

# Overview of Hopewell Furnace Account Books

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## Abstract

This report describes the general content, format and relationships of and between the “furnace books,” the various account books kept by Hopewell Furnace (Elverson, PA) during its historical period. These are the documents called “source material” with “SM numbers” in reports. They form the primary documentary evidence of furnace activity. Each class of book (daybook, general ledger, etc.) is described as to its general content, format, and any special notes useful for understanding it. The relationships between book classes are described, to go with a companion diagram of a sample book set, and a map of all the books and their relationships. Note that while there is considerable redundancy among the books, not all information is duplicated, so a good understanding of the book system is necessary in order to not miss something important. This report is intended to shorten the learning time for researchers who would otherwise be able to figure out the book structure on their own; it is not a tutorial on how to accomplish any particular research project. However, no knowledge of formal accounting is presumed or required. The books are mostly available to the public as scanned page images, plus several exist as physical books at various historical societies, and several are available on microfilm at Hopewell Furnace NHS.

## 1. Introduction

The Hopewell Furnace National Historic Site maintains and interprets a cold-blast charcoal iron blast furnace that smelted iron, with minor interruptions, from ca. 1771 to 1883. Part of the interpretation is to make available historical data about the furnace and its operation. The managers of the furnace apparently did not keep diaries or write other “stories” about operations for future generations as they were running their business. What was obvious at the time would have been a waste of time to record, so much that is unclear to us was not written down. The primary evidence we do have consists of operating documents they felt were necessary for their normal operations, or that were produced by authorities. These documents include: land, census and other official records; deeds; court records; letters to associates; and financial records. The financial records consist of common account books, referred to as “the furnace books,” and are the subject of this report. These are in readily understood accounting form and constitute the bulk of the detailed information available about furnace operations. The details of the books and their relationships need to be clearly understood by anyone attempting to achieve completeness in gathering information. Explaining the furnace books is the purpose of this report. (Those interested in other documents should consult Hopewell staff for assistance.)

In this report, the term “books” refers to the furnace books in general, and a “book” is a single volume, generally the same as an SM number, without regard to its (possibly various) physical forms.

## Companion Spreadsheet Documents

This report has a companion spreadsheet file contains three items: an index of furnace books; a diagram showing inter-book relationships for a specific synthetic example; and a map of all known (and some unknown) books and their relationships. These are described in this report, with the index described next, and the diagrams later, after more details are described.

## Furnace Book Index

The “Index” tab of the spreadsheet is an index of furnace books. As shipped, it is sorted by SM number, but can be re-sorted as convenient. Note that not all SM numbers are included, and SM numbers are not strictly numeric. Also note that many books are known to be missing, but they sometimes appear, so this index cannot ever be considered final, and may, at times, contain uncertain data.

The **Status** field indicates the status of the record/SM Number, with the following codes. **A** is *active*, although this does not mean that all fields are considered final. **D** flags a *duplicate* SM Number record. In cases where multiple SM Numbers were assigned to the same book, the A record is the full and “official” record, while additional SM Numbers are indicated with D records. A D record does not contain full information. An **F** record is *free*, and flags an SM Number that is available for assignment that is otherwise in a range that might be construed as active. Note that SM Numbers that are not in the file are free by definition. An **R** record is *reserved*, and indicates an SM Number that is probably free, but where there is some uncertainty. These are generally left alone. An **M** record is an active record but for a missing book, missing in the sense that it has never been seen in modern times, but it known to have existed from inter-book relationships.

The **OK** field is used for active records to indicate that the data is considered reliable, as opposed to uncertain, perhaps because the book has not been found yet.

The **Type** field is intended to be a coded field, meaning there are not supposed to be arbitrary entries. In most cases one of the existing types should be used, unless a new official type is to be created. Minor differences should be placed in the notes field rather than modifying the type.

The **Start** and **End** fields give the “best” date range for the included material. This generally omits missing pages at the start and end, and also may omit a “stray” or errata range when it is non-contiguous with the bulk of the entries. Such strays are flagged in the notes field. The dates are in YYYYMMDD format, with leading zeroes on months and days as necessary. Note that Excel does not directly handle dates prior to 1900, so these are not of a date type.

The **Location** field indicates where the original paper book is, and generally its owner. HOFU means the Hopewell Furnace NHS. Other known locations are the Historical Society of Pennsylvania (HSP), The Chester County Historical Society (CCHS), and the Berks History Center (BHC). “Unknown” means uncertainty, as opposed to “Destroyed” or “Missing.” The latter two are currently not in use. Missing may get applied to books that were in hand previously but have resisted significant efforts to find them.

The **Scan** field indicates whether the book has been scanned (digitized).

The **MF** fields indicate microfilm roll numbers. This is not a clean concept. A book may be on a single roll, be duplicated on multiple rolls, be split sequentially between multiple rolls, have even and odd pages on different rolls, or not be filmed at all. Further, past microfilm indices are not completely accurate. A roll number starting with “BC” means a roll identified as coming from Berks County; BC1 is not the same as plain roll 1. Numbers flagged with an “\*” were found to be accurate in 2015 or 2016. Additional microfilm rolls or possibilities may be in the notes field.

