—COMPASS CC to C (61 NOTES.)

Rohr Flute	8 feet.
Tuba Sonora	8 ,,
Tuba Mirabilis	8 ,,
Cor Anglais (beating)	8 ,,
Kinura	8 ,,

GENERAL ACCESSORIES.

Step Switch (key.)
Stop Switch (pedal.)
Sforzando Pedal (bringing on Tuba Mirabilis.)