Economics of Compact Book Shelving

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Librarians are concerned primarily with the content of publications, their selection from the world's publishing output, their bibliographic organization, their efficient retrieval, their interpretation, and the stimulation of reading. Despite the primacy of these intellectual functions, library operation requires attention to many mundane tasks, one of which is the housing or shelving of the materials acquired. In libraries where space is ample and many empty shelves are still waiting to be filled, librarians tend to pay little attention to shelving methods; but when library shelves become overcrowded, as most of them eventually do, the librarian is temporarily diverted from educational and intellectual concerns and forced to focus attention on the economics of book storage. Interest in book storage systems should not be taken as a sign of predilection for gadgetry or mechanics but as a task imposed upon librarians by the requirement that they make the best possible use of the resources placed at their disposal.

Much has been written about the predicament of libraries that have run out of space for books. Various alternatives have been carefully compared by many authorities. To cite just a few of the more recent discussions, in 1954, Metcalf considered six possibilities, including innovations in shelving;¹ in 1960, Orne reviewed all aspects of book storage warehouses,² and Ellsworth briefly summarized much of what is known about book storage capacities, storage alternatives, and the economics of the situation.³ In 1961, Hopp succinctly recapitulated some of the most crucial policy questions relating to the handling of infrequently used books.⁴

Also, in 1961, the preliminary edition of a study conducted at the University of Chicago, entitled Patterns in the Use of Books in Large Research Libraries, by Fussler and Simon,⁵ assumed that research collections can be divided into a more frequently and a less frequently

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used portion, and that substantial savings could be achieved by housing the less frequently used portion in a more compact manner than with conventional stack shelving. As the authors put it, “the costs of housing a large stack book collection will be substantially less if some reasonable fraction of the total collection is placed in compact storage.” Weber, who reviewed the study, agreed that “the economic factors involved in housing a research collection may make it desirable to segregate books into two or more levels of accessibility.” Reviewer Logsdon, in enumerating the principal findings and conclusions of the study, included among them the following: “Compact storage of books can save significant operating and capital sums, possibly ranging from 60 to 77 per cent of the costs of conventional housing.” Logsdon also stated that “the carefully marshalled evidence in this study . . . offer(s) much, not only in support of lower cost of housing by compact storage of little-used material, but also in support of going further toward cooperative storage and the reduction of the number of copies of little-used books held by research libraries as a group.” A third reviewer, Mackenzie, wrote similarly that “the conventional book-storage methods are no longer adequate to meet with reasonable financial economy the demands which are being made upon them in ever-greater measure.”

Fussler and Simon wrote hopefully of possible savings through compact storage, but did not indicate the kind of equipment, if any, they would recommend; their sophisticated-looking, but exasperatingly inconclusive chapter on “The Economics of Book Storage” failed to come to grips with the problem in any concrete sort of way, except to say that “. . . some combination of book sizing, shelving books on edge, narrower range aisles, fewer main aisles, shelving somewhat higher than the usual 7’ 6”, and the elimination of empty shelving, will yield a capacity of at least 30 volumes per square foot.” These compactions are the familiar methods advocated in 1949 by the late Fremont Rider in preference to special compact equipment. They have been used at Yale University, where a capacity of sixty-four volumes per square foot (as compared to twenty-one for shelving without gaps) was actually achieved. Yale’s book retirement study, as reported by Ash, also referred primarily to Rider’s methods rather than to the use of compact storage hardware, although cost computations were included for Art Metal and Ames shelving, and unsuccessful experiments with mobile stacks were referred to in passing.

Both the Chicago and the Yale studies reflected a nagging suspicion
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among librarians and the Council on Library Resources, Inc., which financed the studies, that conventional book shelving for infrequently used books may be wasteful. When expectancy of book use is low, it does not seem justified to array books in a manner that utilizes only about 10 per cent of the cubage (which as Rider pointed out was true of most conventional shelving arrangements). Such lavishness is presumed to be extravagant and, therefore, indefensible. Since compaction à la Rider involves no significant added equipment, it is tantamount to cost reduction; but such is not necessarily the case to a sufficient extent if equipment especially designed for compact storage has to be purchased and installed. Rider's methods involve some serious drawbacks; books are no longer displayed continuously by subject classification in the storage area (although the "ribbon" arrangement suggested by Rider may offset this disadvantage somewhat); books shelved on the long edges may cause damage to bindings; marking the call numbers on the narrow edge may also be objectionable or involve expense in the boxing of books; working in 22-inch aisles may prove exceedingly uncomfortable and annoying; and very high shelves and very long book ranges may prove operationally inefficient.

