

A MIDI-compatible acoustic piano

Yamaha has just released its latest musical instrument – a computer operated acoustic piano that is MIDI compatible. For around \$14,000 you get a quality upright piano fitted with a computer controlled recording/playback system. If the very idea seems a bit fantastic, it is!

by PETER PHILLIPS

Being more than slightly interested in pianos that operate from a computer, I was most anxious to see Yamaha's new Disklavier – especially when I learned that the first one to reach Australia was at the NSW Conservatorium during the recent Sydney International Piano Competition.

Unfortunately, I had to fit in with the practice schedules of the various competitors, which allowed me around 20 minutes with the instrument. However this time was well spent, and further information was subsequently made available by Yamaha Australia to enable the major features of this most interesting device to be described.

But before launching into this, I think it is worthwhile to examine the history surrounding the whole genre of player type pianos, as the Yamaha instrument probably represents the pinnacle in the development of such devices.

The starting point

Player pianos go back to the days of King Henry VIII, with the "Virginal that goethe with a whele without playing uppon." The next development was the vacuum operated player piano, now generally referred to as a "pianola". This instrument was very popular, and was largely perfected at the start of this century.

As readers no doubt know, the "pianola" operates from a piano roll, and is powered by a foot operated vacuum pump, giving rise to the term "a foot-blown player". The player piano also put the word "pianolist" into the language; the official title of anyone who claimed expertise in making a pedal player sound realistic. After all, there are three aspects to a musical note – the pitch of the note, its duration and

its volume. If any of these characteristics are missing then you don't have the full story.

Adding the volume, or *expression*, is the hard part, and a good pianolist achieves this by pedalling in a way that raises or lowers the instantaneous vacuum level to bring about the necessary accenting, crescendos, diminuendos and so forth. But although such activity can be creative for the operator and en-

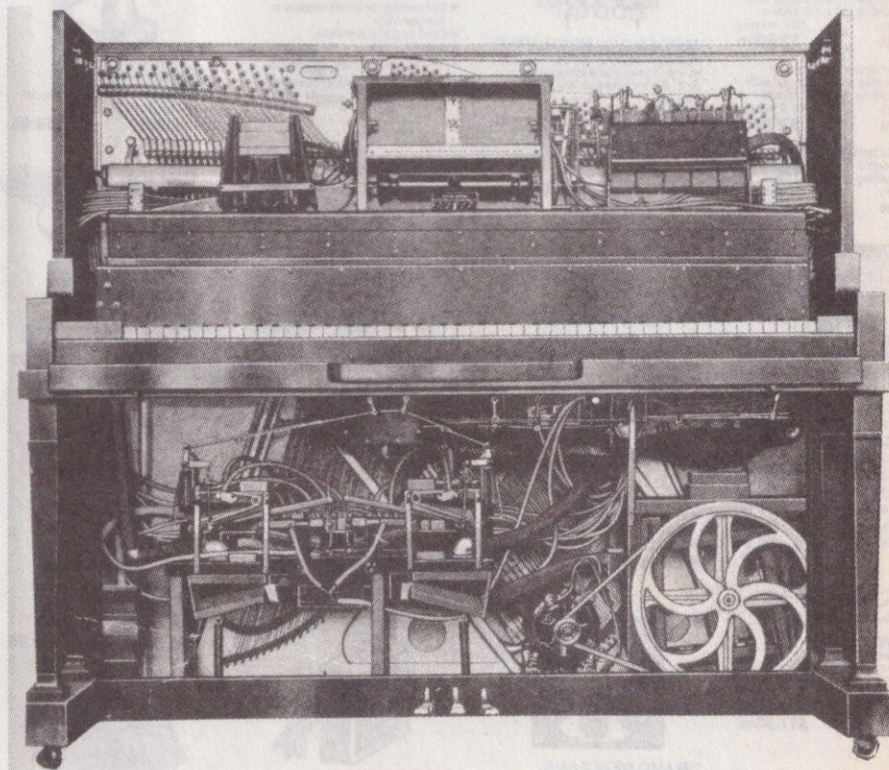
tertaining for the listener, the end result is probably not what the original artist really intended.

It was in order to get around this problem that in 1905, the Welte company of Germany invented the *reproducing piano*, and a whole new industry was born.

Reproducing piano

The reproducing piano is to the pedal player piano as a transistor radio is to a hifi system. Even by today's hi-tech standards, the reproducing piano is a sophisticated instrument, and when the Welte company first marketed its version, it had little idea of the success this instrument would achieve.

