

# Burroughs Instruction Book

on

*Class 1  
Machines*

PROPERTY OF AND TO BE RETURNED TO  
**BURROUGHS ADDING MACHINE COMPANY**  
DETROIT, MICHIGAN

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## INTRODUCTION

This book will enable the student to acquire a thorough foundation of Burroughs Adding Machine construction.

The Class 1 Machine is used as the basis of instruction. It is not only the original Burroughs product, but it is also the foundation for the remarkable development of all other models. Its successfully sustained record, covering many years, is due to correct adding machine construction.

Knowledge can be obtained in two ways, viz.: By personal experience or by attentive study of successful practice, systematically arranged in book form.

It is not how much time is spent in study, but how much can be obtained in the time spent. The basis of efficient study is interrogative analysis covering every phase of the subject under consideration, which will naturally result in a complete knowledge of details.

As a guide to the student to acquire basic information speedily and accurately, a few self-questions are suggested. The more intelligent the questions that can be asked and answered by the student, the greater the progress.

## Burroughs Service

Service as *should be* rendered under the Burroughs Maintenance Agreements, is a source of assurance to the user that the machine will continue its efficiency.

The direct efforts of the inspector to do his work well, to actually *inspect*, requires attentive study so as to spend the time on such parts of the machine that really need attention. Avoid over-boiling and habitual routine. Reports should show individuality instead of having the appearance of form letters.

Sincerity of effort to do good work coupled with service training should impress the inspector with the fact that Service according to *Burroughs* requirements is low in price.

Careful and complete work on off-guarantee machines is the most effective demonstration of the advantages of the Service Agreements.

In rendering service to off-guarantee machines, it is advisable to look over the machine in general and make such recommendations for additional work as are needed, so as to avoid any early return call. This may cost the user more at the time but assures him a greater return for the amount spent.

Most all business concerns are only interested to the extent of the service that the machine is capable of giving, and in requesting service they expect a complete job, and are glad to receive recommendations, and often hold the company who rendered the service responsible if any other trouble arises, even though they only paid for certain adjustments.

### *Tools*

The condition of the inspector's tools reflect his method and his work. This is especially true of the screwdriver, the bit of which should be shaped to conform to the slot of the screw, which is square with a flat bottom.

Sharp or chisel-shaped screwdrivers slip out of and spoil the slot, and result in loose screws and other troubles.

### *Department*

All successful business organizations are built on intelligent service, and concerns such as the Burroughs Adding Machine Company, who market specialty devices, are known through their field representation.

It is therefore highly important that those representing the Company's interests feel their responsibility by rendering the best possible service, which consists of doing their work well and creating a good impression.

To render real service at all times and under all conditions, irrespective of the user's mood or mental state, requires *studied* tact; the art of pleasing others is a valuable tool of the inspector's equipment.

*Appearance.* Clean shaven, pressed clothes, shined shoes, clean linen.

*Speech.* Reserved, avoiding statements due to lack of information.

*Work.* Quietly and systematically.

*Caution.* Avoid accidental damage to office fixtures, dropping oil on rugs, scratching or leaving oil or alcohol on desks.

Considerate and attentive conduct is noticed by users, and promotes *good will*.

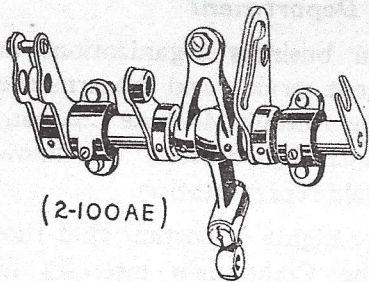
### *Inspector's Reports*

From the inspector's standpoint, the reports are the Company's means by which his efficiency and standing is determined.

Good work reported *carelessly*, or *incompletely*, is an *injustice* to the inspector. Poor work reported *artfully* is usually exposed by return calls.

The user's signature is the approval of the charge and must be secured *only* with the amount charge filled in. If objections are raised, they should be met with information by the inspector, based on authorized Company's instructions.

### 100 SECTION



(2-100AE)



(1-119A)



(1-180)

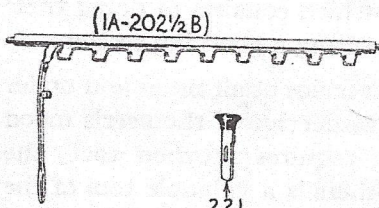


(1-181)



120B

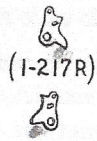
### 200 SECTION



(1A-202½B)



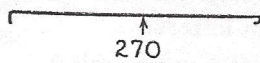
221



(1-217R)



(1-217L)



270



228BR

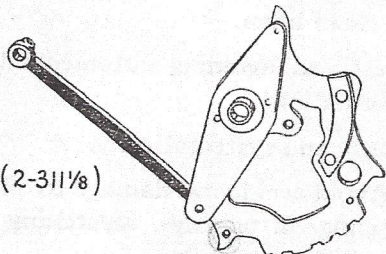


228BL



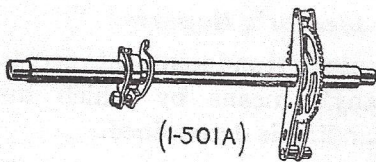
214A

### 300 SECTION



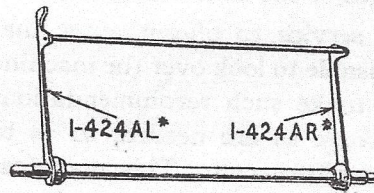
(2-311½)

### 500 SECTION



(1-501A)

### 400 SECTION



I-424AL\*

I-424AR\*

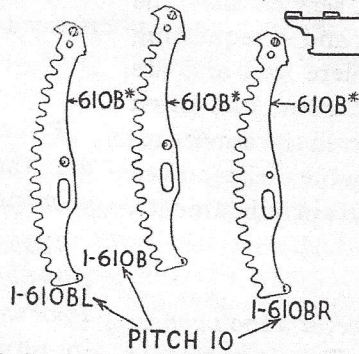


I-413



415D

### 600 SECTION



I-610B\*

I-610B\*

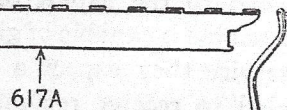
I-610B\*

I-610BL

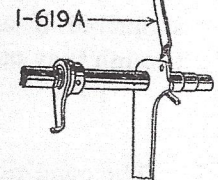
PITCH 10

I-610BR

I-610B\*

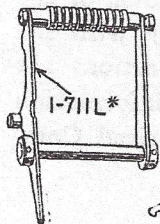


617A



I-619A

### 700 SECTION



I-711L\*



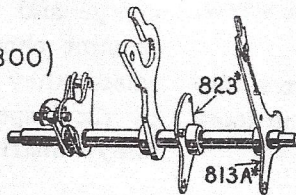
I-713AR



I-714A

### 800 SECTION

(1-800)

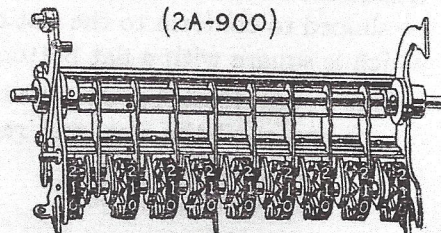


823

813A\*

### 900 SECTION

(2A-900)



## Practical Instructions for Students

It is assumed that the student understands the adding, carrying and the totaling process, as acquired during his interview.

With the case off of the Class 1 machine, depress the five-cent key. The student should now trace all movements of the machine, beginning with the key stem 221, observing that it engages the lever 1-217, and that the 1-217 lever draws the limit wire 270 in place at the same time moving the 214A.

The 214A raises the 415D, freeing the adding rack 1-610B, also moving the 1-424AL, thus locking the total lever and engaging the 228 pawl at the back end of the 214A.

Start the handle and observe that the 2-311 $\frac{1}{8}$  operates the 2-100AE and releases the 2A-900.

The 2-100AE on the forward stroke expands the 1-180 springs to furnish power for the return stroke. It also directly operates the ribbon and the carriage mechanism, and draws the 1-800 rearward through the medium of the 1-181 springs. The 1-800 disengages the accumulator and then the restoring bail 617A, also operates the 214A locking device (1A-202 $\frac{1}{2}$ B). The sectors are now free and timed to descend to their limit stops. Then stud 854 in 823 contacts with the 1-711L releasing the hammers to strike the type. After the printing has taken place the 1-714A trips the 1-713AR and breaks the toggle 120B. Slightly previous to the toggle break, the 813A draws the carry pawls (1-413) resetting device into action and this action is sustained until the forward stroke is completed.

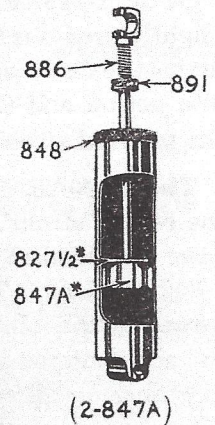
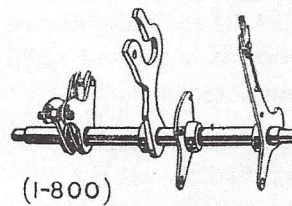
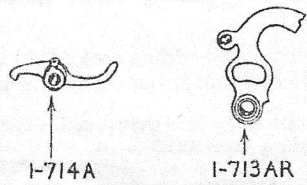
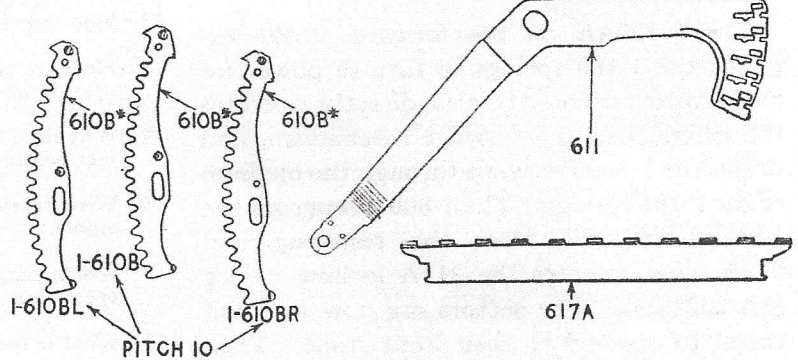
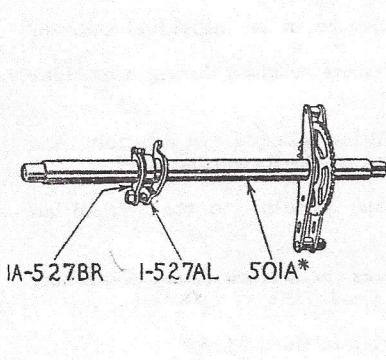
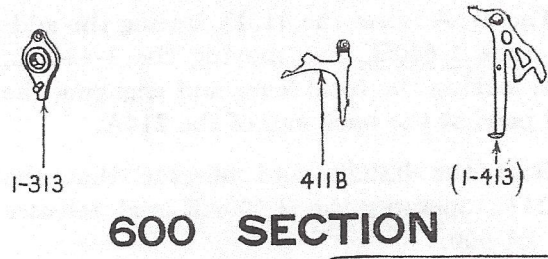
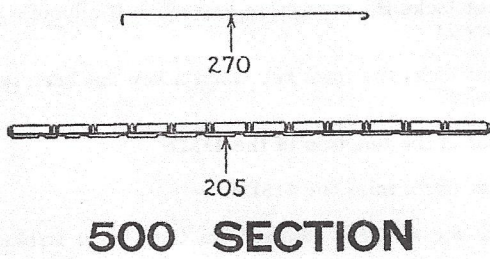
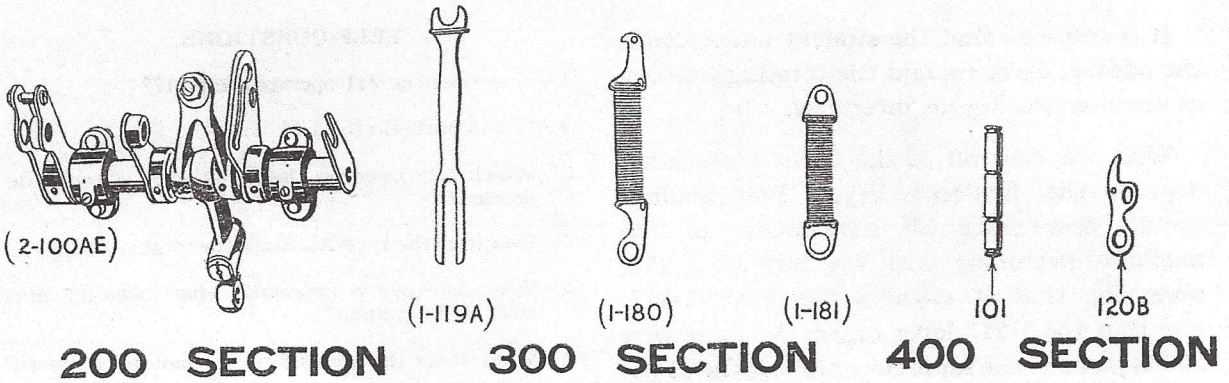
The 2-100AE drives the entire machine on the return stroke, acting directly on the carriage mechanism, the 2-311 $\frac{1}{8}$ , 1-501A and 1-800 sections. The 1-800 which is now returned by the solid connection 1-119A, engages the accumulator and also raises the bail 617A to gather up all sectors, and reset all springs.

The 2-311 $\frac{1}{8}$  releases the key and locks the accumulator just as the machine becomes normal.

