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# The Conservation Department of the National Gallery

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## Early years

The Conservation Department was established in 1946. Before then, the cleaning and repair of National Gallery pictures had been carried out within the Gallery by private restorers. It had become increasingly apparent, however, that a systematic programme of conservation (of which cleaning pictures was only a part) could only be realized by setting up a permanent department within the administrative structure of the Gallery. In the war years when the Collection had been in storage at Manod Slate quarry, routine but essential conservation of pictures had been difficult and by the time of the return to London many were in need of urgent treatment.

During the war, only the simplest types of structural repair could be attempted, in view of the extremely limited facilities available and, understandably, attention had been concentrated on cleaning, which required nothing in the way of elaborate apparatus. Indeed, an unprecedented number of pictures were cleaned then, at Avening, Aberystwyth and Bangor, and at Manod where a special restoration studio had been built. More than seventy pictures cleaned since 1936 were to be included in the 'Cleaned Pictures Exhibition' of 1947–48 and the cleaning was done by nine different restorers.

It is well known that the cleaning of pictures caused considerable disquiet at that time, and it was found necessary to attempt to disarm critics by presenting detailed evidence of every kind to impartial critics from outside. For this reason the Weaver Committee was appointed in 1947. They investigated ten important pictures of which the cleaning had been criticized, examining the pictures themselves, photographic records, laboratory and condition reports and interviewing members of staff concerned. Their report was completed in October 1947 and its constructive recommendations were to have decided effects upon the future of both the Department of Conservation, then in its infancy, and the Scientific Department which had been in existence since 1934.

For the Conservation Department, the most important recommendation was to add to the staff and provide facilities in order to 'deal with arrears of cleaning and general conservation which have accumulated over a span of years owing to the impossibility of keeping up with the rate of deterioration'. At its inception, the Department consisted of a Consultant Restorer (who had worked for the Gallery since 1934), an unestablished Restorer (later to become the first Chief Restorer) and a Craftsman. Two years after the Weaver Report the theoretical complement of the Department was set at a Chief Restorer, two Restorers,

three Assistant Restorers and a suitable number of Craftsmen, but for a variety of reasons this maximum was never realized. The appointment of the Chief Restorer (in 1954) was in accordance with another recommendation of the Weaver Committee 'that a regular administrative procedure be designated for cases of cleaning or repair in order to ensure due allocation of responsibility and enlistment of all available professional advice'.

The conditions in which the Conservation Department worked in those early years were far from ideal. What was then Room XXV (now Room 9), the third largest exhibition room, was used until the present studios were finished. It was quite unsuitable for restoration, partly because its great height restricted the amount of direct sunlight and partly because damaged plaster (loosened by wartime bombs) was a continual source of dust. In addition, the enormous size of the room made impossible any attempt at controlling the atmospheric conditions and, equally impossible, any satisfactory subdivision of the space into smaller units. Therefore operations which should have been carried out in a dust-free environment, such as cleaning and retouching, had to be done side-by-side with others which inevitably created dust.

A further disadvantage was the distance of the conservation studio from the photographic studios and from a room with suitable fume extraction facilities used for spray varnishing. A picture had, therefore, to be moved through the building several times during the course of its treatment, for a full photographic record to be made and for sprayed varnish to be applied. When the new conservation studios were designed, elimination of this continual movement of pictures was an important consideration. In fact, the unsuitability of Room XXV provided many valuable pointers to the way in which the new Conservation Department should function.

## The Building

The new conservation studios were built as part of the extended reconstruction of the west side of the Gallery in the 1950s. During the war, nine bombs had fallen within the perimeter of the building and damage was most severe in the western half. During the necessary rebuilding, the opportunity was taken of providing facilities which were rapidly becoming essential. The first set of air-conditioned rooms (another Weaver recommendation) was completed in 1956, and this underlined the desirability of reclaiming Room XXV for exhibition purposes and giving the Conservation Department more suitable quarters elsewhere.



**Figure 1** The north Conservation Studio. The south-facing slope of the roof (right) has an internal system of venetian blinds. Banks of fluorescent lights are suspended, with counterweights, from tracks running the length of the studio. The large hydraulic easel (right) is capable of raising 750kg. The small vacuum hot-table (3m×1.2m) can be seen beyond the microscope at the far end.

