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ABSTRACT

Three phases leading to the automation of the mechanical building systems on the Harvard campus are described. The systems allow a single operator to monitor and control all the mechanical systems, plus fire, flood, and security alarms, for all buildings in a large area of the campus. (JT)

OPERATIONAL MANAGEMENT OF AREA ENVIRONMENT

BY

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HONEYWELL INC.

Motivation for Centralized Control

Like most universities and colleges, Harvard University has been faced with accepting its share of projected growth in enrollment. On the national level, growth is expected to go from two and one half million students in 1950 to a projected enrollment of nearly 7 million by 1970. To meet the growth challenge, the university undertook an eighty million dollar building program.

With such a program in mind, the buildings and grounds department re-appraised their operational and maintenance methods and costs and, as a result, set up a test area in their North Yard.

(Refer to Fig. 1 - map of Harvard University and Radcliffe College - following page.)

Phase I - North Yard - The Problem

The North Yard of Harvard consists of a complex of sixty-six buildings, the structures ranging from large auditoriums, a theater, gymnasiums, law school buildings and libraries, biology buildings, theological buildings, chemistry and engineering laboratories, dormitories, museums, and atomic energy research complexes. Some buildings are quite new, some have been in service for more than one hundred years.

Fifteen men were operating the mechanical systems within these buildings; nine on the day shift, three each on the late afternoon and 11 P. M. to 7 A. M. shifts.

HARVARD BUILDINGS

Faculty Club	C4
Farlow House	C4
5 Felton St.	D3
Fogg Art Museum	C3
10 Frisbie Pl.	C2
Gallatin Hall	B6
Gannett House;	C3
Gibbs. Lab.	C2
Glass Hall	B5
Gordon McKay Lab.	C3
Gore Hall	C5
Grad. Commons	C2
Grays Hall	C4
Greenough Hall	D4
Gr. Sch. of Design	C3
Gr. Sch. of Education	C3
Gr. Sch. of Pub. Adm.	C3
Hamilton Hall	B5
Harvard Hall	C3
Harvard Union	C4
Hastings Hall	C2
Health Ctr.	C4
Hemenway Gym	C3
Herbarium	C2
Hicks House	B4
Holden Chapel	C3
Hollis Hall	C3
Holmes Hall	C2
Holworthy Hall	C3
Holyoke House	C4
Houghton Lib.	C4
Hunt Hall	C3
Hurlbut Hall	D4
I.A.B.	C4
Int. Legal Studies	C2
Jefferson Lab.	C2
Jewett House	D2
Kendall House	C2
Kirkland House	B4
7 Kirkland St.	C3
Kittredge Hall	A1
Kresge Hall	C6
Lamont Lib.	C4
Lampoon	C4
Langdell Hall	C2
Law School	C2
Law Sch. Adm. Off.	C2
Lawrence Hall	C3
Lehman Hall	C4
Leverett House	C5
Lionel Hall	C3
Littauer Ctr.	C3
Little Hall	C4
Lowell House	C4
Lyman Lab.	C2
McCulloch Hall	B6
McKlintock Hall	C5
Mail	C3
Mallinckrodt	C2
Massachusetts Hall	C3
1583 Mass. Ave.	C2
Mather Hall	C5
Matthews Hall	C3
Mellon Hall	B5
Memorial Church	C3
888 Memorial Drive	C6
917 Memorial Drive	C6
Memorial Hall	C3
Mid-Year House	B5
Morgan Hall	B6
Morris House	B5
78 Mt. Auburn St.	C4
Mower Hall	C3
Music Lib.	C3
Newell Boat House	B5
New Lecture Hall	C3
Nuclear Lab.	C2
Observatory	A1
Paine Hall	C3
Palfrey House	C2
Peabody House	C3
Peabody Museum	C2
Pennypacker Hall	D4
Perkins Hall	C2
Phillips Brooks House	C3
Physics Labs.	C3
Pierce Hall	C2
8 Prescott St.	D4
President's House	C4
Press	A1
Prince House	C2
Printing Office	D3
Purchasing Agent	C4
Quincy House	C4
Randall Hall	D3
Randolph Hall	C4
Richards Hall	C2
Robinson Hall	C3
R.O.T.C. Bldg.	D2
3 Sacramento St.	C1
Sanders Theatre	C3
Sargent Hall	C2
Semitic Museum	D2
Senior House	C4
Service Bldgs.	A5
Sever Hall	C3
Sever Quad.	C3
Shannon Hall	D2
Shaw Hall	C2
Sherman Hall	B5
Smith Halls	B4
Spaulding House	C2
Squash Ct. – House	C4
Squash Ct. – Univ.	C4
Stadium	A6
Standish Hall	C5
Story Hall	C2
Stoughton Hall	C3
Straus Hall	C3
Student Act. Ctr.	C4
Switch House	C4
Telephone – Univ.	C4
Tennis Courts	A5
Thayer Hall	C3
University Hall	C3
Varsity Club	C4
Wadsworth House	C4
Warren House	C4
Watson Hockey Rink	A5
Weld Boat House	B5
Weld Hall	C3
Westengard House	B3
Widener Lib.	C4
Wigglesworth Hall	C4
Wm. James Hall	C2
Winthrop House	C5
Yenching Lib.	D2