## Access to the Furnace Books

*Anyone desiring access to furnace books will need to consult Hopewell staff for assistance, regardless of the physical form of the books (original paper or microfilm).*

Most of the existing books have been scanned, at 400 DPI in RGB24 format. These files are uncompressed and run on the order of 80 MB per page. A set of reduced resolution color JPEG compressed files is available, at several hundred KB per page. Of the remaining books, most have been recorded on microfilm, which can be viewed on a reader at the Hopewell library. A few books are available only in original paper form at various regional historical societies, which will have to be contacted to arrange access. Most of the books available in digital and/or microfilm form also exist in their original paper form and are owned by Hopewell. Note that there are a few books that are missing, and not available in any form.

The index indicates the available forms. Generally, the scanned images are the preferred mode of access, so first check the Scan flag. If an MF field contains an “\*”, then the book can reliably be found at Hopewell Furnace in the microfilm library. If there is an MF number without an “\*”, the film may or may not contain the book, you will have to look. If the Location field contains an actual place, the paper book was last known to reside there, and you will need to contact the staff there to see if the book is available. Note that for several books, microfilm is the only known form, even though the paper book is presumed to be hiding somewhere.

## Report Structure

Following this is an overview of the furnace books and of related accounting concepts. Most of the remaining sections of the report give details for each of the following classes of book:

- General Ledger
- Main Journal
- Daybook
- Store Journal
- Store Ledger
- Cash Book
- Blast Book
- Time Book
- Canal and Railroad Book
- Molders Book
- Order Book
- Hauling Book
- Bill Book
- Miscellaneous Book

Finally, there is a description of the sample relationships diagram, and the complete books map.

## 2. Overview of the Furnace Books

The general format of Hopewell books will be familiar to those familiar with accounting, although they do not conform to modern standards, and in particular, double entry accounting was not used. There

are also inconsistencies, and particular notes for Hopewell's case. This section provides a general overview of Hopewell practices and related accounting concepts.

## Book naming

In modern times the physical books have been given unique identifiers, known as "SM numbers," for "source material." The books generally did not have identifiers in the historical period. There would be, for example, a current daybook, and the clerk knew very well where it was, so there was no need to name the previous ones. The exceptions are general ledgers, which frequently had letter names, but these repeated. Today, however, they all must be uniquely named so they can be reliably referenced. Prior historians chose to call these "source material" and assigned them SM numbers starting at 1. (Non-furnace book documents are identified in other ways.) Note that the numbers were assigned seemingly at random, rather than by date or some other criteria. Most reports refer to data from a furnace book by SM number and page, with no bibliographic entry. Care must be exercised as this simple system did not stay that way. Some books have been called parts 1 and 2 (or A and B) of the same SM number, and some single physical books have had multiple SM number parts assigned to them, sometimes inexplicably. There is also a possibility of duplicate SM number assignments, and books that were never referenced and hence never assigned an SM number. When reading reports, keep in mind that references to furnace books were sometimes given by a book type and date range instead of SM number, and that the type and/or dates are sometimes inaccurate.

There is a minor structure to SM numbers in modern times. Numbers with a numeric portion on 1-87 are known books, taking into account duplicates and possible missing ones. Numbers on 88-99 are believed to have never been used, but this range is held reserved in case any previously missing and numbered books turn up. Numbers in the range 100-122 represent books that have recently come to light (100-106) or only recently been numbered (121-122). The interior of the block (107-120) is free and is being held for newly discovered books that do not have a number from the block starting at 123. Numbers starting at 123 are used for currently missing and never-seen books that are known to have once existed, which are named so that reports can easily reference where missing data would have been found. Note that not all potentially missing books can be known to have existed, so there may exist "dark books" that are not assigned SM numbers in the missing (from 123) range; if they turn up, they get numbers in the 107-120 range.

## Overview of Relevant Accounting Terminology

This is an extremely brief overview of accounting concepts relevant to understanding the furnace books, given in modern terminology. The terminology differences are outlined in the next subsection. The general flow of accounting is that information is entered in *journals*, journal entries are transferred to *ledgers*, and *financial statements* are prepared from ledgers.

**Journals:** Financial information is directly recorded in a *journal*, where a journal is "the book of original entry." There might be many journals, consisting of various specialized journals plus a default *main journal*. Today, a *daybook* is the same thing as a journal. So the storekeeper might have a store journal, someone handling cash might have a cash journal, etc. The key concept is that entries are made one after another in *chronological* order. There is no direct way to tell from a journal how much money a particular person or entity spent – you have to read the entire journal for the desired date range and add up everything of interest (and not miss anything).

**Ledgers:** Questions about a particular entity are answered by *ledgers*, which are organized by *account* rather than by time. Journals are periodically *transferred* or *entered* into a ledger. For a manual (i.e., paper book) process, accounts are added sequentially to new ledger pages as new accounts are needed. If a new person appears in the journal, then an account is started for this person on the next free ledger page. During an update cycle, the journal is scanned in sequence and each entry is copied to the appropriate ledger pages, sometimes with consolidation (i.e., separate entries for sugar, flour and tobacco turn into a single entry for store goods). Once a round of ledger updating is complete, then all the transactions for a person will be together on a single page (with possible overflow pages), and can be easily added up. There can be multiple specialized ledgers, as with journals. There is a single *general ledger*, which contains the most common and important accounts, such as income.