This was achieved by building in two light-well areas to the north and south of Room XXVI (now Room 10). Construction had already started in the northern one where the ground floor was occupied by the air-conditioning plant-room. Both were now filled in to the roof level of the existing galleries, but contained three floors where in the old building there were only two.

The top levels were occupied by two conservation studios, air-conditioned, top-lit and connected by a corridor behind Room XXVI. The incorporation of three levels instead of two meant that the studios, while large enough to accommodate any picture in the collection, were low enough to take full advantage of direct sunlight. The levels below the North Studio continued to be occupied by the air-conditioning plant. Below the South Studio was another studio, artificially lit, originally intended for various routine conservation activities such as blister-treatment and special photography: subsequently it became used exclusively for photography (including X-ray, infrared and ultra-violet techniques) and is now maintained by the Photographic Department.

Conservation workshops (for treatment of supports, carpentry etc) and a varnishing room were provided in the basement level underneath the Library (which, in turn, was under Room XXV). All the workshops and studios were interconnected by two large lifts (one in each light-well area) which also had access

into the exhibition rooms. Thus the movement of pictures could be kept to a minimum and any that was necessary could be achieved without the undesirable stresses caused by manhandling up and down stairs.

The Conservation Department moved into its new studios in the early summer of 1960.

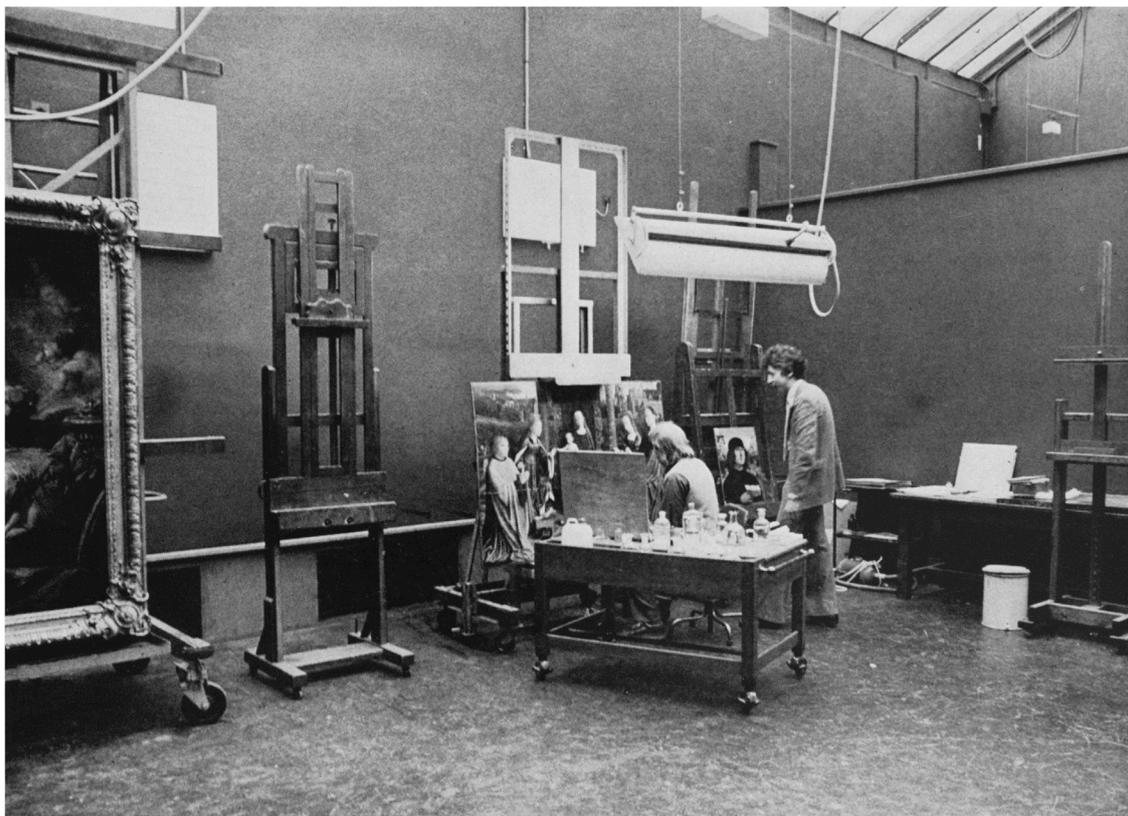
### The Conservation Studios

The two Conservation Studios occupy a combined floor area of about 285 square metres. In addition, there are adjoining offices, a records room, a dark-room, store cupboards and so on. There is also a smaller studio in the adjacent part of the Gallery's new Northern Extension, not in use at the time of writing: through faults in its design, yet to be remedied, there is a problem of excessive condensation which makes storage of pictures hazardous.

Of the main studios, the southern one is divided by a partition of about half roof-height, behind which the Chief Restorer may work on projects of particular difficulty or confidentiality. All walls are painted in dark matt colours to avoid unnecessary reflections, especially disturbing during retouching.

The axis of each studio and the ridge of each glass roof runs east-west. Each roof is double-glazed, the individual units resting on leather pads on wooden beams (this type of construction avoids condensation caused by cold weather outside and high relative humidity inside).

The south-facing slope of each roof is entirely covered with an internal system of venetian blinds, operated from floor level. This serves two functions.



**Figure 2** Part of the South Conservation Studio. Behind the partition at the right is the Chief Restorer's studio. The wheeled trolley, for use beside the easel, holds the restorer's palette box, instruments, solvents, varnishes etc. When not in use, bottles are stored in a trough, visible on the near side.

Firstly, it is possible by closing them to obtain pure north light, a steady, cool illumination, unaffected by the fluctuations of sunshine; in fact, for the examination of pictures the strength of the light source is rather more important than its purity, and restorers, like most human beings, prefer to sit on the sunny side of the room.

