
# SPACE CONTROL CORPORATION

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## SPACE CONTROL SYSTEM

## Instruction Manual

This is a temporary manual made necessary by a delay in the revised Space Control Manual which is still in preparation. Although this temporary manual contains all pertinent information, the new manual will be forwarded to you as soon as it is released.

# HOW TO OPERATE YOUR SPACE CONTROL SYSTEM

## Preparations for Operation

### Transmitter

Install 6D135A Power Pack. Remove rear cover of Transmitter case. Attach the cable connector from the Transmitter to the Power Pack, and place Power Pack in the case with the charging cord adjacent to the opening in the case. Secure the Power Pack in place to prevent movement, and replace the case cover, using the two screws provided. Install the Throttle knob by pushing it over the Throttle control shaft, through the access hole in the top of the Transmitter case. Install antenna by inserting through the rubber grommet on top of the Transmitter case, and then turn clockwise to seat it in the threaded receptacle in the printed circuit board. DO NOT FORCE. Do not carry or handle the Transmitter by the Antenna, as damage to the circuit board may result.

To put the Transmitter in operation, momentarily turn the on-off switch fully clockwise to the "Filament" position, and then back one position to the "On" position. Observe the meter readings at this point.

The Indicating Milliammeter will read the FILAMENT voltage when the Transmitter power switch is in the "Fil." position. 1.5 volts will read approximately full scale. When the switch is turned to the "On" position, the meter will indicate the B-plus current, and is an indication of the power output as well as the B voltage. Full scale in this position is approximately 50 milliamperes. Normal indication will be 30 to 40 milliamperes. This may vary with individual transmitters. To familiarize yourself with the reading for your particular Transmitter, you should observe the reading when the Transmitter Power Pack is fully charged, and again after a normal day's usage. This will furnish your guide for future reference. When using the 6D135A Power Pack, actual operating time will be approximately three hours from a fully charged Pack.

The indicator lamp on the front of the Transmitter is the Charge Indicator, and will light only when the Power Pack is being charged. It serves both as an indicator and as a fuse. Refer to charging instructions in Servicing Procedure section.

## Receiver

The Space Control System receiver is completely tuned, adjusted, and sealed at the factory. When purchased with the System, the 4542 Power Pack is already installed. In order to place it in operation it is only necessary to plug the receiver half of the cable connector into the Power Pack half. This "turns on" the power to the receiver. (Instructions for installing an optional receiver power switch are given in figure 1.)

## Operation

You may now see your Space Control System in operation. Plug in the Aileron Servo, turn on the Receiver, turn on the Transmitter, and operate the controls. Vertical stick movement controls the elevator, horizontal stick movement controls the ailerons, rotation of the knob on the end of the stick controls the rudder, and rotation of the knob on top of the Transmitter controls the throttle. Directly below the throttle control knob, and on the end of the Transmitter case, are the two trim control knobs, FRONT one for elevator trim and REAR one for aileron trim. The very slightest command of any control will meet with the instantaneous action of the corresponding servo. Any or all controls may be operated independently or simultaneously, as desired. Release of the control stick will provide "self-neutralizing" action of all of the flight surface controls by returning the aileron, elevator, and rudder servos to their neutral setting. The throttle will, of course, retain its position until manually restored. Again, if all the controls are operated simultaneously, and the Transmitter power switch is turned to "Off", all flying surface controls will return to neutral and the throttle control will go to the "low speed" position. This is your "fail-safe" feature, which will take over if for any reason you should experience a loss of signal. Under these circumstances, a properly trimmed plane will go into a glide rather than continuing on to be lost.

## Additional Features

Normal operation of the equipment has been described above. If it is desired to operate the Space Control System in an aircraft not equipped for aileron operation, the horizontal "stick" command may be changed over to operate the rudder as shown in Figure 13.

Referring to Fig. 13, remove the blue and green wires from the circuit board, solder them together, and tape. Install a jumper wire across the two terminals on the circuit board from which the blue and green wires were removed.

# HOW TO INSTALL YOUR SPACE CONTROL SYSTEM

## Installation

### Receiver

Installation of the Receiver is quite simple and versatile, and full performance of the system may be realized with practically any method of installation.

However, the method described and illustrated is much to be preferred to other methods. The mounting has been proven by actual field tests to provide the greatest possible protection for the Receiver.

The Receiver may be installed either on its base or on its side. Mounting holes are provided for base mounting. If side mounting is desired, holes may be drilled in the Receiver case. Care must be taken to prevent the screws from hitting the Servos or Power Pack when the Receiver is replaced in its case. If your model will accommodate base mounting, it will provide more convenient access to the Servo pushrod connections. However, the equipment will operate equally well in either position.