RADCLIFFE BUILDINGS

Agassiz House	B3
Barnard Hall	B1
Bertram Hall	B1
Briggs Hall	B1
Buckingham	B3
Byerly Hall	B3
Cabot Hall	B1
Coggeshall House 12 Walker St.	B2
Comstock Hall	B1
Edmands House	A1
Eliot Hall	B1
Everett House	B1
Fay House	B3
Field House	A1
Fifty-five Garden St.	B1
Founders House	B3
Gilman House	B1
Grad. Center	B3
Greenleaf	B3
Gymnasium	B3
Health Ctr.	B3
Holmes Hall	B1
Library	B3
Longfellow Hall	B3
Moors Hall	B1
Putnam House	B3
Rogers House	B1
Saville House	B2
Shop	B3
Tennis Cts.	A1
Tutorial	B3
Whitman Hall	B1
Wyeth Hall	C2

PUBLIC BUILDINGS AND PLACES

Agassiz School	C1
Ambassador Hotel	D3
Baptist Church	C4
Brattle House	B4
Brattle Theatre	B4
Cambridge Trust	C4
Christ Church	B3
Church of Christ Scientist	B2
Church of New Jerusalem	D3
Coop	C4
Coop Annex	B4
Craigie-Longfellow House	A3
Episcopal Theol. School	B3
Epworth M.E. Church	C2
Fire Station	C3
First Cong. Church	B3
First Unit. Church	C3
Friends Meeting House	A3
Harvard Trust	C4
Hotel Commander	B3
Hotel Continental	B2
International Stud. Ctr.	B2
Leslie College	C2
Longy School of Music	B2
Lutheran Church	B4
Mormon Church	A3
N. E. Deposit Library	B6
St. Paul's Cath. Church	C4
St. Peters Cath. Church	A1
Soldiers Field	A5

STREET DIRECTORY

Acacia St.	B3
Adams Ter.	D3
Akron St.	C6
Anderson Bridge	B5
Appian Way	B3
Arrow St.	C4
Ash St.	B3
Ash St. Pl.	B3
Ashton Pl.	D3
Athens St.	C5
Athens Ter.	C5
Avon St.	B1
Ballord St.	C6
Bancroft St.	D6
Banks St.	C5
Bay St.	D5
Beacon St.	D1
Bennett St.	B4
Berkeley Pl.	A2
Berkeley St.	B2
Blackstone St.	C6
Bond St.	A1
Bow St.	C4
Boyle Ter.	A1
Boylston St.	B5
Bradbury St.	A3
Brattle St.	A3
Brewer St.	B4
Broadway	C3
Brown St.	A3
Buckingham Pl.	A2
Buckingham St.	A2
Burns Ct.	A3
Callendar St.	D6
Cambridge St.	C3
Carver St.	D1
Centre St.	D5
Chapman Pl.	B4
Chauncy St.	B2
Church St.	B3
Cleveland St.	D4
Common	B3
Concord Ave.	B2
Cowperthwaite St.	C5
Craigie Cir.	A2
Craigie St.	A2
Crescent St.	C1
Dana St.	D5
De Wolfe St.	C5
Divinity Ave.	C2
Dunster St.	C4
Eliot St.	B4
Ellery St.	D4
Elmer St.	C6
Eustis St.	C1
Everett St.	C2
Farrar St.	D2
Farwell Pl.	B3
Felton St.	D3
Fernald Dr.	A1
Flagg St.	C5
Follen St.	B2
Francis Ave.	D2
Franklin St.	D5
Fuller Pl.	B3
Garden St.	B2
Garden Ter.	A1
Gerry St.	B4
Gilmore St.	D6
Gorham St.	C1
Grant St.	C5
Gray Gardens West	A1
Green St.	D5
Hancock St.	D6
Hammond St.	C1
Harvard Sq.	C4
Harvard St.	D4
Hastings Ave.	B2
Hawthorne St.	A3
Hayes St.	D6
Healey St.	A2
Hilliard Pl.	B3
Hilliard St.	B3
Holden St.	D2
Holly Ave.	A1
Holyoke St.	C4
Howard St.	D6
Howland St.	D1
Hudson St.	B1
Huron Ave.	A1
Irving St.	D2
Irving Ter.	D3
James St.	B3
Jay St.	D6
Kent Ct.	D1
Kent St.	D1
Kinnaird St.	D5
Kirkland Pl.	D2
Kirkland Rd.	D3
Kirkland St.	C3
Langdon St.	B2
Linden St.	C4
Linnaean St.	B1
Longfellow Pk.	A3
McCarthy Rd.	C5
Madison St.	A1
Magee St.	D6
Martin St.	B1
Mason St.	B3
Mass. Ave. to MIT	C4
Mass. Ave. to Arl.	B2
Mellen St.	C1
Memorial Drive	B5
Mercer Cir.	A3
Mifflin Pl.	B4
Mill St.	C5
Montague St.	D6
Mt. Auburn Pl.	B4
Mt. Auburn St.	C4
Museum St.	D1
North Harvard St.	B6
Nutting Rd.	B5
Oxford St.	C2
Palmer St.	B3
Parker St.	A2
Phillips Pl.	B3
Plympton St.	C4
Porter Pl.	A3
Prescott St.	D4
Putnam Ave.	D5
Quincy St.	C4
Raymond St.	B1
Remington St.	D4
Revere Pl.	B4
Riverside Pl.	C6
Robinson St.	A1
Ross St.	B4
Rutland St.	B1
Sacramento St.	C1
St. John's Rd.	B3
Scott St.	D2
Shepard St.	B1
Soldiers Field Rd.	B5
Sparks St.	A3
Sterling St.	C6
Story St.	B4
Sumner Rd.	D3
Surrey St.	C5
Trowbridge Pl.	D4
Trowbridge St.	D4
University Rd.	B4
Ware St.	D4
Walker Ct.	D5
Walker Pl.	B2
Walker St.	B2-B1
Walker Ter.	B2
Warren Pl.	C5
Waterhouse St.	B2
Weeks Mem. Bridge	C5
Wendell St.	C1
Western Ave.	B6
Willard Ct.	A3
Willard St.	A3
Winthrop St.	C4
Wright St.	B1