Secondly, the blinds are closed in summer at times when the studios are not in use, in order to help the air-conditioning keep the temperature down. The 'greenhouse effect' of such an expanse of glass is considerable and shutting out the sun greatly reduces strain on the cooling plant. The temperature and relative humidity are maintained, as nearly as possible, at 20°C and 55%RH respectively; they are monitored constantly and checked at least twice daily by plant-room officials. The pressure of the air is kept fractionally greater than that outside in order that internal conditions might prevail. There is an additional facility available independently to each studio and workshop: at the press of a button a purge system can be operated causing a rapid and complete change of air. This is particularly useful when unpleasant solvents are in use.

Fire precautions are necessarily stringent. There are smoke-detectors at regular intervals in each room. Obviously a sprinkler system is out of the question, and fire extinguishers are of the carbon dioxide gas type. The solvent store for the Department is outside

the building and only small quantities are present in the studios at any time. Solvent-soaked swabs which have been used for cleaning are removed every evening by the warder staff, who also double-check that all electrical apparatus is switched off. A list of all the pictures in each studio is prominently displayed by the door, to avoid unnecessary waste of time if they have to be removed in a hurry.

Where possible, restorers prefer to work in bright daylight and, for dark pictures in which colours are not easily distinguished, in direct sunlight. However, for much of the year in London, natural light levels are insufficient and additional artificial light is needed. This is provided by banks of fluorescent tubes mounted on parabolic reflectors. They can be moved easily in two dimensions: suspended from tracks running the length of the studio, they will move horizontally along the tracks and vertically by simple counterweights. Various fluorescent tubes (including mixtures of different types) have been tried: at the time of writing, the 'Kolor-rite' type (correlated colour temperature: 4000°K) alone is being used. There are other kinds of lamp in the Department: tungsten spotlights and tungsten-halogen floodlights are available, but their colour temperatures are unsuitable for retouching and they become very hot in use.

The restorers work at easels both of the traditional studio type (for smaller paintings) and of a hydraulic type designed by the (then) Ministry of Works. The hydraulic easels are manually operated and incorporate gear mechanisms to enable exceptionally heavy weights to be raised easily by a single person: the largest of these easels will comfortably accommodate the most massive pictures in the Collection. Of a

similar design are hydraulic chairs which allow restorers to work in comfort (a consideration which is by no means unimportant) on the tallest of pictures. The Department has just taken delivery of two-dimensional tracking easels which will allow movement in a horizontal as well as a vertical plane: these are invaluable when scanning a painting microscopically or photographically.