At institutions where Rider's methods have not been considered acceptable (and relatively few have resorted to it), other methods of improved cubage utilization have been explored; these methods all involve equipment especially engineered for compact book storage and, therefore, entail substantial added costs.

There are basically three types of compact book storage equipment currently available in the United States.

1. One type involves swinging or revolving hinged book cases (single or double rows), usually placed in front of, or attached to, regular stationary book cases. An example is the COM-PAC-CASE unit made by Art Metal, Inc., of Jamestown, New York, which consists of two halves of a book case that swing open like a French door. It comes in two versions: (a) one swinging book case or, (b) two swinging book cases in front of each stationary case. (The Snead compact stacks, installed in the 3,150,000-volume Midwest Interlibrary Center (MILC) in 1951, but no longer marketed, represent a variant of this type, in which the entire 3-foot book case swings out into the aisle.) A COM-PAC-CASE installation can be seen in the Illinois State Archives, Springfield. An intriguing-looking variant of the swinging type consists of convex cases on casters that are connected with struts to a center point and can be manually pulled out of their fixed storage frame.
These cases are manufactured by Pivoted Wings, Blackburn, England; the applicability of the latter equipment to libraries has been advertised but not tested.

2. A second type consists of a stationary frame with sliding drawers available in varying dimensions. Current manufacturers of single-headed drawer equipment include the Hamilton Manufacturing Company, Two Rivers, Wisconsin (COMPO) and C. S. Brown & Company, Wauwatosa, Wisconsin, the latter offering what is claimed to be an improved version of the COMPO, but similar in basic design. This equipment has been installed in many libraries, e.g., in the St. Louis Public Library’s Compton Regional Annex and the Oklahoma City Public Library. The manufacturing of a double-headed type of sliding drawer, known as STOR-MOR, which was installed in the 400,000-volume storage building of the University of Michigan in 1954, has been entirely discontinued, except for occasional reorders to expand existing installations.16

3. The third type consists of blocks of ranges of movable cases, with only one inter-range aisle per block; the cases rest on tracks sunk in the floor and are activated either manually or pulled by a small motor connected to a continuous link chain drive or a cable, which is located at the center of the range. This type is marketed under the trade name COMPACTUS; it was invented and patented by the engineer Hans Ingold, of Ziirich, Switzerland, in 1947. It has been installed in many libraries in Europe, Great Britain, Australia, etc. and has recently become available in the United States through Jackson Compactus, Los Angeles, California, which acquired the sole rights to manufacture and sell this system in the United States, Canada, and Mexico. COMPACTUS equipment has so far not been installed in any research library in the United States although early commercial installations can be found in Toronto, Canada (in the Orenda Engine Co., Canada Life Insurance Co., Trader Finance Co., and Canada General Insurance Co.), and in Halifax, Nova Scotia (in the T.B. Wing of the Victoria General Hospital). There is a semi-automatic textbook storage installation in the Anaheim Union High School, California, and a semi-automatic storage area for biological specimens at Arizona State University at Tempe; and installations are under consideration for the West San Gabriel Valley (California) Regional Library and for rare books and manuscripts at Yale University. The company does not consider itself to be in the shelving manufacturing business as such but primarily supplies the patented basic tracks, undercarriage, motor,
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etc., which can be joined to any case-type shelf unit to form a compact stack installation. It should be noted that whereas ordinary shelving requires a live floor load capacity of 100 to 150 lbs./sq. ft. (depending on shelf depth, width of aisles, height, and safety factor) and the Art Metal, Hamilton, and Brown compact designs require a minimum of 160 lbs./sq. ft., a Compactus installation has been said to require up to 287 lbs./sq. ft. (Stromeyer specifies a maximum of 1,400 Kg./sq. meter, which equals about 287 lbs./sq. ft.17 Jackson Compactus, however, claims a requirement of only 180 to 240 lbs.18

