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Snape Concert Hall

Derek Sugden

THE ALDEBURGH FESTIVAL

In her recent biography of Benjamin Britten, Imogen Holst describes the beginnings of the Aldeburgh Festival. It was Peter Pears' first suggestions during the English Opera Group's visit to the Holland Festival in 1947 to perform 'Albert Herring' that led to the first Festival in 1948. It opened in the Aldeburgh Parish Church with the first performance of Britten's newly-written cantata 'St.Nicolas'. Imogen Holst describes Peter Pears' idea of 'a few concerts given by friends' and as she says it still holds good. The list of friends has grown impressively long. I counted 96 artists, orchestras, choirs and groups on the back of the advance programme summary for 1967, the Amadeus quartet, Owen Brannigan, the English Chamber Orchestra, Fou Ts'ong, the Philip Jones Brass Ensemble, George Malcolm, the New Philharmonia, the Northern Sinfonia, Sviatoslav Richter and countless others. It has yet still remained a modest festival with an intimate atmosphere combined with real professionalism and superb timing and organization. The ten days became two weeks in 1966 and this year, three weeks.

Most of the larger orchestral and choral concerts are held in Aldeburgh Parish Church and the surrounding churches, especially Blythburgh and Orford. The largest secular hall used for opera, chamber concerts and recitals is the Jubilee Hall which seats 320. This hall has seen most of the first performances of Britten's new operas.

As the Festival grows only a larger secular hall will provide for those who now wish to come and are needed to support the more ambitious programmes.

A letter from Stephen Reiss, the Festival manager and secretary, to Ove Arup in October 1965 said that they had the opportunity of leasing one of the disused malt houses at Snape. Could we survey it and say whether it was possible to convert it into a concert hall and also provide opera facilities?

THE MALTINGS AT SNAPE

The Maltings at Snape are the sort of buildings you visit every year during the Festival when driving from Aldeburgh to Orford church. They are perfect examples of what J.M. Richards called 'the functional tradition' and are well illustrated in the book of that name which he wrote with photographs by Eric de Maré.

The Maltings were started by Newson Garrett in the mid-nineteenth century. Newson Garrett was a ship owner,

Fig. 1
General view from river before conversion
Photo: John Brandenburger

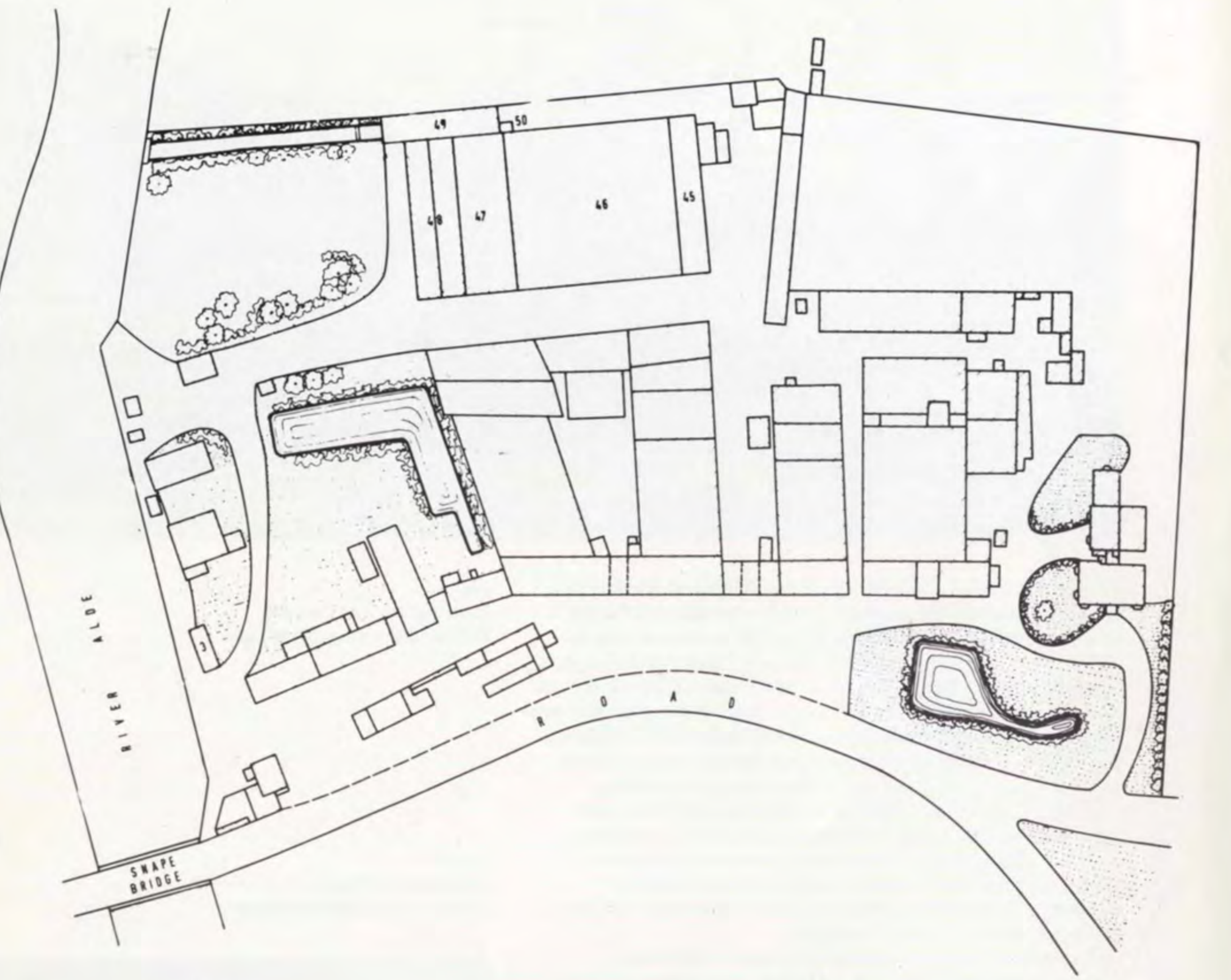
grain transporter , Lloyds agent and Mayor of Aldeburgh. He also found time to produce a large and talented family. One of his daughters, Elizabeth Garrett Anderson was the first woman doctor and the first woman Mayor of Aldeburgh, elected in 1908. His eighth child was Dame Millicent Garrett Fawcett, the feminist and pioneer in education. The Maltings are traditional mid-nineteenth century industrial buildings. Red brick from the local Snape brickworks, timber floors and deep timber roofs in the local shipwright tradition. The Malt House roofs were once finished with Welsh and later Italian slates and the turning bays and low buildings with red clay pantiles. When roof slates and tiles were replaced, they were covered with asbestos slates or sheeting which rapidly grew moss and fitted well with the industrial scale of these buildings.
The tradition has been maintained right through the nineteenth century and right up to the last addition in 1953, which is in reinforced concrete with an asbestos roof. Because it has been carried out in a direct and unself-conscious way it still fits in with tradition at Snape.

Fig. 2
View before conversion
Photo: John Brandenburger

THE SURVEY
Glen Calow and Chris Doubell spent a fascinating two weeks at Snape carrying out a detailed survey of the buildings chosen for conversion and gathering as much local knowledge as possible about the ground conditions, drainage and electrical and water supply. They produced 12 excellent detailed drawings of the building, a main layout drawing, a fully detailed sketchbook and a report on the conversion possibilities.
In addition to the essential survey information and building details their appendix included the following account of the recent history of the Maltings, the change in use of the various buildings and a short account of the malting process.
'The buildings vary in age from about 100 years to 13 years. Many of the buildings have dated stone slabs set in the brickwork but the main block the survey was concerned with, did not.
It can be seen from building details that the blocks 47 and 48 were built with blocks 45 and 46 as a complete unit with germinating, turning and drying blocks. Blocks 49 and 50 were added later. This is confirmed by the date of block 49 which is 1894 A.D.
Over the past two years grain drying and storage proved more profitable than malting and blocks 45 to 50 changed their functions. They were as follows: 45 - storage and bagging for despatch; 40 - a coal bagging and storage bay; 47 - grain drying; 48 - storage; 49 - storage. As recently

Fig. 3
Blythburgh Church
Photo: John Brandenburger

Fig. 4
Site plan



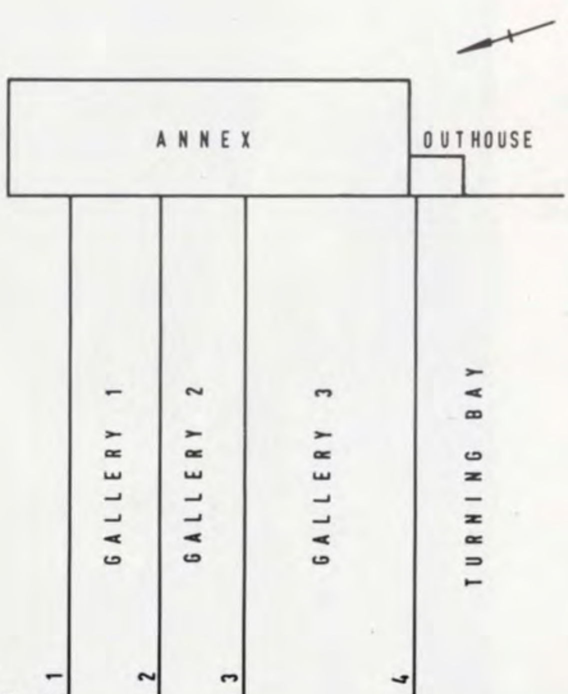
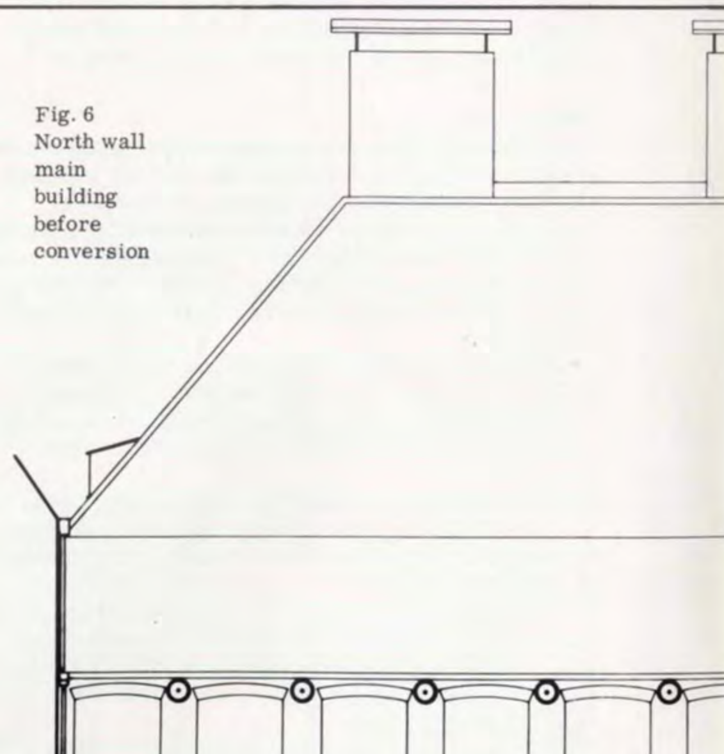


Fig. 5
Key plan
before
conversion

Fig. 6
North wall
main
building
before
conversion



as July 1965 the Maltings changed hands and the whole became used for drying and storage. Blocks 47, 48 and 49 now became redundant.

THE MALTING PROCESS
Malt is produced by the germination and fermentation of barley. There are four stages to the process.

GERMINATION
Barley is laid to a depth of about one foot on a slab floor and wetted down to precipitate germination in the normal way. Darkness also speeds up the process. This growth generates much heat and constant raking and sometimes wetting down is needed to prevent scorching of the grain or even fire.

TURNING
The grain after a few days is passed to the turning galleries where the root and shoot of the seed begin to break out of the seed testa as in normal germination. Plenty of light is admitted here to encourage growth and produce malt by photosynthetic processes in the seed. The malt is continuously turned (by raking) along the turning bays until after three or four days it reaches the drying kiln end.

DRYING
The grain is then passed up through grain chutes to a perforated earthenware tile floor under which coal-fired kilns burn, supplying the necessary heat to dry out the grain and fix the malt.