Working surfaces are provided by laboratory benches, by wheeled trolleys holding the restorer's instruments, solvents, pigments and other materials for use beside the easel, and by a series of heavily constructed tables each 3 × 8ft × 33in. high (0.91 × 2.43m × 0.83m high). The tables are mostly in the basement workshops, but there are some in the studios as well. Being all of the same height, they may be combined to form a surface of almost any size, so the largest pictures in the Collection can be laid down without recourse to the floor. The table tops are solidly constructed and incorporate wooden beams on the underside which form a sound base for vertical clamping, often required in treatment of panels.

The surface examination of paintings is carried out in the conservation studios using a variety of aids. The restorer relies most simply on direct visual inspection and low-power magnification provided by a 2× binocular magnifier or a 6× pocket lens. For greater magnification the Department has a motorized Zeiss 'Operation Microscope' with stereoscopic zoom optics, originally designed for use in microsurgery. Controls are mounted on a foot-operated switch panel, leaving both hands free for manipulative procedures on the picture itself: footswitches are provided for height adjustment, fine focus up and down, zoom magnification in and out.

By variation of eyepiece and objective lenses a range of continuous magnification from 2.5 to 53× can be achieved, with a depth of field quite able to cope with the most extreme variations in surface configuration. Two illuminators are positioned one on each side of the objective; one is for homogenous light, the other is focusable and they may be switched independently to give raking light. Between the objective and the eyepieces a beam splitter is incorporated to allow a monocular observation tube (for a second observer) and a 35mm camera to be mounted.

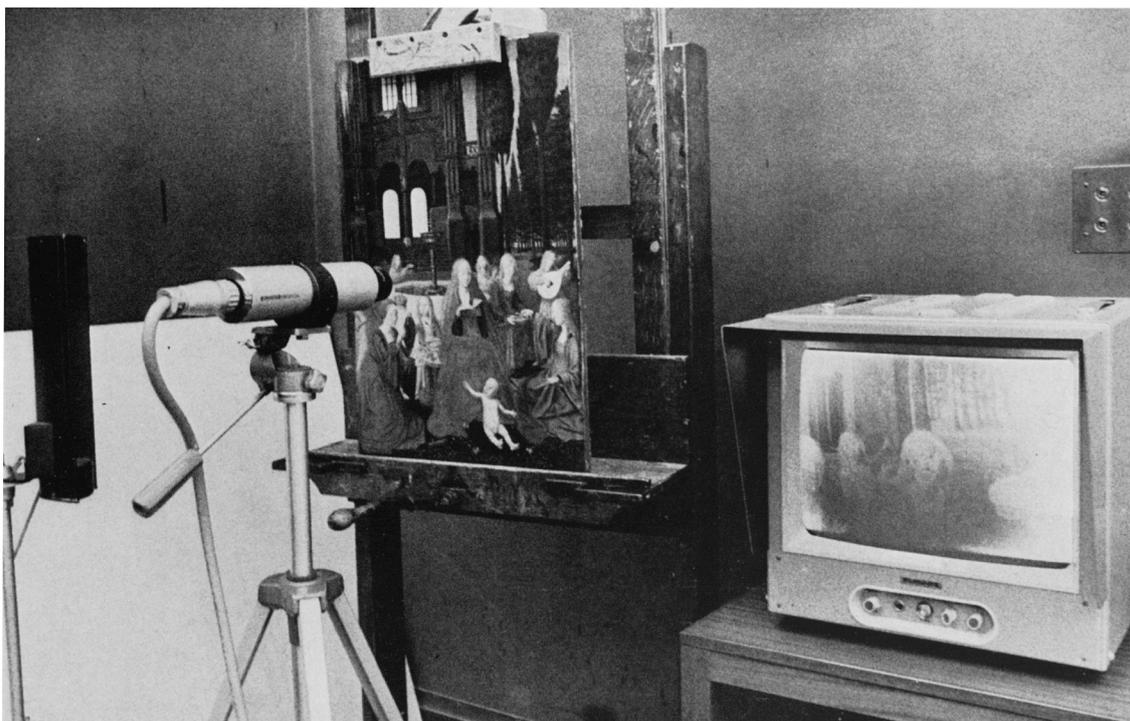
Photographic work is done for the Conservation Department by the separate Photographic Department. This includes colour, panchromatic (normal and macro), X-ray, infrared and ultraviolet techniques and is of an impressively high standard. The Conservation Department has cameras of its own for less formal records of treatment—a Hasselblad 500C/M for the 2¼in. format and a Topcon RE for 35mm; there is also a small dark-room near the North Studio.