### SELF-QUESTIONS

- 1—How does the 221 operate the 1-217?
- 2—Which parts do the 1-217 move?
- 3—Which part operates the 1-400 when a key is depressed?
- 4—How does the 1-424AL block the total key?
- 5—When one key is depressed what locks all other keys in the column?
- 6—What locks the keys when the handle is started?
- 7—What locks the correction key when the handle is started?
- 8—What locks the total key when a key has been depressed?
- 9—What is the function of the 415D?
- 10—What parts raise the 415D?
- 11—How are all keys released on the return stroke?
- 12—How are keys released in an individual column?
- 13—How are the hammers released during a machine operation?
- 14—Why does the printing take place at a certain time just before the end of the forward stroke?
- 15—What prevents the printing to the left of an amount?
- 16—Which part restores the sectors during a machine operation.
- 17—What is the function of the 1-714A?
- 18—Why does the 617A always descend its full distance irrespective of the movement of the sectors?
- 19—How is the adding section engaged and disengaged?
- 20—How is the adding section prevented from being disengaged from the adding racks during the totaling process?
- 21—What is the limit for the adding rack (610) when a number 9 key is depressed, handle forward?
- 22—When a key except a No. 9 is depressed, what is the limit for the adding rack (610)?
- 23—What makes it necessary to complete a forward stroke of the handle before it can return to normal position?
- 24—What drives the machine on the return stroke?
- 25—How does the 2100AE transmit power to the 1-800?
- 26—What section operates the feed of the ribbon?
- 27—What is the function of the 1-619A?
- 28—What section operates the carriage mechanism?
- 29—How does the 2-311 $\frac{1}{8}$  release the accumulator?

### 100 SECTION



## Tracing Operation

### Control

In order to protect the mechanism against violent operation, the power is transmitted on the forward stroke by the yielding connection of the 1-181 springs, which have a sufficient tension to do the work at a certain safe speed. A jerk will cause them to stretch, allowing the 2-100AE to go its full distance, but it is prevented from returning by the locking effect of the 120B toggle. The effect of the dashpot is to allow a gradual follow-up of the 1-800 so as to allow sufficient time for the 1-610B adding rack to limit on the 270 wires or 205 shaft; also permits the type to align in printing position before releasing the hammers; when all the functions have been performed, the 1-714A is tripped allowing the 1-713AR to unlock the 120B thus permitting the return stroke.

The 120B, 1A-527BR and 1-527AL form a link joint between the 501A and 101 shafts and when the machine is at normal, these links are at an angle.

At the end of the forward stroke, the travel of the 101 shaft has brought the center of the links and shaft in a straight line. A spring fastened to the 1-713AR and "527" links pulls the center of the links out of the straight line into the opposite direction; or in other words, the lips of the 120B limits this distance by contacting with the 501A shaft. The action of the 1-180 (main springs) is held up until the work on the forward stroke is completed, and then the 1-713AR strikes the 1-527AL, throwing the center of the links to the opposite side, thereby allowing the return stroke of the machine. The break of the 120B toggle is used as a standard for timing the other parts.

The speed of the return stroke is governed by the dashpot the same as the forward stroke, but the return stroke is protected during operation by the design of the handle mechanism and full stroke pawl 1-313.

### SELF-QUESTIONS

- 30—Why is the 1-119A slotted?  
 31—Why must the machine operate slower than the 2-100AE on a rapid stroke?

- 32—On a quick forward stroke, what prevents machine from restoring until all functions are completed?  
 33—Could the machine be operated with the 120B removed and what would be the result of violent operation?  
 34—Why does the 1-714A release the 1-713AR after all the hammers have released?  
 35—What would happen if the 1-527AL was out of alignment with the 1-713AR?  
 36—What is indicated if the 1-713AR fails to release the 120B toggle?  
 37—What are the functions of the spring 886 and leather washer 891?  
 38—Why will a larger hole in the plunger 847A cause quicker machine action?  
 39—Why is a baffle plate 827½ placed above 847A?  
 40—How is the correct amount of oil in dashpot determined?  
 41—What protects the return stroke of handle mechanism?

### Carrying

Observe that each figure on an adding wheel represents a fractional part of the wheel, just as 5 represents part of 10.

If we add enough units to produce ten, one must be automatically added to the next wheel. Carrying is therefore automatic adding.

The first column never receives a carry. Its adding rack therefore has a fixed limit to adding 9 only.

The other columns being subject to carrying have a variable limit (the carrying pawl 1-413 and stud 258) and all sectors adjust themselves to either limit, due to the slot in the (610) and springs, so that an additional one can be added.

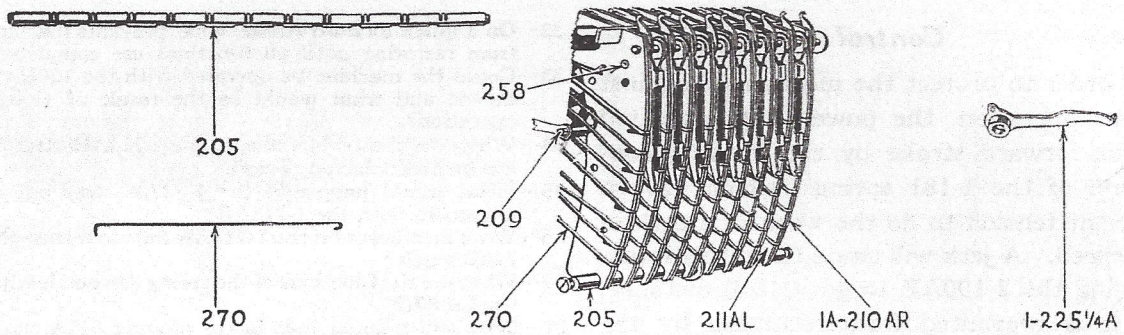
When an adding wheel makes a complete turn, its cam 924 shifts the carrying pawl 1-413 allowing the next (610) adding rack to move to the upper limit, thereby registering an additional one on the dial to the left.

Observe also that the 611 sectors that carry the (610) adding racks are the drivers. These driving sectors always travel the full distance. The slot in the (610) adding rack permits this when the 1-413 carrying pawl is not in a carried position.

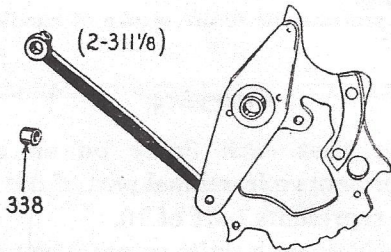
It is important to note that the 924 cam action can take place at any part of the return stroke. The carrying pawl is shifted and held out by the locking detent 411B. The extra one is not registered until the restoring bail 617A comes to normal position.



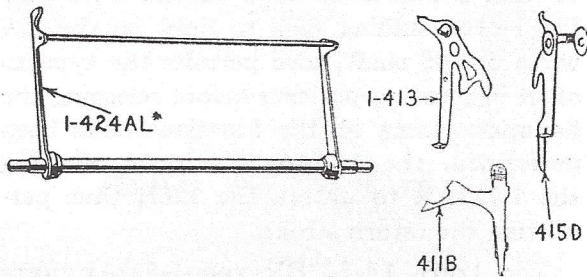
### 200 SECTION



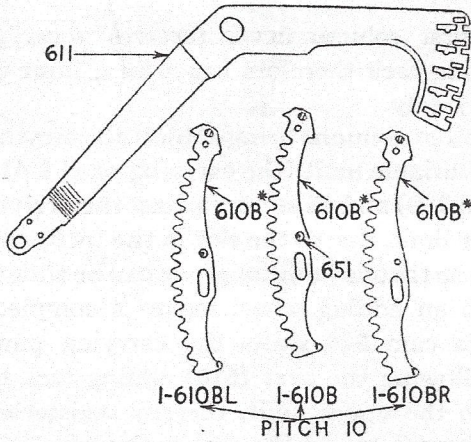
### 300 SECTION



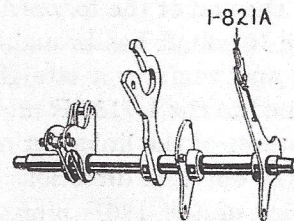
### 400 SECTION



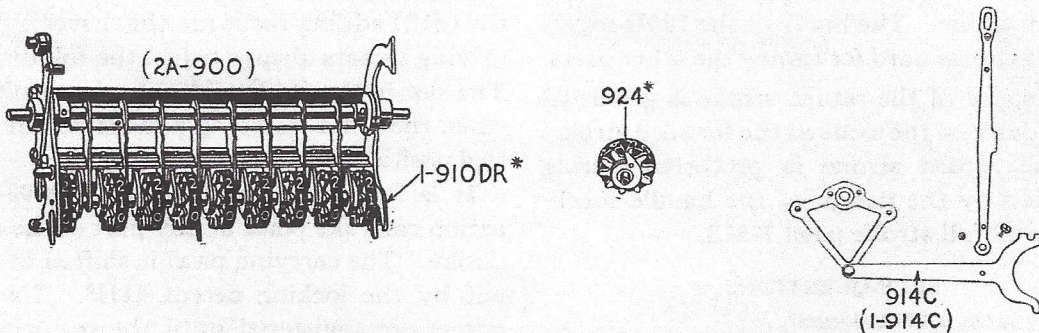
### 600 SECTION



### 800 SECTION



### 900 SECTION



## SELF-QUESTIONS

- 42—How many figures are there on an adding wheel?
- 43—Why must one be added to the next wheel when enough units are added to produce ten?
- 44—Why is the limit stud 258 placed in a different position in the first 1A-210AR and 211AL?
- 45—What prevents the adding rack 1-610B limiting against the 258 when the carry pawl 1-413 is in normal position?
- 46—As the sectors 611 are always driven a full distance, what causes the adding rack 1-610B to move to the limit 258 when the carrying pawl 1-413 is held out of position?
- 47—What moves the carrying pawl 1-413 when the adding wheel makes a complete turn?
- 48—What holds the carrying pawl 1-413 out of normal position after the 924 cam action has taken place on the return stroke?
- 49—Why is it necessary to hold the carrying pawl out of normal position after the 924 cam action has taken place?
- 50—When is the carry registered on the next adding wheel?
- 51—What is the fixed limit that prevents carrying in the first column?
- 52—Why is the locking detent 411B restored on the first stroke following a carry?
- 53—What restores the detent 411B?
- 54—When is the carrying pawl 1-413 restored to normal?
- 55—What restores the carrying pawl 1-413?

*The Compulsory Spacing Stroke*

The adding rack has four functions: locating the type, adding, carrying and totaling.

When adding an amount set up on the keyboard, the adding racks (610) and the type sector 611 travel as one part.

During the process of taking a total, the adding rack (610) and the type sector 611 must also move as one part in order to locate the type in printing line to correspond to the registration on the dials.

In the act of carrying, the adding rack moves independently of the type sector 611 which movement is registered on the next adding wheel.

When a machine is in carried position, it is necessary to take a spacing stroke before taking a total.

Suppose there was no 1-424AL in the machine, and a total taken, what would happen? This can be shown as follows:

Trip a 1-413 in a normal machine that has been cleared, force the 1-424AL out of position, depress total button, pull the handle slowly, note that the 611s all travel same distance and observe that the (610s) *not* carrying

remain stationary, but the one that *carried* travels with the 611, thereby canceling the adding wheel and losing the carry.

*Totaling*

The purpose of the totaling process is to automatically print the accumulated amounts and to clear the adding wheels. Instead of locating the type by the 270 stops, 415D latch and 205 shaft, the type is located by the cam of the adding wheel on the 1-413 carry pawl.

Register 5 in the extreme left column. Depress the total key and observe that all 415Ds will be raised, thereby releasing all adding racks. The 914C (of 1-914C) is disconnected from stud 958 and engaged with stud 959 $\frac{1}{8}$ . Operate the machine slowly and observe that the adding wheels will remain in mesh with the adding racks and those adding wheels which register figures other than ciphers will turn backward until the cam of the adding wheel limits on the 1-413.

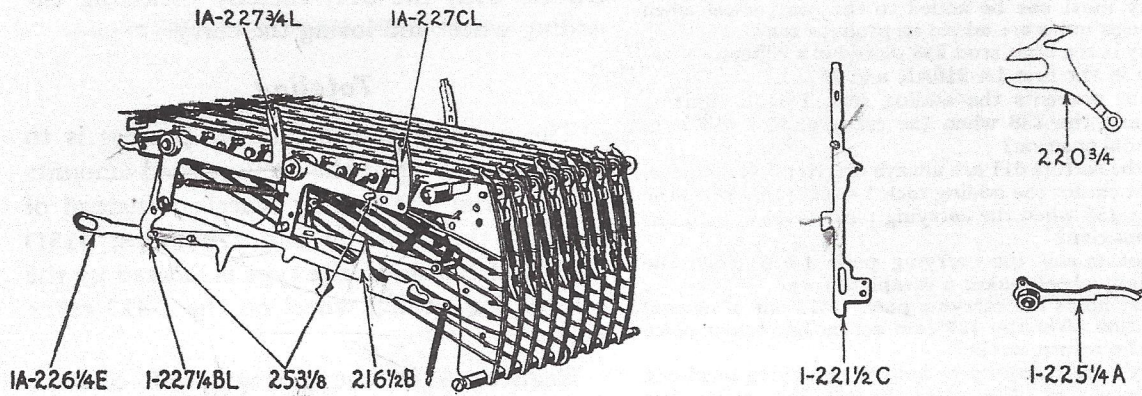
Since the adding racks are in mesh with the adding wheels the adding racks will move downward and locate the type. On the return stroke the 1-821A disengaging the adding section, the sectors are returned to normal independent of the adding wheels, and just as the machine assumes a normal position, the lower part of the 1-910DR is engaged by the roll 338 on 2-311 $\frac{1}{8}$ , which returns the adding section to a normal position.

Printing a clear signal when the counters are clear, or in printing a total where only a part of the sectors are used, the 209 shaft, which raises the 415D, is released before the end of the forward stroke, thereby locking the adding sectors that are engaged with such adding wheels as were clear and preventing unnecessary downward travel of adding racks.

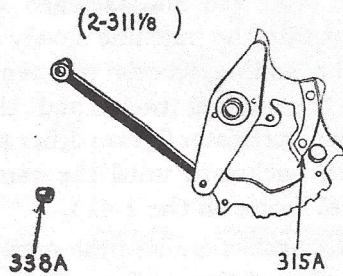
These results are obtained by the coupler 1-225 $\frac{1}{4}$ A which is pivoted to arm 227 $\frac{1}{8}$ . The latter also carries the 216 $\frac{7}{8}$ , which in turn holds the left end of shaft 209.

