Manually Sorted Punched Card System for Pharmaceutical Literature

By JOHN G. WAGNER

A 5 × 8 inch punched card and direct coding system for pharmaceutical literature is illustrated and described. Use of the cards for a cooperative literature searching system and for a separate complete article file is discussed. Although the punched card system was designed for use in a department of product research and development in a pharmaceutical house, it would probably serve equally well for the faculty of a college of pharmacy.

A NUMBER of authors (1–9) have reported on the use of hand-sorted punched cards for bibliographic, data storage, and data processing purposes. Specific articles have been written on the use of such cards for a chemical bibliography (1), an instrumentation bibliography (7), storage of infrared absorption spectra (6), storage of medical research data (8), and processing of psychological data (9).

Keeping track of literature in the pharmaceutical field is becoming an increasing burden. It has become almost a necessity to have a cooperative effort with central filing of abstracts and/or references in order to be able to keep up with the new literature. This is true not only in industrial research and development but also in the academic field. The punched card system for pharmaceutical literature to be described was designed for use in a department of pharmacy or product research and development in a pharmaceutical house, but it would probably serve equally well for the faculty of a college of pharmacy.

The most useful property of punched cards is that of providing a means of cross indexing without the necessity of duplicating entries (4). In initiating the system to be described, most attention was paid to the facility in getting references and abstracts out of the file as in the system proposed by Cox, *et al.* (1).

THE PUNCHED CARD AND CODING SYSTEM

A 5 × 8 inch card sold by the Royal McBee Corporation (10) is used. Although the 155 holes around the perimeter of this card are divided into a series of numbered fields, the latter are not used in the system to be described. The numbers printed on the face of the card are completely ignored and only direct coding utilized, as shown in Fig. 1. This figure shows the back of the card. The material shown is printed directly on the cards in lots of one thousand by an offset printing process.

The "D" opposite a word such as Endocrine means deep punch, while the "S" opposite a word such as Agriculture means shallow punch. There are 58 pairs of "D" and "S" categories, making a total of 116 possibilities for direct coding. One additional hole is utilized if the reference is a patent or specification for a patent. Eight other holes near the cut corner of the card are used for the last two digits of the year; the last digit of the year of publication is placed in the set of four holes nearest the cut corner. The remaining 30 holes, 20 at one edge of the card and 10 at the other edge of the card, are numbered. The categories assigned to 29 of these 30 holes are shown in Table I.

In Fig. 1 there are several heavier black lines which divide the categories into several groups. Referring to the left-hand side of the back of the card, the groups of categories from top to bottom may be titled: pharmacologic classification, method of administration, type of dosage form, nature of process, assay and instrument classification, and source of reference. Referring to the right-hand side, the groups of categories from top to bottom may be titled: chemical and pharmaceutical nature of substance, stability and compatibility group, and a miscellaneous group which starts with "clinical testing" and ends with "drug combination(s)."

The cards may be filed by year and into "patent" and "nonpatent" sections. However, the cards could be filed randomly in one group or into any other specific groups. For example, if the card deck becomes large enough one might wish to segregate a group of categories, such as the assay and instrument classification.

A COOPERATIVE LITERATURE SEARCHING SYSTEM

Since we are now adding to the file of cards at the rate of about 1,200 cards per year, cooperative abstracting has been initiated in our department. Patents present no problem since we merely cut out pertinent abstracts of the patents from the *Official Gazette* and paste them on the cards. When a rubber cement is used a card will be perfectly flat after the abstract is pasted onto it. Most of the

