NAVAL AIR TECHNICAL TRAINING U[illegible]
Naval School, Camera Repair
U.S. Naval air Station
Pensacola, Florida

GRAPHEX SHUTTER INFORMATION SHEET 13 January 1950

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SETTING LEVER

The setting lever cams the main lever into the cocked position and then resets due to the setting lever spring. The setting lever moves the dust shield up during the cocking action and the red dot becomes visible. The focus lever can now be used. When the red dot is in view, it is a visual indication that the shutter is in the cocked position.

SHUTTER BLADES

The shutter blades are driven by the revolving ring on which they are mounted. Looking from the front of the shutter the leaves go on from fove to one in a counter clockwise manner. Blade # 5 goes on the revolving ring operating stud. There is a spacer that goes over leaf #1. The purpose of this spacer is to make certain that the shutter blades overlap properly when they meet in the center of the shutter.

MAIN LEVER

The main lever is moved to the cocked position by the setting lever. Near the end of the cocking action the main lever cams over the tongue of the release lever and drops behind it. It will be held in this position until the release lever is moved from it. Then the tripping action will take place. When the main lever is moved to the cocked position it causes the focus lock to become disengaged from the focus lever. After the shutter has been cocked the focus lever can be used to open and close the blades. After the blades have been opened by the focus lever, they must be closed by the focus lever although it is possible to close the shutter by tripping. As the main lever nears the end of the cocking cycle it strikes the pallet lever. This action moves the pallet out of contact with the star wheel and decreases the load that the retard lever spring will have in recycling the retarding device.

RELEASE LEVER

The release lever, when rotated is removed from the path of the main lever. This leaves the main lever free to travel under spring tension. As the release lever is rotated it moves the time lever out of the path of the main lever. When the release lver is returned to its normal position it removes the bulb lever from the path of the main lever. This lever action can be seen when the speed cam is removed from the shutter.

LEAF LEVER

The leaf lever is situated under the main lever. When the main lever is released it strikes the leaf lever, turning it counter clockwise. On the other end of the leaf lever there is a recess. The revolving ring operating stud, which is located on the revolving ring, rides in this recess. As the revolving ring operating stud is turned counter clockwise by the main lever, the blades are opened. When the blades reach the full open postionn, the main lever by passes the leaf lever. A this time the main lever comes in contact with

the revolving ring operating stud and pulls the stud back to the normal position. In doing so it closes the blades and returns the leaf lever to its original position. After the shutter has been tripped the blades are held closed by the main lever. When the main lever is cocked it is forced over the leaf lever and the release lever. At the end of the cocking action it drops behind these levers due to its own spring tension. At this time the leaf lever holds the blades closed.

During time and bulb exposures the time and bulb levers hold the main lever. The main lever holds the leaf lever which holds the revolving ring.

RETARDING ACTION

The retarding action in this shutter is accomplished, up to 1/100, by a series of wheels and a pallet. When the shutter is set for one second the entire retarding device is in operation. When the shutter is tripped the main lever comes into contact with the retard lever. The main lever must force the retard lever out of its path before it can complete its cycle. As the retard lever is moved it in turn will operate the retarding device wheels and the pallet. The amount of resistance that is offered to the main lever is controlled by the speed cam. The speed cam controls the position of the pallet and of the retard lever.

At the speeds of 1 second, 1/2, 1/5, and 1/10 of a second the pallet is in contact with the star wheel. The different speeds are obtained by varying the distance the retard is allowed to travel. At the speeds of 1/25 and 1/50 of a second the pallet is held out of contact with the star wheel by the speed cam. At the speed of 1/100 of a second both the pallet and the retard lever are held out of contact and the entire retarding device is inoperative. The retard action for 1/100 of a second is accomplished by the main lever striking the retard weight. At the speed of 1/200 there is no retarding action. This is called the free speed. At the 1/400 setting there is also no retarding action but there is added power applied to the main lever by the high speed spring. Therefore 1/400 is called the free boosted speed.

On the time and bulb settings only the pallet is out of engagement. Therefore the retarding action will be the same as that for 1/25 of a second.