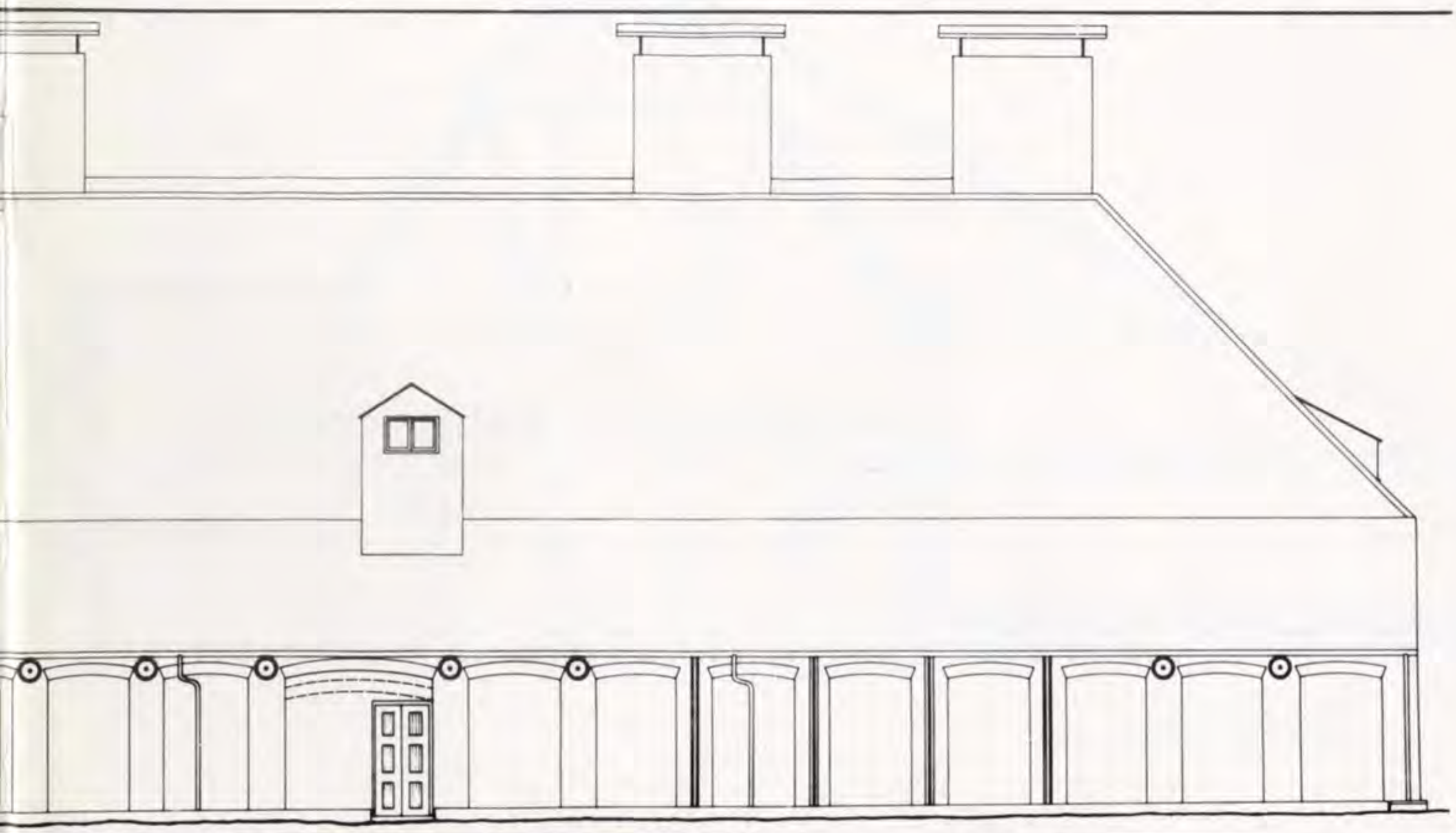
CLEANING
The root and shoot, now shrivelled, are removed by a tumbling process in a large drum before storage or despatch as required.
The buildings the survey was concerned with were first built for use as:

Germination bays	-	Block 45
Turning bays	-	Block 46
Drying kilns	-	Block 47
Storage and despatch	-	Block 48
Cleaning	-	Block 49

THE BRIEF
The survey report was completed by November 1965 and by December 1965 Arup Associates were asked to prepare designs and supervise a contract for the concert hall to be ready for the 1967 Festival!
The brief was for a concert hall to seat between 700 and 800. It was to be provided with lighting facilities for opera, an orchestra pit, and with a removable proscenium. It was to have a restaurant and changing rooms. It was to be wired for the BBC for recording during the Festival and for the Decca Record Co. for stereophonic recording. Decca also required a flat floor within the auditorium and any rake had to be built up with removable platforms. Car parking had to be provided for 450 cars. Lorry access had to be provided to a loading bay which in turn had easy access to the stage.
The stage was to be the full width of the auditorium and 40 ft. deep, to be 4 ft. above auditorium level and to have a 1 ft. rake.

THE DESIGN - GENERAL
Many modern auditoria have failed because designers and often their clients have tried to create spaces for opera, concerts, drama and meetings within a single envelope. We agreed with the Festival Committee that this hall should be designed specifically as a concert hall and it was reconfirmed on many occasions that it was to be primarily a concert hall with certain facilities for opera. We also felt strongly that the whole conversion both inside and out should retain the character of the Maltings and that as much of the existing structure as possible be preserved. In addition to the detailed survey to help us, John Brandenburger photographed the existing buildings in great detail before demolition started.

THE DESIGN - THE PLAN
The plan for the conversion aimed at a single space enclosing auditorium and stage, the largest possible foyer to create the sense of occasion and to use wherever possible the existing brick walls. It had already been decided that the roof must be replaced and therefore the wall dividing buildings 47 and 48 could be removed, i.e. wall 3 separating gallery 2 and 3 shown on the key plan. The cross walls and hoppers were removed down to the lower level



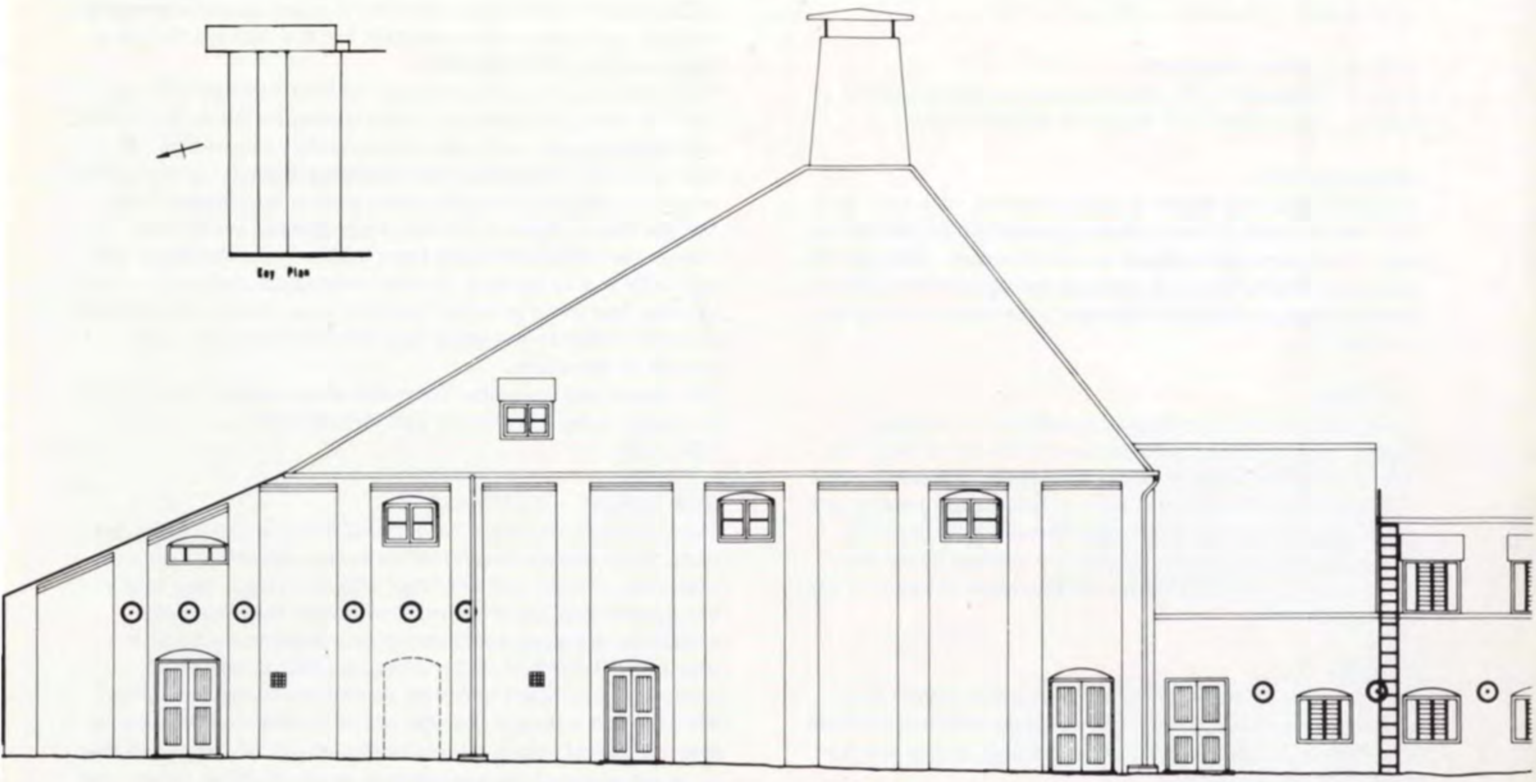


Fig. 7
West wall
Main building, before conversion

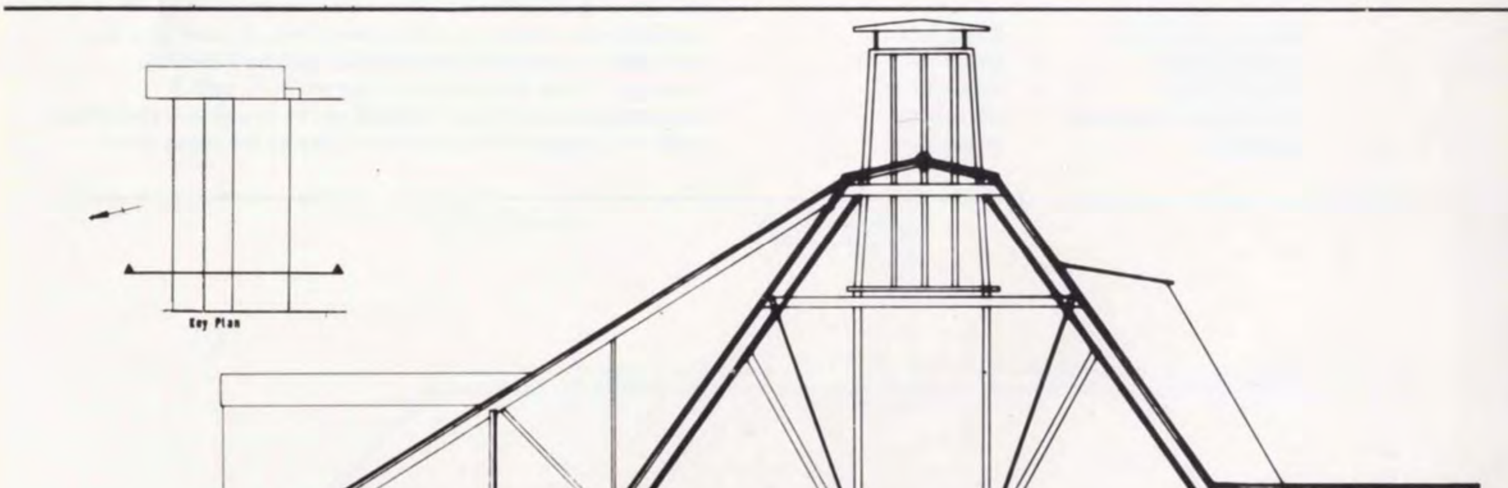


Fig. 8
Typical cross section
Main building, before conversion

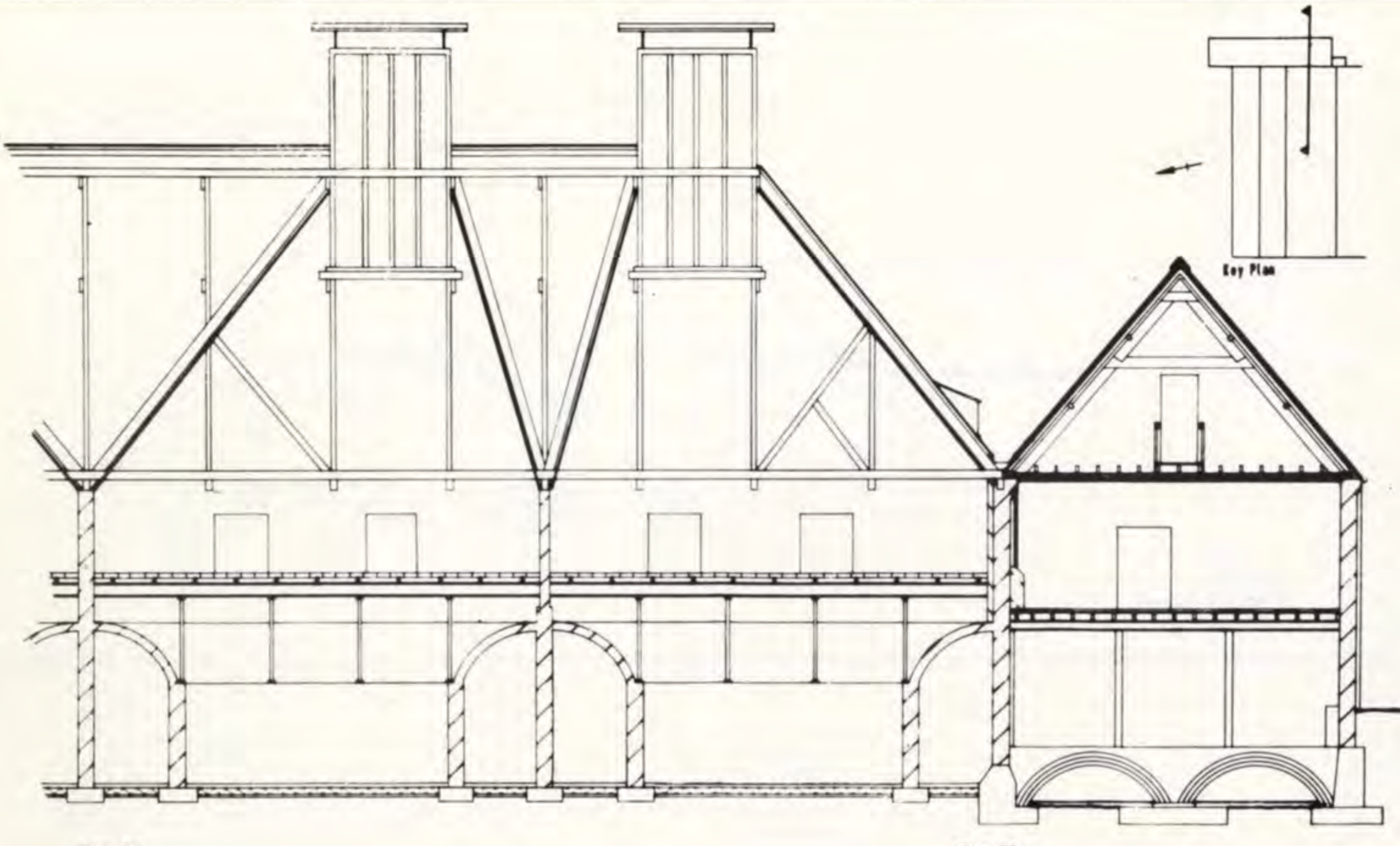


Fig. 9a
Longitudinal section
Main building, before conversion

Fig. 9b
Cross section
Annex

of approximately 3.25 O.D. After digging two further trial holes and taking readings it was decided to make the auditorium floor at 3.5 O.D., some 2 ft. above ground-water level. This was slightly above the approximate floor level of gallery 3 and the turning bay. This also gave acceptable levels for the stage 4 ft. above the auditorium and which in turn fixed the level of the changing rooms and loading bay. Plan and structure are interdependent and we had not yet achieved our large foyer that was really necessary, running the full length of gallery 1. We still retained the flat auditorium with a built-up and removable raking floor. A further meeting with Decca was a real breakthrough. Because of the size of the stage Decca only wanted a further 30 ft. of flat area. We felt we could accept this as a permanently flat area and start the rake at this point. We then proposed a suspended reinforced concrete slab and underneath housed the plant rooms and lavatories. We now had a foyer running the full length of the auditorium with steps and a half-landing at the west end giving access to the rear of the auditorium and with a staircase at the east end giving access to the restaurant. The two-storeyed annexe building was the natural place for changing rooms, giving access direct to the stage and for the restaurant at first floor level, giving wonderful views to the east across the marshes and good access from the foyer.
Car parking was arranged against the buildings on the site but mainly in the area by the pond to the north of the Malt House. Cars will be able to drop people by the north corner of the building and then park. The main entrance to the foyer is in the centre of the north wall and the foyer level is extended to the full width of the terrace on the north side and arrived at by shallow steps. The large open area to the north is bounded by the river and a channel of water on two sides and by a bank of shrubs and trees on the west side which should shield this area from the parked cars. This area will be re-grassed and provide an open space to the main front of the concert hall. The terrace on the north wall will be extended up to the water channel which runs in arches under the north west wall of the restaurant. A simple timber bridge will connect this terrace to the restaurant terrace which gives splendid views to the east across the Marshes.