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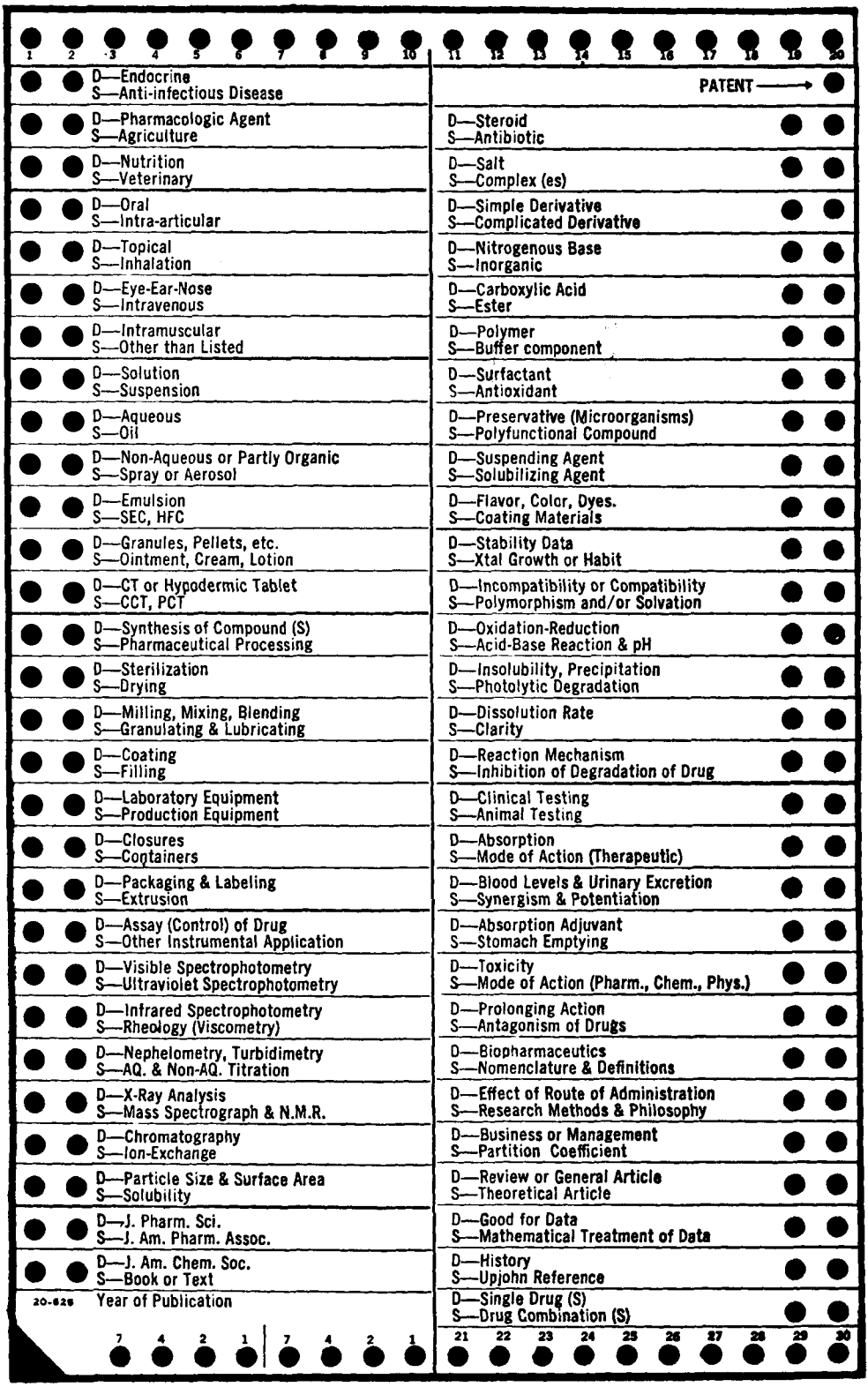

Fig. 1.—Copy of the direct coding system printed on the back of the 5 × 8 inch card.