The shutter speeds can be adjusted by bending the retard lever stud, the pallet stud and by filing or swedging the speed cam. FILING OR SWEDGING THE SPEED CAM SHOULD ONLY BE RESORTED TO WHEN YOU ARE <u>CERTAIN</u> THAT IT IS THE <u>ONLY</u> THING THAT WILL ACCOMPLISH THE PURPOSE. The true operation of the speeds will depend upon the gear condition, lubrication, cleanliness of the unit, conditions of the springs and the temperature at which the unit is operated.

The time and bulb levers are held out of the path of the main lever by the speed cam at all settings except time and bulb.

SYNCRO UNIT

When the main lever is cocked the main lever operating stud comes into contact with the retarding sector gear lever and rotates it to the cocked position. The syncro lock lever then engages the retarding sector gear lever and holds it in the cocked position. At this time the main lever operating stud moves out of contact with the retarding sector gear lever. During the cocking action the lock lever will not close the electrical contacts because the lock lever will pivot.

After the lock lever has passed the contacts it is snapped back into position by the lock lever spring. The lock lever will close the contacts when the retarding sector gear lever is released.

When the shutter is set on the 20 millisecond delay the syncro release goes into the path of the main lever at the end of the cocking cycle and the other end of the syncro release lever rides against the stud on the retarding sector gear lever. When the main lever is released the main lever operating stud strikes the syncro lock lever. This releases the retarding sector gear lever which then rotates counter clockwise, closing the electrical contacts.

As the retarding sector gear lever rotates the retarding sector gear lever stud is in the act of withdrawing the syncro release lever from the path of the main lever. After the syncro release lever has been fully removed from the main lever the main lever goes through its normal tripping cycle. When the retarding sector gear lever finishes its travel it comes into contact with the clutch spring. The purpose of the clutch spring is to position the retarding sector gear lever or to hold it in such a position that the main lever operating stud will be certain to engage the retarding sector gear lever during the next cocking cycle.

The syncro unit is movable so that various delays can be obtained for use of the shutter with bulbs of different delays. On the off position the syncro unit is held out so that it will not be engaged by the main lever operating stud. The clutch spring will be compressed at this time. When using the zero millisecond setting the contacts are closed by the zero lever. The zero lever is actuated by the zero stud which is mounted on the main lever. On the 5 millisecond setting the contacts are closed and the main lever is released at the same time. On the 20 millisecond setting the contacts are closed 15 (approx) milliseconds befor the main lever is released.

The amount of delay of the syncro unit is adjusted by bending the syncro release lever. The long arm of the syncro release lever is bent so that the angle formed by the two arms is greater to secure a longer delay. The greater the angle formed by the two arms, the greater the delay.

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GENERAL INFORMATION

"M" or "20" setting: Use bulbs with a 20 millisecond delay such as the #5, #22, #40, etc. These bulbs are wire filled.

"F" or "5" setting: Use bulbs with a delay of 5 milliseconds such as the "SM" and "SF" bulbs. These bulbs are gas filled.

"X" or "0" setting: Use strobe lights. This is an electronic flash of high intensity and very short duration, usually between 1/5000 and 1/50,000 of a second. This bulb is actually a quartz tube filled with xenon gas. When a high voltage is sent through this gas, it is illuminated for a very short time.

When working with this shutter do ALL work with tweezers. Never touch the parts with the fingers. The acid, which the human skin leaves on the parts will in time cause the metal to corrode.

Always check to be certain that the screws have the proper shoulders and clearance. When assembling the shutter, check the operation of each part as it is built up; then check sub-assemblies etc. That way you can be quite certain that the shutter will work properly when it