In a normal ledger, each account is split into two parts, *debit* and *credit*. These are always together, either splitting a single page or on two facing pages. Debits are on the left, marked “Dr.” and credits are on the right, marked “Cr.” The account for a worker would record, for example, store purchases as debits and wages as credits, among other possibilities. Each side can be totaled, and the difference between the two sums tells the account’s position with respect to the furnace.

**Financial Statements:** These are high level summaries of the furnace’s financial position, such as a balance sheet or a profit and loss statement. These are prepared from the ledgers. Hopewell staff does not know of any extent financial statements in the modern sense.

## Hopewell Terminology and Practice

Hopewell’s historical period terminology is not always consistent with modern terminology, and it sometimes is inconsistent within the books themselves. This report will generally follow period terminology in order to match the books. This is an outline of period terminology and its relationship to modern terminology, plus an overview of period practice as it differs from that described above. The general accounting flow is that information was recorded into various “books,” which were then *journalized* into a *main journal*, which was then transferred into a *general ledger*. There was also an intermediate *store ledger*.

Hopewell used the term *book* in a general sense, so instead of *cash journals* there were *cash books*. The default book for entering everything that did not have a specialized book was the *daybook*. Unlike modern practice, a Hopewell daybook is not the same thing as a journal, and a Hopewell main journal is not the book of original entry in the modern sense. Instead, various books received the original entries, and these were transferred to the main journal in a process known as *journalizing*. The main journal is generally neater than the books, and the journalizing process sometimes consolidates (removes detail), omits non-financial entries, and reorders entries. Be aware that the terms daybook and journal are not used consistently. In particular, frequently journalization notations refer to “entering in the daybook” when the entry is actually made in the main journal.

Only two types of ledger have been seen, *store ledgers* and just plain *ledgers*. The latter are *general ledgers* and are called such in this report. Unlike modern practice, the store ledgers were also journalized into the main journal. Note that the Hopewell general ledger does not contain all of the modern set of accounts.

Care must be taken with journalized entries, as information is sometimes dropped in the process. If the cash book tells why the cash was paid/received, the “why” may not be copied into the main journal.

Some entries for the same person may also be consolidated. Also, sometimes agreements are entered in the daybook and do not make it into the main journal or general ledger. So if you want to get complete details on payments, in general you need to look at the books feeding the main journal also. Various books are missing at various times, so you may need to piece together information from different books; the books map is helpful for this.

Hopewell did not use a double entry accounting system, but did seem to follow general accounting concepts in keeping its books. Day books and most journals record credits and debits sequentially down the page. The general ledgers and cash books use the standard left-right division, with debits (marked "Dr.") on the left and credits (marked "Cr.") on the right. Also note that in such cases the word "Contra" is used as a heading to identify the right side. The debit side of a ledger account is identified by the account holder, and the credit side is labeled "Contra." This is not the modern use of the term for account relationships. Store ledgers are debit-side only.

The word "sundries" is used in both the common sense of "various unspecified items" and also to mean "many." If there is a single journal entry for, say, the furnace paying amounts to various people for various things, there will be a single heading for the "furnace paying sundries." Sundries is not a special account, it simply means that there are multiple subentries following, equivalent to multiple "furnace pays X" entries. In the other direction, a set of entries for various people buying things from the store would have the heading "Sundries Dr. Furnace," meaning that each of the following subentries represents the specified person being debited, in order to pay the furnace.

Accounts are in the name of a worker, but appear to be for an entire household.

## Special Accounts

The bulk of accounts in the general ledgers are for people, including entities such as stove dealers and other furnaces or forges. Modern accounts, such as assets, accounts payable, etc., have not been seen. The *Furnace* account seems to have been in (almost?) universal use, and represents the business itself. Furnace is debited for wages paid and credited for items bought. At least one book uses a "general charges" account, although the difference between this and furnace, if any, has not been investigated. A *Repairs* account has also been seen, but transactions do not necessarily involve money to or from someone, and its nature has not been determined. A *Cash* account is commonly used, which consolidates cash payments into and out of the furnace.

No attempt has been made to locate and enumerate all special accounts; the reader must be watching for ones relevant to their project, and decide how to deal with them.

## Money Amounts

Earlier books record money amounts in pounds, with three columns for the standard pounds, shillings and pence format. There were 20 shillings per pound and 12 pence per shilling. Rates sometimes appear in an abbreviated format: "7/6" means 7 shillings and 6 pence and "3/" means 3 shillings, no pence. Later books are in dollars and cents. Most amounts are in whole cents/pence, but the resolution seen is a half cent and quarter pence.

It appears that Hopewell clerks used a uniform exchange rate of \$2.67 per pound. Beware however that the general conversion rate varied with both time and place (old travel accounts speak of "Pennsylvania money" or "Pennsylvania currency" since that had a different value than "Maryland money.")