HARVARD BUILDINGS

Adams House	C4
Advocate	B4
Agassiz Museum	C2
Aldrich Hall	B6
Allston Burr	C3
Alumni Ctr. (Business)	B5
Alumni Records	C4
Ames Hall	C2
Andover Hall	D2
Anechoic Lab.	C2
Apley Court	C4
Appleton Chpl.	C3
Apthorp House	C4
Athletic Dept.	B4
Austin Hall	C3
Baker Library	B6
Batchelder House	C3
Biological Labs	C2
9 Bow St.	C4
Boylston Hall	C4
Briggs Cage	B5
473 Broadway	D3
Bryan Hall	B4
Buildings & Grounds	A6
Busch-Reisinger Museum	C3
Business Sch. Pkg. Lot	B6
1746 Camb. St.	D3
1750 Camb. St.	D3
Carey Cage	B5
Cruft Research Lab.	C2
Chase Hall	B6
Chemical Labs.	C2
Claverly Hall	C4
Comparative Zoology Mus.	C2
Computation Lab.	C2
Conant Hall	C2
Converse Chem. Lab.	C2
Coolidge Lab.	C2
Crimson	C4
Dana-Palmer House	C4
Dane Hall	C2
Dean's Ho. Business Sch.	B6
Dillon Field Ho.	B5
2 Divinity Ave.	D2
Divinity Hall	C2
Divinity School	D2
Dudley Hall	C4
Dunbar Lab.	C2
Dunster House	C5
Eliot House	B5
Emerson Hall	C4
Engineering Lab.	C2