When the sub-total or total keys are depressed, the arm 1416 $\frac{1}{2}$ B on 1-1400 $\frac{1}{4}$  carries the coupler 1-225 $\frac{1}{4}$ A rearward. Before the end of the forward stroke, the

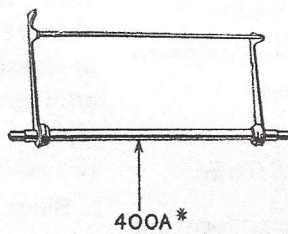
### 200 SECTION



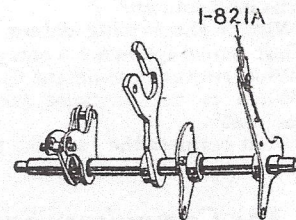
### 300 SECTION



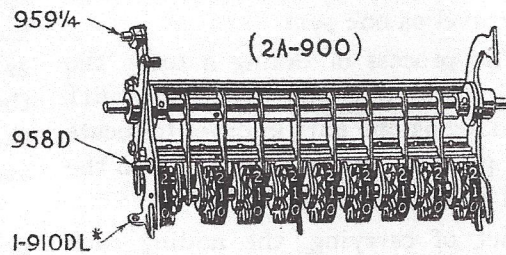
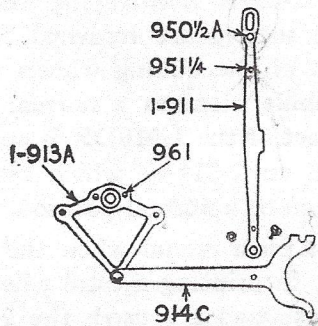
### 400 SECTION



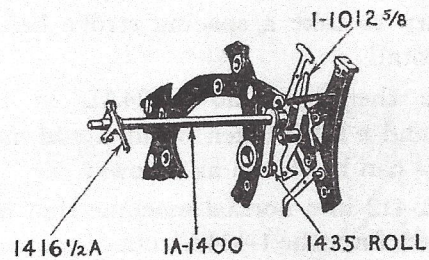
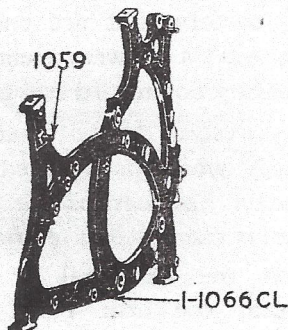
### 800 SECTION



### 900 SECTION



### 1000 AND 1400 SECTIONS



1-922BL releases the 1-225 $\frac{1}{4}$ A thereby allowing the 209 to return, releasing the 415Ds which now engage the upper step of adding racks.

#### SELF-QUESTIONS

- 56—When taking a total why is the type located by 924 cam and foot of carrying pawl 1-413?
- 57—When taking a total what is automatically done besides printing the accumulated amounts?
- 58—When there is an amount in the accumulator and the total key is depressed why does the 209 shaft raise the 415Ds?
- 59—Why do the 1-610Bs drop the full limit in the columns in which there were amounts, after the total is printed, and after the section is moved out of mesh, and the balance of the 1-610Bs held up by the 415Ds engaging the upper step of the 610Bs?
- 60—What releases the 1-225 $\frac{1}{4}$ A to engage the 415Ds in the second step of the adding rack when the total key is depressed and the machine is operated?
- 61—When the accumulator is clear and a total stroke is taken why are the adding racks held up?
- 62—Why does the roll 1435 on 1A-1400 locate on the front of the cam 315A on 2-311 $\frac{1}{8}$  when the total stroke is taken?
- 63—How does the roll 1435 prevent the depression of the total key after the forward stroke is started?
- 64—How does the 1-1012 $\frac{5}{8}$  prevent taking a second total stroke without restoring the total key?
- 65—Why does the stud 253 $\frac{1}{8}$  in 1A-226 $\frac{1}{4}$ E actuate the lever 1-227 $\frac{1}{4}$ BL?
- 66—What limits the depression of the total key?
- 67—What could happen if a second stroke could be taken after a sub-total without releasing the total key?
- 68—Why does the 914C engage the stud 959 $\frac{1}{4}$  on lower end of the 1-910DL when the total key is depressed?
- 69—Why is the slot placed in upper end of 1-911?
- 70—Why does the 1-821A engage the rear stud 961 in 1-913A, disengage the 2A-900 on a total stroke and engage the 2A-900 with the adding racks by engaging the same rear stud 961 on a listing stroke?
- 71—Why do the adding wheels remain in mesh with the adding rack on the forward movement of the total stroke?
- 72—When an accumulated amount is on the adding wheels what limits the movement of the adding wheels when the machine is cleared?
- 73—Why are the sectors returned to normal independent of the adding wheels?
- 74—How does the roll 338A in 2-311 $\frac{1}{8}$  prevent the 2A-900 becoming disengaged with the handle in normal position?
- 75—Why does the clear sign only print and the accumulated amount remain in machine when the 1-225 $\frac{1}{4}$ A is held out of engagement with the 1416 $\frac{1}{2}$ A?

#### Sub-totaling

The purpose of the sub-total is to print a total and retain the accumulated amounts on the adding wheels.

The sub-total key when depressed carries the total key down.

The link 216 $\frac{1}{2}$ B engages the stud 950 $\frac{1}{2}$ A (in 1-911) limiting the movement of the 1-911, which prevents the 914C hold on the adding section. Consequently the 1-821A cannot disengage the adding section on the return stroke and the adding wheels return to their original position.

#### SELF-QUESTIONS

- 76—Why does the 216 $\frac{1}{2}$ B engage the stud 950 $\frac{1}{2}$ A in the 1-911 when the sub-total key is depressed?
- 77—Why does the 1A-227 $\frac{3}{4}$ L depress the 1-227 $\frac{1}{4}$ BL?
- 78—What limits the depression of the sub-total key?
- 79—What is the function of the cam point on 216 $\frac{1}{2}$ B?
- 80—Why does the stud 951 $\frac{1}{4}$  in 1-911 raise the 216 $\frac{1}{2}$ B after a total?
- 81—With the total key depressed could the sub-total key be depressed if the cam on 216 $\frac{1}{2}$ B that engages stud 253 $\frac{1}{8}$  in 1A-227CL were removed?
- 82—Why do the adding wheels remain in mesh on both the forward and return stroke?

#### Non-Add Key

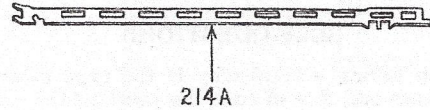
The purpose of the non-add key is to print numbers identifying groups of figures.

When the 1-221 $\frac{1}{2}$ C is depressed and the machine operated the 1-821A is prevented from engaging the rear stud 961 in 1-913A, which allows the adding section to remain out of mesh until the sectors have returned to a normal position before the adding section is engaged with the adding racks.

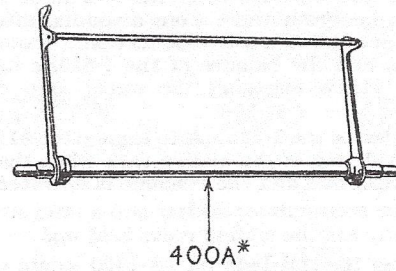
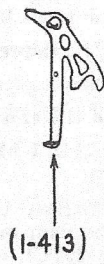
#### SELF-QUESTIONS

- 83—When the non-add key 1-221 $\frac{1}{2}$ C is depressed why is the 1-821A held out of engaging position with the 961 stud in 1-913A?
- 84—What prevents the depression of the total and sub-total keys when the non-add key is depressed?
- 85—What holds the non-add key in a depressed position?
- 86—How is the non-add key returned to normal position without operating the machine?
- 87—How does the 220 $\frac{3}{4}$  prevent the depression of the non-add key after a stroke is started?
- 88—What prevents the non-add key from being operated when a total or sub-total key is depressed?
- 89—Why does the non-add key stem actuate the 1-227 $\frac{1}{4}$ BL?
- 90—What change on the 1-221 $\frac{1}{2}$ C would be necessary to allow the character to print when an amount is accumulated?

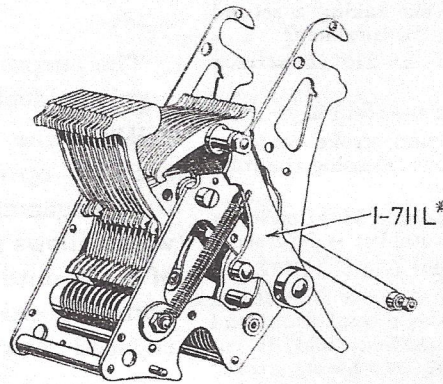
### 200 SECTION



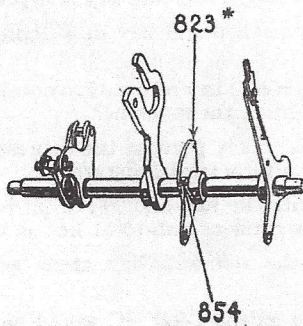
### 400 SECTION



### 700 SECTION



### 800 SECTION



### 900 SECTION



### *Principles Underlying All Adjustments*

A part is *adjusted* if it performs all of its functions positively.

*Testing* is the process of proving the part is adjusted.

*Adjusting* is the process of locating the part so as to accomplish definite action.

①—*Hold*. A definite amount of contact to insure connection of parts until their functions have been performed.

②—*Clearance*. Parts which engage at certain intervals must have safe distance or space between each other so as to avoid premature action, likewise all moving parts must have space to avoid interference.

③—*Lead*. When one part moves to engage another, the driving part must have excess movement to insure positive engagement.

④—*Limits*. All adjustments are made with a definite limiting position to and from.

⑤—*Equalization*. All parts that receive the entire motion of the driving parts are adjusted by equalizing the action of the driving parts.

⑥—*Increase or Decrease of Movement*. All parts that receive only a part of the motion of the driving part are adjusted by advancing or retarding their point of contact.

⑦—*Condition*. That the physical state of the part and its connections are perfect.

#### SELF-QUESTIONS

- 91—What could be the result of indefinite hold? If too much? If not enough?
- 92—What would be apt to occur if the 1-413 carrying pawls have no clearance? For example, the cam of the adding wheel 924 set at 9 and foot of 1-413.
- 93—What can happen if a pawl has no lead? For example, the 228 and 214A.
- 94—What would happen if a limit stop or position were changed? For example, what would happen if the limit point of the 1-413 which rests against the 400A shaft were changed?

95—How is the driving motion equalized so as to insure lead of the spacing pawl of platen? (Positive feed.)

96—How is the movement increased or decreased by advancing the point of contact? For example, the 1-711L contacting with stud 854 in 823.

Note—The marginal numbers throughout this book refer to the principles involved governing all adjustments.

### *How Adjustments Are Made*

Adjusting or locating parts so as to comply with the principles underlying all adjustments, is accomplished by arrangement, and also by bending, offsetting, and peening.

*Arrangement*. This is a process employed in the Burroughs Calculator where it is a matter of meshing the gear wheels so that cams and limit points of the gears will assume definite positions. No other adjustment is necessary.

*Bending*. Example—Type aligning.

*Offsetting*. Example—Adjusting the side of the 1-413 for play.

*Peening*. Example—Adjusting 1-413 carry pawls for clearance of 924 cam of adding wheel.

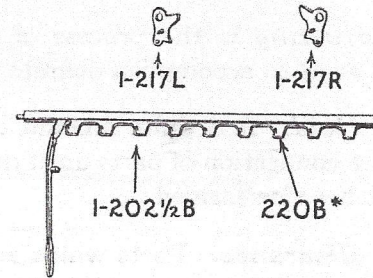
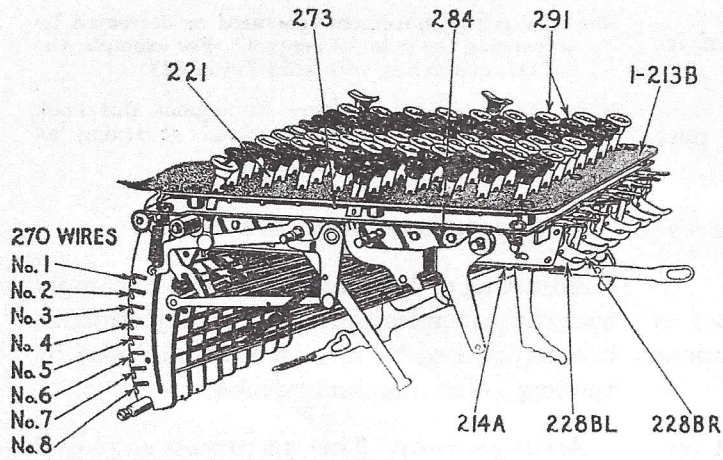
Peening is an operation of stretching metal with the use of a blunt chisel. If a piece of steel is peened across its entire width, the piece becomes longer. On the other hand if the peening is applied to only a part of the piece, it will bend the piece in the opposite direction to where the tool was used.

### *Advantages of Peening*

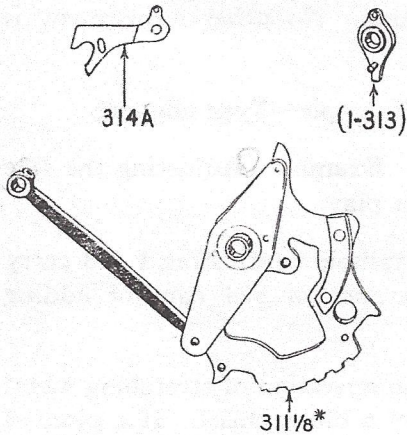
Parts whose design consists of branches or having irregular shape where only a slight movement is required which would be difficult to secure and possibly disturb other locating limits by attempting to bend in the ordinary manner.

*Caution*. Peening requires forethought. The student must understand the principles of the operation clearly so as to avoid defacing the parts with tool marks.