## Banking

The furnace effectively functioned as a bank, with many transactions done on account rather than with cash. It is clear that cash was readily available to workers, but most transactions between worker and furnace appear to have been done on account. This was a paper and ink version of Electronics Fund Transfer (EFT). Wages were credited to accounts, store purchases debited from them, families paid each other for work through their accounts, and money could be withdrawn from them as cash.

It appears that the furnace was also capable of the modern banking function of money creation through credit. Wages appear to rarely have been credited more than once a month, and for some workers, possibly only once per year. Further, transfer to the general ledger was only periodic. Hence, there was no running indication of whether a particular worker's account was positive. In an accounting sense then, paying another family for work (i.e., laundry) on account could sometimes constitute the furnace extending credit, and hence money creation.

While not common, there are entries that appear to be people making deposits, having the furnace hold their money on account rather than keeping it themselves as cash. These take the form of cash "received of him" with no obvious reason for the person to have been in debt to the furnace.

## Page Numbers

Caution must be exercised when assuming consistency in book page numbers, as there are frequent problems. In general, there are two numbering schemes, paired and sequential. In paired, every pair of facing pages has the same number, with the left called "A" and the right called "B." Sequential numbering assigns the next number to each page, as in a modern book. However, sometimes the two are mixed, and there are cases with letters A-D. There are also cases where the page numbers built into the filenames of the scanned versions do not match the ink page numbers visible in the page images. (SM 60 is a particular example, where the page numbers and internal transfer page numbers do not match those in the filenames.)

The reader must also generally beware of missing pages at the ends and in the middle, and a few cases of pages from another book (and even the wrong type of book) being found in the middle.

## Missing Books

There are books known to have once existed, but there is no record of any modern era historian ever seeing them. They may simply have been lost, and there are also stories of CCC personnel burning some. Their former existence is established by inter-book relationships. For example, a missing main journal reveals much about its own structure by the journal page numbers in the receiving general ledger, and by the journalization notations in a feeding cash book (assuming these exist). However, there is no certainty that some seemingly missing books ever existed. In particular, some journals record cash transactions as journalization from the cash book, while others record cash transactions seemingly directly, implying that no cash book was in use at the time. Sufficient work as not been put into trying to resolve this question for all times. So some time slots can be filled in with information about a clearly once-existing book, while others must be left blank due to insufficient knowledge. In the former cases, SM numbers have been assigned to such missing books, and records added to the index.

## Consistency and Lack Thereof

At a very general level the books are consistent over time, and similar to books for the unrelated Hopewell Forge. However, at increasing levels of detail, numerous exceptions should be expected to what is described here. Users must be prepared to recognize and resolve any problems that might impact their specific project, without expectation of seeing any warnings in this report. This report is intended to shorten your learning time, not tell you everything you need to know.

## 3. General Ledgers

The bulk of a Hopewell general ledger (GL) is made of accounts for workers (households). There may also be accounts for other companies, and a few special accounts. The only special account that seems universal over time is the *Furnace* account, representing the business itself. Purchases from the store are credited to furnace, and wages are debited from furnace. See the general comment on special accounts, above.

General ledgers usually contain the least detail for a set of transactions; the main point is to get the final money amount. You frequently must consult the main journal or an earlier book to find more detail.

The general ledger page number (GLPN) is partially an account number for the account, although only temporary, and frequently not unique. Accounts with many transactions usually get their own page, while several little-used accounts may occupy the same page. When a page runs out of room, the account is transferred to a new page later in the ledger, usually with forward and backward links. For example, the furnace account will almost always occupy multiple pages in a single book. The GLPN can be used to resolve questions of spelling, Jr. vs. Sr., etc. It also appears in the main journals as part of the transfer process, and provides a link between main journal and general ledger.

### Identification

Unlike other books, most or all of the general ledgers are named, by a letter "A" through "E." When an A ledger is full, accounts are transferred to a B ledger, etc., and E wraps around to A. So GL names are not unique, you have to watch the dates. When a ledger book is full, or a desired stopping date is reached, then all accounts are carried forward into a new book. The new ledger will reference the old ledger by its letter-name and by the page, where pages are called *folios*. Carries internal to a ledger mention only the page. Sometimes the old ledger tells where the account was transferred to (new ledger letter and page).

### General Format

Some ledgers, apparently the older ones, use a two page format. The left pages (A pages as scanned) are on the debit side and are labeled with the account name, while the B pages are on the right (credit) side and are labeled "Contra." Each account occupies a page pair. In other books, an account is on a single page, and page is divided in half, with the usual debit on left and credit on right. Otherwise they have the same format. Note that there are cases of the debit side encroaching into the credit side.

The detailed structure of the debit and credit sides is the same. The first column contains the date. Note that the year can change part way down the page. Next is the description. Next is the page number of the main journal from which the entry was copied. The journal is not identified, rather it is implied by the date. The right-most column has the amount. Note that journals are entered in sequence, so for a



given account, the journal page numbers are non-decreasing. The exception is when a new journal is started with the same ledger, and the page numbers restart low (but not necessarily at 1).

When space on the current page is exhausted, the account is carried or transferred to a new empty page. The carried money amount seems to be only debit or credit, but one example has been seen for the furnace where both its debit and credit sums were carried forward in the same book. However, in one example, the carry from the previous book was a net credit-side-only balance.