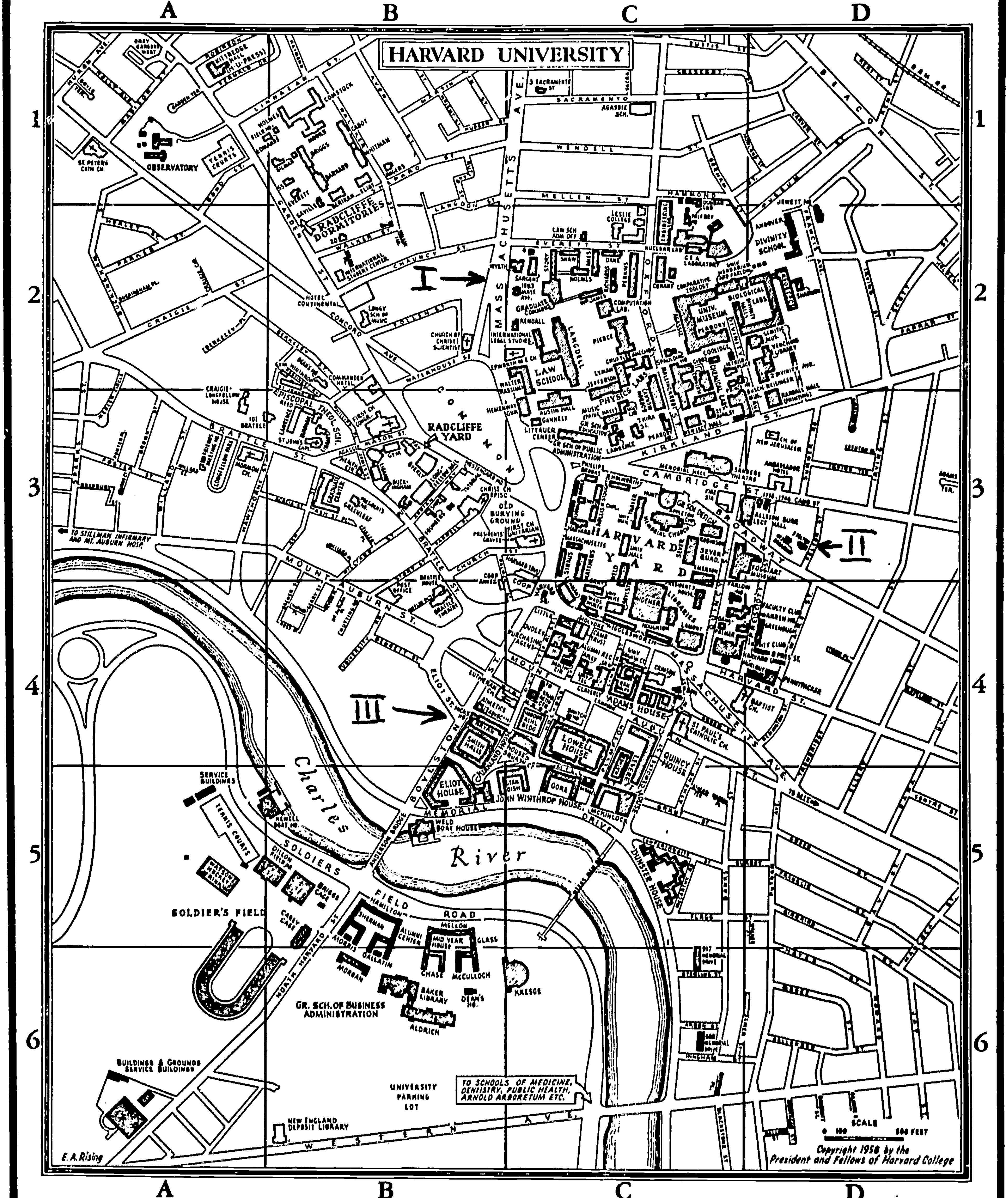

Figure 1

Note: Designators I, II and III, erroneously omitted in the original document, have been supplied.

These men regularly made at least two trips per shift through these buildings, their function being to start and stop odd-hour equipment that could not be operated by time clocks, to check temperatures and pressures and to know generally that all was well with the mechanical plant. The day shift covered oiling, changing filters and minor maintenance as well. Major maintenance was handled by a separate service group.

The University in late 1959 decided to consider automation as a means of using existing operating personnel to better advantage rather than hiring more men to meet the building expansion requirements.

Automation for the North Yard area required a system capable of activating up to five hundred mechanical devices, such as motors for compressors, pumps and fans, or for opening and closing valves, or checking pressures, or operating flood control equipment and other similar mechanisms. Such a system must be capable of monitoring five hundred temperature points from locations as much as one half a mile distant. The system must also provide means for listening to equipment operation, especially on start-ups of large fans, absorption machines and compressors, etc. The automation would have to include alarm provision for critical equipment controlling laboratory temperatures, culture rooms, low temperature boxes, humidity in rare book libraries and manuscript areas, for security, flood alarms and for fire.

Human engineering for such a plan of operation became an important consideration.

On the basis of the above requirements, a conventional system for centralized control would have necessitated a panel board approximately sixty feet long. To operate such a board would keep a man constantly on his feet. The operator would soon tire from searching for identification of buttons, lights, schematics and all of the other equipment such an arrangement would present. In addition, the amount of wiring needed to bring all this information to its proper destination would have become staggering to the imagination and impractical.

The Solution

The system developed affords the operator ease of operation both physically and mentally. It is called a Selectographic System.