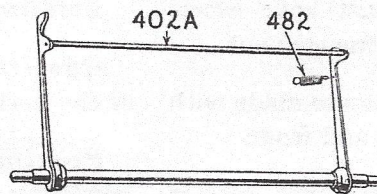
## 200 SECTION



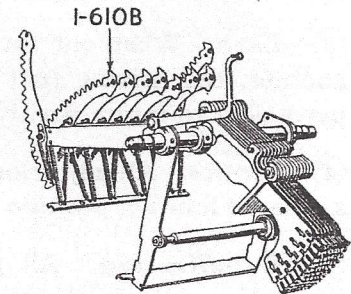
## 300 SECTION



## 400 SECTION

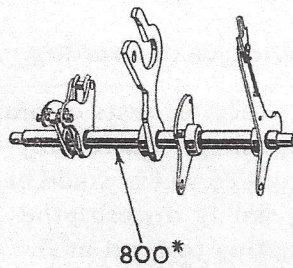


## 600 SECTION



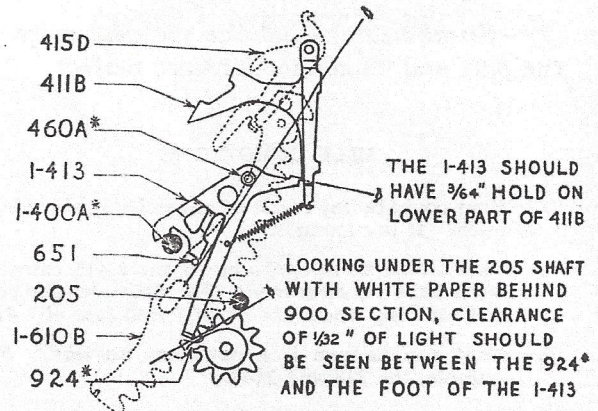
COMPLETE 600 SECTION

## 800 SECTION



## 1-413 ADJUSTMENT

LOOKING UNDER THE 460A\* STUD, I-413 MUST BE FLUSH WITH 651 STUD



## Sections

### 200 Section

\*④—The key stems 221 must align with 217s.

The keystems 221 resting on the upper key-board plate 1-213B are the true limit of travel for the lever 217, the wire 270, the strip 214A, and the 402A shaft. The 270 limit wire must have definite length, not so long as to jar out of place, not so short as to limit travel of 214A.

\*③—The 214A must have lead past 228BR or BL and should align centrally with (228).

\*⑥—The curved end of the 214As must be adjusted so as not to release the adding rack 1-610B before the 270 wire has been drawn into place.

The key action must operate freely so as to avoid more than one wire being drawn in place when one key is depressed.

Test for free action of keys.

Always have a key depressed in some other column than the one receiving the test. This is important so as to eliminate the 482 spring assisting in restoring the 214A which depends wholly on the 284 spring.

#### SELF-QUESTIONS

- 97—What would happen if the 221 key stems did not align with (217) key levers?  
 98—What does the key stem 221 limit on when depressed?  
 99—If one key in a column fails to restore, what is indicated?  
 100—What holds the 214A after the key has been depressed?  
 101—Why should a key stem be depressed before placing a key button 291 on the key stem 221?  
 102—When testing 214A for free action, why is it necessary to have a key depressed in some other column?  
 103—What can occur if the 214A has no lead?  
 104—What restores the 214A when it is released from the (228) if the 482 and 284 springs are eliminated?  
 105—If one key in a column does not give lead of 214A over (228) what does it indicate?  
 106—Why are the limit wires 270 tested for proper length?  
 107—What is the result if the 1-610B adding rack is allowed to drop before the 270 limit wire is drawn in place?  
 108—What will happen if two limit (270) wires are drawn in at the same time?  
 109—Why are the numbers 3 and 4 limit (270) wires formed out of a straight line?  
 110—What would happen if a 273 strip were removed?  
 111—Would a key stem 221 return to normal if a 284 spring were removed?  
 112—Why does the 220B on 1-202½B block the 214As?  
 113—Why is the 402A shaft assembled in the section, in the rear of the lugs on 214As?

114—What is the mechanical reason for an amount being repeated by depressing the repeat key?

### 300 Section

To insure full travel for the entire machine the full-stroke pawl 1-313 is used. This compels the completion of each stroke of the handle.

To avoid juggling at the beginning of the return stroke, the 314A is used.

The 311½ contacts with 600 section, thereby releasing the depressed keys at the end of the return stroke; it also prevents the total key from being depressed after the handle is started, and prevents the handle from being started until the total key has been depressed all of the way. The limit of the 311½ is against the 800 shaft on the forward stroke.

#### SELF-QUESTIONS

- 115—Why is it necessary to have full travel of the machine on the forward stroke and what would happen if it did not?  
 116—What juggles are possible with the 314A removed?  
 117—What limits the 311½ on the return stroke?

### 400 Section

#### The Adjustment of the 1-413

Examine 1-413 for condition and tight stud.

The arm of the 1-413 which limits the 651 ⑦\* stud of the 1-610B has a definite length, this is indicated by the amount of play between the arm of the 1-413 and the stud 651.

Too much play allows the 1-610B to ②\* ascend higher, and reduces the clearance of the 924 cam of the adding wheels and the next 1-413.

Lack of play interferes with free carrying and if it lacks considerable it can interfere with the engagement of the 1-610B and 415D. Always use this test if the adjustment of a 415D or 1-610B has been changed, or if either one of these parts has been replaced.

Hold of 1-413 arm on 651 stud should be flush, looking from above, tail of 1-413 ①\* limiting on the 1-400A shaft.

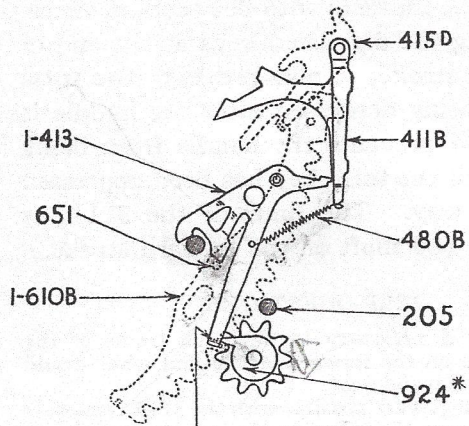
Clearance of  $\frac{1}{32}$ " between foot of 1-413 ②\* and 924 cam, 9s on adding wheel, 1-610B limiting on 1-413.

Clearance of  $\frac{1}{32}$ " between foot of 1-413s ②\*

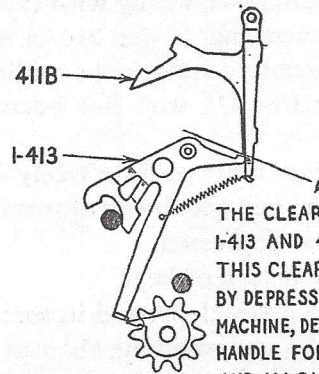
\*See circle figure notes on page 13.



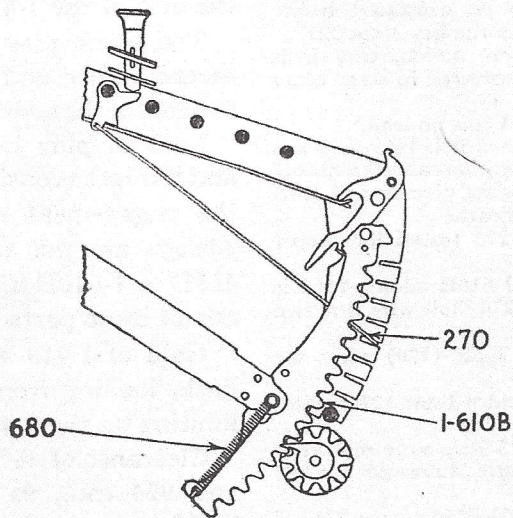
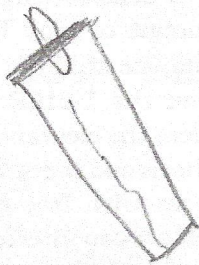
## 1-413 ADJUSTMENT (CONTINUED)



MACHINE IN NORMAL POSITION,  
THERE SHOULD BE  $\frac{1}{64}$ " CLEARANCE  
BETWEEN 924\* AND I-413



THE CLEARANCE BETWEEN  
I-413 AND 411B SHOULD BE  $\frac{1}{32}$ ".  
THIS CLEARANCE CAN BE SEEN  
BY DEPRESSING No. 1 KEY, OPERATE  
MACHINE, DEPRESS No. 9 KEY, PULL  
HANDLE FORWARD, HOLD 411B  
AND ALLOW HANDLE TO RETURN  
SLOWLY TO NORMAL POSITION



and 924 cam, 9s on adding wheels, 1-610B limiting on upper stops (carried position).

\*①—Hold of 924 on top on foot of 1-413 to prevent slipping off in taking total.

\*②—Clearance of 924s over foot of 1-413s, include cipher on adding wheel with 1-610B

\*④ limiting on 415D. The same clearance must exist with each row of keys depressed to limit the 1-610Bs on the 270 wires and the 205 shaft.

Test: Unhook 480B springs, draw the handle to the forward stop, and rock the adding section in and out and watch the 1-413s to see that no movement is affected.

\*①—Hold of 411B detent should be  $\frac{3}{8}$ " on 1-413.

\*③—Lead: When carrying, the 1-413 should have enough lead to allow a clearance of  $\frac{1}{8}$ " between the 1-413 and the 411B. Test: Add 1, draw the handle forward and drop the 1-610B in the same column, allow the handle to return slowly, raise the 411B slightly and observe the amount of clearance. Test for carrying after the 1-413s have been adjusted, depress all 9 keys and add them, add 1 and before the handle becomes normal stop the second adding wheel with the finger, still retaining hold of the second wheel, stop the third one allowing the second one to turn very slowly. Try all 1-413s in the same manner.

Finally try the supreme test, which consists of 9s on all adding wheels, 1 depressed and allowing the handle to return very slowly so the 680 springs of the second bank will shift the next left 1-413. Try the same test for all other 1-413s.

#### SELF-QUESTIONS

118—Why should the 1-413 be examined for condition and tight stud before every other test?

①119—How is the play between the arm and the 651 stud observed?

120—What is the effect of too much play?

121—What is the effect of no play?

122—How is the forward hold of the arm on the 651 stud observed?

①123—Why should there be  $\frac{1}{32}$ " clearance between the cam 924 and the foot of the 1-413 with 9s on the adding wheels?

124—Why should the clearance between the 924 cam and the 1-413 be tested for both limiting points of the adding racks?

①125—Why should the cam 924 have the proper hold on the 1-413 during the totaling process?

126—Why should there be clearance between the cam 924 and the top of the foot of the 1-413 when the adding section is rocked into mesh with the adding racks?

①127—Which tests will indicate the clearance of the cam 924 over the 1-413?

128—Why is the hold of the detent 411B on the 1-413 necessary?

①129—Which test will indicate hold and clearance of 411B on the 1-413?

130—How is free carrying determined?

①131—Which is the supreme test for free carrying?

#### Characteristics of the 1-413

The 1-413 is one of the most important parts of the adding machine. To understand its adjustments completely as soon as possible ought to be the aim of every student. With this knowledge gained, progress is assured.

The adjustments of the carrying pawl 1-413 are based on relative action and location of other parts, that is, the adding wheel cam and adding sector respectively. To analyze and classify these characteristics awakens interest and enables the student to see clearly how to apply the principles underlying all adjustments.

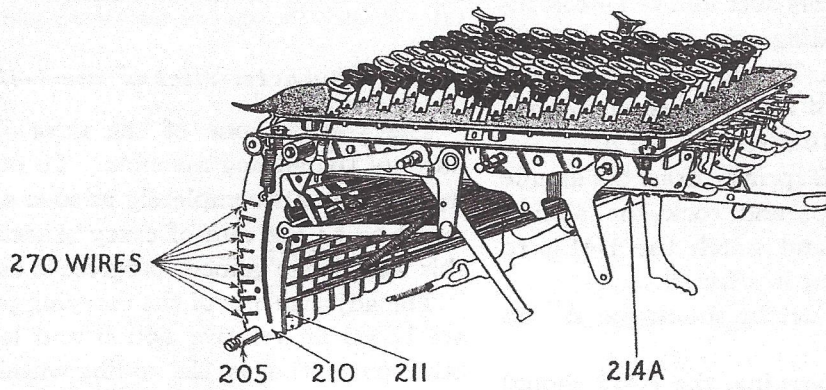
The spring resistance which must be overcome by cam 924 when it trips 1-413 varies according to the position of 1-610. When cam 924 trips 1-413 before 1-610 limits against 1-413, then only 480B tension is involved. On the other hand when 1-610 is limiting against 1-413, springs 680 are expanded which adds an additional resistance for cam 924 to overcome. The cam of the adding wheel, actuated by the 680s on the 1-610B to the right, overcomes the resistance of the 680 to the left through the medium of the longer lever, that is, the foot of the 1-413.

In adjusting the 1-413, its relation to the action of the 924 cam must be considered, to insure smooth and rapid carrying. The power of the cam is strongest nearest its center (center of wheel) when it shifts the 1-413. As the foot of the 1-413 travels backward on the cam, the power of the cam diminishes, the resistance of the 1-413 increases as it is shifted off the 651 stud. It is therefore necessary to avoid too much clearance.

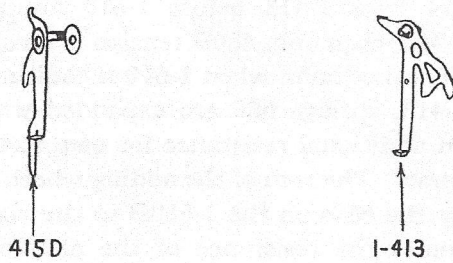
The object of the slow carrying test is to insure positive action, not depending on momentum; as a matter of fact all action in the Burroughs must be safe and positive, so as to give accurate results no matter how operated.

\*See circle figure notes on page 13.