Other companies quickly took up the challenge, and by 1920 there were



Inside one of the original reproducing pianos, giving an idea of the complexity involved in the days of pneumatic mechanisms. In this case the mechanism is one of the Welte-Mignon type, installed in a typical upright piano. Note the pneumatic 'motor' at upper right, to drive the paper roll over the 'tracker bar'.



The new Yamaha Disklavier is very suitable for music teaching and practise. A part cancel feature lets you play back one hand as you focus on the other.

numerous brands of these instruments available, all vying for their share of the market. Although they all used different techniques, the essential components of any reproducing piano were a vacuum pump operated by an electric motor, and a complex pneumatic system to control the instantaneous vacuum level to the playing mechanism.

The information to control the level was encoded onto the piano roll along with the note information, in the form of extra holes down both sides of the roll – and was recorded during the original performance. Effectively, all the owner had to do was load the roll into the instrument and enjoy the concert performance that would result.

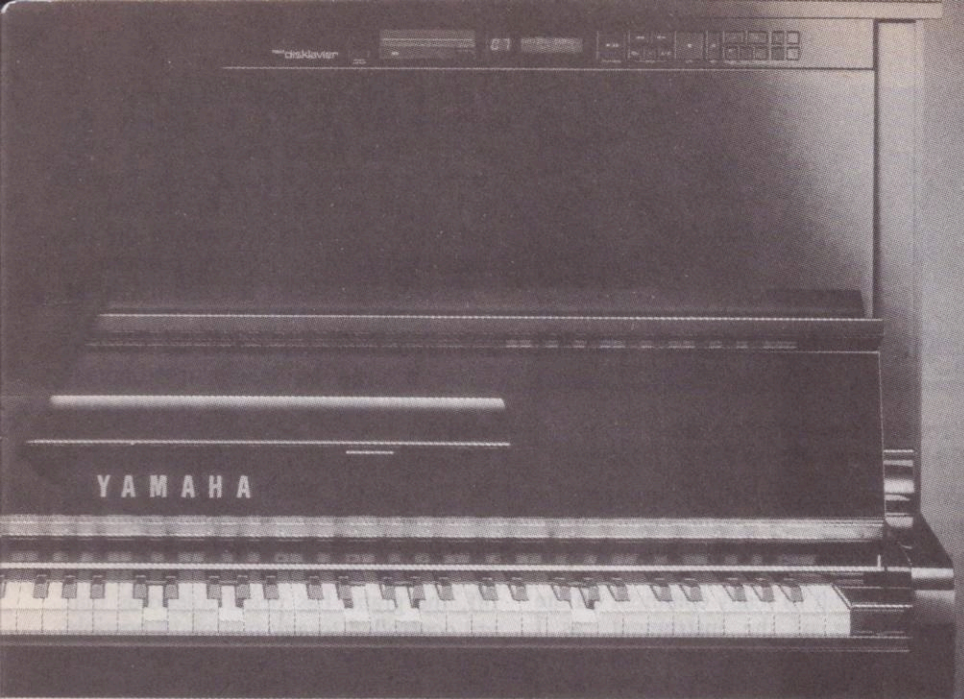
Of course, the owner would have previously parted with a lot of money for this technological innovation, typically \$1000 for a “no-frills” upright, or up to \$5000 for a good quality grand. At a time when an average house cost \$1000, it is little wonder that the repro-

ducing piano was aimed at the upper middle class and beyond.

However the market was sufficient to support this rather specialised industry, and virtually all the famous concert pianists of the times made rolls for one or more of the systems. The companies producing the instruments all realised that the money really lay in the sale of rolls, and thousands of titles were produced, with prices ranging from \$1.50 up to \$15.00 each.

The average playing time of a roll was around 4 minutes, making the reproducing piano roll a very expensive medium. Even pianola rolls were expensive on a dollar versus playing time basis, but with over 2 million player pianos, and thousands of reproducing pianos sold in America alone by 1920, it seemed price was no object. However, the development of the gramophone, the increasing popularity of radio, and finally the 1930's depression all contributed to the eventual demise of the player industry.

And so, by the start of World War 2, one of the more fascinating industries of this century was defunct. But during its time some incredible innovations had been achieved. For example, the Aeolian company developed the “Concertola”, a reproducing piano with its roll playing mechanism situated remotely from the piano, but connected to it with a wiring loom of some 100 wires. This system allowed the owner to load up to 10 rolls, and to select them using a hand held push-button unit. The American Piano Co, which marketed the “Ampico” reproducing piano, developed the “Ampichron”, a system that would cause the Ampico player to mark the time of day with a short item of music, preceded by the appropriate chime. And, of course, where money was no object, reproducing mechanisms could be had in some of the finest pianos made – including Steinway, Bechstein and Mason & Hamlin, with an art case an optional extra. Heady times...