is completely assembled the shutter will operate properly

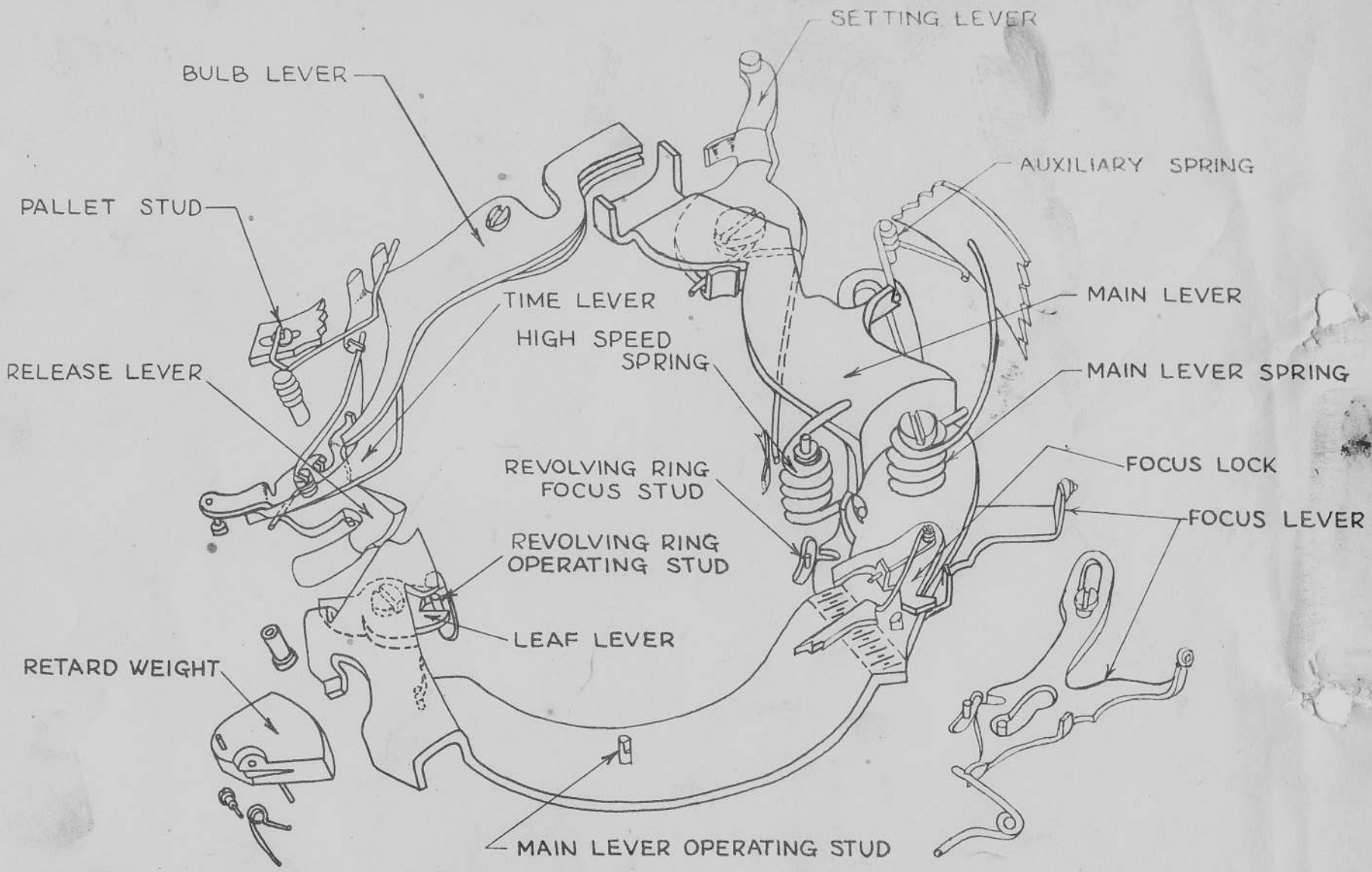
Always make certain that all bushings and shafts are free from rust and dirt. Where there are two metal surfaces that work against each other, such as the time and bulb levers and the retarding sector gear lever and the syncro unit support plate, be especially careful that these parts are perfectly clean so that there will be no more than the minimun amount of friction.

Never force parts or apply great amount of undo pressure. If something does not fit you may be quite certain that a mistake has been made somewhere. FIND it and CORRECT it before trying to proceed with the assembly.

To use graphite for lubrication of the retarding device wheel bearings, rub a small amount of graphite over the top of the retarding device cover. Work the wheels until the graphite reaches the wheel bearings. Thoroughly blow out any loose graphite before reassembling any additional parts.