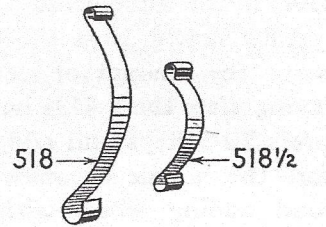
### 200 SECTION



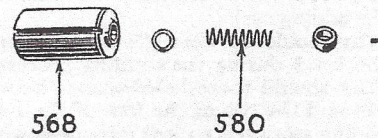
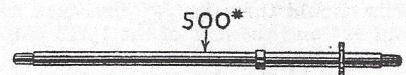
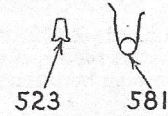
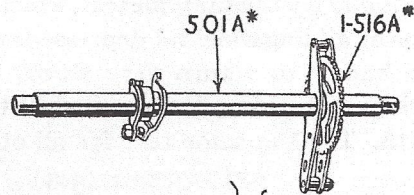
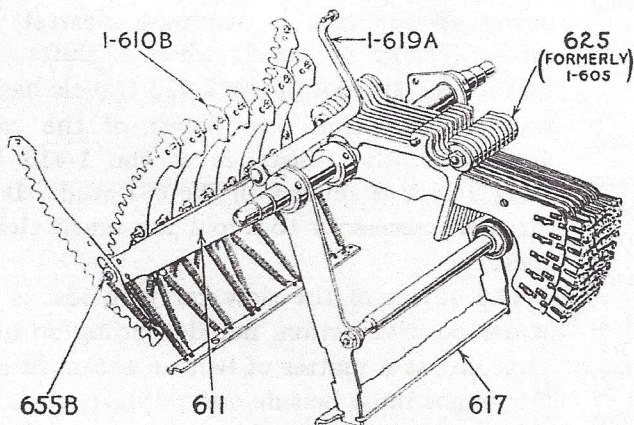
### 400 SECTION



### 500 SECTION



### 600 SECTION



## SELF-QUESTIONS

- 132—Why does the spring resistance which must be overcome by cam 924 differ according to position of 1-610?
- 133—Give examples of combinations which when added illustrate the preceding question?
- 134—What combination of numbers added will cause the 680 springs to drive the 1-610B adding rack in a carry?
- 135—Why is the coming action of the 924 strongest near its center?

## 500 Section

## The Ribbon Reverse Movement

The 501A shaft acts as the lower spool. It is the reversing medium, but reverses only when the upper spool is empty, i.e., when the ratchet has unwound the entire upper spool; a continued pull throws the feed pawl on the other side, and unwinds. The constant rotation of the upper spool takes up the loose ribbon.

The upper shaft, which is actuated by the arm 1-619A, always revolves in the same direction.

The upper spool is loose on the shaft, and held in place by tension spring 580.

When the upper spool is winding up, it is moving in the same direction as the shaft; when unwinding, in the opposite direction. This action insures tight winding of the ribbon on the lower spool, which is necessary to insure positive reversal, also to prevent type from catching in the ribbon.

518 and 518½ springs are used to overcome the drag of the pawl 523 and 1-619A arm; i.e., to prevent the 500 and 501A shafts from rocking backwards; they should exert smooth friction, a *biting action* interferes with the reverse.

The 581 spring should have enough tension to overcome the tension of the 580.

The 580 spring should have sufficient tension to insure tight winding of the ribbon on the lower shaft; the latter condition is necessary since the reversal will not take place until the ribbon is wound tight enough to exert the pull to throw the pawl 523 on the other side of the ratchet wheel 1-516A.

## SELF-QUESTIONS

- 136—Why does the 501A shaft reverse only when the ribbon has been completely unwound off the spool 568?

- 137—How does the reverse take place?
- 138—How is the shaft 500 revolved?
- 139—Why is the spool 568 loose on the 500 shaft?
- 140—How is tight winding of the ribbon on the shaft 501A secured?
- 141—What are the functions of the 518 and 518½ springs?
- 142—What is the effect of a biting action of the 518 and 518½ springs?
- 143—What should be the relative tension of the 580 and 581 springs?
- 144—If the 581 spring is too weak, what effect will this have on the reverse?
- 145—If the 580 spring is too weak, what will be the result?

## 600 Section

1-610B. The bottom part of the slot (4)\* on which the 655B limits is the only part requiring direct adjustment, as it affects the alignment of an entire column of type.

The tests for hold, clearance, and release are obtained by adjusting the 415D, 214A and 1-413 respectively; and in replacing a (610) these tests should be tried. Also test for free action between guides "210" and "211." (2)\*

Aligning of type.

In printing amounts set up on the keyboard:

The 270s are the limit points for 1 to 8 inclusive.

The 415s are the limit points for (4)\* ciphers when listing.

The 205 is the limit point for 9s in listing or totaling.

In totaling, 1-413s are the limit points for 0 to 8 inclusive.

## SELF-QUESTIONS

- 146—Why does the bottom of the slot in the 1-610B control the alignment of an entire column?
- 147—What holds the adding racks upward when the machine is in normal position?
- 148—What holds the adding racks upward when (1)\* the machine is on either stroke with no keys depressed?
- 149—Why is the slot needed in the adding racks?
- 150—What part limits the 1 to 8 type?
- 151—What limits the 9 type?
- 152—What limits the type when a total is printed?
- 153—Why should the alignment include the position of the type and the full impression?
- 154—How can the guide comb 625 (formerly 1-605) affect the alignment?
- 155—What limits the adding racks when the machine is in normal position?
- 156—What limits the adding racks when the machine is at rest after a carry has taken place?
- 157—What can result if the contact point of the 611 and the 617 is worn?
- 158—How can a round hook affect the hold of the latch 415D?

\*See circle figure notes on page 13.

**Type Alignment**

The listing alignment is the first adjustment of the type. A slip is made showing the printing of all figures including the ciphers.

Print mix up.

1 2 3 4 5 6 7 8 9  
9 8 7 6 5 4 3 2 1

Align mix up, selecting type making the best impression.

Align all 1s, 2s, 3s, etc., with the respective 1s, 2s, 3s, that were aligned in the mix up.

If the entire column is high, examine the 1-610 and 611 connections, a new 1-610 will usually correct this. Should the column be low examine the 650<sup>5</sup>/<sub>8</sub> and 655B for free action, and also the 270 wires for condition.

The alignment must provide a full face print in addition to being square with the edge of the paper.

As the 9s limit on the 205 shaft both in the listing and totaling, they are aligned  $\frac{1}{4}$ " higher in the listing and will show  $\frac{1}{4}$ " low in the totals. This is necessary to get the clearance of the 924 over the foot of the 1-413s.

Tool alignment—When printing a total, the 924 limits on the foot of the 1-413 to locate the type in the printing position with the exception of the 9s which limit on the 205 shaft.

Examine all 411s, 415s and 1-413s for condition and free action. Test for  $\frac{1}{4}$ " clearance of the 924 cam over the foot of the 1-413 with 480s unhooked, by rocking the 900 section in and out (with the hand), having all 3s, then 5s and 7s in printing position, handle forward and 313 in the last notch of the 311.

Align totals

3 9 3 9 3 9 3 9 3  
3 9 3 9 3 9 3 9 3 s  
9 3 9 3 9 3 9 3 9  
3 3 3 3 3 3 3 3 2 \*  
3 3 3 3 3 3 3 3 3  
3 3 3 3 3 3 3 3 3 \*

When aligning totals, print total of all 3s. Raise the figures which print low, by slightly

lengthening the foot of the respective 1-413s. The feet of the 1-413s must be kept at right angles and in good condition.

After the totals are aligned test the 924s for clearance over the foot of the 1-413s and for clearance under the 924s with 9s in.

3 0 3 0 3 0 3 0  
3 0 3 0 3 0 3 0 \*

3 0 3 0 3 0 3 0 3  
3 0 3 0 3 0 3 0 3 \*

Alignment of Ciphers—The ciphers are aligned in the totals first, by adjusting the type, using the 3s as shown above.

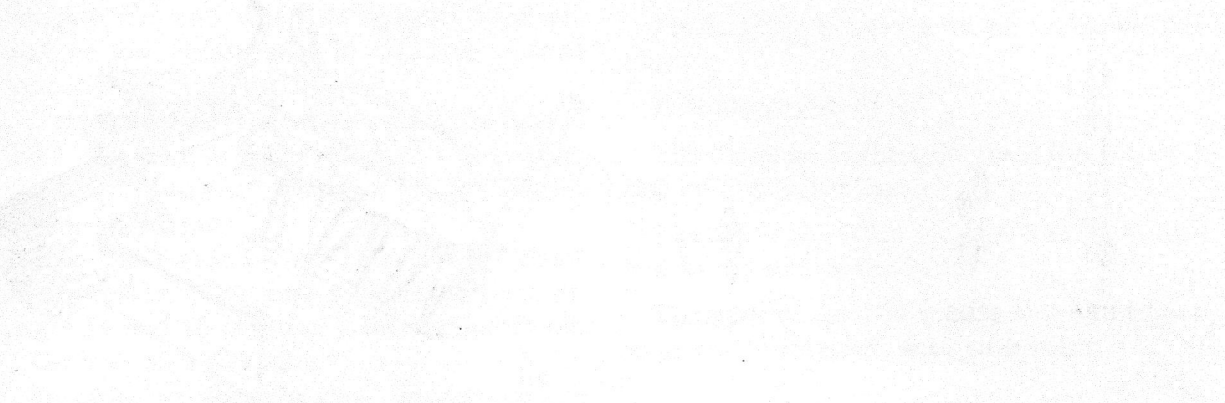
The ciphers print automatically in the listing from the foot of the 415s and are aligned by adjusting the foot of the 415s up or down using the 3s as a guide.

See that the 415s have proper side-hold on 1-610 and clear the No. 2 270 wires.

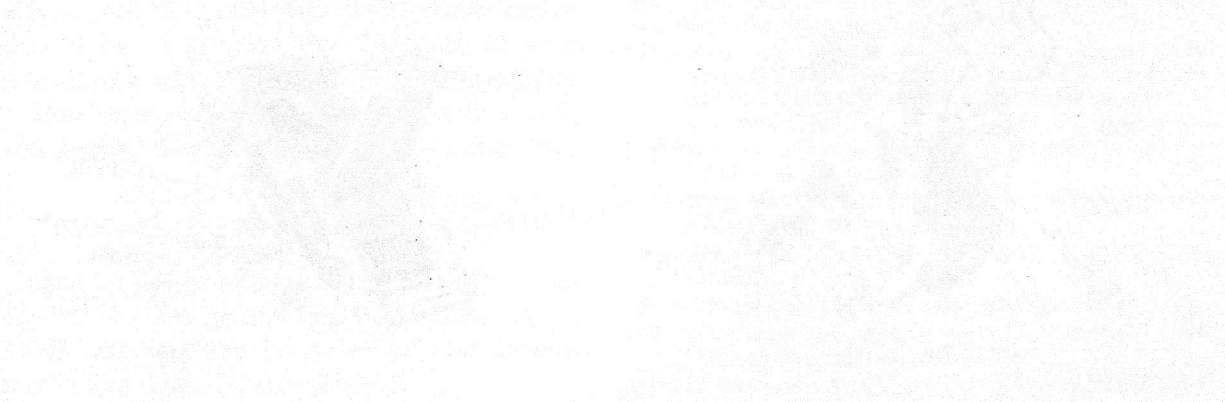
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0  
1 1 1 1 1 1 1 1  
2 2 2 2 2 2 2 2  
3 3 3 3 3 3 3 3  
4 4 4 4 4 4 4 4  
5 5 5 5 5 5 5 5  
6 6 6 6 6 6 6 6  
7 7 7 7 7 7 7 7  
8 8 8 8 8 8 8 8  
9 9 9 9 9 9 9 9  
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0  
1 0 0 0 0 0 0 0

Adjust the up-and-down alignment, first by spacing the ciphers with the graduation on the line finder, then align the balance of figures using the print of the ciphers alternately with each row of figures as a gauge. Use Kit 537 for side alignment.

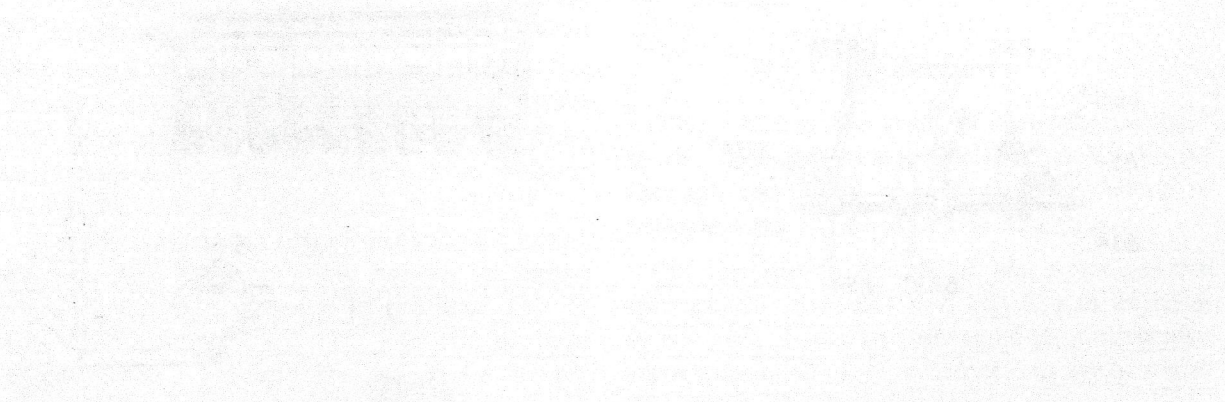
FOR THE USE OF THE STUDENT



SECTION 1

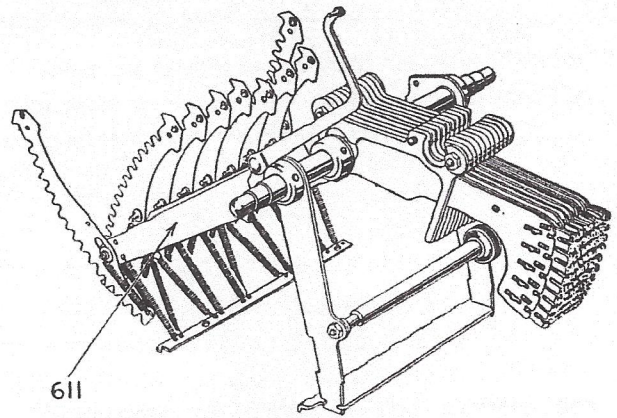
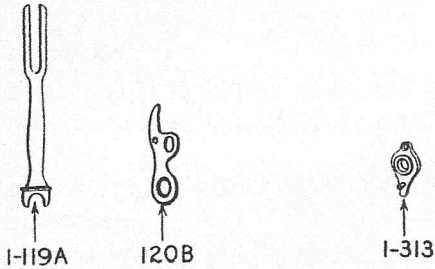