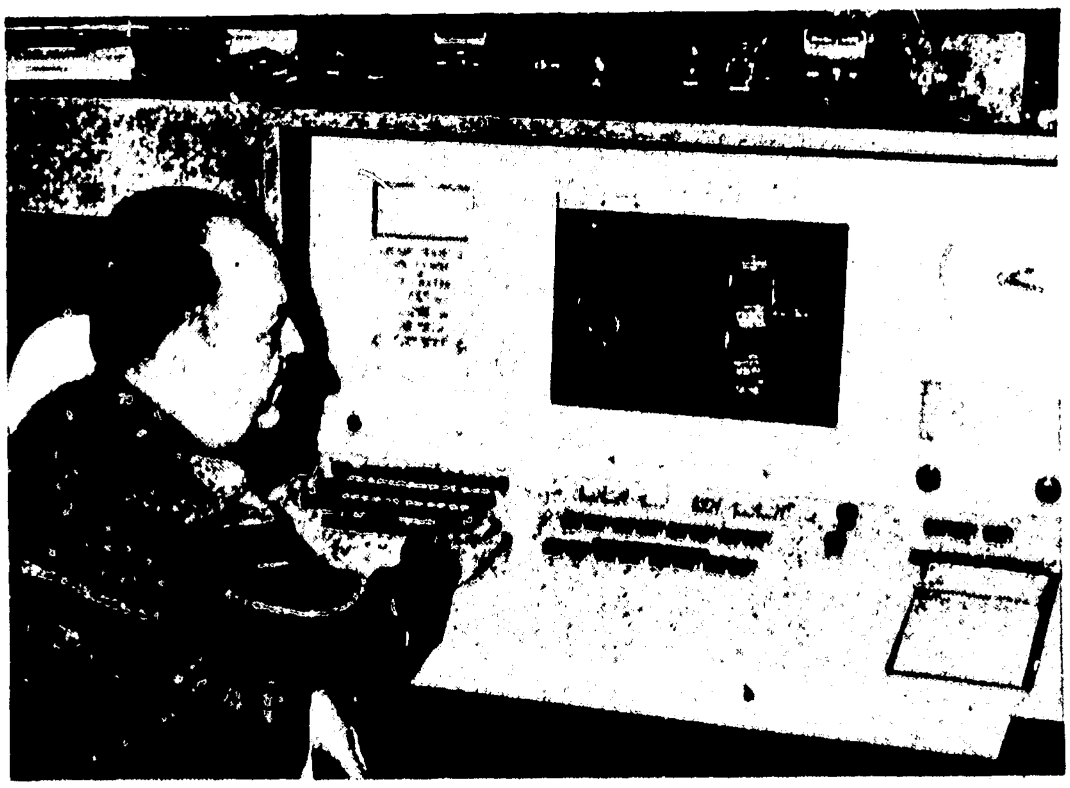

Figure 2

Figure 2 shows an operator at the Selectographic console. From a seated position, he confronts but one system problem at a time; he neither has to reach nor strain to operate or check out any one of fifty systems.

Simply stated, the Selectographic Console consists of fifty systems-select buttons (per system), ten start-stop buttons, eleven temperature-check buttons, provision for intercom, alarm lights and buzzers, a view screen, a temperature indicator and a pilot-light test switch. Other items such as a clock and plug jacks for systems recorders are also used. From this Selectographic Console one operator can cover all the need for starting and stopping odd hour equipment not controlled from a time clock and check temperatures and pressures for the entire sixty-six buildings. Men are still needed to oil, change filters and do other minor maintenance such as periodically checking all mechanical equipment.

By pressing the desired system-select button, the schematic diagrams for the mechanical equipment involved will show on the view-screen located in front of the operator. Each start-stop function used for pressure check or valve operation or to operate motors is numbered and identified on the schematic diagram. When the system button is pressed and the schematic diagram for the system shows on the view-screen, the ten console start-stop buttons become identified through switching action with the mechanisms indicated on the screen. The numbered start-stop buttons on the console corresponding to those on the screen can now operate the identified equipment. In this manner fifty systems-buttons and ten start-stop buttons can operate up to five hundred different pieces of equipment throughout the area.

The ten temperature-check buttons on the console lettered A through J also have their corresponding letters on the system schematic shown on the view screen. By use of these buttons temperature check for any desired point may be read out on the temperature indicator located on the face of the console to the left of the view-screen. The eleventh button lettered K checks outside air temperature only. All of the functions of the console are accomplished with comparatively few wires.