The COMPACTUS type of installation comes in three versions: manually operated, semi-automatic, and automatic. A semi-automatic installation contains one stationary range, usually between two blocks of several ranges each; the stationary range may or may not contain the motor and the switch panel. In an installation designated as completely automatic, all book ranges are movable. Most installations are semi-automatic. Safety devices to prevent attendants from becoming sandwiched and injured between ranges have been judged as perfectly adequate.18 Electric power consumption is considered negligible in the total operating picture, considering that the motor needs to be only a small one and an optional device for having the motor automatically switched off after designated intervals is part of the installation. H. Strahm, the director of the Municipal and University Library of Bern, Switzerland, called inventor Ingold the Galileo in the library field for having solved the motorization of book stacks in a most elegant manner; he expressed surprise that such stacks had not been invented by a librarian, who as a result undoubtedly would have won professional fame. The library basement at Bern has a semi-automatic COMPACTUS installation that increased storage capacity from 53,700 volumes to 130,440 volumes (octavos only).20

A system similar to COMPACTUS, installed in the National Diet Library of Japan, is marketed under the trade name ELECOMPACK (Tokyo, Japan). Whether or not this equipment can be economically imported into the United States and installed here is not known. The Company president Hanichiro Naito has stated: “My staff and I should be very happy if our ELECOMPACK filing system were widely adopted in your country.”21 Negotiations are underway. The equipment is so designed that, at the press of a button, an aisle can be created between any two book ranges within a block of nine ranges placed on each side of a single stationary book range that contains the control panel. The ranges portrayed in the company’s catalog
consist of five 3-ft.-wide double-faced book cases movable on rails by means of two feeders.22

Another system of movable rolling stacks, not yet developed in the United States to the point of marketability, are laterally moving single book cases activated manually or by an electric motor. The cases are placed in the aisles of a regular stationary installation; they are suspended from a rail (like a monorail car) and move in a track on the floor. A mock-up was displayed at the 1964 American Library Association Conference, St. Louis, by the Aetna Steel Product Corporation, New York, which reports that it is still compiling engineering data.

There may well be other manufacturers than those mentioned which are offering compact storage equipment. No attempt has been made at complete coverage since the chief concern in this review is the identification of types. There are also additional book storage conceptions which have not yet been developed into marketable products in the United States and are, therefore, of only theoretical interest.

Any type of equipment not offered commercially in the United States, such as, a scheme of motor-driven bookcases that can be propelled laterally into a main access aisle, is not worth serious consideration by librarians until a manufacturer is ready to risk marketing it. It is partly for this reason (in addition to patent restrictions) that COMPACTUS was not installed in any United States institution until a franchised manufacturer was available, even though it had been successfully used in Switzerland, England, Sweden, Germany, etc. as long as ten years ago.

Several evaluative reviews of compact storage equipment have been published in the past decade. The most comprehensive and penetrating of such studies was made by the Czechoslovakian librarian Drahoslav Gawrecki in 1960.23 He surveyed all possible compact storage ideas for the purpose of developing recommendations as to the most serviceable types of equipment for compact book storage which the state-controlled steel fabricators of socialist Czechoslovakia might provide. He developed ingenious layouts to achieve maximum compaction with a combination of different types of equipment on the assumption that such equipment might be manufactured when needed. He concluded that the COMPACTUS type is best, that laterally moving cases and the drawer-type are also useful, and that the swinging type is least applicable. He particularly stressed the advantage of combination arrangements involving more than one type in a given area, and questioned the value of capacity calculations made for a single type of

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equipment in isolation. A great deal of interest in compact storage is in
evidence in other countries in the Soviet orbit. This interest may stem
from the overcrowdedness of the book stacks of research libraries in
these countries during a period when the chances for constructing ad-
ditions or new buildings are rather slim; hence, there may be a strong
desire to utilize existing space to the best advantage. Capacity increase
rather than cost savings has been the predominant if not the only
interest in this connection. For Poland, Przybylo was offered a com-
petent review of the literature, including developments in other Slavic
countries. For the USSR, Pashchenko evaluated different types of
equipment; his conclusion favored revolving book cases in preference
to the drawer-type. Pashchenko claimed to have been the first to plan
a compact storage installation in the USSR (Academy of Sciences,
Moscow, which involved blocks of movable cases in groups of twenty-
four). He regarded movable pull-out bookcases as particularly promis-
ing.