SECTION 2



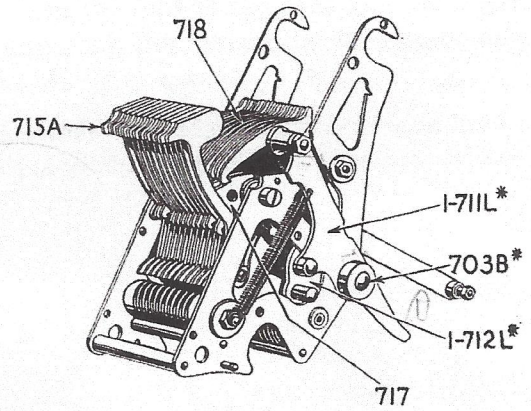
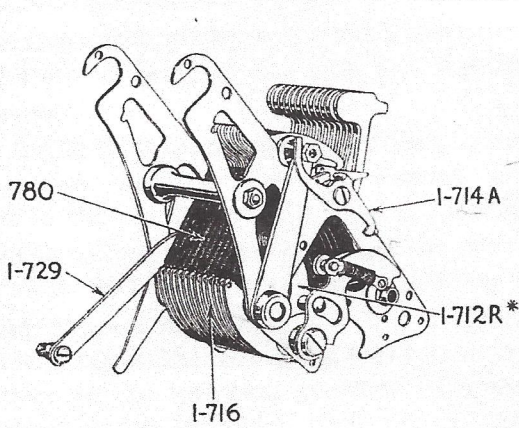
# 100 AND 300 SECTIONS

# 600 SECTION



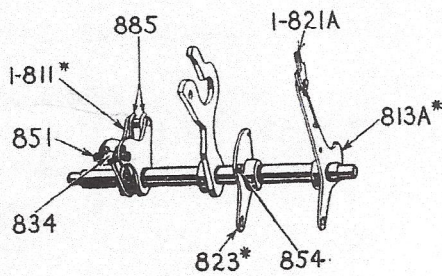
# 700 SECTION

COMPLETE SECTION 2A-710



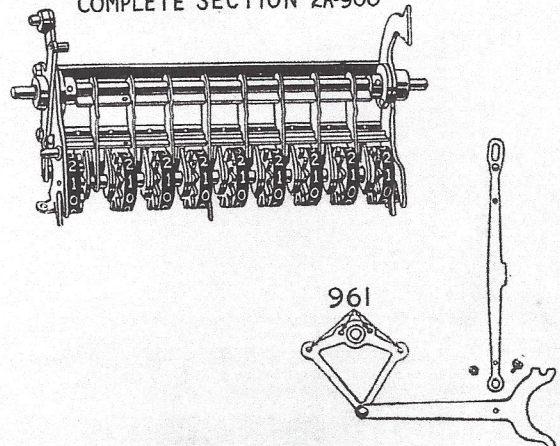
# 800 SECTION

COMPLETE SECTION 1-800



# 900 SECTION

COMPLETE SECTION 2A-900



Align symbol type by bending type, to align with top of figures. First inspect 511 $\frac{1}{4}$  for position and when all symbol type are high or low, locate stud in 1-612 to contact sooner or later with 229 $\frac{1}{2}$ .

Test the 924s for clearance with the foot of the 1-413s with 9s in the machine. See cut on "1-413 adjustment" on page 14 of Class 1 Instruction Book.

Test the 1-413s for  $\frac{3}{4}$ " hold and  $\frac{1}{4}$ " clearance in 411s. See cuts and instructions on pages 14 and 16 of Class 1 Instruction Book.

Go over all 1-413 adjustments.

In order to insure a good impression, the platen must be set at a correct distance from the type, which is determined by the clearance between the type and the platen.

Machines below serial number 881255, should have .040 to .050 clearance. Machines above 881255 non-tally roll construction, should have .070 to .080 clearance, so as to permit the use of the ribbon shutter device.

Machines which are equipped with a tally roll device, should have .097 to .112 clearance.

### 700 Section

The 2A-710 is an important part of the control of the machine, due to its releasing the 120B after all the functions of the forward stroke have been accomplished.

If the machine is released, before all of the functions have been attained, it is termed short-stroking. This may include partial printing, also non-engagement of the 1-821A and rear 961 stud.

\*①—In most cases, adjusting the 1-714A for \*②clearance or hold will give the desired results. The positive way is to increase the action of the 1-711L by advancing its contact \*⑥ with the stud 854 in the 823, and then more hold can be given to the 1-714A without losing the necessary clearance.

Test for resetting of the 1-716s: add 1 in the extreme left column, allow handle to return very slowly and observe if the last 717 to the right covers the 1-716. If out of test, examine the 1-719 and the 1-712s for length and condition.

Hammers (715A) must have square face and align with the 0 and 9 type.

715As must be free with no excessive side play.

718s align with 611s.

The distance of the type from the platen is also an important factor.

The roll of the 1-716 must be free on its stud and in the slot of the 715A.

The eyes of the 780 springs must be closed so as not to interfere with each other.

### SELF-QUESTIONS

- 159—Why is the 2A-710 an important part of the control of the machine?
- 160—What is understood by short-stroking?
- 161—What is the effect of a short stroke on the functions of the 1-821A?
- 162—How does the movement of the 1-711s (on 703B) limit the adjustment of the 1-714A?
- 163—If an adjustment of the 1-714A has properly timed the toggle break, and resulted in not printing one or more of the right ciphers, what is indicated?
- 164—Why is it essential that all 1-716s reset before the 1-313 is in a normal position?
- 165—Why should that part of the hammer which strikes the type be square?
- 166—Why is side play of the hammer (715A) not desirable?
- 167—Why should the 718s align with the 611s?
- 168—Why does the printing depend on the space between the type and the platen?
- 169—What causes the hammers to immediately clear the type when printing takes place?
- 170—Why should the eyes of the springs be well formed?
- 171—What would be the effect of a loose stud on a 1-716?
- 172—Why should the hammer align with the cipher and the 9 type?
- 173—How can a partially filled dashpot affect the printing?

### 800 Section

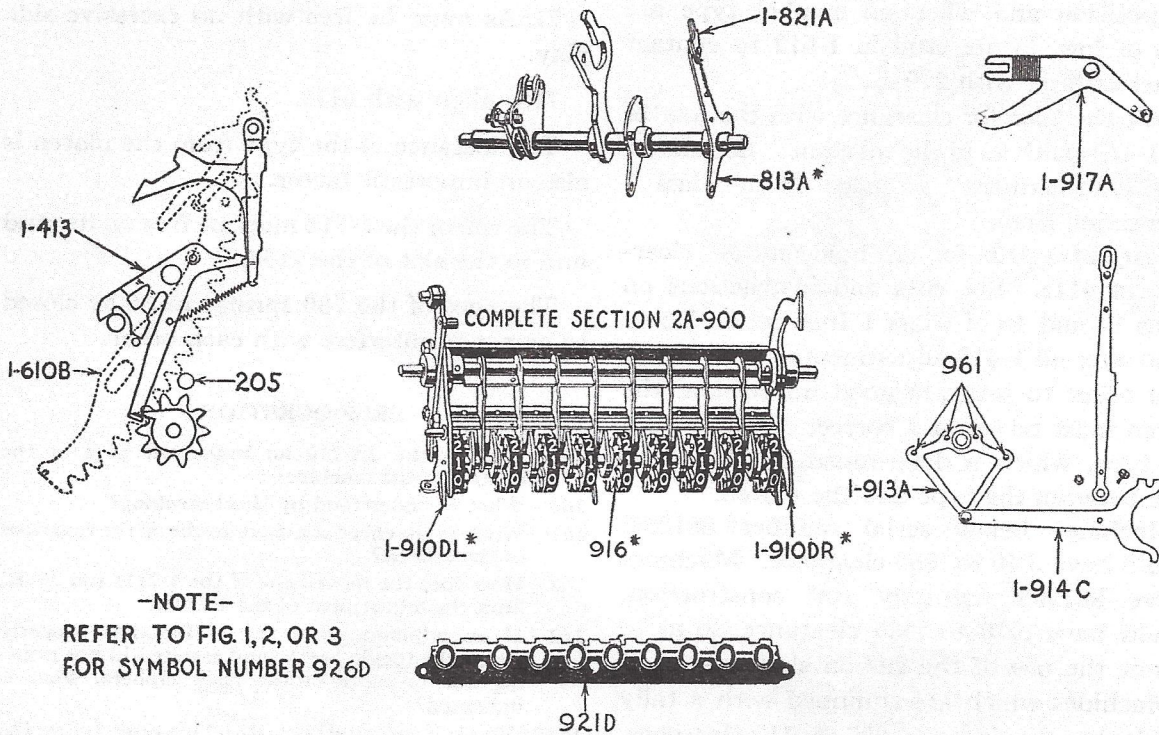
The 1-800 is the start of control, due ④\* to the fact that the entire mechanism limits through the 1-800 on a fixed post, which is integral with the base of the machine.

On the return stroke of the machine the springs 885, stud 851 and roll 834 in limiting on the post absorb the vibration that naturally accompanies all moving bodies that are brought to a quick and definite stop.

\*See circle figure notes on page 13.



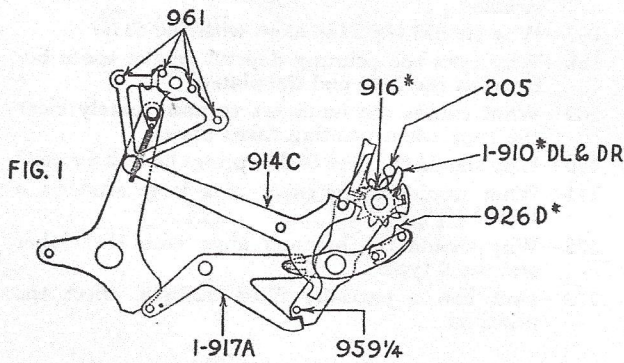
# 900 SECTION



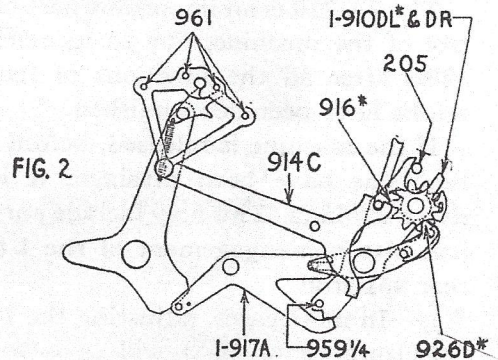
-NOTE-  
REFER TO FIG. 1, 2, OR 3  
FOR SYMBOL NUMBER 926D

## 1-917A ADJUSTMENT

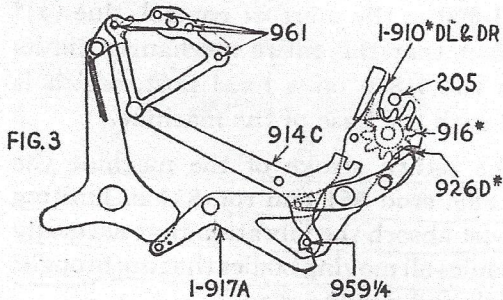
POSITION OF 1-917A ON TIGHT POINT



POSITION OF 1-917A ON LOOSE POINT



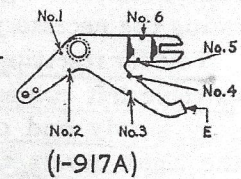
POSITION OF 1-917A TOTAL KEY DEPRESSED,  
ABOUT TO THROW OUT 900 SECTION



- TO ADJUST LOOSE AND TIGHT POINTS.
- 1 PEENING AT No.1, LOOSENS LOOSE AND TIGHT POINTS.
  - 2 - - No.2, TIGHTENS - - - - -
  - 3 - - No.4, LOOSENS - POINT.
  - 4 - - No.2 & No.4, TIGHTENS TIGHT POINT.
  - 5 - - No.1 & No.3, - LOOSE - AND LOOSENS TIGHT POINT
  - 6 IF END AT E IS TOO LONG, PEEN AT No.1, & No.3.

TO ADJUST RACK

- 1 PEENING AT No.5 BRINGS RACK FARTHER FROM THE 916\*
  - 2 - - No.6 - - - CLOSER TO - - -
- NOTE:- ADJUST LOOSE AND TIGHT POINTS BEFORE ADJUSTING THE RACK  
USE BLUNT CHISEL IN PEENING No.3, No.4, No.5, No.6.



(1-917A)

### 800 Section—Continued

This section is in motion continuously from the time the machine starts until it becomes normal. It is therefore controlled primarily \*③ by the full stroke pawl 1-313, and an important test on the return stroke is that the 1-821A has lead on the forward 961 stud, before the 1-313 is normal, so as to make impossible the starting of another stroke with the 2A-900 in mesh. If out of test, examine \*⑦ 1-119A for length and 834 roll for condition. See Timing page 26.

\*③—On the forward stroke the 1-821A should have lead over the rear 961 stud so as to insure engagement of the 2A-900. The 1-821A is a most important part. It must have absolute free action so as to insure its positive engagement with the 961 studs. Its function is to throw the 2A-900 in and out of mesh. This will be shown more clearly under the subject of 1-917A adjustment.

The bottom part of the 813A acts as a cam to hold the 2A-900 in place.

#### SELF-QUESTIONS

- 174—Why is the 1-800 the starting control of the entire mechanism?  
 175—What is the function of the 885 springs?  
 176—Why are the slots in the 1-811?  
 177—During what part of both strokes is the 1-800 section in motion?  
 178—What tests are applied to test the 1-821A?  
 179—In what way can the 1-119A affect the test of the 1-821A?  
 180—Why must the 1-821A have absolute free action?  
 181—What is the purpose of the bottom cam surface of the 813A?

### 900 Section

\*④—The 2A-900 or accumulating section should be adjusted for proper mesh of the 1-610B with the "916" adding gear. There should be a little play in the teeth for the entire length of the 1-610B. This is secured by bending the ends of the "910s" limiting against the 205 shaft.

Note—This adjustment affects the adjustment of the 1-413s if changed.

The direct adjustments of the 1-917A itself  
 \*② consist of a non-cramping tight point

when 2A-900 is engaged. A comparatively loose point when not in mesh, that is, locking detents (926s) have the right amount of play when engaged with "916s," and no interference with the "916" when disengaged.

The function of the 1-917A is to lock the adding section 2A-900 in or out of mesh with the adding sector 1-610Bs during the operation of the machine. One end has a stud which contacts with the bottom of the 813A, the other end has a horizontal flat surface on which the 1-910DL rests on the forward stroke, and a vertical flat surface against which the 1-910DL rests on the return stroke.