When each account page is finalized, the debit and credit sides are made equal. When the two sides are unequal, the difference is entered on one side and carried, then added with the remainder of that side to get a sum equal to that of the other side. See the books sample, below.

## Reconstructed Ledgers

Earlier historians attempted (with varying success) to reconstruct several of the missing general and store ledgers from the journals that fed them. This can be done in general, since the ledger is supposed to be a mere reorganization of the journal information. These are identified in the books database. Note however that the quality of the work varied, and several should be used only with care, if at all.

## 4. Main Journal

At Hopewell, the main journal was the place where financial transactions were re-recorded, neatly, from the daybook and other books. It is possible, but not verified, that sometimes a day book was not in use, in which case original entries would have been made directly into the main journal. This uncertainty is due to lack of some daybooks, but not knowing whether some are simply missing or never existed.

Main journal entries involve payments to workers and vendors, purchases from the store, payments from dealers, transfers between workers, cash deposits and withdrawals, and any other transaction involving money. Be aware that this was not used as a diary. The journal does not state "X repaired Y," but rather that X was paid some amount to repair Y. For example, when a worker (X) repairs the bellows (Y) he gets paid some amount. There may be some useful details in the entry beyond the names and amount, but if no money changed hands for an action, it appears unlikely that the action got recorded in the journal.

Each page usually has a date at the top, but a page can contain multiple dates, and a single date can span multiple pages. Note in particular that only the page-top heading has a date in large glyphs. The horizontal line that separates groups of entries usually has a gap in the middle into which goes either the ditto mark, meaning "same date," or else a new date, which can be quite small, and may not contain the month if it does not change.

## The Basic Transaction

The basic transaction is "party A pays party B X." This has a heading of the form "A Dr. to B." The "Dr." is the standard accounting abbreviation for debit. So the heading reads "A's account is debited and the money is credited to B's account." Either party may be a person, firm, or special account. If A buys something from the company store, this would be "A Dr. to Furnace." If worker A is paid for work done for the furnace, this would be "Furnace Dr. to A." Under the heading is a more complete entry that specifies the amount and some sort of reason, although the reason is sometimes degenerate (i.e., "paid him").

## Multiple Transactions

In addition to the one-to-one basic transaction, one-to-many and many-to-one are also possible, under a single heading, although not many-to-many. Both of these involve multiple parties either paying or getting paid by the same other single party. In this case the heading uses the term *sundries* for the multiple parties, with the individual parties listed below. The most common case is for a number of store purchases. This has the heading “Sundries Dr. to Furnace” and is followed by the individual buyers, items and amounts. The form “A Dr. to Sundries” is also used, meaning that A owed money to several parties, and these are listed below as individual transactions, but all under a single heading. This is common when the furnace is paying wages to a set of workers.

## Journalizing

Usually, but not all the time, specialized books (such as the cash book) are copied, entered, transferred or *journalized* into the main journal. This means that the entries are copied, although not necessarily with all the details, and sometimes with consolidation. Note that journalization notes frequently state that the transfer is made to the daybook, but it appears to always go to the main journal.

Daybook journalization can involve non-trivial rearrangement of entries, especially for grouping. For example, if there were two groups of store purchases close together in the daybook, they might get consolidated in the main journal. This can result in entries not having the same date order in the two books. If you are searching for the corresponding entry in the other book, you may find it several days away. Note that daybook journalization was usually not noted in either book.

Other books, such as the cash book, usually have explicit notes on journalization. The book will have a notation as to where in the main journal the transfer was made, and the group in the journal will have a corresponding notation. Typically, the journal header states that the following are for transactions from a specific date up to the present (journal page) date in the book. If a store ledger is being journalized, the header might be “Sundries ... Due to Furnace for store goods & provisions received since <DATE> up to this date as P. store ledger.” Following that will be a list of individual transactions.

## Transfer to the General Ledger

All main journal entries must be transferred to the general ledger in order to determine the status of accounts. Each account occupies a single page (or part of a page) in the ledger at any time. To facilitate this transfer, Hopewell clerks generally wrote the GLPN next to each party in the journal. These are the 1-3 digit numbers on the left side of the journal page. Ledgers are not necessarily synchronized with journals in time. It is possible for a ledger book to run out of pages, in which case the next transfer will see the ledger page for a journal drop rather than stay the same or increase. You need to know which ledger is the current one, and this appears to never be stated. This must be found by date, or using the book map.

## 5. Daybook

At most (but not necessarily all) times, the current daybook was the book of original entry instead of the main journal, for all transactions that did not have their own specialized book. It is possible that there was always a daybook, but missing books make this difficult to be certain about. Most, but not all, daybook entries were journalized to the main journal. In some cases, day book entries were consolidated in the process. The daybook is generally sloppier than the main journal and has no GLPNs.

A daybook may or may not have main journal page numbers that indicate where the entry was transferred. However, some indication is generally present to indicate that an entry was journalized. The most frequent is a check mark in the left column, but it appears that scribbling over them was sometimes used.