THE DESIGN - THE STRUCTURE AND FINISHINGS
The roof design was the key to the whole building. We aimed at a solution which would keep the basic shape of the old roof. In removing the long wall between gallery 2 and gallery 3, it was essential to move the ridge of the roof over to the new centre line of the auditorium. Both we and our clients wanted as much height as possible and we chose a 45° slope which was a compromise between the two existing slopes (the north east slope being a later addition to create more space over gallery 2). To retain as much character as possible we also wished to retain the smoke hoods. Studies for the heating and ventilation scheme were done at an early stage and we confirmed the existing size for natural exhaust. This led to a flat top to receive the ventilators of some 12 ft. minimum width. After many sketches we finally adopted a simple roof truss at 12 ft. 2 in. centres of approximately 60 ft. span. It was of standard triangular construction except for the centre section with the minimum 12 ft. flat top where crossed ties were used. The auditorium width varied by as much as 18 in. so the solution was ideal in that all the truss halves could be identical and any variation taken up in the cross-braced centre section. The trusses were designed with all the compression members in timber and all the tension members in steel. The rafter backs are of 2/10 in. x 2 in. douglas fir, the upper struts of 1/12 in. x 3 in. douglas fir and the internal struts of 6 in. x 3 in. douglas fir. All the ties are of 1 in. diameter high tensile steel with bottle screws. All connections are made with standard timber

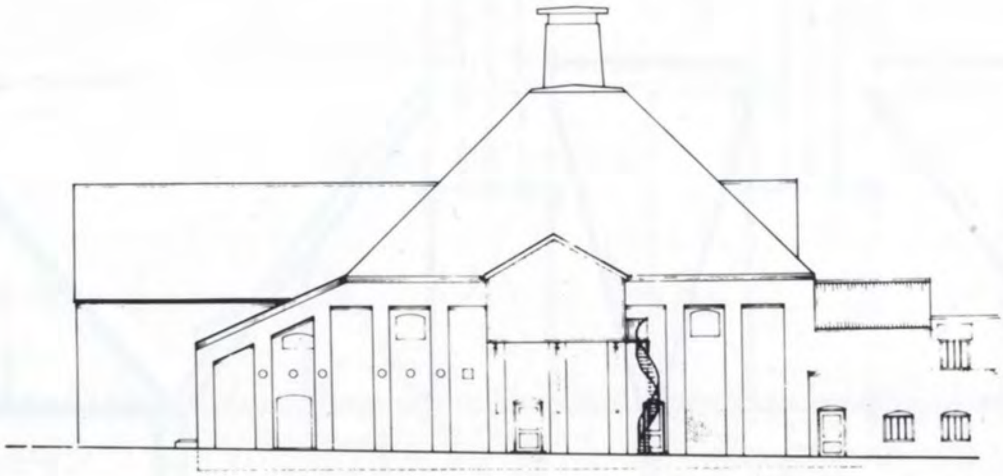


Fig. 10a
West elevation

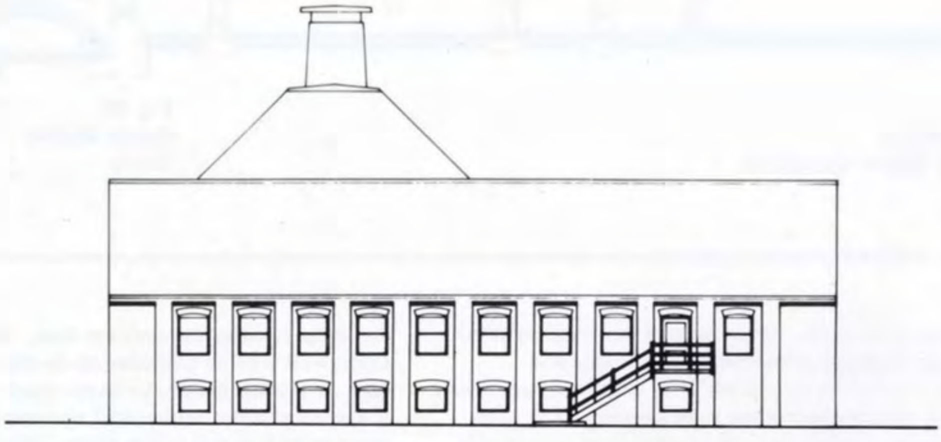


Fig. 10b
East elevation

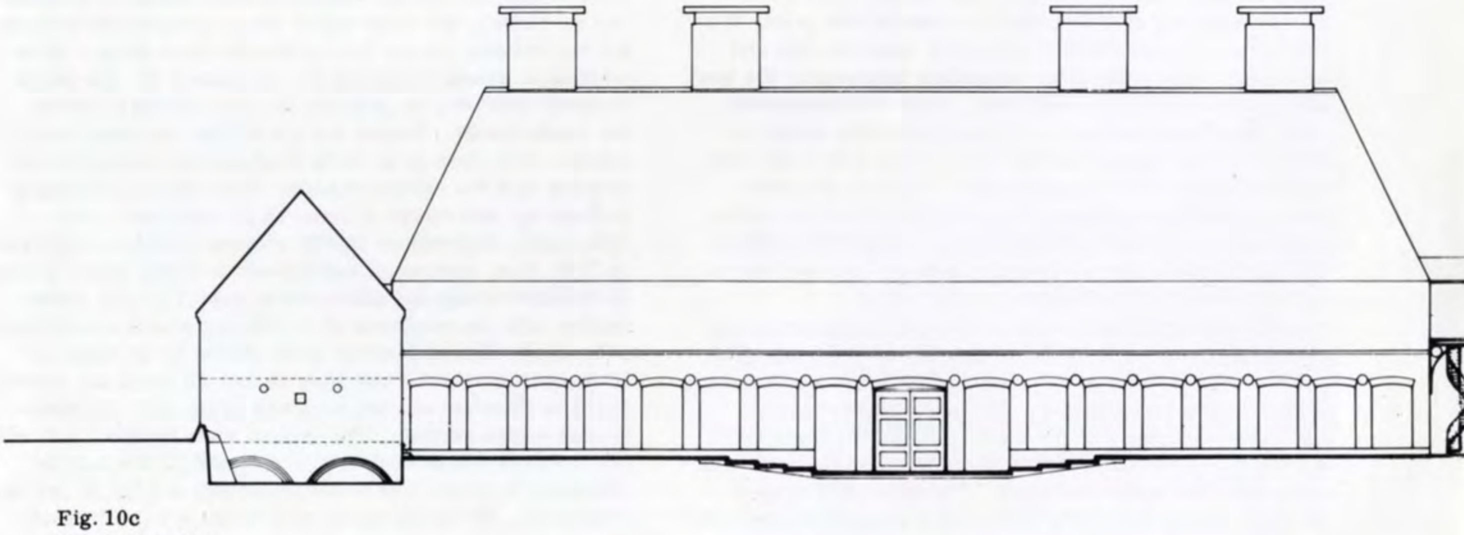


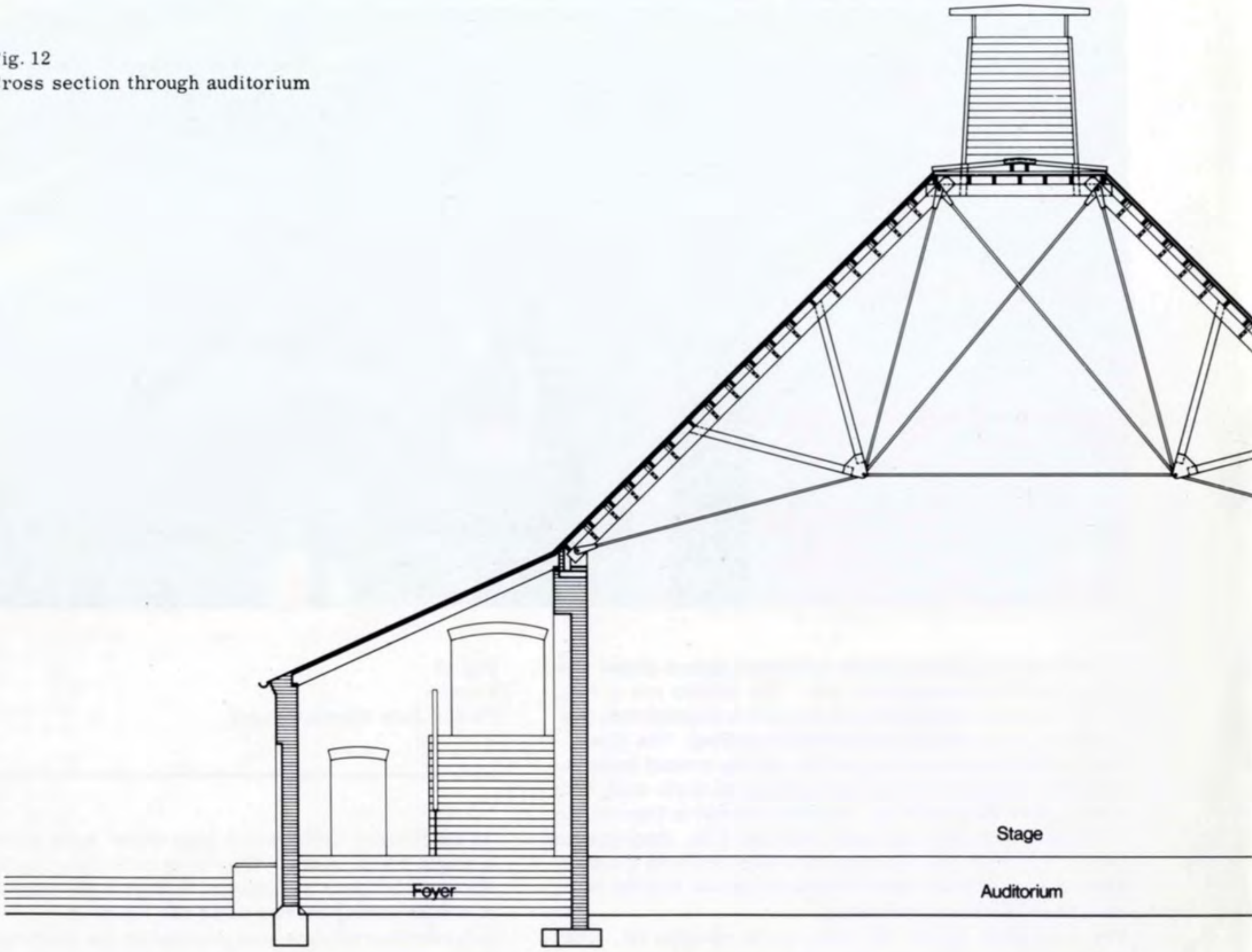
Fig. 10c
North elevation

connectors and purpose-made mild steel gusset plates and 2 in. diameter pins and lock nuts. The purlins are of 6 in. x 2 in. German whitewood and the roof is formed with two layers of ¾ in. tongued and grooved boarding. The first layer is laid normal to the purlins and the second layer at 45°. The roof truss has a fixed end on the north wall, with a mild steel shoe and 2 in. diameter pin and is fixed to the reinforced concrete ring beam with four ¾ in. diameter rag bolts. The south wall bearing has a free end with the shoe carried on a Glacier Metal bearing to ensure that the main roof ties are always in tension.
The hip rafters are of 2/ 10 in. x 2 in. douglas fir. The rafters and purlins were assumed to be propped during erection and advantage was taken of the shell action of the 2 layers of boarding to limit the deflections of the purlins and rafters. The analysis of the roof truss was done on the Eliott 803B computer using the plain frameworks programme.
Before the plan and main outlines of the reconstruction were finally resolved it was decided to raise the existing walls 2 ft. This solved many problems. It gave good clearance above the staircase to the restaurant and rear auditorium entrance. It improved the gutter detail between the junction of the main hall and the restaurant and improved the junction of the new turning-bay roof and the main hall and gave adequate room for the main ventilation duct. In addition to raising the walls and because cross walls had been removed, the main auditorium walls were stiffened by the addition of 2 ft. 3 in. x 1 ft. 1½ in. piers and arches on the foyer side and by 13½ in. x 9 in. piers on the turning-bay side which carried a reinforced concrete beam. Above the arches and the beam, the walls were thickened to 2 ft. 3 in. and were finished with a reinforced concrete ring beam which provided a seating for the roof trusses and tied in the tops of the raised walls with the gable walls.
The increasing demands for opera facilities such as trap doors through the stage with access underneath to the sides and to the dressing rooms together with the orchestra pit already planned for, led to a decision to open up the whole of the area below stage down to a depth of 4 ft. 6 in. below the auditorium and giving good access to both sides and to give choice for the depth of the orchestra pit underneath the stage. The area under the stage was designed in reinforced concrete with an internal waterproof rendering. A sump was provided.
The rake of the stage had been the subject of much discussion and it was finally decided to provide a steel frame operated by suitably coupled jacks. The jacks finally chosen were