At the beginning of the forward and the return stroke, the 1-917A is not contacting with the 813A and at that time and in that position only can the moving in and out of mesh of the adding section take place.

1. To insure positive action of the engaging and disengaging of the accumulator, the 1-821A and the 1-914C require testing for hold, clearance and lead. 2. The 1-821A must raise the 1-913A without cramping the 205 shaft. 3. The shield 921D must clear the adding wheels.

#### Adjustment of 1-917A

1-917A free, without side play.

1-910DR and DL parallel to 205 shaft, and have  $\frac{1}{32}$ " play on loose point.

Fork and 961 free without play, adjusted to secure  $\frac{1}{32}$ " play of 926D and 916, tested with 9s, 926Ds held up.

If 2A-900 fails to disengage at right time in totaling, adjust hook of 914C to take hold quicker, exercising care not to lose clearance of  $\frac{1}{32}$ " over 959 $\frac{1}{4}$  stud.

#### SELF-QUESTIONS

- 182—What adjustment is necessary to insure the proper mesh of the adding wheels and adding racks?  
 183—How can the mesh adjustment affect the carry pawls (1-413)?  
 184—What do the direct adjustments of the 1-917A cover?  
 185—What is the function of the 1-917A?  
 186—What locks the 1-917A during the operation of the machine?

- 187—Why is it only possible to disengage 2A-900 at beginning of forward stroke, and engage and disengage 2A-900 at end of forward stroke, and beginning of return stroke?
- 188—What will happen if the 2A-900 mesh does not take place at the right time?
- 189—Why must the 1-821A and the 1-914C meet the test for hold, clearance and lead?
- 190—If 1-821A has not equal side hold on front and rear studs 961, what is indicated and how corrected?
- 191—What could occur if the mesh of the adding wheels were too tight?
- 192—Why should the 1-917A have a minimum of side play?
- 193—How is the mesh affected if the 1-910DR and DL are not parallel to the 205 shaft?
- 194—What is the purpose of the loose point?
- 195—Why is it necessary to have a tight point when the adding wheels are engaged with the adding racks?
- 196—If, when 916s are meshed with 926s and have more play at one end of detent rack than the other, how is it corrected?
- 197—How is the adjustment accomplished to secure clearance between the adding wheels and the detents 926D?
- 198—If the 2A-900 fails to disengage at the right time what adjustment is necessary?

### *To Adjust Loose and Tight Points*

1. Peening at No. 1 loosens loose and tight points.
2. Peening at No. 2 tightens loose and tight points.
3. Peening at No. 4 loosens loose points.
4. Peening at No. 2 and No. 4 tightens tight points.
5. Peening at No. 1 and No. 3 tightens loose points and loosens tight points.
6. If end at E is too long, peen at No. 1 and No. 3.

### *To Adjust Rack*

1. Peening at No. 5 brings rack farther from the 916s.
2. Peening at No. 6 brings rack closer to the 916s.

Note—Adjust loose and tight points before adjusting the rack.

Use blunt chisel in peening No. 3, No. 4, No. 5 and No. 6.

## Sequence of Timing Operation

### Forward Stroke

- A—Proper oil level and correct speed to allow sectors to correctly index.
- B—Hammer release.
- C—Lead of 1-821 over rear stud 961.
- D—Toggle release.
- E—Full stroke pawl 1-313C leave  $311\frac{1}{8}$ .

### Return Stroke

- F—Lead of 1-821 over front stud 961.
- G—Full stroke pawl 1-313C leave  $311\frac{1}{8}$ .

### Sequence of Timing Tests

- A—Oil level should be  $\frac{1}{4}$  inch from top edge of dashpot when plunger is in lower position.

S P E E D S			
Class	1	Hand Speed	Motor Speed
Style	7	120—125	116—120
	9	120—125	116—120
	11	110—115	106—110
	13	105—110	100—104
	15	95—100	90—92
	17	93—98	88—90
Class	2		
Style	9	115—120	114—118
	11	110—115	103—107
	13	105—110	100—104
With Shifting Carriages	15	95—100	90—92
	15	100—105	94—96
	17	95—100	90—92
With Shifting Carriages	17	90—95	85—87
Class	6		
Style	9	110—115	106—110
	11	105—110	102—106
	13	100—105	90—96
	15	95—100	88—90
	17	90—95	84—86
14 Column Accumulating Capacity	17	75—77	70—72

1 (C & E)— $\frac{1}{32}$  inch clearance between full stroke pawl 1-313C and  $311\frac{1}{8}$  at the end of forward stroke, to insure engagement of 1-821 and rear stud 962.

2 (F & G)— $\frac{1}{32}$  inch clearance between 1-313C and  $311\frac{1}{8}$  at end of return stroke, to insure engagement of front stud 961.

Adjustment: Correct length of 119A plus bushing 834 is necessary to meet this test.

Caution: When out of test observe whether or not bushing 834 is on stud 851, improper length 119A or strained 100 section.

With No. 9 keys depressed, including July key in SKS, when machine is slowly operated by hand, the following timing conditions should take place:

3 (B)—Bail 617A should clear all sectors 1-611 before first hammer is released.

Adjustment: Clearance can be secured or increased by locating lower part of 711L rearward. Only a minimum amount of clearance can be allowed for 16 pitch sectors. This adjustment of 711L is limited by hammer release and toggle tests.

4 (B)—All hammers 715 should be released before rear pocket prong on 1-821 clear stud 961.

Adjustment: Lower part of 711L is located toward front of machine. This adjustment is limited by test No. 3.

5 (D)—When rear pocket prong of 1-821 is passing stud 961, 1-714 should have  $\frac{1}{32}$  hold on 1-713.

6 (D)—With handle forward and toggle locked in, there should be  $\frac{1}{32}$  to  $\frac{1}{16}$  inch clearance between 1-714 and 1-713.

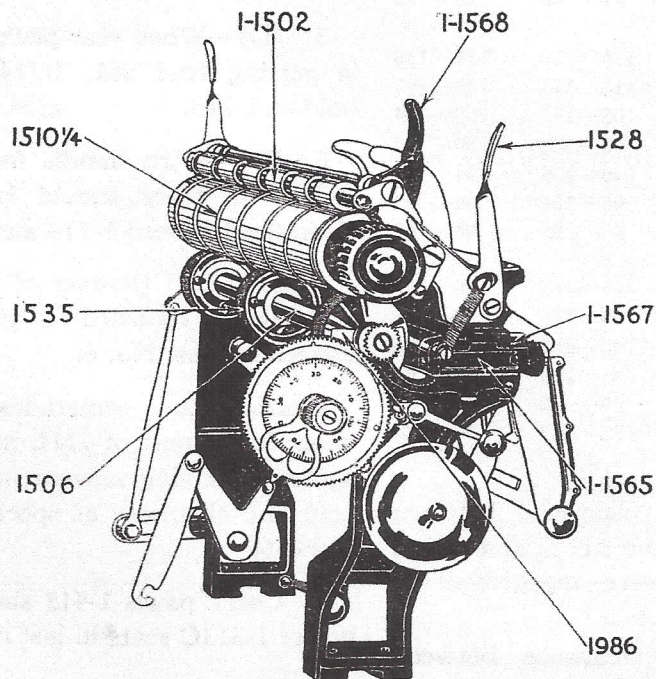
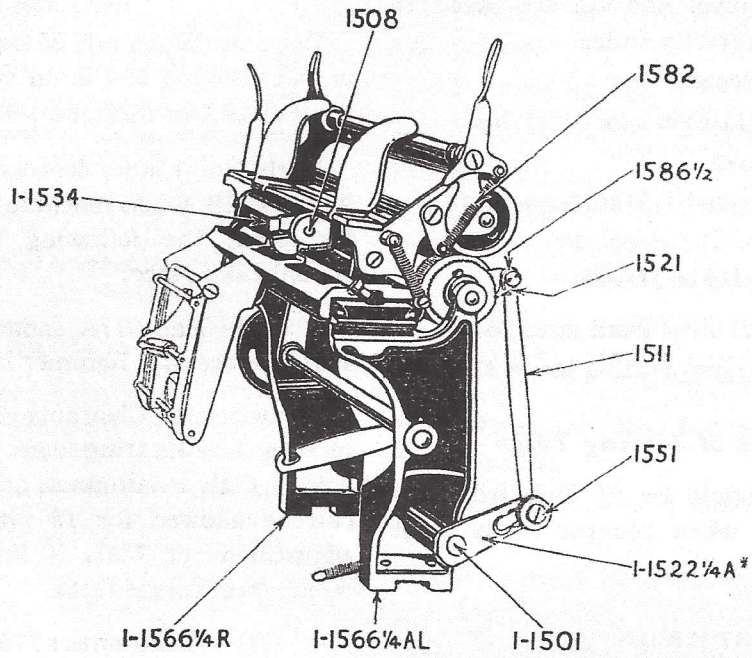
Adjustment: Contact of 1-714 on 731 (on 1-711AR) is retarded for test No. 5 and advanced for test No. 6.

Caution: It is sometimes necessary to advance lower part of 711L in order to provide sufficient driving movement to insure proper hold and clearance as specified in tests Nos. 5 and 6.

7—Carry pawls 1-413 should reset slightly before 1-313C seats in last notch of  $311\frac{1}{8}$ .

Adjustment: Contact of  $918\frac{1}{4}$  on stud  $856\frac{1}{4}$  (in 1-813A) is advanced or retarded.

# 1500 SECTION



### 1500 Section

The 1500 section is a friction feed carriage, the platen is  $10\frac{1}{4}$  inches long, and has no direct feeding connections, its motion is derived by contact with steel rolls 1535 fastened to the 1506 shaft.

This 1506 shaft has a ratchet fastened to it, and the pawl 1521 operating it is connected by the link 1511 and levers of the 1-1501 which connect directly to the 500 section; therefore, the travel of this shaft is the full travel of the return stroke of the machine.

\*②—In order to facilitate the insertion of the paper, narrow bands  $1510\frac{1}{4}$  extend partly around the platen; to hold the sheet against the platen long pressure rolls 1-1502 are used. The effect of the pressure rolls is increased by the direct contact of the sheet running between the platen and the steel rolls.

In order to equalize the pressure applied to the sheet so as to insure straight feeding, the center of the pressure rolls is smaller in diameter; and for that reason, narrow rolls of paper are fed by the direct contact of the steel rolls 1535 only.

According to the foregoing explanation, the medium that feeds the paper in this carriage is the rotary friction of the platen and 1535 rolls and also the rotary friction of the pressure rolls. Any stationary friction parts, such as bands pressing against the platen or pressure rolls, binding of the pressure rolls or platen in their bearings, will overcome the feed friction and create irregular spacing.

### Adjustments

Platen shaft and pressure roll shaft free-running with pressure roll released and 1582 springs off. Pressure rolls to have even contact on the platen to insure positive friction.  $1510\frac{1}{4}$  bands even clearance all around platen to avoid interference. Tight 1535 and ratchet hub. Enough friction on the right 1535 to overcome the drag of the 1521 pawl.

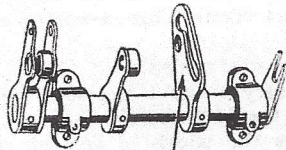
The diameter of the steel rolls 1535 determines the width of spacing. Should special spacing be required, rolls of special diameter should be used.

To print in several columns on a sheet, the carriage can be moved to different positions horizontally by swinging it back and moving it to the right or left after releasing 1528 lever which raises 1-1534 free of the notches in the casting 1-1565.

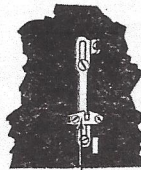
### SELF-QUESTIONS

- 199—What is meant by a friction feed carriage?
- 200—Why are no direct connections necessary on this style of carriage?
- 201—Why are the steel rolls milled?
- 202—Why is it necessary to have the steel rolls absolutely tight on the 1506 shaft?
- 203—What determines the width of spacing of this carriage?
- 204—What limits the platen movement?
- 205—What is the purpose of the shield  $1510\frac{1}{4}$ ?
- 206—What is the function of the pressure rolls 1-1502?
- 207—Why is the diameter of the pressure rolls smaller in the center?
- 208—If a narrow strip of paper is inserted between each steel roll 1535 individually and one of them does not grip the paper tightly, what does this indicate?
- 209—If the diameter of the steel rolls is increased or decreased, what effect will this have on the width of the spacing?
- 210—If the diameter of the platen is increased or decreased, what effect will this have on the width of the spacing?
- 211—If the 1565 casting is raised by placing a shim between it and the castings 1-1566 $\frac{1}{4}$ AL and R, in what way will this alter the location of the platen?
- 212—What is the distinction between rotary and stationary friction?
- 213—What is the effect of a stationary friction part on the width of the spacing?
- 214—What test is used to determine the free movement of the platen and pressure roll shafts?
- 215—Why should the pressure rolls have even contact?
- 216—Why should the  $1510\frac{1}{4}$  have even clearance of the platen and the pressure roll shafts?
- 217—Why should there be more clearance between the platen and bands when carbon sheets are used?
- 218—When the carriage is used for single sheets and it is necessary to print amounts close to the bottom of the sheet, why should the clearance between the platen and the bands be reduced to a minimum?
- 219—Why should the link 1511 align properly with the 1-1522 $\frac{1}{4}$ A when the screw 1551 is removed?
- 220—Why is it important to limit the tension of the 1586 $\frac{1}{2}$  spring?
- 221—What effect will too much tension have on the pawl 1521?
- 222—How is the 1586 $\frac{1}{2}$  spring tension adjusted?
- 223—What is the function of the friction spring 1986?
- 224—Why is the platen frame 1-1568 hinged on the 1-1567?
- 225—What is the function of the latch 1-1534?
- 226—How is the 1508 shaft held in position?
- 227—What is the purpose of the bell dial?
- 228—How is the bell dial reset to a normal position by shifting the carriage to another column?
- 229—How is the belltrip adjusted to ring at the proper time?