The Disklavier's disk drive, display panel and controls are discretely housed at the top of the piano case.

computer, perhaps even make a cup of coffee have opened up a whole new world.

A particular problem in any conventional mechanical instrument, such as a piano, is the need to provide a mechanical interface between the sound recording and the piano action. In a vacuum operated player the mechanism is a bank of pneumatic bellows operated by valves in turn operated by the roll. In an electrically operated instrument, the actuators are solenoids. Either way, the actuators need to cope with the mechanics of the piano, requiring the piano action to be well regulated. Finally, the whole system is relatively complex, and physically large.

However, if the sound is produced by electronic generators, there is no need for any mechanics, excepting the actual keyboard. The popularity of the all electronic keyboard is obvious, and instruments ranging from a few hundred dollars up to many thousands abound.

Yamaha has been at the forefront of this industry, and produces a wide range of keyboard units. The latest technology

includes the sampling piano, which generates the sound using actual piano sounds recorded and stored in memory. The sound quality is excellent in most cases, and the velocity sensitive keyboards used in all but the most basic units mean the discerning artist is catered for.

Typically, today's electronic keyboards are all MIDI compatible, allowing any keyboard to be used with any other, or to be sequenced from any MIDI source. The sound module is often separate to the keyboard, allowing 'mix and match' if required, and recording a performance is relatively easy. Electronic pianos of this type are also usually portable and reasonably small. So where does the Yamaha Disklavier fit in?

Finally, Disklavier

When a firm like Yamaha introduces an instrument such as the Disklavier, one can be sure they have done their homework. After all, Yamaha musical instruments are now acclaimed throughout the world, and their pianos are

often chosen by artists against Steinway and other leading brands.

Obviously Yamaha has figured that although electronic pianos are very popular, as well they should know, there is still one fundamental fact that cannot be avoided – the sound is still only an approximation of a real piano. It is unlikely that technology will ever invent a means of making a vibrating speaker cone sound exactly like a vibrating string.

The Disklavier (a name I suppose I will get used to!) incorporates virtually all the features of an electronic keyboard, but still retains all the qualities of a conventional piano. In my opinion, it has to be a winner. It has a lot of facilities, and the potential to reproduce a performance exactly as played.

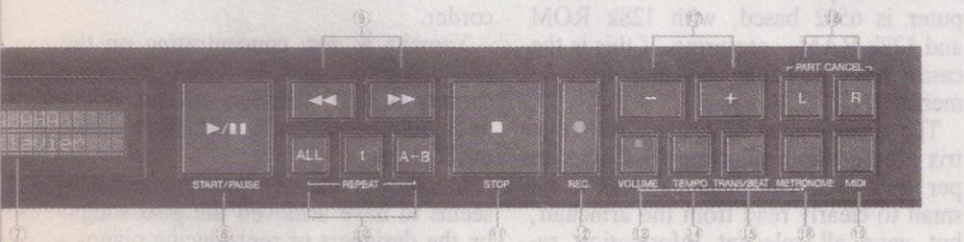
For starters, the range of expression levels is MIDI compatible, which amounts to 128 different volumes. Each key is independently controlled from the expression level point of view (as far as I know, anyway), unlike both the Superscope and the original reproducing pianos. The latter employed a fairly sophisticated method to achieve the effect of individual control however, and all brands used two regulators – one for the bass half of the keyboard, another for the treble.

The Yamaha system uses pulse width modulation (PWM) to direct power from the 100V DC supply to the solenoids, in a similar way to the Superscope instrument. With this method, the duty cycle of the waveform determines the power applied to the particular solenoid.

Considerable research has been done to ensure that the solenoids are mounted where they will cause minimal interference to the sound from the piano, and I was hard put to even find them! It turns out they are mounted under the keys, as close to the point of contact between the key and the piano action as possible.

The solenoids are mounted in two rows, and the rear solenoids have larger cores than the front row to compensate for their different mechanical advantage. Temperature cutouts are also mounted in each solenoid, as their small size only allows intermittent operation.

Perhaps the most striking feature of the whole instrument is the installation of the player system. The computer (in the model I saw – others have the computer separate) is attached to the underside of the lid, and the control panel is mounted on a cutout section of the front of the piano. The only other obvi-



Repeat buttons; (11) Stop; (12) Record; (13) Volume; (14-19) Special functions such as Tempo, Metronome, MIDI and part cancel.