TABLE I.—ADDITIONAL CATEGORIES FOR PUNCHED CARDS WHICH ARE NOT PRINTED ON THE BACK OF THE CARD

1. Adsorption
2. Colloidal phenomenon (phenomena)
3. Computers, tape input, programming, etc.
4. Correlation of chemical and physical properties with biological activity
5. Correlation of *in vitro* and *in vivo* rate data
6. Dental
7. Dielectric constant(s) and/or dipole moment(s)
8. Drug binding in physiological systems
9. Extensive bibliography
10. Government and government regulations
11. Graphical representation of data
12. Isomerism
13. Kinetics
14. Molecular and atomic structure
15. Molecular weight
16. Optical activity
17. Physical methods of measurement other than listed on card
18. Physiology
19. Proposals and ideas for future research and development
20. Report writing aids
21. Solvents for reactions
22. Solvents for recrystallizations
23. Stability constants
24. Statistics
25. Sustained action, oral
26. Sustained action, parenteral
27. Thermodynamic quantities
28. Weighing, automation of, etc.
29. Coating and fluidization

articles to be abstracted are chosen from *Current Contents* (11). The title of each article, the surnames and initials of the authors, and the journal reference is typed onto the front of the card. The cards are then assigned for abstracting and a simple record kept of the number of cards assigned to each scientist on a given day. When the cards are returned with the abstracts on them, an entry of the date they were returned is made and then the number of days required for abstracting is noted. When about 50 to 100 cards have been returned, the cards are coded using a china red marker to indicate where "D" or "S" cuts are to be made in the cards. Since only the abstractor would often know whether there are any categories involved in the numbered holes (Table I), the scientist doing the abstracting is requested to have Table I with him when he reads the article and to mark the appropriate holes with a china red marker.

The cards bearing abstracts are circulated to about fifteen scientists. Hence each scientist gets the benefit of the others' abstracting. When each deck of coded cards has completed the circuit of scientists, they are punched appropriately and filed in drawers.

RESULTS OF THE LITERATURE SEARCHING SYSTEM

The growth of the punched card file of pharmaceutical literature in the Product Research and Development Unit of The Upjohn Co. is shown in Fig. 2. The system was initiated on October 15, 1956. There has been steady growth in the number of cards added to the file in each subsequent year. At the present time the rate of addition is greater

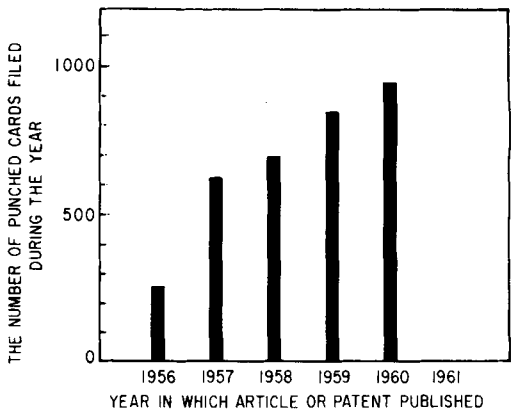

Fig. 2.—The growth of the punched card file of pharmaceutical literature in the Product Research and Development Unit of The Upjohn Co.

than 1,200 cards per year. It is estimated that by the end of 1962 there will be between 5,000 and 6,000 cards in the file.

The average time and range of time required for abstracting[1] articles varies widely, depending upon the particular scientist doing the abstracting and his duties at the time the cards are assigned. Average abstracting times for individual scientists range from 2 to 40 days with corresponding ranges from 1 to 7 days, and 13 to 72 days. During 1960 a total of 975 abstracted cards were circulated to 14 to 15 scientists. The average time for a deck of cards to circulate among the 14 or 15 scientists was 48 days, with a range of 16 to 82 days.

The usefulness of the file of punched cards may be illustrated by a few examples. When the author was requested to write a recent review article (12), it required only about 1 day to retrieve about 500 pertinent references and abstracts from the file. Reduction of these to about 200 references resulted in the principal material from which the review was written. When a scientist is assigned the task of writing an Invention Report for the Patent Law Unit, preparatory to the filing of a patent application, most of the pertinent patent and other literature references can be obtained readily from the file. The file has been used to answer some of the myriad of questions one is asked by personnel within and without his own unit of the Company during a working year; the file has even been used to answer telephone queries while the line has been held open.