In the Federal Republic of Germany, Stromeyer's authoritative and
thorough treatise on book stack problems in 1958 contained a chapter
on space saving through new types of shelving systems. This chapter
offered a detailed and critical account of COMPACTUS, which the
author compared, point by point, with the Snead (MILC) system; COM-
PACTUS was judged to be preferable despite some reservations.
Stromeyer considered other systems (notably sliding drawers) less suit-
able and only rarely applicable, but failed to give reasons for such
negative evaluation. He paid some attention to the economics of book
shelving, concluding that local circumstances will determine whether
COMPACTUS involved a higher or lower over-all cost (including
building construction) and implying perhaps that cost considerations
were not of paramount importance.

In England, ten years ago Hill presented a descriptive review of all
types of compact equipment, including rolling book cases, COM-
PACTUS, the Snead system, the Art Metal system, Hamilton drawers,
and Ames drawers. His conclusions as to the economics of book
storage were exceedingly cautious and hedged with qualifications.
He expressed doubt as to the applicability of compact storage in
public access situations.

In the United States, Kaplan in 1960 traced compact storage de-
velopments and expressed criticism of unsubstantiated claims made
in the literature; he reported that evidence of savings in cost effected
by compact shelving was almost non-existent. In 1962 Metcalf pre-
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presented a lucid review of compact shelving methods as well as equipment. He recommended that "... movable shelving be regarded as a last resort, and that the library first consider whether portions of its collections might be placed in a stack with narrower shelves and aisles, shelved by size, or perhaps transferred to a cooperative storage building..." 29

Despite an abundance of information on, and attention to, compact storage equipment as well as a considerable amount of competitive advocacy, no conclusively valid and reliable data are presently available on the basis of which one can determine which type of storage equipment, if any, is most suitable for a given situation. What are lacking are rigorously controlled comparative cost-accounting evaluations of existing installations, with full data on original capital outlay, including building construction and cost of operation and maintenance. The need for this sort of information, grounded in actual operating situations rather than imagined constructs and theoretical computations, is evident; in Kaplan's words:

Savings developed by systems of compact shelving must be regarded with suspicion when presented theoretically. In any actual installation the shape of the room and other factors will seriously affect savings. The library profession would benefit from a demonstration of how these factors influence the capacity of each type of compact shelving. 30

It is possible to compute theoretically achievable savings for the combined cost of compact shelving equipment and a given building construction cost in a specific situation, as was done by Muller, 31 who showed that storage equipment becomes more applicable as building cost goes up. Studies at Yale University, 32 following a similar methodology for a specific assumed construction cost of $20 per square foot, concluded that per-volume cost for 22-inch aisles spacing would be about one-fourth of that for conventional spacing, and that compact equipment would not substantially reduce the cost per volume as compared to conventional shelves with 36-inch aisles. The Yale method was later applied by Elecompack, Ltd., Tokyo, in one of its advertising brochures, in which an illustrative block diagram implied that the combined cost of conventional stacks plus building construction cost would be about 44 per cent higher than the combined cost of ELECOMPACK plus building construction, at least for Japan: "The difference of overall cost between ELECOMPACK and conventional

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shelves widens as the value of the combined total of construction cost of conventional book shelves per unit floor space increases, which means that the overall cost can be reduced greatly." 33

Lester Mattison showed that, for 23 by 23 ft. bays in a modular building, "savings effected by substituting COMPO-type compact shelving for standard bracket shelving in a $20 per sq. ft. building amount to only 4% . . . Compact shelving in a low cost storehouse building is 59% costlier than wood utility shelving and 35.4% costlier than bracket shelving." He concluded that "cheap shelving in an expensive building and expensive shelving in a cheap building appear to be equally incongruous." 34

For shelving equipment currently on the United States market, Tables 1 and 2 present comparative data on the crucial question of the economics of compact storage. The question is posed in terms of the number of volumes that can be shelved in the storage portion of a storage building for a fixed amount of money, viz., $500,000. (A constant construction cost of $25 per square foot, exclusive of equipment, is assumed although the required greater floor load capacity for compact equipment will probably involve a higher cost of about $1 per square foot to provide increased concrete slab thickness, wider column-footings, and stronger bottom structure.) Caution is in order since the figures are based on informal quotations supplied by manufacturers, and no attempt was made to determine the reliability of such quotations.