Fig. 11
Foyer
Photo: John Brandenburger

10 ton Simplex Unilift worm gear screw jacks operated by a single 2 h.p. motor. They were to be fixed inside 6 in. diameter columns and operate through a pin connection. A simple sliding bearing using two layers of polytetrafluorethylene was provided at the rear support of the stage to ensure that the jacks operated vertically.
The base floor to the auditorium is in concrete with a suspended reinforced concrete slab over the lavatories and plant rooms. The foyer floor was excavated down to the auditorium level and a new concrete floor provided with reinforced concrete staircase and landings to the rear of the auditorium and the restaurant. The foyer roof was a simple lean-to roof using 9 in. x 3 in. Columbian pine joists and one layer of ¾ in. tongued and grooved boarding.
The turning-bay roof adjacent to the Malt House had already been modified and the series of small pitched roofs covered in red clay pantiles had been replaced by poor corrugated iron. The original idea was to replace this with the original roof. This would have created real problems with the design of the main air handling duct. The present owners of the Maltings also had long term plans for raising this turning-bay roof to increase their storage. We produced a scheme that met their requirements and followed the profile for the new section of roof over the turning-bay. The new shape meant that the main ventilation duct could now be installed in a much more straightforward manner. Space was left at first floor level for general storage and on the ground floor directly underneath the duct, a director's box with ante-room, a stage director's room and a latecomers' lobby were provided. This lobby and a staircase from the rear of the auditorium also provided the secondary means of escape. There was also good access from this area to the loading bay and main stage door.
To keep the atmosphere of the Maltings, it was essential to keep finishings to a minimum. The whole of the roof is in untreated timber. The walls of soft red brick were grit blasted and sealed to get back their original colour. The floor and stage were finished with Gurjun hardwood strip with medium density cork underneath the fixed seating. The doors and door frames are in Columbian pine with a matt polish. All the steelwork was left in its original sheradized finish. The foyer floor and staircase were

Fig. 12
Cross section through auditorium



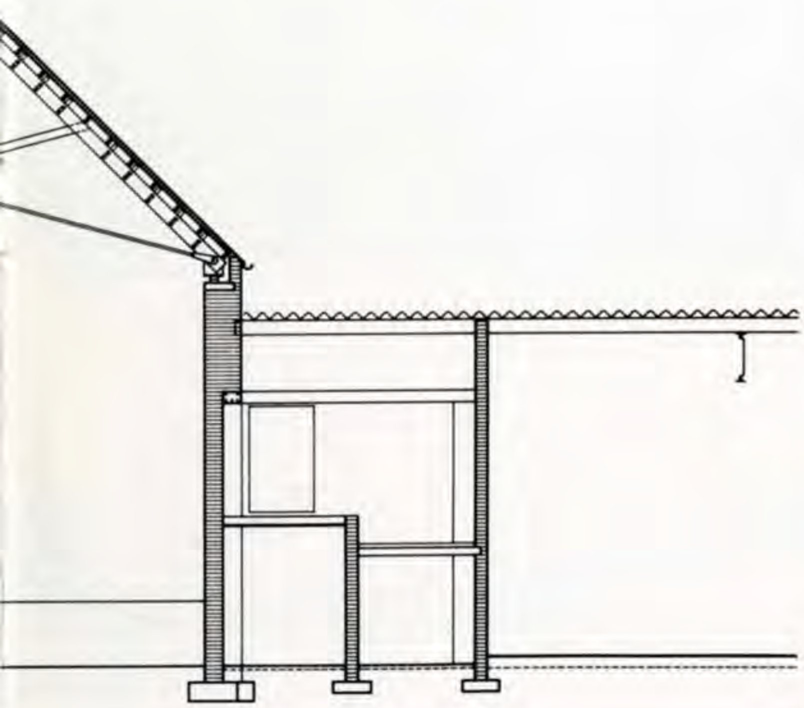


Fig. 13 left
Restaurant and bar
Photo: John Brandenburger

finished in 12 in. x 12 in. red pammets. Lavatory floors are in heather brown quarry tiles. The restaurant was left untouched apart from cleaning and repainting and resurfacing the existing pine floor. Changing rooms and the turning-bay have trowelled concrete floors with fair-faced brickwork painted white.

To keep the auditorium as a single space, the director's box and opera lighting control box were kept outside. The director's box, ante-room, stage director's box and late-comers' lobby are all in the turning-bay area against the south west wall of the auditorium and are finished with cork floors and hessian on the walls to give a quiet environment. The ceilings and joinery are in Columbian pine. The eventual size of the opera lighting control box with access outside the auditorium as well as inside, led to the only addition outside the original walls of the old Malt House. We produced a design based on the granary hoists on the main frontage, supported from similar rolled steel joist brackets and clad in white weather-boarding. Access was provided by a traditional circular staircase.
Externally the roof is finished with battens, counter battens, felt and 24 in. x 10 in. blue-black asbestos slates. Originally the roof had been covered with Welsh slates but when the roof had been altered on the north-east face these had been replaced with asbestos tiles. Asbestos weathers very naturally at Snape, nearly the whole of the roofs having been replaced with asbestos tiles or sheets over the years. The turning-bay roof is finished with Turner's SUPER SIX asbestos sheets and all the gutters and downpipes have been replaced with new bitumen-painted asbestos but re-using the old gutter brackets wherever possible, especially on the north-east face. The external walls have been raised and patched with soft red facings from Wm. Reade's Aldeburgh brickworks. The original bricks were made in Snape but the brickworks are now closed and the Aldeburgh reds blend very well with the old Snape bricks. All the softwood joinery, handrails and doors will be painted white similar to the main front. Tie plates are being used wherever possible to tie the old walls to the new reinforced concrete floors and these will be painted black. The new sash windows and staircase to the restaurant will be finished white and the external wall of the restaurant and the external north east wall, which were originally tarred, will be finished with black rubber-based paint.

THE DESIGN - LIGHTING AND ELECTRICAL SERVICES
The lighting of the auditorium and foyer plays as much, if not a greater, part than the structure itself in the atmosphere that is created throughout a concert or opera performance. It must be part of the total design of the space and cannot be considered as a separate entity. When one thinks of the difference between the classical eighteenth century Italian opera house, horseshoe in plan, with its tiers of boxes, its sophisticated audience, its sparkle and social occasion at one end of the scale, and the modern cinema with isolated man in the dark and nothing between him and the images on the screen - the anti-social occasion at the other end of the scale, there is of course a variety of approaches to the lighting of a concert hall which will be used for certain operas.
During a concert performance we felt that everything above should be dark but a low level of light which did not show up the roof space should be provided for score reading. To achieve this we have used tungsten halogen fittings of a special design of 1 KW rating. These lights are fixed on the ring beam at the intersection of the wall and roof on the sides of the auditorium only, one equi-spaced between each roof truss. They light the opposite sides of the roof from where they are mounted. The fitting has been designed so that there is no overspill of light on to the brick walls. Sparkle is added to the walls by the use of specially designed wall fittings mounted in line with the tungsten halogen fittings above, but only 7 ft. 6 in. from finished floor level. Score reading lights are suspended from between the roof trusses giving a low level of illumination. These fittings provide only downward lighting with no visible source point. All the fittings in the auditorium are on dimmer circuits and various degrees of illumination can be set. It is intended to light the roof only before and after concerts and during intervals and rely on the score reading lights during performance.

It was not structurally possible to create large glazed openings on the north-east face of the foyer and it was decided to make this an enclosed space by a very highly artificially lit area. Against a general background light it was decided to emphasize the new brick arches opposite the main entrance doors. This has been achieved by the use of fluorescent fittings mounted in a continuous row high up on the external wall and by use of a timber baffle. All the light is thrown up on to the timber joists and ceiling, providing an overall soft background light. To provide some sparkle, wall-mounted fittings as used in the auditorium are fixed 7 ft. from floor level below the continuous row of fluorescents. The lighting of the brick arches is achieved by the use of LYTESPAN trunking with two 300 watt fittings illuminating each arch. The LYTESPAN is mounted on the 9 in. x 3 in. roof joists.
For the control of the stage and opera lighting an 80-way three pre-set board is installed together with the latest electronic dimmer units. The control board is located in the cantilever lighting control box at the rear of the auditorium. Trunking for all lighting circuits runs in a large section, trunking running at the rear of the tungsten

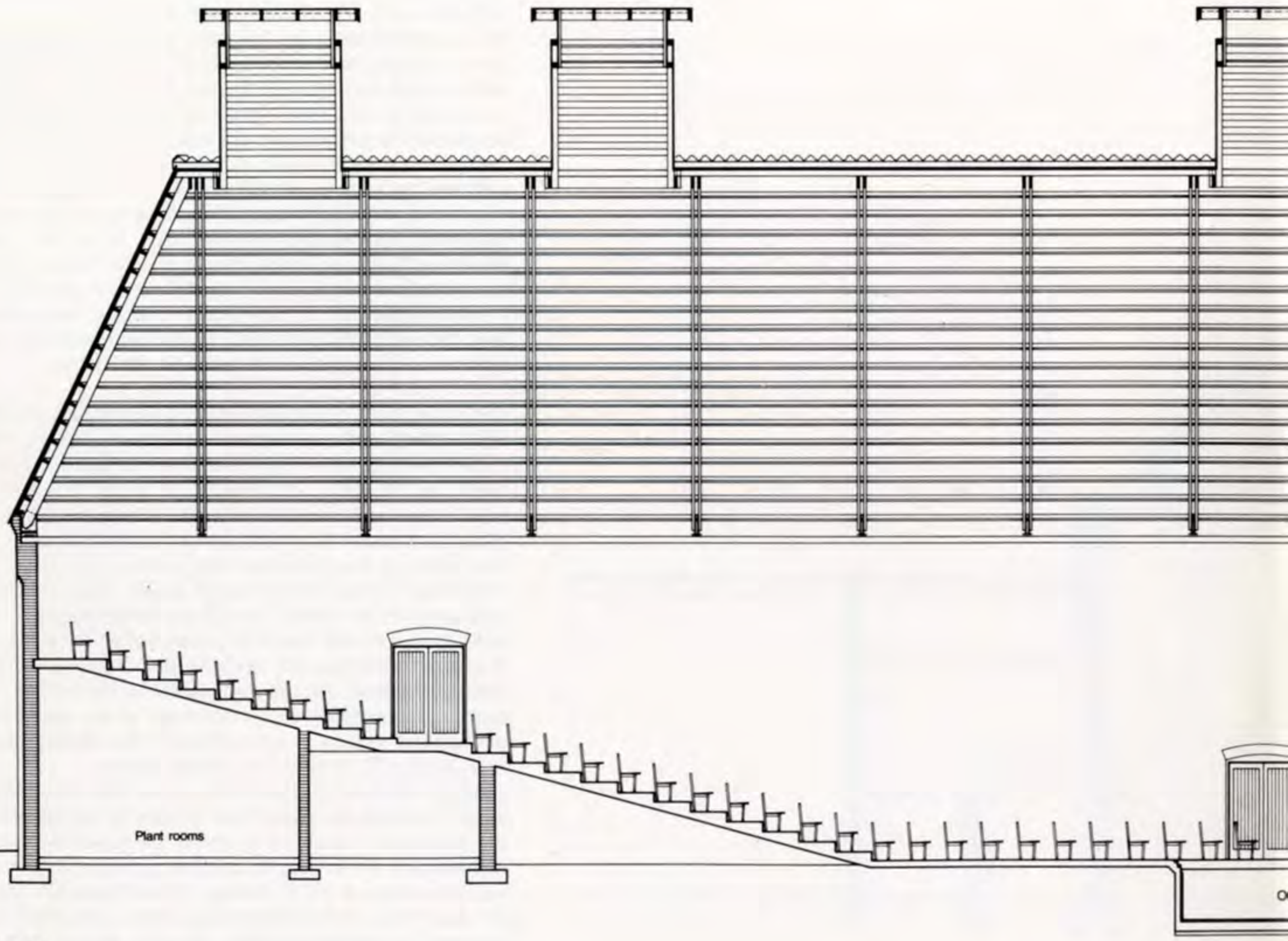


Fig. 14
Longitudinal section

halogen fittings on the ring beam. Two patch panels are located under the stage on each side, which will allow high- and low-level lights to be grouped up if required and also provide additional outlets. Sockets for effects machines are also provided both at high- and low-level.
Lanterns will be hung on a high-level wall-mounted lighting bar running two-thirds of the way back into the auditorium from the stage and on both sides. Bars are also provided over the stage for three bays connecting the centre node points of the roof trusses. Cables will run out to these lanterns in special troughs clipped to the roof tie rods.
Independent of this opera lighting system, there will be twelve vertically hung lanterns for concert lighting. These will be suspended immediately over the stage area and mounted on the roof truss tie rods. They will be controlled by their own dimmer unit. Orchestra music-stand lighting, if required, will be from dimmer controlled socket outlets.
A sound system is installed giving the stage manager a portable unit which can be used off-stage, mid-way in the auditorium and in his own control room. This unit has facilities for control of relay to all back stage areas, lighting control box, dimmer room, some public areas, calls to dressing rooms, announcements to public areas and auditorium, interval bells, cue lights to control positions and talk-back arrangements to certain control positions.
The building will be used for BBC transcription recordings and for BBC Midland recordings and live broadcasts during the Festival. Decca will also use the building as a recording studio. With BBC and Decca engineers we have designed a system of conduits, trunking and boxes throughout the building to allow microphones to be set up where and when required. We hope this system will do away with the usual tangle of wires and microphones usually seen when broadcasting or recording is taking place. A recording room has been provided at the loading bay end of the dressing rooms and all the recording facilities terminate here. Provision is also made from the loading bay for the direct entry of cables into the room from a recording van. This system will avoid the usual array of cables running around buildings and popping into convenient windows and through doors during recording sessions.
A maintained system has been installed for emergency lighting with outlets in all public areas and throughout the backstage rooms. The fittings have been carefully concealed between the main rafter backs of the roof trusses in the auditorium so as to be as inconspicuous as possible.