The daybook otherwise looks just like the main journal, and the above descriptions of transactions and journalization also apply here.

## 6. Store Journal

A store journal is the daybook of the company store. Transactions were recorded as items were bought, in chronological order. It has the same format as the main journal. In general, the headings are always "Sundries Dr. to Furnace." The reason it looks more like the main journal than the daybook is that the entries are transferred to a store ledger instead of the main journal. The numbers in the left column are *store ledger* page numbers, not GLPNs. It is the store ledger that gets journalized to the main journal. The format descriptions for the daybook and main journal otherwise apply here.

## 7. Store Ledger

A store ledger is a reformatting of a store journal but organized by account instead of time, just as the general ledger relates to the main journal. The description of the general ledger applies here, except that there is no credit side to the accounts. Store ledgers are journalized to the current main journal.

## 8. Cash Book

A cash book, if it existed, recorded cash transactions involving the furnace. The furnace could buy things from outside vendors with cash and be paid cash by dealers, although intermediate credit was usually involved, and notes could also be used. Normally worker transactions were on account, but a worker could get cash and deposit cash. Cash transactions were sometimes entered directly in the daybook, but at other times a separate cash book was used to record these. New entries from the cash book were usually, but apparently not always, periodically journalized into the main journal. It is not clear what happened to entries not journalized, as this is complicated by missing books and missing pages in existing books. Independent of this, cash book SM 67 is weird.

### General Format

A cash book consists of alternating *cash* and *contra* pages. A cash page is for cash taken in, while a contra page is for cash going out. Cash coming in (i.e., a worker deposit or dealer payment) is credited to the other party's account, while cash going out (i.e., worker withdrawal or furnace purchase) is debited from that account. (At least at some times, the furnace also maintained a *cash* account, so consolidated transactions would be credited or debited against that, to reflect total cash movement.) Cash is the page on the left, contra is on the right. Cash outgo was much more frequent than income. Hence most cash pages are either only partially filled or empty. Sometimes the corresponding contra page is carried over (backwards) to the lower part of the cash page. Note that the page following a cash page is always a contra page, i.e. cash page then contra page and so on. They always alternate.

Transactions are recorded in date order down the proper page (cash or contra) until the page is full, or else it is time (for whatever reason) to journalize the accumulated transactions. If the end of the page is reached with no journalizing, the amounts are totaled and carried forward to the next cash or contra

page. In this case, that next page starts with an “amount brought forward” entry at the top. An un-journalized group of transactions, with a running total, can be carried across many pages. When journalization is done, the balance resets to 0, and there is no carry-forward. It is possible for journalizing to be done mid-page, with a new set of transactions, and running total, starting immediately.

Note that detail may be lost in journalizing. If particular, there are cases where several transactions of the furnace paying for things are consolidated into a single main journal entry for the furnace paying only the total amount.

### Cash (cash in) Examples

Two forms of cash-in transactions are common. The first is a purchase, entered as “to furnace received of ... for ...” The second is a deposit, with two variations. A deposit into one's own account is “to ... received of him” while a deposit of money from someone else is “to ... received of ...” The latter is one person paying another, but by depositing cash in their account rather than paying cash in person.

As an example, consider pages 9A, 10A and 11A of cash book SM 31. As “A” (left) pages, these are cash (cash in) pages and marked as such. Note the “Dr.” notation: “cash” is being debited as, say, Philip Filman on p. 10A gives up his \$0.50, but his account will be credited. The balance brought forward onto p. 9A is immediately journalized. The main journal date and page number are given. A new group of transactions is started immediately, and carried first to p. 10A and then to 11A. This is then journalized. Note the sudden drop in main journal page number, which means that a new main journal book was started. This must be located by the entry date, which turns out to be p. 1a of SM 32.

For the journalization, consider p. 1A of SM 32. Its headline date is 13 April 1846, but half way down is a horizontal line with a very small “may 1” in the middle. The header is then “133 Cash Dr to sundries, Rec since 1st April last up to this date as of the cash book.” The “133” is the GLPN for the cash account at this time. “Cash Dr” means that people's cash is “debited,” they are giving it in to the furnace, they now have less cash in their pockets. Then each line contains the “to” person or entity and their corresponding GLPN, plus the amount.

### Contra (cash out) Examples

Contra pages are exactly like cash pages, except that the cash is flowing out from the furnace. These are “B” or right pages. Each contra page is marked with “Cr” meaning that “cash” is credited, that someone is getting the cash. However, of course, their account is being debited for the same amount.

Examining p. 10B, most transactions involve people getting cash. When the furnace pays, it is buying something or paying for work in cash. The person being paid for shoes in Philadelphia presumably represents the company store paying cash to buy shoes as agent for the person, whose account will be debited. “Paid him in full” is probably a cash withdrawal. “Paid for a Bible” probably means that the store bought a bible on someone's behalf, just like the shoes.