The use of infrared and ultraviolet fluorescence techniques in the examination of paintings is standard to any Conservation Department. It is probably true to say that ultraviolet fluorescence photographs are seldom taken nowadays—certainly they are not often done at the National Gallery—largely due to the undesirability of exposing a painting to pure UV radiation for several hours. It is a much simpler



**Figure 3** Hydraulic easel and chair. This small hydraulic easel is designed to carry 150kg. The chair will rise to a seat height of 2.1m and has surfaces on either hand for solvents, paints and instruments.

**Figure 4** The Zeiss 'Operation Microscope'. The foot-operated switch-panel leaves the operator's hands free for work on the picture itself. The microscope can be used with the picture in an upright or a horizontal position. To the left of the normal eyepieces is a monocular observation tube for a second observer.



matter to examine a painting quickly with a hand-held UV lamp in a darkened room and see at once the information obtainable.

Until recently, restorers, historians and museum scientists have desired a similar way of making an infrared image instantly visible—without having to wait for photographs to be developed and printed. This is now possible through a system (pioneered by J. R. J. van Asperen de Boer in Amsterdam) incorporating an infrared vidicon connected to a closed-circuit television monitor. In conjunction with the Scientific Department, the Conservation Department runs one of these. The method (*infrared reflectography*) also has advantages over conventional infrared photography in that it is sensitive to longer wavelengths in the infrared region of the spectrum: this allows penetration of pigments (principally greens) which otherwise appear black on an infrared photograph.

There is inevitably some overlap in equipment between the conservation studios and workshops. There are, for example, sets of electrically-heated spatulas in each room for the routine treatment of blistering or flaking paint. The type currently in use is the Willard Developments thermostatic controller type 'E' with a number of different spatulas of varying head-shape and size. The control-box is calibrated directly in °C and will maintain a remarkably steady temperature anywhere in the range up to 100°C; the actual temperature in the spatula head may be monitored by a dial read-out plugged into the control-box. The same controller can be used for full-sized hand-lining irons and, here too, the thermostatic control is very precise.

Another item of equipment duplicated in the studios and workshops is a vacuum hot-table for the lining of canvas pictures. In one studio there is a small hot-table, 6×4ft (1.83×1.22m), which is used for small

**Figure 5** Infrared vidicon television system: a simplified version of a system pioneered by J. R. J. van Asperen de Boer. The painting is illuminated by a quartz lamp (in a black reflector, left) controlled by a variable resistor. The camera, containing a PbS detector, is connected through an amplifying system to the monitor (right).