Fig. 15 above far right
Opera lighting control box
copied from traditional granary hoist
Photo: John Brandenburger

Fig. 16 right
Opera lighting control box supports
Photo: John Brandenburger

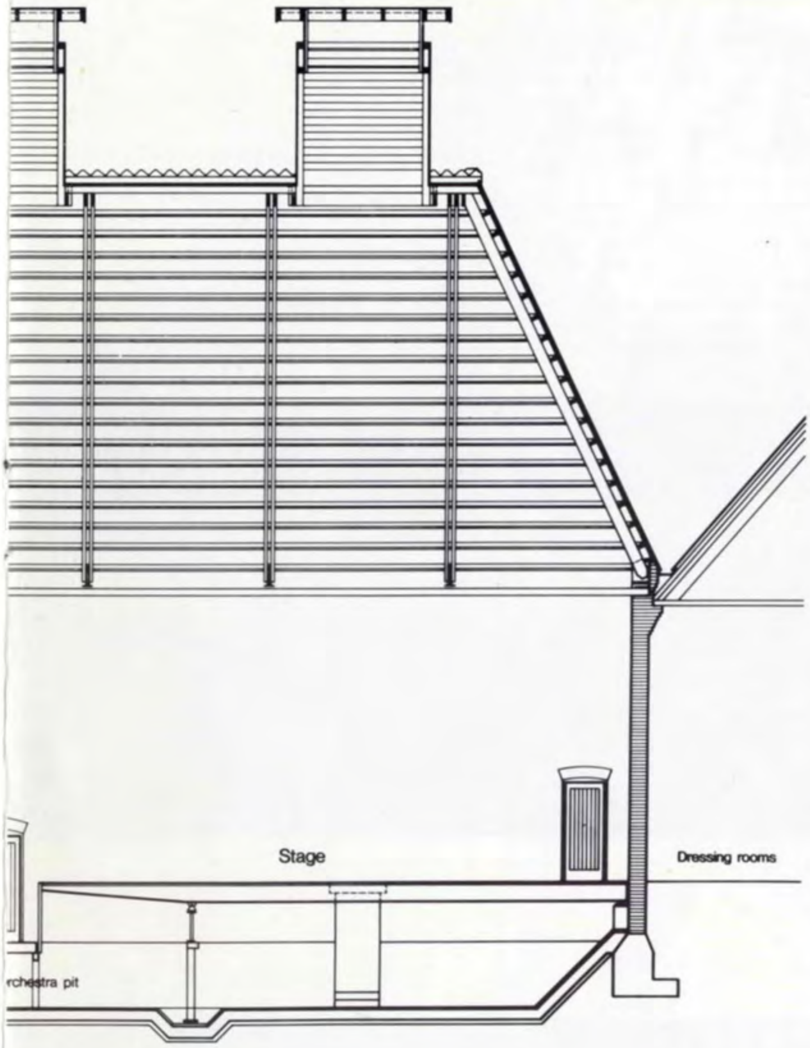

Stage
Dressing rooms
rchestra pit

Fig. 17 above
General view 30 April 1966
Photo: John Brandenburger

The battery for this installation is located in the main electrical equipment room below the raised part of the auditorium.
An automatic fire alarm break-glass system is installed with pushes and bells located throughout the building. The battery is again located in the main electrical equipment room.
Ample 13-amp sockets are provided for general maintenance and cleaning purposes, together with a separate supply and control unit for the kitchen located above the dressing rooms at the south end of the restaurant.

THE DESIGN - MECHANICAL SERVICES
Like every other part of Snape Concert Hall the mechanical services had to be done very cheaply and somehow this part of the brief affects mechanical services more than anything. In a normal building it can mean all the difference between a few old radiators with opening windows and sophisticated dual duct air conditioning. Another important factor at Snape was the lack of room for plant, the necessity for quiet operation and its intermittent operation, especially during the heating season. As a place of public entertainment the concert hall had to be artificially ventilated and at a high rate during the summer to avoid overheating. During the winter the rate could be lower to provide the amount of fresh air that was required. During the winter the air had to be heated and the preliminary calculations showed that it would be possible to heat the hall using the warm air system only, without having any re-circulation air. When the ventilation plant was off, it would only be necessary to provide enough heat to protect the fabric of the building and this could very easily be done with off-peak electric floor heating. This was the eventual solution. As the plant was seldom to be used during the

Fig. 18 below
General view April 1967
Photo: John Brandenburger

winter, it was very important to minimise the capital cost of providing the heat, and at first an electric installation was investigated. Costings showed that it would cost in the order of £1,000 simply to switch the heater battery on once and that the heater battery itself would cost £600. We looked for a cheaper solution. No gas was available and the next most suitable fuel is light fuel oil. There are many furnaces on the market which produce hot air directly from oil burners but all these furnaces contain a very noisy fan. We decided to take the combustion chamber from a standard furnace and to install it in the ductwork serving the concert hall so that the air was circulated over the combustion chamber by a quiet fan, which would be needed in any case for the ventilation system. A firm called Activair Ltd. eventually undertook to provide a combustion chamber with oil-burning equipment to this brief. The heating and ventilating system finally consists of an air intake through honeycomb brickwork on the west gable. The air is then filtered, passes through a fan and is blown over heating equipment provided by Activair Ltd. It rises in a vertical builder's work duct and is distributed by a main 7 ft. x 4 ft. sheet metal duct in the turning-bay and is discharged into the auditorium by 7 ft. x 9 in. slots in the south wall. The size of the old smoke-hoods on the original Malt House were such that they would allow natural exhaust of both the air introduced by the ventilation system and any other open doors. The smoke-hoods have been copied in size and design but are provided with motorised dampers which can be opened and closed electrically from the main control board. With the foyer doors closed, the dampers can be opened and all exhaust is through the roof ventilators. With the foyer doors open and the ventilators closed, exhaust can be through the foyer. The main air flow can therefore be varied during performances and intervals.

To maintain the fabric of the building and its contents during the winter months, a system of background electric floor heating has been installed. This is placed in the foyer, the dressing-room area, lavatories and also in the centre of the auditorium. This heating is all on off-peak tariff. The water supply comes from the existing shallow well and tank that serves the whole of the Maltings. A connection is made to this supply at the far end of the turning-bay and is run direct to the various appliances in the new conversion. Space in the conversion was at a premium and it was not possible to provide a central hot water supply and individual electric hot water heaters have been provided. The drainage has been designed with the minimum possible drain lines reducing the excavation through the existing floor slabs. Because of the ground-water problem, pitch-fibre external drains were used to enable the lines to be made up on top of the trench and then dropped into the trench, wedged and backfilled. The septic tank is of traditional design. Because of the high ground-water level where it was constructed - some 2 ft. above the water level in the auditorium - it was found impossible to have a complete gravity system. It was found necessary to lift the effluent to a height above the ground-water level to enable the sub-soil drains to irrigate. This was done with a pair of submersible sewage pumps. Apart from some additional hard standings which have been provided with surface water drainage the existing surface water system has been maintained.

THE FURNITURE

The auditorium seating presented a formidable problem. It should be removable, preferably stackable, linkable and firmly fixed to the floor, but above all it had to look right in a building which still retained a marked mid-nineteenth century atmosphere. It was Richard Butt of the BBC Midland region who suggested a cane chair similar to the seating at Bayreuth. I wrote to the Director at Bayreuth and Wolfgang Wagner replied sending photographs, a fully dimensioned sketch and confirmed the robustness of the chairs at Bayreuth by saying that most of them had been in continual use since 1876 and were still in fair condition. We then looked round for people who were willing to make them in the time and within the tight budget. We found a local firm in Ipswich who were very willing. After meeting them we made a sketch design which they roughly priced and made many comments on the construction. After revising our sketches they then made a prototype, which, with a few modifications, is now in full production. To keep the character right through the building we have chosen the Thonet bentwood chairs with cane seats for the orchestra and the restaurant.