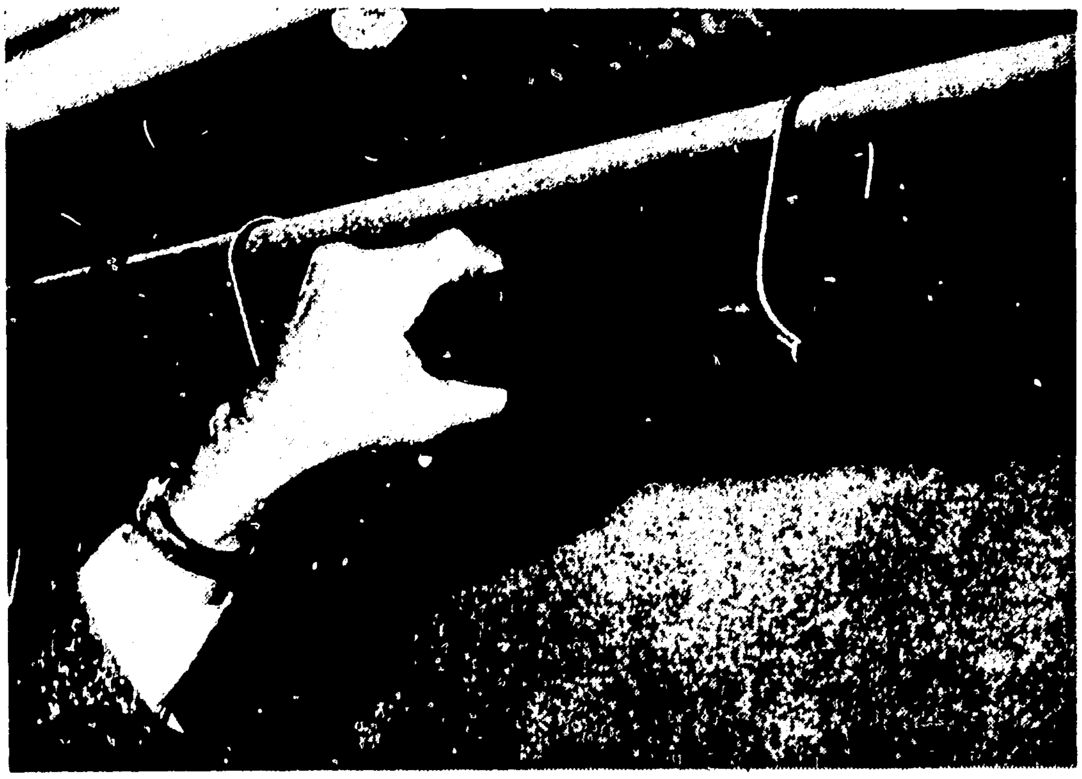

Figure 3

The hand, Figure 3, is around the main cable serving the entire project. Special relays called multiplexers located in mechanical equipment rooms near the controlled devices make it possible to use a base circuit of thirty-eight wires plus one system wire for each system. By using thirty-eight wires plus fifty system wires, eighty-eight wires prove sufficient for all of the start-stop and temperature-read-out described above. A sort of reversal of this circuitry makes it possible to use comparatively few alarm wires with the result that all functions are handled on a base circuit of one hundred twelve wires.

After a year of operation, reduction in man-power by reallocation to other assignments or by old age retirement had eliminated six operators for this area, One of the gratifying results of this venture was the effect upon personnel involved. Such a system presented quite a challenge to the operators; they liked their new work assignments better than the previous methods used. They seemed to recognize the university's need for improvement in methods and they cooperated fully; in fact showed a marked desire to expand the system to complete coverage for all areas. The operators have requested and have been given schooling for the purpose of fully understanding the system. Their part in accepting progressive methods has been most heartening in a time when so much adverse publicity has been given to automation.

The South Yard (Area III - Figure 1)

As a consequence of the initial venture in the North Yard and its successful outcome, Harvard decided to proceed with phase II, the centralized automation of the physical plant in the South Yard. This decision was made at the time the ten story Health Center was under construction. This building, located in Harvard's South Yard, is part of a much larger project involving a complex of multi-story buildings which when finished will cover a full city block. It is to be known as the Holyoke Center.

Since the start of this second control center, an apartment complex accommodating four hundred married students has been completed on land fronting the Charles River between Dunster House and the Power Plant. (Refer to map.) This group of buildings consists of three twenty-one story structures and five smaller ones and are all included in phase II.

The South Yard control center is very similar to the North Yard installation. All of the air conditioning systems at the Health Center (existing and future) are, or are to be, operated from this console, which will also operate all odd-hour equipment in the other buildings in the South Yard area and includes monitoring similar to that done in Area I. Greater use of intercom for listening to equipment start-ups in mechanical equipment rooms is utilized on this installation.

Arrangements have been made for recording temperatures. All temperature check points for any selected system may be recorded continuously for record or analysis of operation by use of a twelve point strip chart recorder with plug jacks and switching arrangements provided at both centers.

Remote Surveillance

Harvard has several buildings located at a distance not connected by tunnels or trenches as is the case in Areas I, II, III. The Observatory is approximately a mile from the Health Center, South Yard. It houses the astrophysics laboratory, which along with other important research, houses the tracking station for the satellites. The Loeb Drama Theater with its ultra modernistic architecture and up-to-the-minute air conditioning systems is another vital area. These and several other buildings are scanned from the console at the Health Center for proper functioning of the mechanical plant on a special system devised to operate on lines leased from the local telephone company. Any off-normal conditions immediately alert the console at the Health Center. Provisions for "listening in" on mechanical equipment rooms and communication afford better service by operator personnel to the area than was formerly the case. This system saved its initial cost the first year in reduced operational labor and travel time.

Phase III - "Main Yard" Area II

The success of phases I and II established the fact that operation of the area environment from a central point was a proper approach to the many changes confronting Buildings and Grounds Administration. It could just as well be the proper answer to the operational problems of many other commercial or industrial properties.

The Holyoke Center is just as much a multi-purpose building as would be any modern office structure; it has stores, Health Center for students, garage, special function rooms for faculty meetings, restaurant facilities and administration offices. The married students' apartment complex is comparable in operational problems to that of any four hundred apartment group of high rise buildings.

Phase III basically will cover Area II on the map, known to Harvard men as the "Main Yard". Buildings in this area date back to 1720. George Washington borrowed one from Harvard for barracks for his soldiers. The nationally-known Fogg Museum with its art treasures, the President's House, the Chapel, to mention a few, are here ranging in age and architecture from Early American to the latest mode, such as the controversial Visual Arts Center, designed by the famous French architect LeCorbusier.