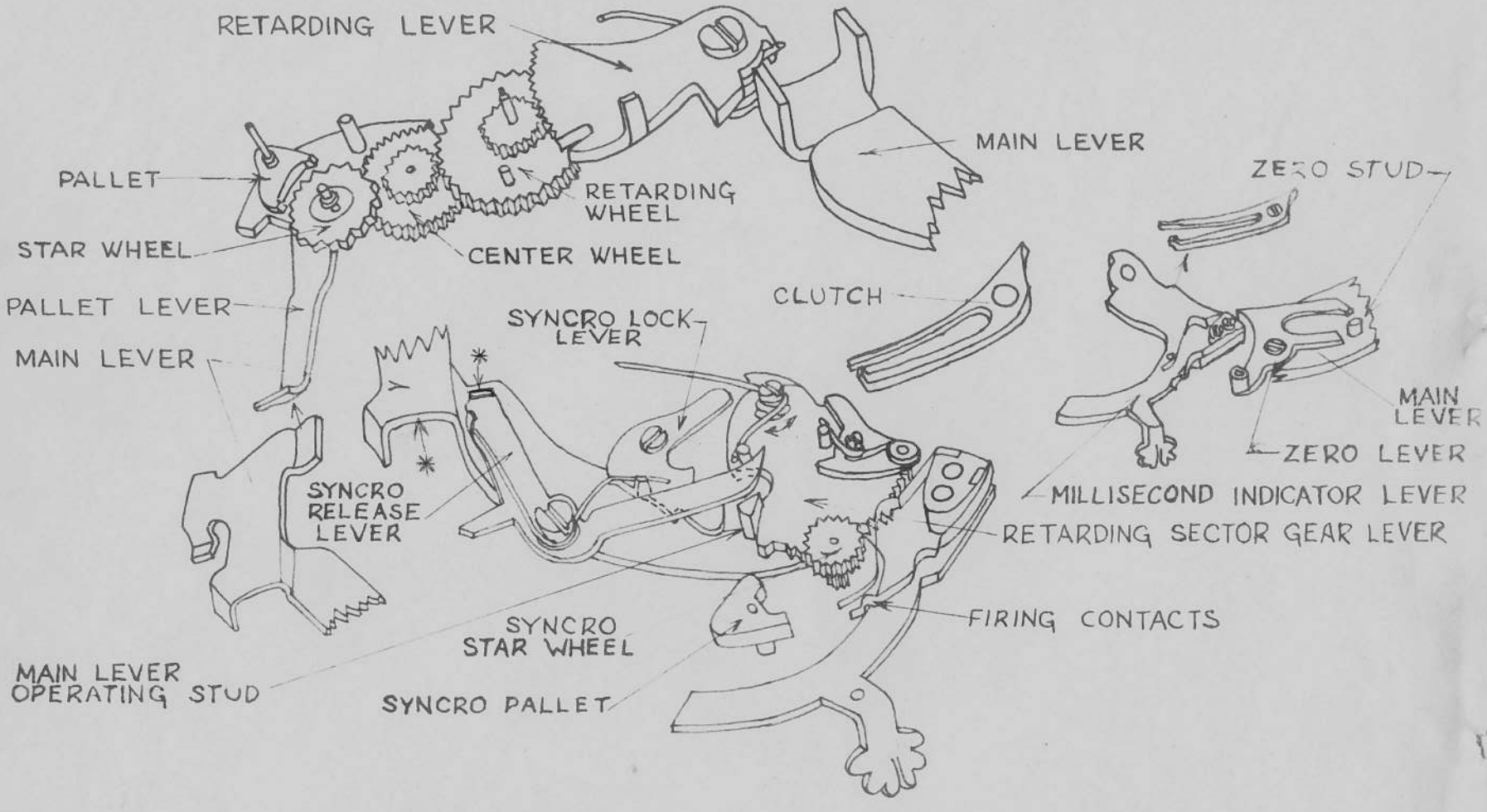
To use graphite for lubrication of the shutter blades, work the graphite into the blades with a piece of cloth. NOT WITH THE FINGERS. Wipe off all excess graphite before reassembling.

When adjusting the syncro unit for proper syncronization between the shutter and the flash on the 20 millisecond setting, the shutter should reach the full open position 19 milliseconds after the current is applied to the flash bulb.