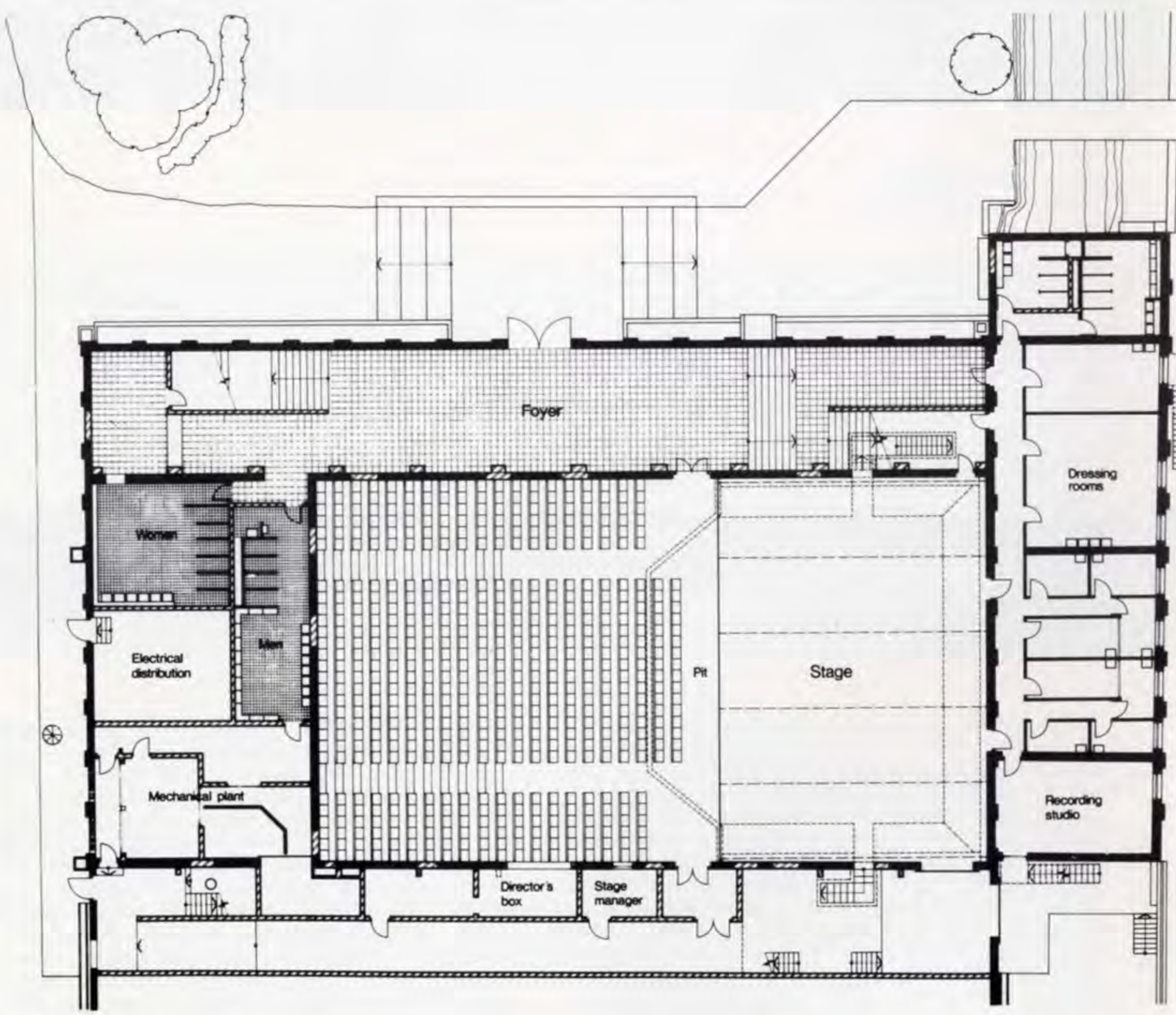


Fig. 19
Entrance level

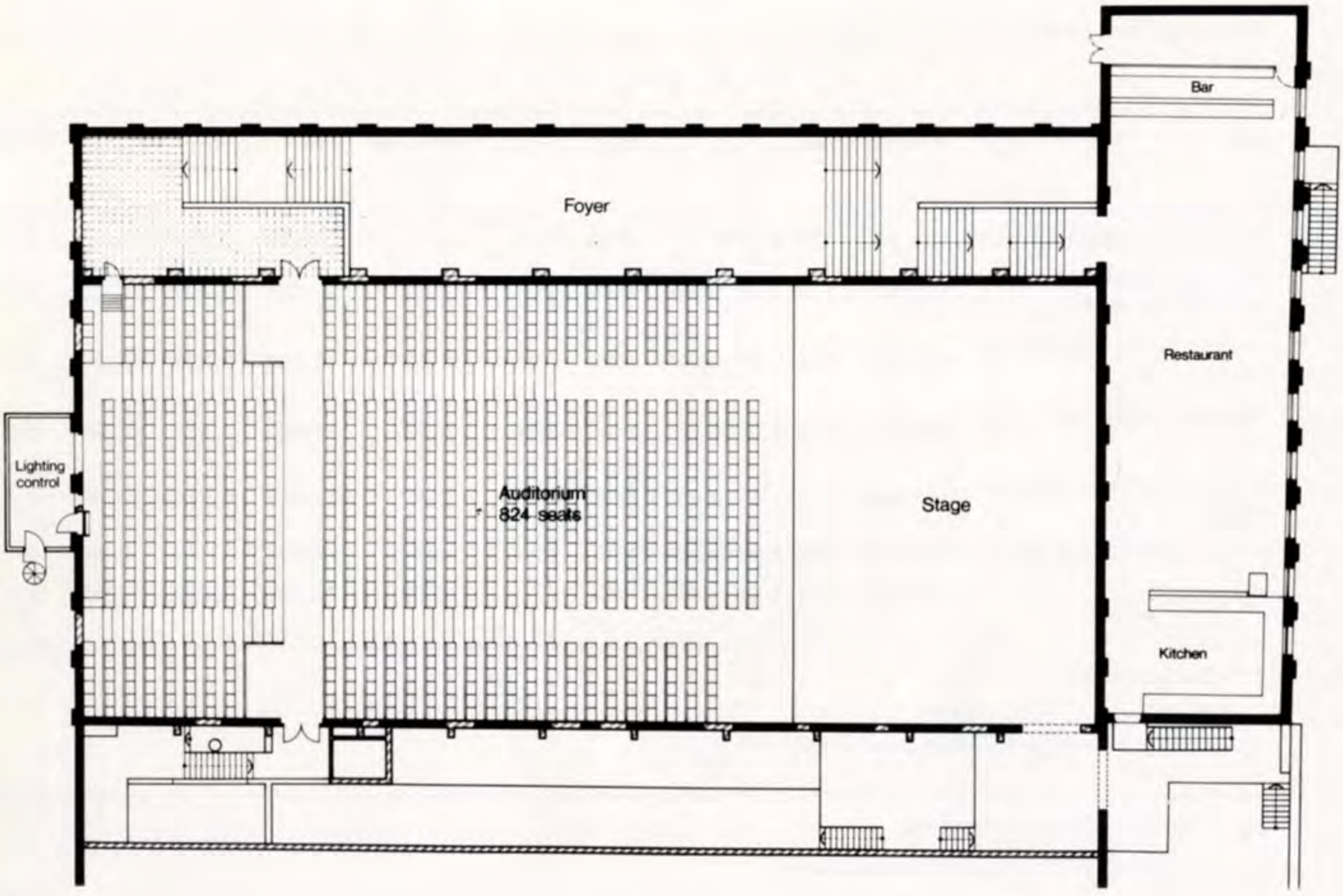


Fig. 20
Plan upper level

Fig. 21
Auditorium seating
Photo: David Weaver

THE ACOUSTICS

Jacques Barzun's theme that the majority of men are outside the concept of C.P. Snow's 'The Two Cultures', and that most of us are part of a scientific culture, explains how easily we create gods of pseudo-sciences. We are surrounded by them today - economics, cybernetics, ergonomics, and, I believe, acoustics. If a few scientists wave some mathematics at us most of us swallow the results of their 'science' without questioning. As Muggeridge says 'Towards any kind of scientific mumbo-jumbo we display a credulity which must be the envy of African witchdoctors.'* We neither question the scientists' parameters nor do we ask if they have collected them all. The refreshing thing about Beranek's book on acoustics is the empirical approach and collection of data of some 54 concert halls and opera houses throughout the world. We can go on measuring and calculating but finally any reaction to music is a highly subjective thing. I believe it is also dangerous to talk about acoustics in an abstract way, to divorce them from their physical surroundings, because the whole architecture of the space in which music is made is as much responsible for our whole response to the music. It is as dangerous to talk about only the acoustics of a hall as to think we can rely only on our intellect for judgement.

If, however, we look at the halls that Beranek visited and talk to other listeners and musicians, there are certain ones that everyone seems happy with. They are the Boston Symphony Hall, the Grosser Musikvereinssaal in Vienna, the Leipzig Neues Gewandhaus, the St. Andrews Hall, Glasgow,

* In: The Observer (Review) p.17, 26 March 1967.

COMPARISON OF PROPERTIES OF KNOWN CONCERT HALLS WITH SNAPE

(The properties of the halls are reproduced from L.L. Beranek 'Music, acoustics and architecture'. John Wiley & Sons, 1962)

Hall	Volume	Size	(N_A)	t_I	$T_{500-1000}$ Occup.	S_A	S_O	S_T	S_A/N_A	V/S_T
Boston Symphony Hall 1900	662,000	170' x 80' x 65'	2631	15;7	1.8	15,000	1,600	16,600	5.7	39.9
Vienna Grosser Musik-Vereinssaal 1870	530,000	180' x 70' x 60'	1680	12;9	2.05	10,600	1,400	12,000	6.3	44.2
Leipzig Neues Gewandhaus 1886	375,000	130' x 65' x 60'	1560	8;6	1.55	9,750	1,250	11,000	6.3	34
Glasgow, St.Andrews Hall 1877	569,000	170' x 75' x 60'	2133	20;8	1.9	13,500	1,400	14,900	6.3	38.2
Amsterdam Concertgebouw 1888	663,000	140' x 95' x 60'	2206	21;9	2.0	12,200	1,600	13,800	5.5	48.0
Basel, Stadt Casino 1876	370,000	120' x 65' x 50'	1400	16;6	1.7	8,000	1,650	9,650	5.7	38.3
Snape 1967	288,800	134' x 58' x 37'*	824	21	2.25	4,700	2,320	7,020	5.7	41.0

* Average height.
Height to top of walls = 25 ft.
Height to underside of flat portion of roof = 49 ft.

N_A = Number of seats in the hall

t_I = Initial-time-delay gap in milliseconds

$T_{500-1000}$ (Occup.) = The mid-frequency reverberation time defined as the average of the reverberation times at 500 and 1000 cycles per second (cps) (approximately the C's that lie one and two octaves above middle C) for the fully occupied hall. In acoustical literature, reverberation time is normally given for a frequency of 500 cps, which is generally longer than $T_{500-1000}$. $T_{500-1000}$ is believed to provide a more meaningful measure, because the centre of the hearing range for music lies within this frequency range.

S_A = Audience seating area in square feet.

S_O = Area of the orchestra or open area of the orchestra pit in square feet. It includes the area occupied by the orchestra, plus a strip of 3.5 ft. wide around the periphery, unless the players are seated against a wall.

S_T = Total surface area occupied by the audience, the orchestra, and the chorus, if any, in square feet.

V = Volume of the hall in cubic feet.

the Concertgebouw, Amsterdam and the Stadt Casino at Basel. If we come nearer home, I have always been happy listening to music in the town halls of Watford and Wembley, and Walthamstow has the same reputation. If we go nearer still to Aldeburgh, the churches of Blythburgh and Orford stand out.
The church at Orford is famous for the successful recordings made there by Decca of 'Noyes Fludde' and 'The Burning Fiery Furnace', and the recent BBC recording of Haydn's 'Creation' conducted by Benjamin Britten at the last Festival. I find the acoustic and the whole atmosphere of Blythburgh Church ideal and I certainly find it impossible to separate out my feelings about the acoustics and the architecture.
If we look at some of the main characteristics of these successful nineteenth century halls, we find many things in common. They are usually rectangular in plan and are mainly between 60 ft. and 80 ft. wide. The Concertgebouw is the one outside this, being 95 ft. wide. They usually have flat ceilings and are between 50 ft. and 65 ft. high. Many of the ceilings are coffered and most of the surfaces are very broken and the materials are usually heavy plaster. Practically no thin wood is used. Their acoustic characteristics are shown in the above table and the calculated properties of Snape are shown for comparison.

It is interesting to compare the size of Blythburgh Church with Snape. Blythburgh Church is 135 ft. x 55 ft. x 35 ft. high - vertically the same plan as Snape, but some 15 ft. lower. Blythburgh is of stone with a brick floor and the only timber is in the roof and this is very heavy. Snape is of solid construction with brick walls with a textured surface from the grit blasting, a hardwood floor fixed to concrete with no air gap and certainly a timber roof but made of two ¾ in. layers of boarding firmly nailed together. There are no large irregularities on the brick walls but the exposed roof presents many with the exposed roof trusses and ~urlins. The stage is of heavy hardwood strip - 1¼ in. Gurjun and is on a long span structure - a construction which should ensure that the base is not absorbed.
It is hoped that musical tests and a recital will be carried out as soon as the auditorium is completed.

THE RECONSTRUCTION AND ITS PROBLEMS
Demolition started in May 1966 and real reconstruction work about two months later. By this time we had decided to open up the whole of the area below the stage down to -1.0 O.D. Our trial holes dug at both ends of the auditorium showed the water level at approximately +1.5 O.D. There were extensive heavy old foundations to break out and the

effect of the mechanical digger was to turn the clay into a slurry which was very difficult to remove. A sump using a 4 ft. diameter precast concrete sewer pipe was sunk just outside the excavation and a 6 in. diameter pump was necessary to keep the excavation free of water. The sides of the excavation had been cut back at 45° to the existing footings. The excavation was slow and because these slopes were not immediately blinded they dried out and shrank away from the footings. As the excavation proceeded they were removed in short sections and replaced by 8:1 lean dry concrete. We had allowed in the bills of quantities for extensive underpinning of the main walls of the auditorium and these proved very necessary. The excavation showed up very poor cavity brickwork on the north wall and total lack of foundations on the south wall. In addition to the underpinning the 9 in. reinforced concrete sloping walls of the orchestra pit were turned into these main brick walls to give them additional support. While work continued, the main brick walls were being patched, nearly rebuilt in many places and raised to the new level to take the new reinforced concrete ring beam which received the new roof trusses. The roof was due to start in the middle of November but was nearly three weeks late. The auditorium was finally made weatherproof when on one sunny morning in February the four ventilators, complete with their motorised dampers, were erected and fixed in position. The electrical installation is now well on and the screeds are completed in the auditorium ready for the Gurjun hardwood strip and the cork tiles. The changing rooms, kitchen and restaurant are well under way and a real start has been made on external works. Some difficulty was encountered during excavation for the septic tank, as the ground-water level was some 2 ft. higher than shown in our trial holes.

Because of this high water table which did not vary with the tide, it was necessary at this late stage, to add a further chamber with submersible sewage pumps to make sure the sub-soil drains functioned properly.

ACKNOWLEDGEMENTS

To design and build a concert hall cum opera house in just over a year needs the hard work and enthusiasm of an impressive number of people. John Culshaw, Kenneth Wilkinson and Cyril Windebank of Decca, Jimmy Burnett and Thomas George and Dr. Alexander of the B.B.C. helped over the installations for recording and gave invaluable advice on the acoustics. Colin Graham, the English Opera Group producer, and Bill Bundy of the Royal Opera House, Covent Garden, were our advisers on all aspects of opera house lighting and control and also helped with their advice on the lighting generally. Martin Carr of Theatre Consultants Services and Francis Reid of Glyndebourne, helped with their advice.

Leslie Hutchinson of William Brown & Co. (Ipswich) Ltd. helped with his experience of engineered timber, but of all the contractors and sub-contractors Freddie Corke and Bill Muttitt of Wm. C. Reade of Aldeburgh Ltd. have brought an enthusiasm and patience and drive which are very rare in the building trade today.

David Armstrong, Julian Thompson and Zetta Barron made all the models. John Brandenburger and Colin Dollimore were the architects. Ron Marsh helped me with the analysis of the roof. Max Fordham and Richard Sercombe designed the mechanical services and drainage. Max Fordham also did work on the acoustics. Tom Butt carried out the whole of the electrical and opera house lighting design. David Weaver designed the furniture and John Mackrory-Jamieson was the quantity surveyor. John Beedham, our building surveyor, helped with many of the detailed drawings and specifications and the day to day administration of the contract.

To be deeply involved in converting a mid-nineteenth century industrial building to a concert hall which will be so important to the future of music-making at the Aldeburgh Festival is the sort of job one dreams about. It has not only become a reality but our clients, the Chairman, the Countess of Cranbrook, the artistic directors, Benjamin Britten, Peter Pears and Imogen Holst and the secretary of the Aldeburgh Festival, Stephen Reiss, have, with their ideas, enthusiasm, patience and friendliness, made it the most exciting job.

The Hall will be opened on 2 June by H. M. Queen Elizabeth and H. R. H. the Duke of Edinburgh. At the opening concert Benjamin Britten will conduct his new overture 'The Building of the House'.

SNAPE CONCERT HALL

Client:
Aldeburgh Festival of Music and the Arts

Designed by:
Arup Associates Architects and Engineers

Main Contractor:
Wm. C. Reade of Aldeburgh Ltd.

Nominated Sub-Contractors

Roof and Slating:
Wm. Brown & Co. (Ipswich) Ltd.

Electrical:
Wm. Steward & Co. Ltd.

Heating and Ventilating:
Norris Warming Co. Ltd.

Waterproofing:
Sealers (London) Ltd.

Hardwood and Cork Flooring:
Hollis Bros. Ltd.

Kitchen Equipment:
The Caterers Mart Ltd.

Stage Steelwork:
Robert Stevenson (Structural) Ltd.

Nominated Suppliers

Steel Staircase:
S. W. Farmer & Son Ltd.

Screw Jack for Stage:
Equipment & Engineering Co. Ltd.

Roof Slates:
Turners Asbestos Cement Co. Ltd.

Ironmongery:
G. & S. Allgood Ltd.

Fire Fighting Equipment:
Dunford Fire Protection Services Ltd.

Direct Contractors

Opera Lighting and Controls:
Strand Electric & Engineering Co. Ltd.

Sound Reinforcement:
Sound Systems Ltd.

Auditorium Seating and Restaurant Tables:
Wrinch & Sons Ltd.

Orchestra and Restaurant Chairs:
Goods and Chattels Ltd.