This hypothetical tabulation shows that a building with conventional shelving will house maximally about 348,000 volumes (assuming eight volumes per lineal foot). Semi-automatic COMPACTUS, although unquestionably providing the densest type of compact shelving, surprisingly yields space only for about 16,000 volumes more (4.6 per cent). It does increase capacity per square foot by about 150 per cent but provides a negligible cost advantage in original construction and equipment outlay at the prices currently quoted. It should be mentioned, however, that the quotations relate to relatively small installations and may be assumed to be lower for larger installations. Rider's familiar adage evidently applies to COMPACTUS: "The only place where saving would be effected would be in the amount . . . of the stack building 'shell'. . . . What we have here . . . is greater compactness of storage, but no over-all economy." 35 It is possible that the cost of such mobile stacks is lower abroad. A librarian who recently returned to the United States from a study tour, during which he
<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Shelving Cost Per Sq. Ft. of Area Occupied by Shelving</th>
<th>Shelving Plus Building Cost of $500,000</th>
<th>No. of Sq. Ft. of Floor Area Obtainable for $500,000</th>
<th>Maximum Volume Capacity Per Sq. Ft. of Floor Area (Compactness)</th>
<th>Total Volumes in Bldg. Costing $500,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPO (Brown)</td>
<td>$13.98</td>
<td>$38.98</td>
<td>12,827</td>
<td>40</td>
<td>513,080</td>
</tr>
<tr>
<td>COMPO (Hamilton)</td>
<td>19.33</td>
<td>44.33</td>
<td>11,279</td>
<td>44</td>
<td>496,276</td>
</tr>
<tr>
<td>COM-PAC-CASE (Art Metal)</td>
<td>19.04</td>
<td>44.04</td>
<td>11,353</td>
<td>41</td>
<td>465,473</td>
</tr>
<tr>
<td>COMPACTUS semi-automatic</td>
<td>46.44</td>
<td>71.44</td>
<td>6,999</td>
<td>52</td>
<td>363,948</td>
</tr>
<tr>
<td>Conventional (Art Metal)</td>
<td>3.02</td>
<td>28.02</td>
<td>17,844</td>
<td>19</td>
<td>339,036</td>
</tr>
<tr>
<td>Conventional (Brown)</td>
<td>3.86</td>
<td>28.86</td>
<td>17,325</td>
<td>20</td>
<td>346,500</td>
</tr>
</tbody>
</table>

1. Gross area cost, including stairways, main corridors, toilets, elevators, heating and ventilating equipment, et cetera.
2. Quoted price for a layout of equipment divided by the number of square feet occupied.
3. The building cost unit price is assumed to be constant, i.e., equal for different types of equipment. Actually, a somewhat higher cost may be associated with compact equipment since greater floor load capacity must be provided for. A cost of $25 per sq. ft. without equipment is based on experience at the University of Michigan where recent air-conditioned buildings cost $23 to $26 per square foot, exclusive of the cost of land.
4. Obtained by dividing $500,000 by the building cost per square foot as shown in column 3.
5. Number of lineal feet of shelving in an installation layout divided by number of square feet multiplied by eight, since shelving is assumed to accommodate eight volumes per lineal foot. (Figures are rounded off to the nearest digit.)
6. Column 4 multiplied by column 5.
7. This capacity figure is higher than the figures computed for the Brown equipment since the theoretical layout and drawings do not show structural columns, which would reduce capacity to some extent. The drawers are 36 inches deep, 18 inches wide, each drawer having a shelving capacity of 72 lineal inches.
TABLE 2