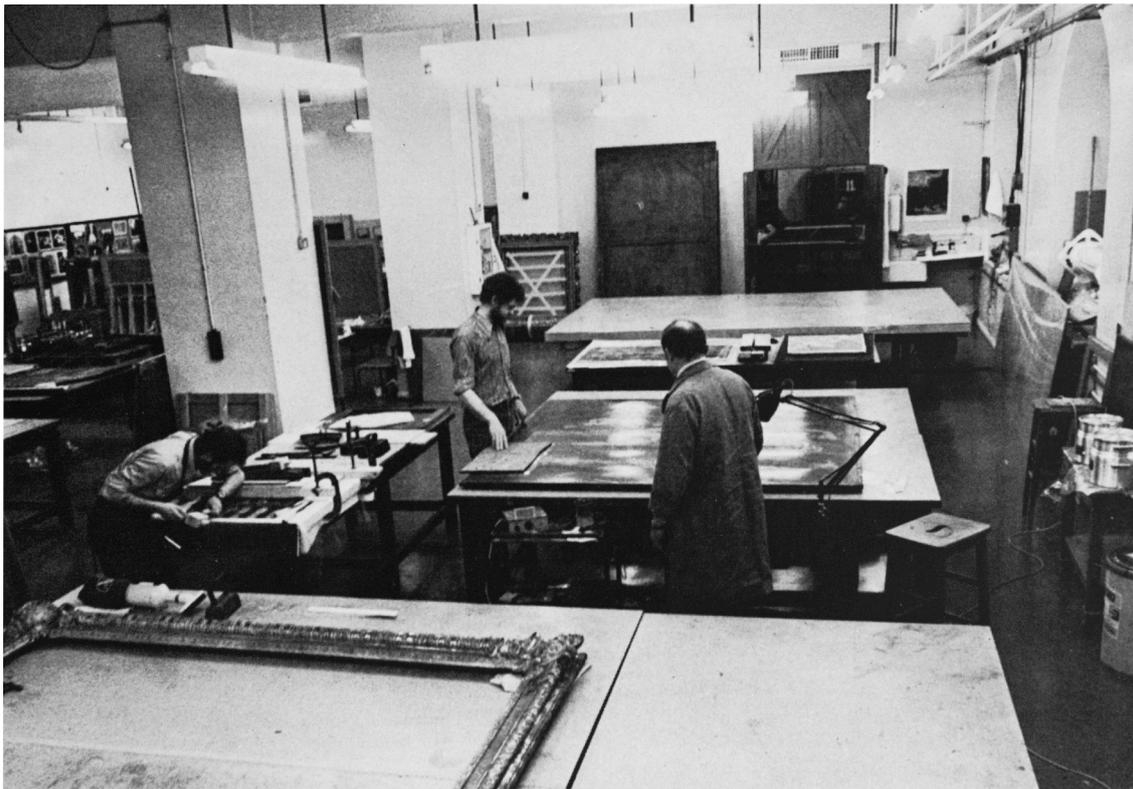
linings and experimentation (on lining methods, adhesives and so on), while in the workshop is one of the largest in existence, measuring 13×8ft (4×2.5m). This is more properly described below.

In general, activities in the conservation studios are confined to work on the painted surface of pictures—that is, surface examination, cleaning, restoration, and to a limited extent, blister treatment. In connection with these, the Department keeps a wide range of related materials—pigments, oils, natural and synthetic resins, waxes and so on. Many are used on the pictures themselves, but a number are simply kept for research purposes. Not unreasonably, experimentation with new materials on National Gallery pictures is forbidden.

### The Conservation Workshops

The workshops consist of four principal rooms and two storage areas. The two largest rooms—the main workshop and the carpentry shop—have a combined area of about 320 square metres; in addition, there is a varnishing room and the 'hospital'.

The hospital fulfils the precise function its name implies: it provides a totally stable environment for ailing or fragile pictures awaiting treatment. It is completely enclosed, air-conditioned, and its temperature and relative humidity are under constant surveillance. The number of National Gallery pictures in there now is small, but immediately after the war there were many in too delicate a condition to be put on exhibition. A National Gallery report of those



**Figure 6** The main Conservation Workshop looking south. The work-tables may be combined to form a surface of almost any size: a single one, with a panel undergoing treatment clamped to it, can be seen centre left. The small trolley, centre foreground, holds electrically heated spatulas with their control box. The photographs on the wall (extreme far left) are part of the permanent display of conservation materials and methods. Beyond the large hot-table (far right), through the doors, are the carpentry workshop and the 'hospital'.

years speaks, rather charmingly, of pictures 'reposing among the steam-kettles of the hospital'. The steam-kettles are no longer there, but maintenance of a fairly high relative humidity is still a priority for fragile panel paintings.

In the carpentry shop, all basic woodwork necessary for the conservation of support layers is done. This includes the making of stretchers for canvases and composite panels for marouflage treatments, but not work on the pictures themselves. Equipment is the same as in any carpentry shop and includes a power saw and planer with vacuum dust extraction, a full range of woodworking tools, benches and so on. A storage area for timber is adjacent.