Installing a third center for the main yard could have been routine. In a never-ending search for improvement and acceptance of new ideas, however, the decision was made to use the main yard as the center for all of Harvard University with the exception of the Harvard Medical Center which is located miles away across the river.

The Master Plan (Phase IV)

As a result of the decision to make Weld Hall, in the Main Yard, the center for all operational activities, the control center there will be more sophisticated than the other two area consoles. This third center will have the capability of assuming all functions of both North and South Yard consoles by means of a switching action when desired by the Weld Hall operator.

The new center at Weld will eventually serve the entire 246 buildings which comprise Radcliffe College, the North, South and Main Harvard Yards and across the Charles River, the Harvard Graduate School of Business Administration, Buildings and Grounds Headquarters, Printing and Athletic buildings as identified in Figure I.

More human engineering became necessary to make such a system workable. When fifty systems could be checked out in from one to two hours, checking two hundred systems presented the problem of an unacceptable time requirement if handled in the same manner as Phases I and II. To eliminate time and energy in button pushing for check out these functions are now being further automated.

When the master control center is completed in September it will have a capacity for two thousand temperature check points. Planned circuitry will make possible an automatic temperature scan that can take place at the rate of a point per second. Any off-normal points will automatically print out on a tape in blue, the time, the area, the system and the point. Critical alarm scan will print out in red as well as alert the board by alarm horn and red light. By the addition of two switches and four area buttons the console will be kept as simple as possible. There will be two view-screens each having capacity for 100 systems schematics. Other than these changes all consoles will be basically the same at each center.

A control center of such proportions indicated the necessity of providing further means of helping the operator to keep the console functional. Automatic scanning will permit the operator to focus his attention mainly on off-normal problems. He will still have responsibility for odd-hour operational control and have all alarm functions to process. He will have to direct the field force and keep track of their whereabouts and be familiar with fire and security alarms now to be channeled into this center. It becomes his responsibility to know of all systems charges and to record those charges so that the center will remain current and functional at all times.

During near peak load conditions the operator will be responsible for monitoring the total steam demand so as to avoid any increase in demand charges. The steam rates now are based upon a demand load of 235,000 pounds per hour. With the economies that accrue from better control of the use of steam, it is hoped that present peak requirements may be maintained in the face of the very sizeable new building program. Steam consumption is now metered and the consumption for the entire plant will be read out at the center console. As near peak conditions arise, the master operator will have to decide whether Harvard can hold the line. He will have the ability to shut off building service valves throughout the entire area. It will be his judgment as to what buildings can be taken off the line and for how long.

As stated, the new console at Weld Hall will be essentially the same as the other two control centers. However, a specially designed message center will make it possible for one operator to handle this very busy control area. The message center, familiarly referred to as "the electric notebook", will afford a means of recording minor systems changes and of placing this information where it will become integrated into the daily functioning of the board. Its other purpose is as a daily reminder to take the place of the clip-boards used at the other centers for current instructions of a more or less temporary nature. (See Figure 4, below.)