Basic Reference Data for Computing Shelving Costs Used in Table 1

<table>
<thead>
<tr>
<th>Source of Quotation</th>
<th>Type of Equipment</th>
<th>No. of Lineal Ft. for the Project Quoted</th>
<th>No. of Sq. Ft. of Floor Area Occupied by Shelving</th>
<th>Total Cost Quoted</th>
<th>Shelving Cost Per Sq. Ft. of Area Occupied by Shelving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown &amp; Co. 7/17/64</td>
<td>COMPO</td>
<td>10,444</td>
<td>2,075</td>
<td>$ 29,000</td>
<td>$13.98</td>
</tr>
<tr>
<td>Hamilton Mfg. Co. Estimate 11/3/64</td>
<td>COMPO</td>
<td>111,720</td>
<td>20,000</td>
<td>386,635</td>
<td>19.33</td>
</tr>
<tr>
<td>Art Metal, Inc. Estimate 5/25/64</td>
<td>COM-PAC-CASE</td>
<td>32,182</td>
<td>6,255</td>
<td>119,100</td>
<td>19.04</td>
</tr>
<tr>
<td>Jackson Compactus 12/18/63</td>
<td>COMPACTUS semi-automatic</td>
<td>30,576</td>
<td>646</td>
<td>30,000</td>
<td>46.44</td>
</tr>
<tr>
<td>Art Metal, Inc. 3/25/64</td>
<td>Conventional ranges 39' long</td>
<td>14,942</td>
<td>6,255</td>
<td>18,800</td>
<td>3.02</td>
</tr>
<tr>
<td>Brown &amp; Co. 7/17/64</td>
<td>Conventional</td>
<td>5,187</td>
<td>2,075</td>
<td>8,000</td>
<td>3.86</td>
</tr>
</tbody>
</table>

8. This figure was initially computed as being 36 volumes per square foot, based on an installation involving 24 "cars," each 9.1 foot long, equipped with 12.5-inch wide shelves, each car containing seven shelves, i.e., 9.1 times 7 times 2 times 24 equals 30,576 lineal feet. Assuming eight volumes per lineal foot, the capacity of the installation is 244,608 volumes. Dividing this figure by the number of square feet (646) results in a figure of 36 volumes per square foot. The capacity, however, would be much higher with narrower shelves (eight inches) and a narrower main aisle that provides access to two stack blocks instead of only one as in this installation. Reducing shelf width from 12.5 to 8 inches allows for an increase of over 50 per cent in the number of cars. Hence to assume a capacity figure of 52 volumes per square foot for eight-inch shelves does not seem unreasonable (as against twenty-six volumes per square foot with 12.5 inch shelves). At Bern University, volume capacity was computed to be 559 square meters, or 52 volumes per square foot. (See Stromeyer, op. cit., Tabelle).

9. Brown reported in a letter dated 10/14/64 that on two recent small jobs where both Brown and Hamilton submitted bids, the bids compared as follows: (1) Brown $6,043, Hamilton $8,310, and (2) Brown $8,275, Hamilton $9,914. The situation may be different in the case of larger jobs. The Brown cost figures relate to drawer units that are 48 inches deep.
visited compact stack installations, stated in a letter to the writer in July 1964 that "What it all comes down to is simply this: if in Europe a proposed eleven-story building with conventional book stacks can be reduced in size to a four-story building, with mechanized bookstacks, then the savings in building costs alone more than compensate for the higher expenditure for mechanized bookstacks." To which one might reply: To be sure, a 64 per cent shrinkage in building size is impressive and a source of fascination and amazement; but conclusions as to savings do not necessarily follow. If COMPACTUS type shelving were to come down in price in the United States, it would probably become the preferred type of compact equipment.

For the time being, the two other types of compact shelving seem to offer the most appreciable cost advantages. *Hinged cases* with two swinging cases and narrow aisles (2 ft.) result in savings that are reflected in an increase of book capacity by about 34 per cent. Savings obtainable through *sliding shelves* can be assumed to result in a book capacity increase of about 47 per cent, minus a correction for the higher floor load requirement. Both of these types of equipment show similar compactability, i.e., nearly 100 per cent as compared with the tightest kind of conventional shelving model illustrated by Stromeyer. Assuming that the cost quotations are trustworthy, both hinged and sliding shelves but particularly the sliding shelves, appear to be worth serious consideration in the planning of storage stacks for research collections which are to be housed in a building costing $25 or more per square foot, exclusive of equipment. (It is noteworthy, however, that even the most advantageous type of compact equipment, economically speaking, achieves only a somewhat better result, than the increase of about 40 per cent in capacity that can be achieved by reduction of range-aisles from 36 to 22 inches, which Yale University has found to be "practical." In cases where building costs per square foot are much lower, the appropriateness of compact shelving equipment becomes increasingly questionable.