A CARD SYSTEM FOR COMPLETE ARTICLE RETRIEVAL

The same type of card as shown in Fig. 1 may be used as an index to a complete article (reprint or photostat) file also. In this case only the title, author(s), reference, a code number, and the year of publication is placed on the front of the card. The code number is written large in the upper right-hand corner with the year of publication in brackets beneath the number. Reprints or photostats added to the file are numbered consecutively by attaching a red-bordered label to the upper right-hand corner of the first page of the article and stapling the label

[1] Time between assignment of the card and its return.

to the page in case the adhesive becomes weak in later years. The articles are filed consecutively by number. Each year's articles are placed in a separate hanging file in a conventional file drawer. The cards are coded after reading the article and are then filed. Retrieval of the articles via the card index has been found to be very rapid and efficient.

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Cellulose Acetate Succinate as an Enteric Coating for Some Compressed Tablets

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The preparation and testing of compressed tablets of barium sulfate and sodium chloride coated with cellulose acetate succinate (CAS) are described, and the statistical evaluation of the data obtained is presented. The most satisfactory coatings were obtained when the test material, in an acetone-ethyl acetate solution, was applied by a modified "pan" method using talc as a dusting powder. Generally, CAS coatings which were stable for 3 1/2 hours in Simulated Gastric Fluid USP XVI dissolved sooner than control coatings of CAP applied and treated in the same manner. Disintegration times were slightly lower for most tablets placed directly into Simulated Intestinal Fluid, USP XVI than they were for tablets first treated with Simulated Gastric Fluid USP XVI for 3 1/2 hours and then tested in the former solution. None of the tablet coatings showed signs of cracks as a result of storage at −2 ± 2° for 21 days or 45 ± 2° for 10 days; however, some of these showed statistically significant differences in average disintegration time when compared with samples stored at room temperature. When test and control tablets were stored at 40 ± 2° and approximately 81% humidity, the majority of coatings were unsatisfactory. Tablets lost less than 3.56% tablet weight as a result of the simulated gastric fluid treatment. Preliminary *in vivo* tests with human subjects indicate that CAS has merit as an enteric coating. Pancreatin appears to have little effect on the disintegration times of the test coating.

THE IMPORTANCE of a good enteric coating for compressed tablets has been long recognized (1–3). Recently, the interest in this area has been stimulated by reports (4–6) of new enteric coatings and improved methods of evaluating enteric coatings. While considerable studies have been reported on the use of cellulose acetate phthalate (CAP) (4, 7–9) as an enteric coating, little experimental work has been published on the use of cellulose acetate succinate (CAS) for this purpose. Malm, *et al.* (10), prepared some cellulose succinate compounds as early as 1940; however, the authors did not fully study the enteric coating properties of the compounds.

Since CAS and CAP appear to possess similar solubility properties, and since there still exists a need for more efficient and inexpensive enteric coating material, as well as more data on the substances presently employed for this purpose, this study was undertaken. Also, it was felt that CAS might be less toxic than corresponding phthalate products, if the former proved to be a satisfactory enteric coating material, since succinic acid is normally found in the body.

EXPERIMENTAL

Material.—The cellulose acetate phthalate and cellulose acetate succinate used were obtained from Eastman Kodak Co., Rochester, N. Y. CAS has the following composition (11): combined acetyl, 20.6%; combined succinyl, 33.6%; No. of acetyls per anhydroglucose unit, 1.65%; No. of succinyls per anhydroglucose unit, 1.15%; No. of hydroxyls per anhydroglucose unit, 0.20%; free succinic acid, 0.21%; free carboxyl (corrected for free succinic acid), 15.0%.

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