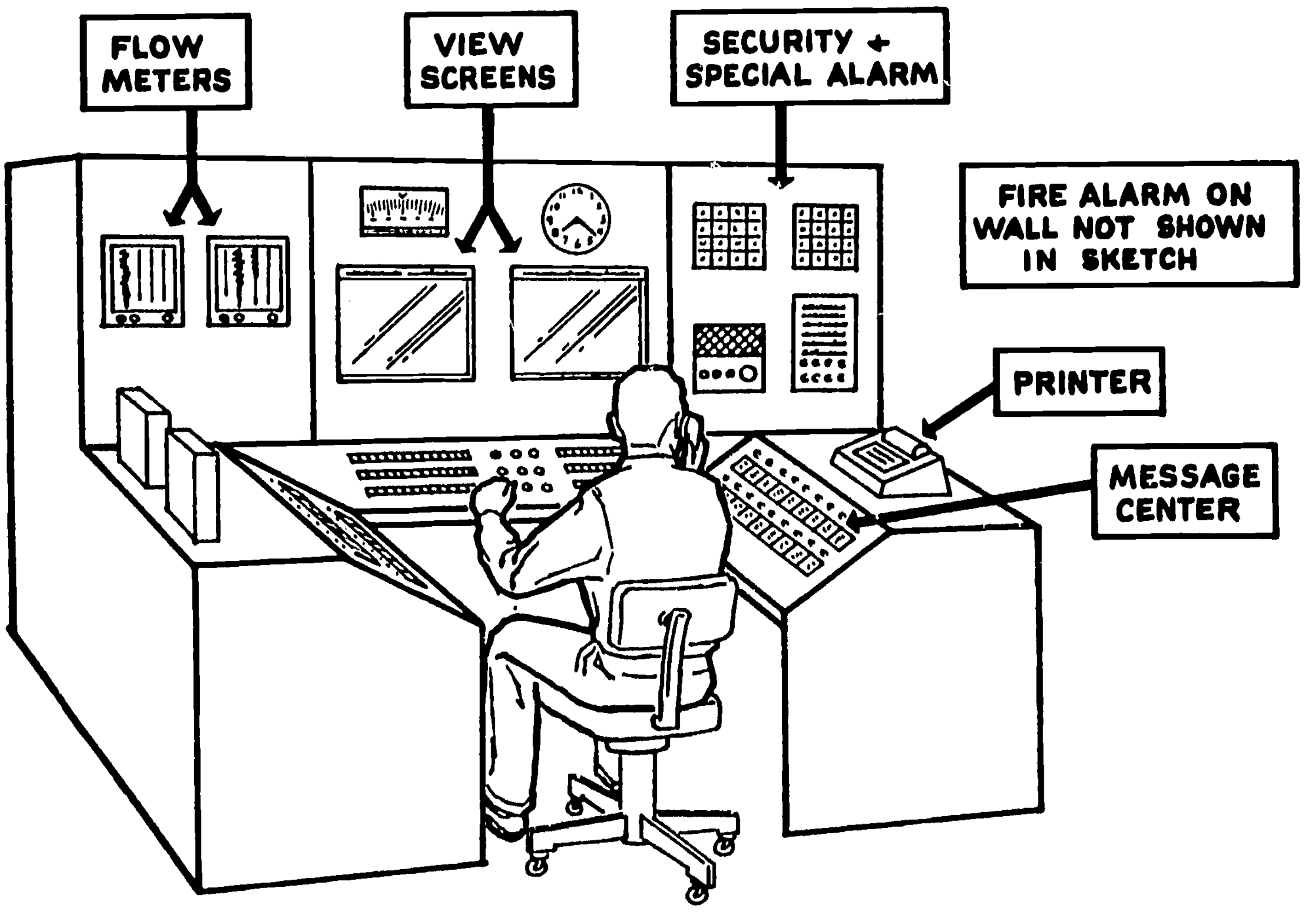

Figure 4

On each side of the operator a sloping shelf contains a radical innovation, two groups of fifty unique MICRO SWITCH assemblies, a total of two hundred -- one for each system. The MICRO SWITCH assemblies house four lights under a glass cover, each cover two inches square. Under the glass cover two of the lights are white and two are amber. The two white lights become energized whenever the corresponding systems button on the console is activated. Each MICRO SWITCH is teamed with a push button connected to the two amber lights. Under the glass top which is easily removed is located a card on which minor systems changes may be typed. When the white light blinks on, the message is easily read through the glass.

The outer surface of the glass is reserved for grease pencil notes, notes used to remind the operator of the day-to-day schedule changes; that is, changes of a temporary nature. Whenever such a message is written on the glass surface of a switch, the local amber light button is pushed. The amber lights remain on, that is for all switches that have accumulated messages. When the instructions have been fulfilled, the amber light is "pushed out" and the message easily erased from the glass by use of a rough paper towel.

A mock-up of this system and simulated use by the operators received their approval. The message center appears to be a good answer to the problem of relieving the operator from as much detail as possible.

The operators assigned to this center feel confident that with the automatic scanning, print out and message center board that they can control the area environment as easily for two hundred forty odd buildings as they now do for sixty odd.

CONCLUSIONS

In summary, the foregoing explanation has outlined the development by Harvard of a new system for operational management of the area environment. The success of each former phase has given the executive personnel of the University the confidence needed to progress to this next new development.

Factory research, encouraged by the success of centralized control, is even now studying the possible use of computers to further automate the control of area environment. Computers appear to hold the answer to even greater economy of operation of the physical plant. For example, they could be used for evaluation of load requirements, for programming, for costing and for inventory control.

Without the availability of a single district steam system serving the two hundred or more buildings at Harvard the type of centralized control outlined in this article would never have been considered. Once the pattern for practical control of all the operational functions of multi-building complexes has been established, its use will spread rapidly.

With the trend toward centralization of operational control will come a corresponding spread in the demand for District Steam.

ACKNOWLEDGEMENTS

TO: Mr. Cecil Roberts, Director of the Dept. of Bldgs. & Grounds and the Planning Office, Harvard University, who, by his foresight and leadership, encouraged his staff to seek better methods for the operations management of the physical plant.

It was his decision to take the rather daring step forward for control and surveillance of large groups of buildings from a single control center. In so doing, he entered an untried, unproven field; he established a better way of meeting current problems in building management.

TO: Mr. Henry J. Muller, Deputy Director of the Dept. of Bldgs. & Grounds at Harvard University. Many of the features of the system detailed in this article are a result of Mr. Muller's expression of need; in fact, the message center is mostly his creation. It was his interest, belief and enthusiasm for the concepts represented in this type of centralized building control that made such an installation possible.