This contra section continues until the middle of p. 11B, at which time it is journalized. In the main journal, this starts immediately after the cash transactions. The header is “133 Sundries Dr to Cash paid since 1st April last up to this date as of cash book”. Then the individual transactions are listed, but without the detail seen in the cash book. At the end of a page there is a subtotal, but this is for the main journal section on this page only, it is less than the total indicated on p. 11B of the cash book, since the

transfer is not complete, and carries over to the next main journal page. There, the header is repeated, and the remaining transactions found. An important point is that there seems to be only one line for all furnace payments, all furnace payments are lumped in the last entry. Again, the subtotal is only for this page. If this is added to the subtotal of the previous page, you get the amount from the cash book.

## 9. Blast Book

A blast book records details of what was made during a blast. A blast is nominally the period from when the furnace is blown in to when it was blown out, but there is difficulty with the accounting for stoppages. Nominally a blast is identified as "Blast of 18xx," which means it started in that year and went until they decided it was over (rather than temporarily stopped), frequently but not always into the next year, and possibly glossing over stoppages in the middle. Mostly the blast books do not directly identify the span of the blasts, but SM 60 is an exception, with most blasts specified by dates and times for "putting fire in the furnace," starting ore, starting the blast, and then blowing out. (Note that some time books also contain this information.) In general, readers must use caution when determining blast intervals.

Most blast books follow a general form where there is a complete list of loads sent to various places, split into pig iron, gate metal and castings. Most quantities are listed along with a running total. For common stoves there is a matrix that shows production of stove type vs. date, and then there is a list of "sundry castings."

There is generally a section for pig and gate metal, organized first by recipient and then by shipment. Each recipient has a block, headed by "Account of Pig/Gate Sent to ...", and then a list of shipments, described by date, "By Whom Sent" and weight in tons/hundreds, and possibly with a running total. Each section should indicate where the total is journalized to, but beware of historian notes.

The stove matrix is organized with one row per delivery, which includes the recipient and the hauler, notes, date, plus a matrix showing how many of each stove was shipped. The notes section may include a table of stove weights.

There is evidence that tables are not precisely split by page boundaries between blasts, meaning that a page that is nominally for one blast may be split, and include a table for the previous or next blast. It is important to match the blast book to the corresponding journal to see where the journalization went.

Beware of stove sales in blast book vs. journal listings. The stove matrix gets journalized sometime after the end of the blast, and generally, multiple shipments from the matrix get consolidated into one block in the journal, and all these blocks are contiguous in the journal. However, stoves can be sold outside this recording system, where an entry appears elsewhere in the journal (and presumably in the daybook) but not in the blast book matrix. This means that the journal must be daybook/scanned carefully in order to ascertain all the stoves made during a blast.

SM 60 is partially different. It starts with various notes for each blast, and then has a data section for each blast. The data includes weekly production data for the furnace, then a record of pig iron shipped to various places, with occasional notes indicating that they cast some random plates. No general casting was done in this period, so there is little of note.

## 10. Time Book

Time books have several sections, consisting of remarks, time tables, and miscellaneous records. The remarks and time tables are organized by month, and sometimes include useful information about the blasts, including start-up data and reasons for stoppages. The time tables record work done, in resolutions of a quarter day, frequently but not always for unspecified work. Note that most furnace work (keeping, filling, etc.) is recorded in the daybook instead.

## 11. Canal and Railroad Book

Originally all furnace input and output was transported solely by wagon. No canal or railroad ever entered the furnace proper, but both eventually came through the region. As this occurred, output was taken by wagon to the nearest canal landing or railroad station. These books record such loads. Generally, they list what was carted, broken down by type of ware, date and who it was for. These appear to not have a direct relationship to any other books, meaning that what got journalized was based on the sale and not the act of shipping.

## 12. Molders Book

A molders book details work done by a molder. They are organized by molder, and generally have two sections showing what was credited (not necessarily made) by date. One section is a table for common stoves, the other is a list of everything else. The molding data is making its way into the main journal, but the molders books contain no references to journalization.

## 13. Order Book

This is a record of casting orders, organized by customer. It is not clear that these are related to any other book, and no investigation has been done to confirm their apparent details. It appears that the list is a running record over time of what was ordered. The meaning of the dates at the page tops is not clear, as it does not seem that all the orders were made at the same time (otherwise separate lines for the same stove type would have been consolidated). It appears that the left column of numbers is the number originally ordered, while the lists of numbers in the right column represent the record as cast or shipped. For example, for an order of 12, it appears that "7 2 2" means that they first cast (or shipped?) 7 stoves, then 2 more, and then 2 more, and never cast the final one.

## 14. Hauling Book

These are random records for hauling various things, including iron, castings, ore, corn and others.

## 15. Bill Book

There is one bill book, SM 78. This is a running record of when someone was billed, the amount, how long the credit was good for, and when the bill was paid (or protested).

## 16. Miscellaneous Books

They contain all sorts of things, including ore hauled, time accounts, victuals eaten, others.

## 17. The Sample Books Diagram

The “Sample” tab of the companion spreadsheet is a concise example showing a set of common books and their most common relationships. This is further described in this section. Note that it can only be representative of the actual books, as many of the low-level details vary frequently. For this reason, and to keep the example small, a synthetic set of books was created rather than using excerpts from actual books. However, readers well educated in the Western Classics will have no difficulty recognizing the personalities and events depicted.