# 1700 SECTION



121A\*

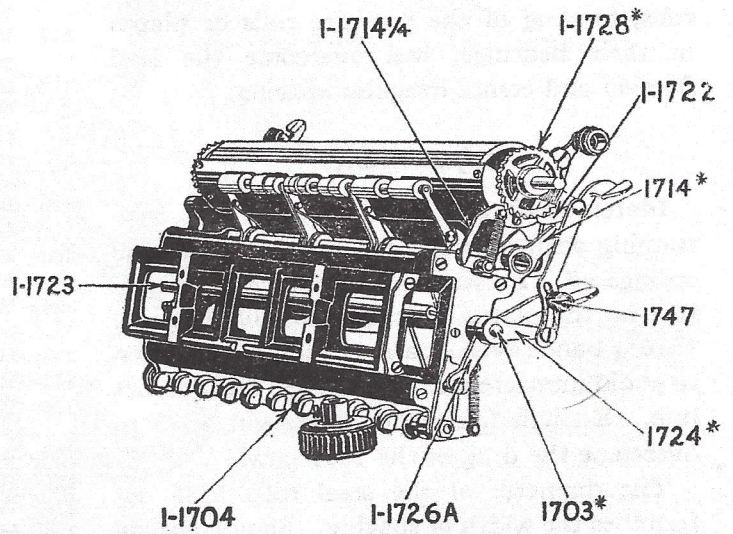
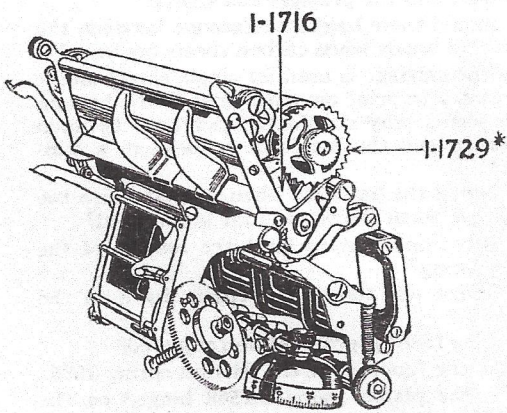


1-1716 1/4



1-727

## COMPLETE CARRIAGE 3-1767



### 1700 Section

The 3-1767 is a positive feed carriage, that is, the motion is applied directly by the spacing pawl 1-1722 to a ratchet wheel 1-1728 fastened to the platen shaft. Accurate spacing is secured by a detent wheel 1-1729 fastened to the left end of the platen, and a detent 1-1716.

The platen is  $12\frac{1}{4}$  or 18 inches long and has individual pressure rolls below the printing line. The operating power is taken from the cam 121A of the 100 section by the 1-727 arm connected to the vertical feed slide.

The spacing pawl 1-1722 is connected to the bail shaft 1703, to which a bail 1-1723 is fastened. This bail is always in the fork of the feed slide and travels the full forward and return strokes.

Single, double or triple spacing is secured by shifting the knurled knob 1747, in the link, so as to engage the arm 1724 *earlier or later*, resulting in longer or shorter travel of the spacing pawl and platen.

When the platen is in printing position, the \*④ roll in detent 1-1716 is firmly placed between the teeth in the star wheel; it is held in place by a spring, so that if the platen is turned a trifle, the effect of this detent returns \*② the platen to its proper position. Now \*③ when the spacing pawl is turning the platen, this detent action moves the teeth of the ratchet beyond the limit of pawl travel; i. e., the detent furnished the *lead* to insure *clearance* of pawl and tooth, and since the star wheel is endless, all spaces are alike.

\*③—The spacing pawl on the end of the forward stroke requires lead to insure engagement. At the end of the return stroke the spacing pawl requires *clearance* of the tooth, to permit the detent effect to secure a definite \*② printing line, and insure accurate spacing.

According to principle No. 4, the spacing pawl 1-1722 which operates on the return stroke, must have a limit when at rest with proper clearance, and the 1714 post answers this purpose.

### Adjustment

According to Rule No. 5 the travel of the

bail is constant. By bending the arm 1-727 or the bail 1-1723, a quicker start and earlier release or vice versa, is secured. This is how clearance of the 1-1722 is secured.

According to No. 4 the detent should be in the center of the star wheel (1-1729) and the frame carrying the 1-1722 resting on 1714.

According to No. 3 the spacing pawls should have clearance on the forward and also the return operations.

When the carriage is in the printing position, it can be revolved only forward, owing to the spacing pawl being in contact with the ratchet wheel 1-1729. When the platen is raised, a cam 1-1714 $\frac{1}{4}$  throws the pawl out of place so that the platen will turn in either direction.

Horizontal movement of the carriage for printing in different columns can be obtained by raising lever 1-1726A. This causes the stops on stop bar 1-1704 to be raised clear of 1-1716 $\frac{1}{4}$  stop block fastened on the back plate. These stops are adjustable permitting different widths of columns.

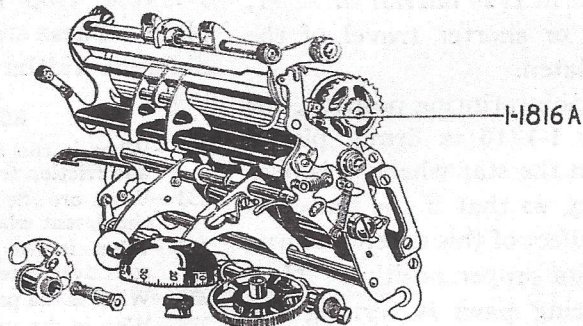
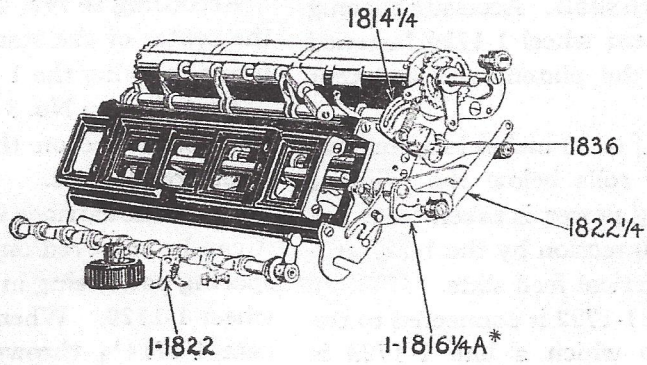
### SELF-QUESTIONS

- 230—What is the distinction between a positive feed and friction feed?
- 231—What are the functions of the detent 1-1716 and the detent wheel 1-1729?
- 232—What is the advantage of individual pressure rolls over those fastened on a shaft?
- 233—What is the purpose of the bail 1-1723?
- 234—Why is the width of the spacing changed by an earlier or later engagement of the knob 1747 and the arm 1724?
- 235—What position does the detent 1-1716 occupy in the detent wheel 1-1729 when the machine is in a normal position?
- 236—Why should the spacing pawl have lead over the ratchet teeth at the end of the forward stroke?
- 237—Why should the spacing pawl clear the ratchet teeth when the machine is in normal position?
- 238—What prevents the platen from turning when the machine is in normal position?
- 239—What part determines the printing line?
- 240—What adjustment is made in order to secure lead and clearance for the spacing pawl?
- 241—If the diameter of the platen is increased or decreased how will that change affect the width of the spacing?
- 242—Why is it necessary to tilt the platen in order to turn it backward?
- 243—What is the function of the cam 1-1714 $\frac{1}{4}$ ?
- 244—What is the function of the lever 1-1726A?
- 245—How are the widths of the columns adjusted?
- 246—How is the bell dial reset automatically?
- 247—What other function has the bell dial besides indicating that the bottom of the sheet has been reached?

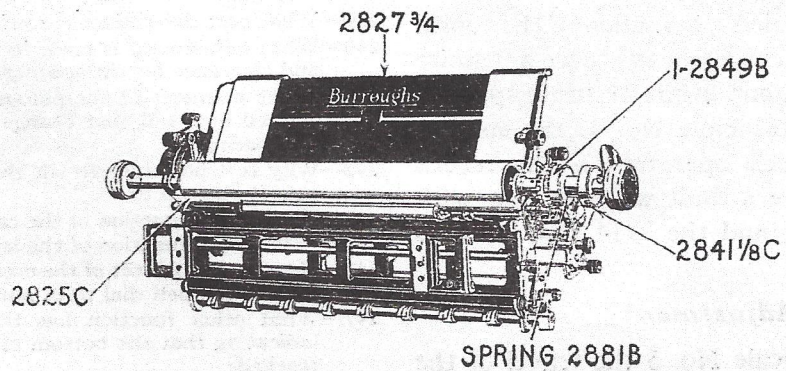
\*See circle figure notes on page 13.



# 1800 SECTION



# 2800 SECTION



### 1800 Section

This is an improved positive feed carriage, embodying the same principles of construction as the 3-1767. The difference of construction simplifies the adjustment and this only will be explained.

A hinged back facilitates reaching the inside of the machine, also the interchanging of differently constructed carriages.

The spacing pawl 1-1822 is disengaged when the machine is normal, which permits the platen to be turned either way. This position of the pawl 1-1822 is obtained when it contacts with the 1836, thus pushing the entire pawl 1-1822 away from the ratchet wheel, thereby securing a lead and clearance of the ratchet and pawl.

It is possible as a rule to adjust the throw-out of the 1-1822 cam by bending its cam part, thereby obtaining the equalization under Rule 5 as applied to the 3-1767.

The detent 1-1816A retains the platen in a stationary position during the printing operation.

This carriage also is equipped with paper clamps having small rolls, to guide the paper around the platen automatically.

The different spaces are secured by shifting the link 1822 $\frac{1}{4}$  away from the center of arm 1-1816 $\frac{1}{4}$ A. This movement assures uniform motion, as compared with the pick-up of the 3-1767.

#### SELF-QUESTIONS

- 248—What is the advantage of the hinged backs?  
249—How is the spacing pawl 1-1822 disengaged before the machine becomes normal?

250—How does the spacing pawl secure lead and clearance when it disengages from the ratchet wheel?

251—How is the spacing pawl adjusted to disengage at the proper time?

252—What is the purpose of the paper clamps?

253—What part is adjusted in order to secure lead for the spacing pawl at the end of the forward stroke?

254—What is the function of the cam 1814 $\frac{1}{4}$ ?

255—How are different widths of spacing secured by shifting the link 1822 $\frac{1}{4}$ ?

256—Can the bell dial in this carriage be locked away from the platen?

### 2800 Section

This section is an improved 1800 carriage, to assist insertion of sheets and to find the location of the printing line.

These advantages are secured by the improved paper shield 2825C which is curved, and the high vertical guide, 2827 $\frac{3}{4}$ .

Locating the printing line without releasing the pressure rolls and adjusting the paper directly, is accomplished through a ratchet and detent unit 1-2849B having a milled concave surface which is free on the platen shaft. The connecting medium 2841 $\frac{1}{8}$ C has a conical milled end sliding on the platen shaft but keyed so as to prevent turning. The compression spring 2881B holds them together so that by sliding milled cone 2841 $\frac{1}{8}$ C towards the twirler, the platen can be turned and the printing line located without disturbing the ratchet and detent.

#### SELF-QUESTIONS

- 257—In what way can sheets be inserted easier in this style of carriage than in the 1800 section?  
258—Can the printing line be located in this carriage without directly touching the paper?

## Final Inspection Using Class 1 Instruction Book

Examine side frames, and base for condition.  
 Examine nuts, screws, studs for being tight.  
 Examine 270 wires, 217s, 273s for condition.  
 Examine No. 7 wire for clearance with 222 $\frac{1}{4}$ .  
 Test No. 1 wires to clear 402 shaft with total depressed on old style machine.  
 Test 221, total, elimination and error keys for free action in the keyboard, and test springs.  
 Test 228s lead and hold on 214s and examine 217 for condition.  
 Test 1-202 $\frac{1}{2}$  for locking 214s (with handle forward).  
 Test 910L for condition.  
 Test 901 for condition.  
 Test 910 R. & L. to be parallel on 205 shaft.  
 Test 900 section for mesh with 610s.  
 Test 910R for  $\frac{1}{4}$ " play between 205 shaft and 338 roll.  
 Examine 915s and 916s for condition.  
 Align 916s (dial wheels) with 610s (adding racks).

Examine 1-917 for condition. Test loose and tight points, rack to clear 926s by  $\frac{1}{32}$ ", see page 25 for all adjustments.

Align 311 and 313 top and bottom.

Test 1-119, 885 springs and 834 roll for condition. 120 free on 552.

313 to clear 311 by  $\frac{1}{32}$ " first with handle forward, then normal.

713 to align and clear 714 by  $\frac{1}{32}$ " handle forward, 120 locked.

Test 813 for being tight on 800 shaft.

Examine dashpot connection for free action on 602 shaft.

821 to trip from rear 961 stud before 713 and 313 release.

Test 821 for free action and for locking under rear 961 stud, and printing 9s on one shaft machines.

900 and 913 free, 914 lead over 959 $\frac{1}{4}$  stud when totaling.

911 free to drop (on 251 screw in 227 $\frac{1}{4}$ ).

## Sector-Alignment 600 Section

Examine 692 comb for being tight on 600 shaft.

Test 611s for side play between 659 and 658 pins.

For side play change to larger 659 pin.

If 611 is tight, smaller pin is required (washers in later model comb).

Test 611s for free action and align 610s between 210AR and AL.

Examine type.

Examine 682 springs for condition and to clear the 611s.

Examine 654 $\frac{1}{4}$  studs.

Space 611s for proper space between bands, ( $1\frac{7}{16}$  inch).

Test 611s for rubbing (long type studs).

Depress alternate 9s, move handle slowly forward and see that type and springs clear each other, then use opposite 9s.

See that 611s run straight up and down, use top of 611 to right on this operation as a guide while moving 611.

Test 1-702 for condition and resetting.

Test 717s to drop over 716s before 313 leaves 311 with No. 1 key on left. (Page 23.)

Examine 751 stud for condition.

Locate 700 section to align 718s with 611s.

Examine 229 $\frac{1}{2}$  to align with 718s.

Align 718s and 717s, 716s and 717s and examine for condition.

Test 715s to align with top and bottom type.

Test 715s for free action and for side play.

Test 715s to clear 611s and 717s sideways.

Examine 780s.

Examine 592, 525, 518 and 518 $\frac{1}{2}$ .

Install ribbon, examine 523 and 581 for condition.

Test ribbon reverse, see page 19.