The main workshop is specifically for the conservation of supports (the structural layers of pictures) which, with a few exceptions, can be characterized as either canvas or wood panel. The most striking item of equipment in the room is the massive 4 × 2.5m vacuum hot-table, for the lining of canvas pictures. Like the small one in the Conservation Studio, it is designed and built by Willard Developments. Driven by a 415 volt supply, it incorporates two sets of heating elements—the main system and separate edge heaters which lie under the perimeter of the table. The purpose of the extra edge heater is to compensate for heat losses from the exposed sides of the table. It is switched on 10–20 minutes before the main heaters

to minimize losses during the heating period; this initial warming-up time is dependent on the ambient temperature of the room. The main heaters may be switched to 'boost' which speeds up the heating process considerably and increases the main element loading from 12½ kW to 16½ kW.

There are separate controllers for the main heaters and the edge heater which cycle the elements off and on at the temperature set on the dial. Overriding both is a safety control normally set a few degrees above the other two; if that temperature is reached all elements are cut off and will only come on again if a reset button is pressed. Cooling fans and a vacuum pump are incorporated in the normal way. The vacuum ports, set at intervals around the outside of the table, have sealing screws removable by an Allen key: this enables any part of the table to be used without having to cover the whole surface with a membrane. The hot-table is at the same height as the work-tables already described—allowing canvases under treatment to be slid from one to the other.

It is not within the scope of this article to discuss specific methods of treatment. Accounts of these will be found elsewhere. For the lining of canvas pictures, it will suffice to say that the Conservation Department uses both hot-table methods (including vacuum envelope techniques) and hand-lining. For the latter there is a range of specially shaped lining irons in the workshop, including those which connect to the spatula controller. For lining fabrics and adhesives, only materials of proven properties are used. Of course, new methods and materials are tested within the Department, but only on worthless pictures kept for that purpose.

The other main activity in the Conservation Work-



**Figure 7** The main Conservation Workshop looking north. The large vacuum hot-table (foreground) measures 4m×2.5m. The control panel incorporates separate controls for main and edge heaters and a safety cut-out overriding both. When not in use, the hot-table is covered and provides another work surface. The varnishing room and the lift serving the North Conservation Studio are beyond the doors just visible at the far right.

shop is the treatment of wood panels (which comprise just under half of the National Gallery Collection). Procedures are usually more empirical than with canvas paintings and have to be devised and tailored to suit individual cases. For this reason, the workshop has a whole range of clamping devices capable of dealing with any eventuality. There are different sizes of G-clamps, including traditional wooden carpentry types, and a variety of longitudinal and overhead clamps. Again, it is not proposed to describe specific procedures, but typical cases involve the removal of restrictive battens or cradles from the backs of panels, rejoining them or securing splits and mounting them on balsa-wood backings or in protective trays. In rare cases, complete transfer might be carried out.

Treatment of blistering or flaking paint by heated spatulas (already described) is a standard but essential operation, mostly carried out in the Workshop. It is sometimes a necessary preliminary to the applying of facing layers before support treatment, but more usually simply routine for certain problem pictures which are regularly checked.

The Workshop, like the Studios, has all necessary materials for operations carried out within it—waxes, resins, canvas, release materials and so on. There is also, in one corner of the Workshop a permanent (and now rather venerable) display of materials and methods used in conservation. Originally devised as a travelling exhibition, and added to when Sebastiano del Piombo's

*The Raising of Lazarus* (No. 1) was newly transferred and cleaned, it still serves as a useful layman's introduction to the subject for the many interested groups who visit the Department.

The final part of the Workshop area is a varnishing room containing an extraction hood, situated next to the main workshop and adjacent to the lift serving the North Conservation Studio. The compressor and cylinder are located outside the room, connected through an air line to the spray guns inside. The exclusion of all electrical devices is deliberate, in order to avoid electrical sparks in an atmosphere of varnish and solvent fumes. For the same reason, the motor driving the extraction fan is isolated from the atmosphere inside.

The only other room which may be said to be part of the Conservation Workshop is situated at the far end of the building. It contains a wood-and-glass chamber, with gas extraction facilities, for gassing worm-infested pictures. This is a problem that now seldom arises and then only very occasionally with incoming pictures: it has not been necessary to use it for many years but the facility exists, should it be required.