The example shows a full set of the most common books that are inter-related. Note that there is no certainty that cash books, store books and/or daybooks were used at all times, or were sometimes not used, so the reader must beware. For this set of books, the store journal feeds the store ledger; the store ledger, cash book and daybook are journalized into the main journal; and the main journal feeds the general ledger. Various lines show related elements, although not all possible lines are included, in order to reduce clutter. A brief explanation of the set follows.

**Cash Book:** The cash-in page shows the furnace receiving cash, first for a non-account holder who buys store goods with cash, and by Sir Bedevere making a deposit of money that he does not wish to hold as cash. Note that the reason for his acquiring it is not relevant to the furnace and is usually not recorded. The notion that cash is debited is interpreted to mean that the other party gives up cash; the furnace acquires the cash, and the other party’s accounts are credited. The cash-out transactions are shown split across two pages, and both represent withdrawals of cash, just as from a bank. Arthur and Bedevere acquire cash, but have their furnace accounts debited. All transactions are journalized.

**Store Journal:** Purchases on account from the company store are recorded as they are made. (The Camelot store appears to have carried a greater variety of merchandise than the Hopewell store did.) Note the forward and backward linking with the store ledger using the respective page numbers. Also note the potential consolidation of entries and loss of detail from the journal to the ledger.

**Store Ledger:** The chronological purchase record is reordered by account (purchaser) as the primary sort, with entries remaining chronological within account. Note the potential consolidation and loss of detail, and the page number linking with the journal. The consolidated transactions for a date are journalized into the main journal as shown. The primary linkage between the store ledger and main journal is the date; sometimes a journal page number is present in the ledger notation.

**Daybook:** This records transactions that do not belong in the cash book or store journal. The “Furnace Dr.” entries are for the furnace paying for things, in this case, wages. The other two entries show the general nature of on-account transactions. In this case the furnace blacksmith is also doing private work, but rather than use cash, is paid on account. Here, Sir Bedevere needs some parts for his latest project, while King Arthur attempts to get some protection the easy way (he had much better success against the Black Knight than he ever did against Purple Worms).

**Main Journal:** This shows how the journal is the place of record for financial transactions, although with potential loss of detail. All upstream transactions appear here, in some form. Like the store journal, it is chronological, and is linked to the general ledger using forward and backward page numbers. Since only one journal page is shown, the backward link journal page numbers in the general ledger pages are all the same, which is rarely the case in real ledgers. The most significant point is that each journal transaction generates two ledger entries, one for each side of the transaction, and that “Sundries”

headings represent multiple transactions with one party being constant. So the “Cash Dr. to Sundries” represents two independent transactions, one between cash and the furnace, the other between cash and Sir Bedevere. The accounts for the furnace and Bedevere are credited, while the cash account is debited (even though the furnace is gaining cash).

**General Ledger:** This should be mostly clear based on the general description given above. Note that only four pages are shown despite the fact that six accounts are represented in the journal. Every journal transaction results in two ledger entries, one for each side of the transaction. Note the consolidation in the cash account entry, and be aware of the possibility for further loss of detail.

The possibly odd part is the method of achieving balance between the debit and credit sides at the end of the page. Usually, but not all the time, the difference is entered in the smaller side and added to the sum, so the two totals match. This difference represents the net carry-forward to the new ledger page or new ledger book. Sometimes a difference is settled in cash, in which case there will be a transaction indicated. Otherwise, this balancing entry is not a transaction. Note however that a balancing amount transfers to the other side of the ledger. In Arthur’s case there is a positive (net credit) balance, so it is added to the debit side of this ledger page, but carries to the credit side of the next ledger page. The carry out notation usually, but not always, tells where the carry is to, although this is not shown here.

## 18. The Books Map

This is the “Map” tab of the companion spreadsheet. It lays out all known and suspected but unknown books in a grid, by date and type. It directly shows missing material and relationships between books. Note that while the vertical direction is time, resolution is limited compared to the height of text, so descriptions do not always appear in an ideal location given their date.

The boxed areas with SM number titles represent books whose content is known. Yellow tinted areas within these represent pages known to be missing. Entire yellow tinted boxes represent books not known to us but that are known to have existed due to references from existing books. Empty areas that could be construed to contain books may or may not represent books that once existed, or may indicate where there is insufficient evidence to determine how many books were there. Blue tinted books are reconstructed ledgers and show the SM numbers assigned by prior historians; these numbers do not have a consistent relationship to other books.

The entries and arrows give example or landmark book entries that are related by transfer or journalization. These help trace information transfer from one book to another, and also provide future landmarks in case a suspected new furnace book is found. The “Furnace” entries trace the furnace account. This is useful for figuring out where main journals and general ledgers begin and end with respect to each other, and could be useful for determining the place of a future book.

The start and end dates must be handled with care since they are not always obvious. Many books are missing pages at one or both ends. Tabular books (such as blast books) frequently have an entire date range on each of many pages, so finding the earliest and latest dates is error prone. In these cases, the first and last dates may or may not be on the first and last pages. Finally, there are cases of overlap, where it appears that there were simultaneous parallel books, and also cases of a “stray entry” that is out of place with respect to the bulk of the book. Check surrounding books if completeness is important.