Advantages other than cost have also been claimed for compact storage; among them are lower custodial service, repair, maintenance, utilities, security, ground maintenance, overhead cost, and lower cost in book delivery and reshelving (since distances have been shortened). Although some of these advantages may appear self-evident, no studies have been found that satisfactorily quantify all these alleged operational economies. Since library budgets of universities rarely include utility costs, library administrators are not likely to be overly concerned
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about such cost factors; and the alleged economy in book delivery and reshelving is likely to be cancelled out to a considerable extent by the increased labor involved in shelf manipulation (sliding, rotating, etc.). In any case, all such factors combined probably account for savings of less than 2 per cent per year of original construction plus equipment cost. If a $500,000 building of, say, 17,500 square feet could be reduced in size to 7,000 square feet by the use of COMPACTUS-type stacks, the savings in plant maintenance would amount to about $10,500 a year ($1.00 a square foot per year). On a 5 per cent compound-interest basis, it would take twenty-five years to build up enough capital to construct another building of the same dimension. Obviously, from the long-range institutional (rather than the more narrow librarian's annual budgetary) point of view, such savings should not be disregarded. However, since all types of compact shelving installation do involve some reduction in direct and easy access to books, over-all cost savings will have to be very substantial before librarians will resort to such measures for this reason.

References

5. Fussler, Herman H., and Simon, Julian L. Patterns in the Use of Books in Large Research Libraries. Chicago, University of Chicago Library, 1961. (Published originally in a limited edition for review and criticism by University of Chicago Library.)
6. Ibid., p. 245.
16. A representative of this company, in analyzing the recent decline of demand for STOR-MOR equipment, expressed the view that most librarians with a storage problem would rather build a new building or addition than purchase a compact storage system, for they fear that the consideration of compact storage would cause governing authorities to lower the priority of their request for a new facility. Also, librarians are reluctant to conceive of any of their materials being placed in what may appear to be inaccessible or "dead" storage since all books are presumably being used constantly. Moreover, double-headed drawers are admittedly less applicable to small rooms and corners of large rooms than the single-headed type of drawer design of Brown's or Hamilton's. (This information was obtained by the author in April 1964 from the W. R. Ames Company, Milpitas, Calif.)
22. Miura, Michio. *Library and Elecompack*. (A translation of the textual portion of this brochure was supplied to the author and has been sent, along with the brochure, to the American Library Association Library Technology Project, 50 E. Huron Street, Chicago, Illinois.) For a brief description, see "Goods and Gadgets," *ALA Bulletin*, 58:651, July-Aug. 1964. The company president states that ELECOMPACK differs in structure from COMPACTUS, and he expects to obtain a patent of his own. ELECOMPACK has two feeders as compared to only one per bay for COMPACTUS. Each range of bookcases is fastened to the feeders independently, thus keeping the ranges from shoving against each other when moved. It is equipped with safety devices, and it is possible to centralize control for several blocks of stacks.
23. Gawrecki, Draboslav. *New Shelving Equipment in Libraries Abroad*. (Title translated from Czech). Martin, Matica Slovenska, 1960. Five volumes are issued in three booklets. Volumes 1 and 2 contain 67 pages; volume 3 contains 40 pages; and volumes 4 and 5 contain 98 pages. (A typewritten translation, uncorrected, has been deposited with the American Library Association Library Technology Project, 50 E. Huron Street, Chicago, Illinois, and is also available on microfilm or copyflow enlargement, OPB 22289, $8.20, from University Microfilms, Inc., Ann Arbor, Michigan.)
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30. Kaplan, op. cit., p. 27.
33. Information in an advertising brochure of Elecompack, Ltd., Tokyo. (Translated from the Japanese.)
35. Rider, op. cit., p. 34.
36. Stromeyer, op. cit., p. 139; Model C3: 21 volumes per lineal foot.
37. Muller, op. cit., p. 81. See also Ash, op. cit., p. 52.