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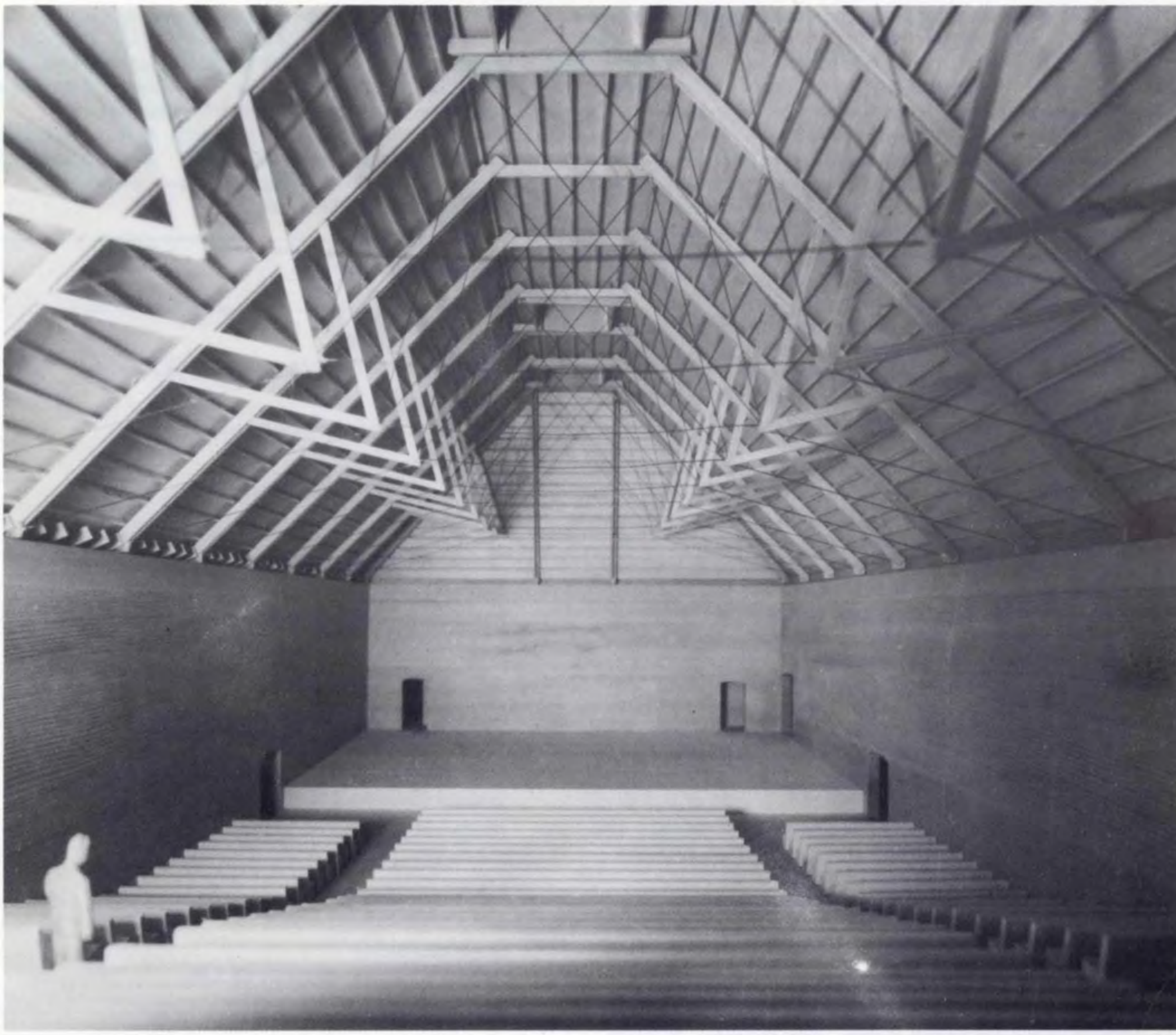
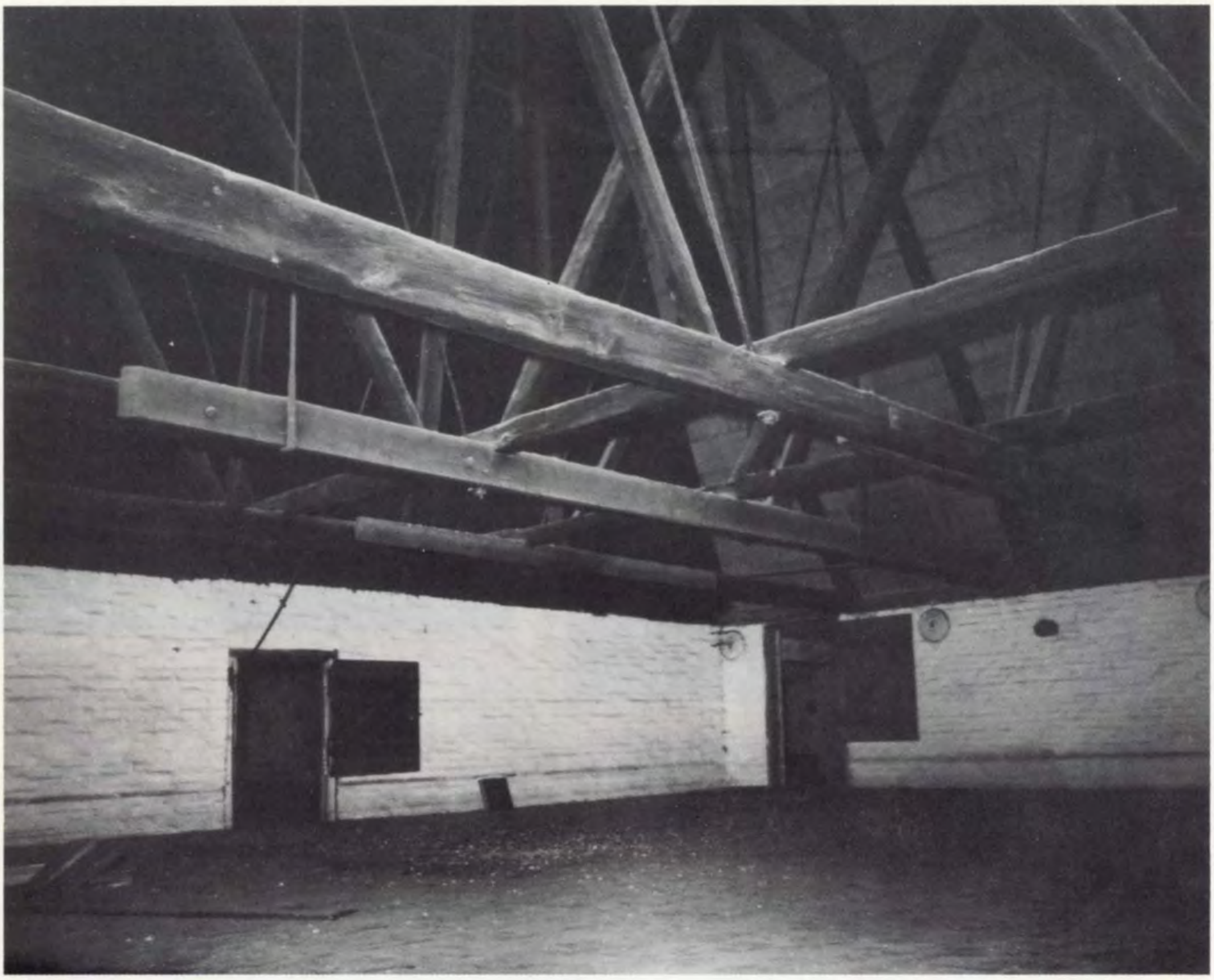


Figs. 22 and 23
Interior and exterior of model
Photo: John Donat Photography



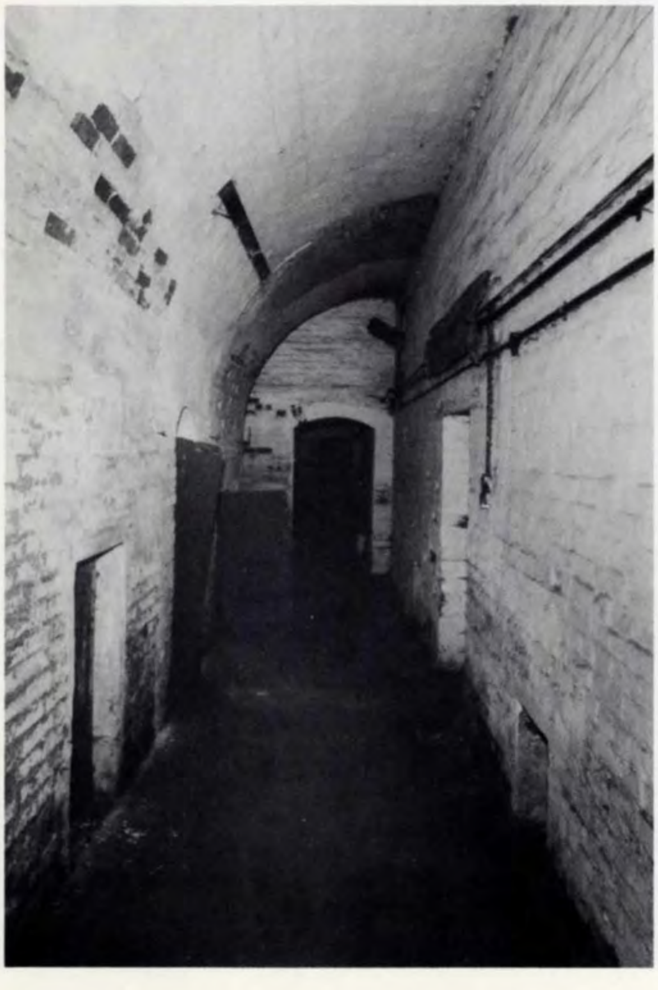


Fig. 24 above
Existing roof construction
Photo: John Brandenburger

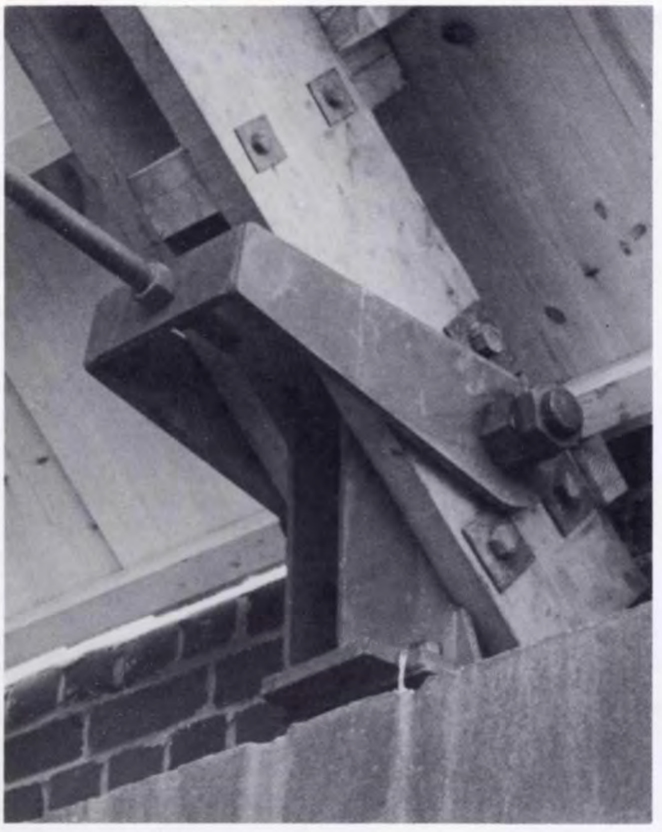
Fig. 25 left
Old Maltings' kilns
Photo: John Brandenburger

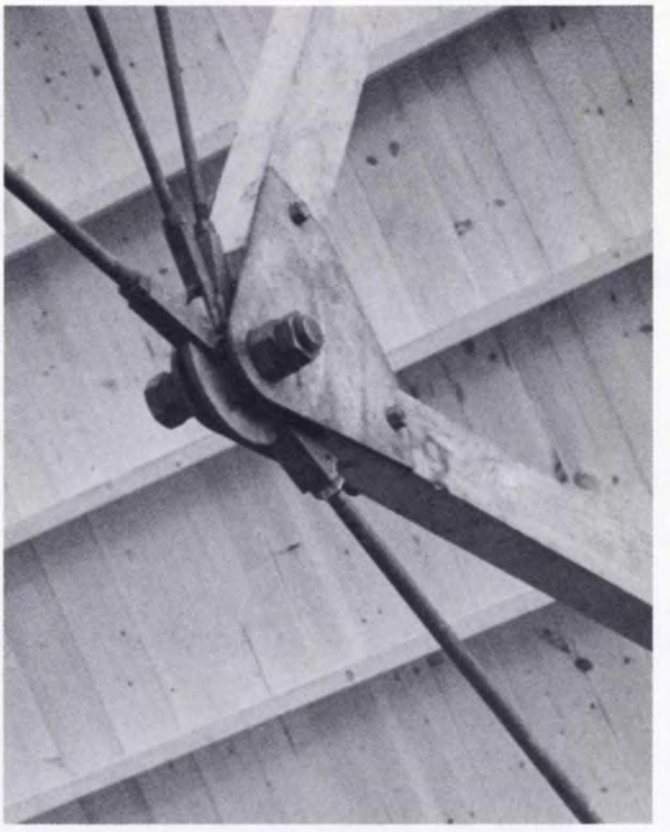
Fig. 26 below
Traditional details
Photo: John Brandenburger