## Records

One of the most important duties of the Conservation Department is to compile and maintain a full 'Conservation Record' for every picture in its care. Each picture in the Collection has a dossier (often extending through several volumes) in which is recorded every treatment carried out. Where possible, the history of a picture's condition is traced back to before it entered the Gallery, but certainly after acquisition everything is recorded.

The actual size of the dossier volumes is dictated by the necessity to include 15×12in. X-rays. They are made of stiff, buff-coloured paper which (it is promised) is chemically stable enough to last indefinitely. On the first few pages are recorded the physical characteristics of the picture (dimensions, brief account of condition etc.) and an ordinary photograph for identification, followed by a chronological list of all recorded treatment, including the names (where known) of the restorers responsible. On the pages following are mounted detailed examination, treatment and laboratory reports, photographs (whole picture, details, macrophotographs, 10×8in. colour transparencies and so on) at all stages of treatment and X-rays, infrared and other technical photographs. X-rays are in the form of prints taken from the X-ray positive via an intermediate negative; the original positive is always available for reference, but prints are considered more versatile for record and display purposes (especially in the form of composite X-ray mosaics).

For a more convenient source of reference, the information recorded in the full dossiers is also summarized on record cards. The dossiers can be very unwieldy if there are several volumes, and a card-index providing a concise summary for each picture is useful. The cards also list the movements of pictures loaned to other museums or government buildings.

In addition to the many types of photograph included in the dossiers, the Department is building up an extensive collection of 35mm slides for lecture purposes. It also has a number of 3¼in. colour slides taken in the post-war years which form an irreplaceable record of the cleaning of pictures at that time: fortunately these can be re-photographed on a 35mm format for present-day equipment.

### Organization of the Department

Today, the Department has a staff consisting of a Chief Restorer (of Keeper status), four Restorers, two Conservation Officers and one general assistant. Members of the Department are responsible, through the Chief Restorer, to the Director and, ultimately, the Trustees of the Gallery.

All major projects involving cleaning and restoration have to be approved, both before starting and on completion, by the Board of Trustees who visit the Department every month. A picture is assigned to one restorer who then becomes responsible for it until completion of treatment. Projects are rarely shared (this only happens, for example, in the case of a many-part altarpiece) but this does not mean a restorer works in isolation. He consults constantly with colleagues within his own department, with the member of the Keeper staff in charge of the relevant School of Painting (who collaborates in writing a preliminary report presented to the Trustees) and with members of the Scientific Department who may be asked to solve particular problems of pigment or medium analysis. In addition, the Conservation Officers can assist with treatment of supports and blister laying.

Restorers do not specialize in particular schools or periods of painting; they should be able to (and do) deal with any picture in the Collection. They have several projects in hand at any one time—it is customary to have some quick, easy jobs running concurrently with a long, tedious one so that boredom is avoided. The shortest period a picture spends in the Department for cleaning and restoration is one month (the frequency of Board Meetings); the upper limit of time is theoretically limitless—unless a picture is needed for a particular exhibition, there are no deadlines—but it rarely exceeds a year. Only projects involving cleaning and restoration need be shown to the Trustees; the decision to carry out relining for example, or panel treatment, is made internally.

The duties of members of the Conservation Department are by no means confined to treating pictures. There is, for instance, a regular check on the condition of every picture in the collection which is repeated every few weeks. There is, too, a substantial amount of documentary work—compiling the conservation dossiers, answering enquiries from other museums and the public, writing reports, articles, papers, lectures and so on. Then the restorers must be able to train other restorers; attend conferences; keep up to date with current methods, research and the testing of new materials; and keep half an eye on developments in apparently unrelated fields of industry.

It is probably true to say that nearly all of the materials and equipment used in modern conservation were originally developed for some other purpose entirely: a restorer must be an eclectic, able to turn to his advantage a multitude of different technical disciplines. The Conservation Department as a whole must also maintain an open-minded and varied approach: its first priority is the care of pictures, but it has another role as communicator. It must be prepared to absorb information and disseminate it. It must talk in the language of other restorers, of painters, of art historians, of scientists and of laymen. Versatility and expertise in all its roles is its aim.