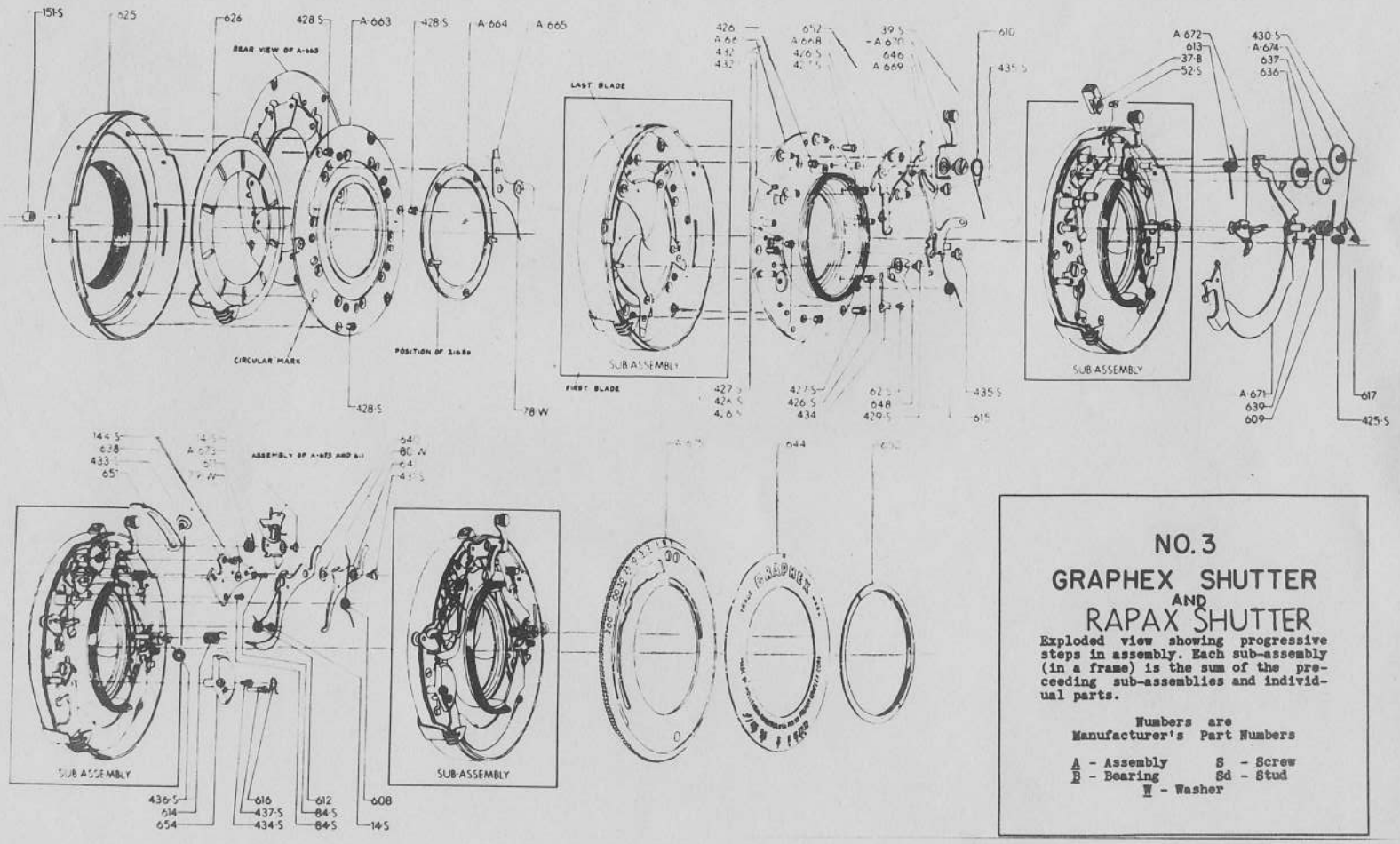
GRAPHEX SHUTTER

3-15-50



GRAPHEX SHUTTER No. 2

2-7-50



NO. 3
GRAPHEX SHUTTER AND RAPAX SHUTTER

Exploded view showing progressive steps in assembly. Each sub-assembly (in a frame) is the sum of the preceeding sub-assemblies and individual parts.

Numbers are Manufacturer's Part Numbers

A - Assembly
B - Bearing
W - Washer
S - Screw
Sd - Stud