Fig. 27
Roof under construction
Photo: Zetta Barron

Fig. 28
Roof under construction
Photo: Zetta Barron

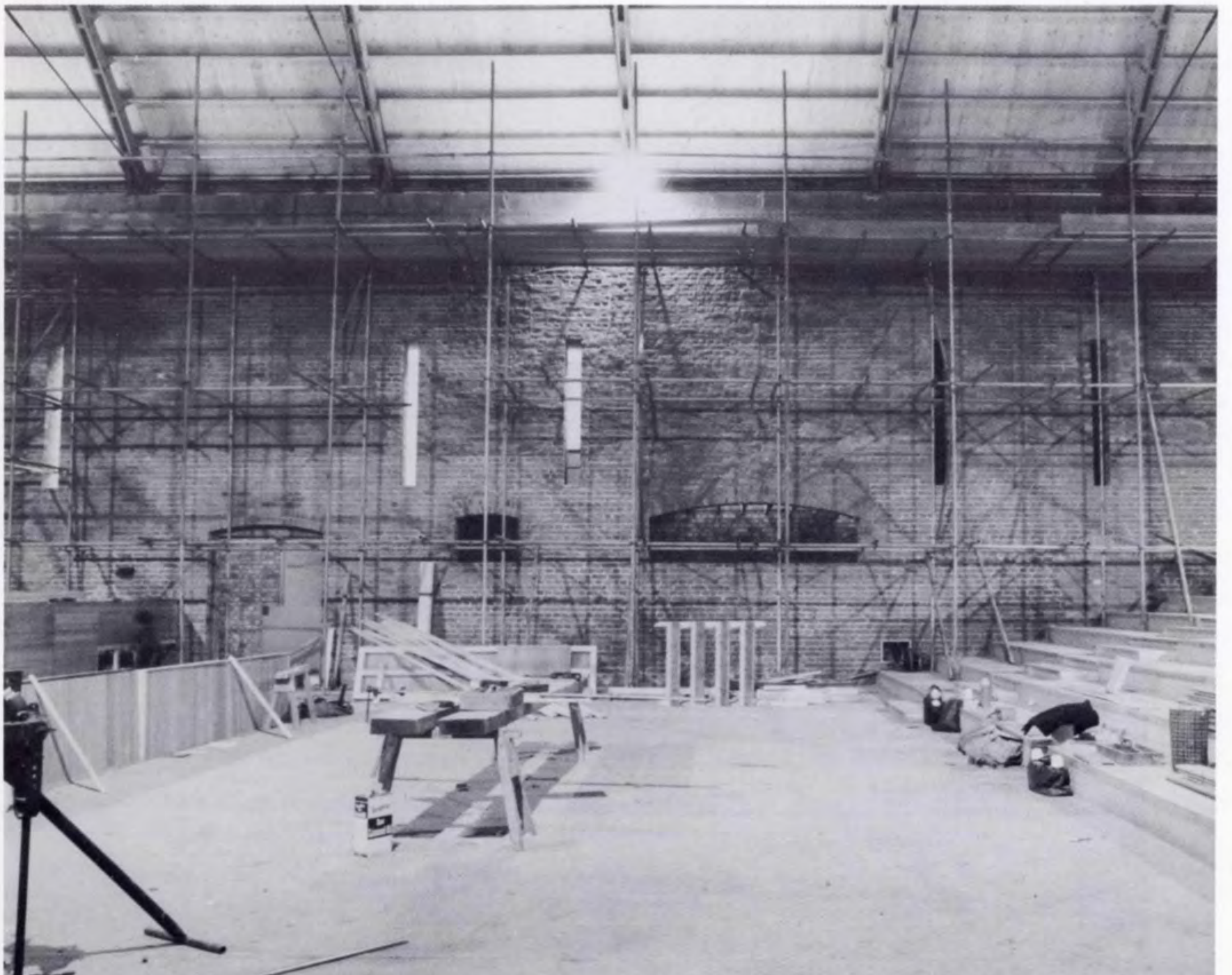
Fig. 29
Two layers of 1 in. boarding
Photo: Zetta Barron





Figs. 30 and 31 above and right
Roof details
Photo: John Brandenburger

Fig. 32
Auditorium showing new openings in existing wall
Photo: John Brandenburger



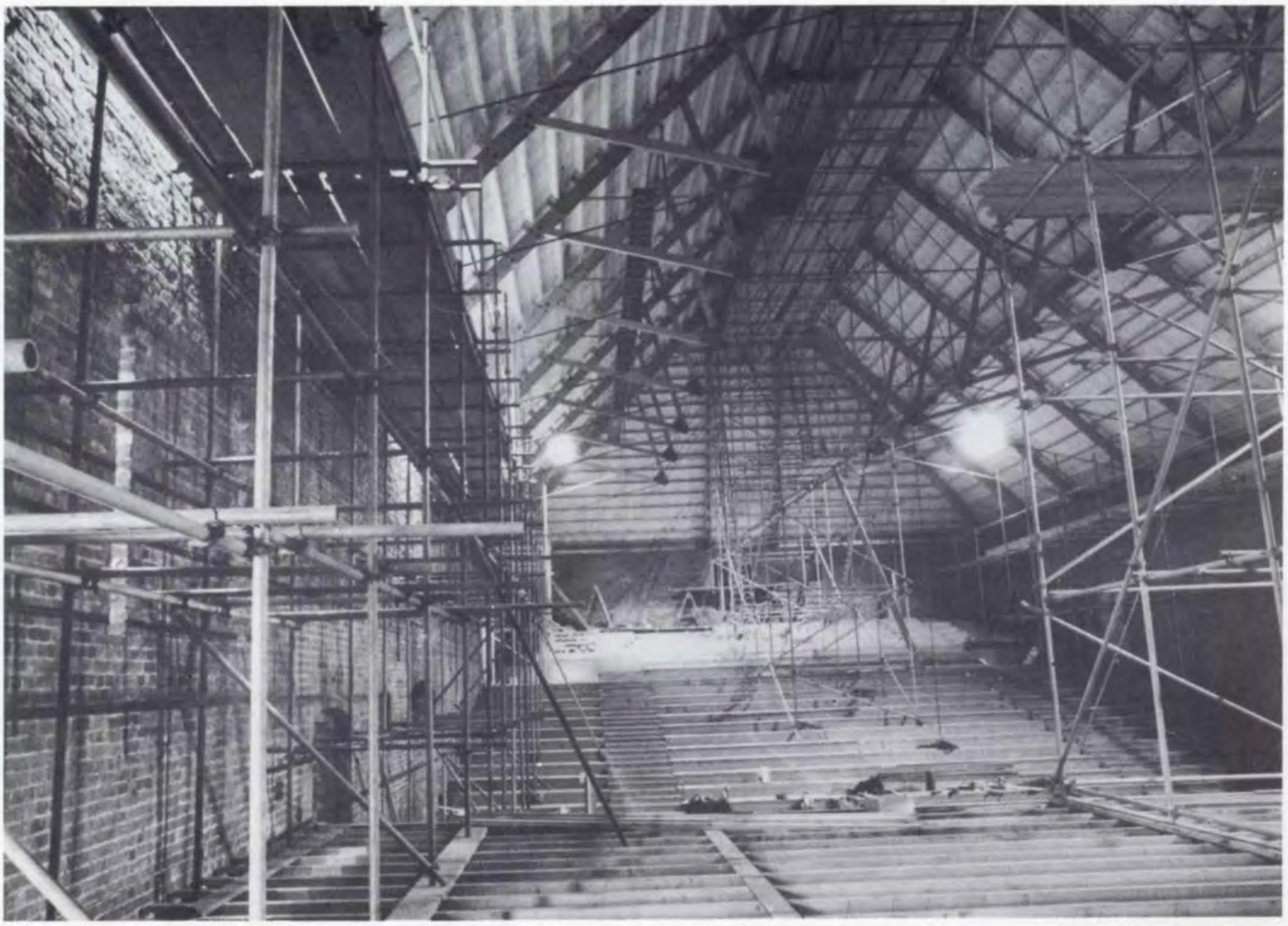


Fig. 33 above
View from stage
Photo: John Brandenburger

Fig. 34 below
Looking towards stage
Photo: John Brandenburger

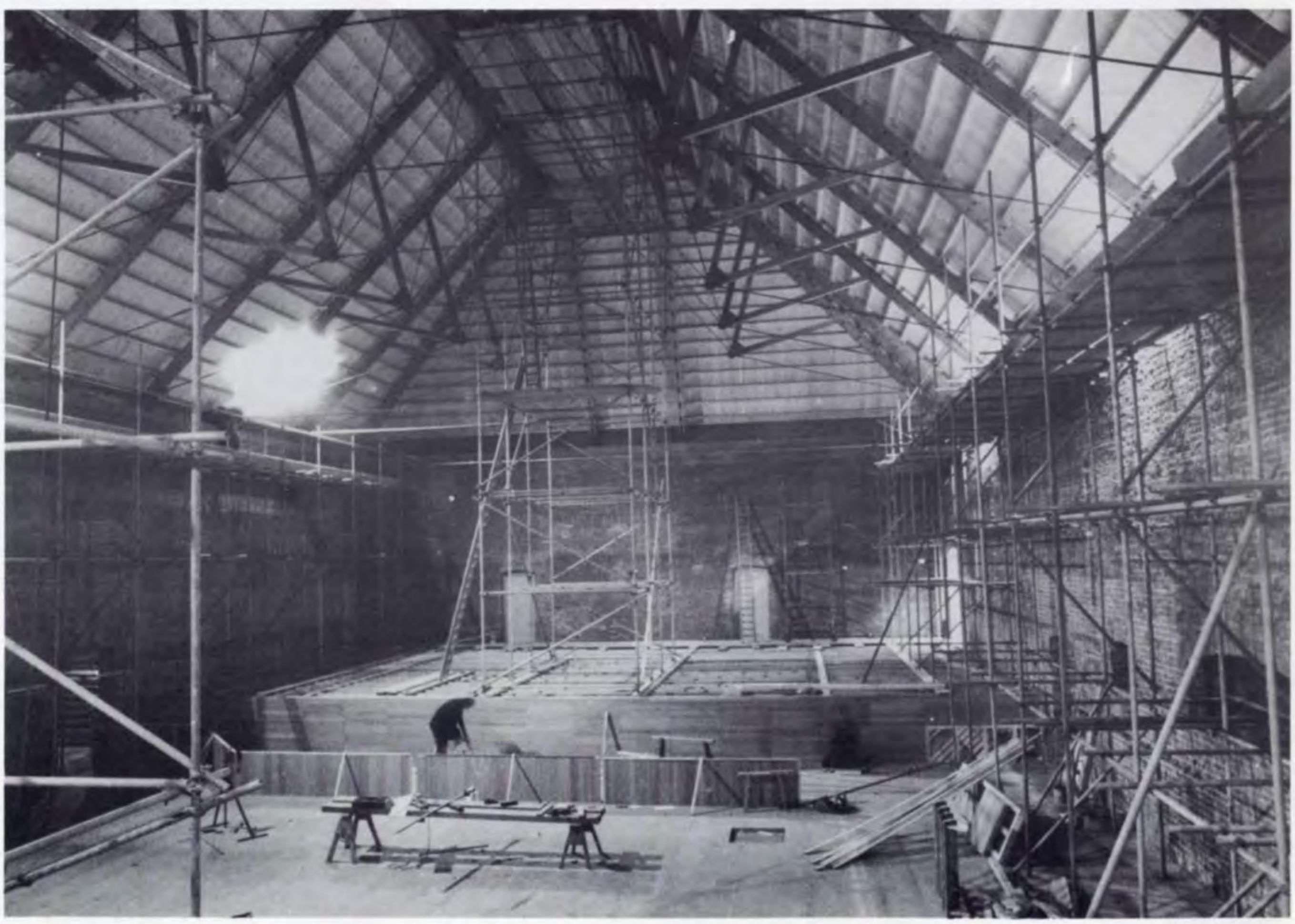


Fig. 35
Roof ventilator
Photograph supplied by Wm. C. Reade of Aldeburgh Ltd.

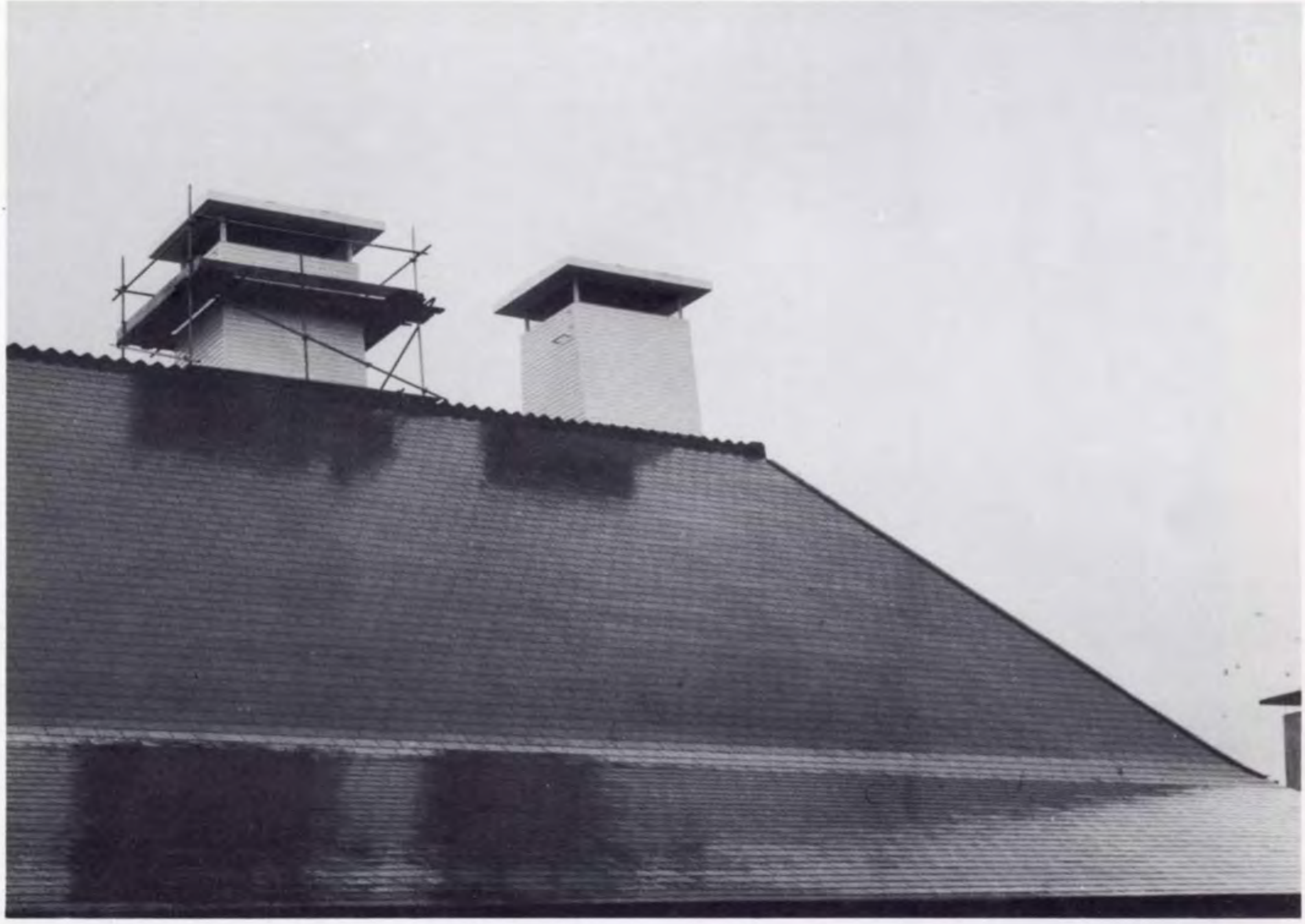


Fig. 36 above
New roof
Photo: John Brandenburger

Fig. 37 below
View of new roof from car park
Photo: John Brandenburger

Fig. 38 above
General view
Photo: John Brandenburger

Fig. 39 below
Alterations to the restaurant block in the traditional manner. Photo: John Brandenburger

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