It is recommended that the Receiver be mounted directly to a balsa plank. This should be approximately 3/8" thick, soft to medium balsa - NOT hard balsa. It should be mounted with the grain fore and aft in the plane, with approximately 2" of unobstructed area directly in front of the Receiver. While this is not absolutely necessary, it does allow room for deceleration in case of a sudden impact.

To mount the Receiver, it is necessary to remove the Receiver from its aluminum case in order to provide access to the mounting holes. This is accomplished by removing the six screws indicated in figure 2. DO NOT remove any of the other screws as the others are the mounting screws which secure the servos to the board. After lifting the Receiver chassis from the case, move the 4542 Power Pack so as to clear the mounting hole beneath it. The 4542 Power Pack may be gently pushed back from the mounting hole by pressing against it with a pencil or similar object through the cable opening in the end of the Receiver case. It is not necessary to loosen the Power Pack mounting strap.

The empty Receiver case may be bolted to the balsa plank, as

illustrated in figure 3., using 4/40 screws through the grommets. DO NOT over-tighten. Figure 4. illustrates optional mounting tabs which will permit the removal of the Receiver assembly without the necessity of removing the chassis from the case. If desired, additional Receiver cases are available from the factory for individual mounting in various airplanes, so that the Receiver chassis can be quickly transferred from one to the other without disturbing the basic installation.

After the Receiver case is installed, the Power Pack may be repositioned by pushing it back into place under the mounting strap, after which it should be firmly taped as shown in figure 5., to prevent shifting from vibration. (The equipment may be operated equally well with the Power Pack outside of the Receiver case, whereby it may be positioned as ballast in the nose or elsewhere to establish the center of gravity of the airplane.)

The Receiver may now be re-installed in its case with the six screws. A touch of "Goo" or "Contax" cement should be placed on each screw head to prevent loosening from vibration.

## Antenna

The Antenna is of standard antenna wire, already installed, 30 inches in length. It may be installed in any convenient manner, but should be kept at least 1/2 inch away from any other wiring or metal object, including the Receiver case.

## Aileron Servo

Figure 6. illustrates the approved method of mounting the Aileron Servo. This Servo is packaged separately for remote installation in the center of the wing. This Servo is held in place by means of a strap, which should be made to suit the particular requirements of your plane, and should be positioned to provide maximum accessibility.

When installing pushrods, care must be taken to avoid limiting travel to less than the normal travel of the Servo drive disc. If the Servo is mechanically blocked before completing the command given by the Transmitter, unnecessary current drain will result.

# SERVO CONNECTIONS

The Servo-to-control-surface connections may be made by practically any method. Pushrods are normally employed as this is usually the simplest method. It is desirable to keep the pushrods as light as possible, and to permit "free" rotation of all of the Servos. Of course this may not be possible in all cases, but it is necessary to permit free travel throughout the normal operating range of the Servo, so as to prevent stalling of the Servo and causing unnecessary current drain. Special construction details are shown in figure 7. for the Throttle linkage, where stalling of the Servo would be most likely to occur.

## Servos

Three Servo drive discs are visible on top of the Receiver. The disc on the forward (line of flight) end is the Throttle control disc. On the left rear is the Rudder control disc, and on the right rear is the Elevator control disc. The remote Aileron Servo is connected by a cable and C101 Cable Connector. Each disc is pinned to the Servo shaft and is drilled to permit pushrod connections for operation in either direction, according to the action desired. The holes in the disc may be enlarged to accommodate larger wire, or additional holes may be drilled for variations in outputs.

Before making connections to the Servo drive discs, turn on the Receiver to restore Servos to their netural positions. Then turn off the equipment and you are ready to make pushrod connections. Suggested mechanical detail is shown in figure 8. Rudder and elevator connections are simple pushrods. The suggested "keeper bar" as shown will prevent the pushrods from vibrating out of the Servo drive disc holes, and will still permit removal by flexing the pushrod. Nosewheel steering may be accomplished by extending the rudder pushrod forward to the nosewheel. Because of landing impact, this pushrod should be of shock-absorbing design as shown in figure 9.

Throttle connections are usually more complicated and we highly recommend the linkage as shown in figure 7., although you may devise your own method. Where construction of the model presents obstacles to straight-line pushrods, 3/32" tubing may be used to guide .020 music wire pushrods around such obstacles. This will permit

free movement as long as there are no kinks in the tubing. Terminations at the Servo end of the pushrods should be made following the suggestions shown in figure 10. Termination at the Throttle end should be made as in figure 7, allowing approximately 2-1/2" of clearance beyond the end of the guide tubing. Adjustment of the bend in the pushrod will synchronize the movement of the throttle arm with the movement of the Servo drive disc, and will absorb any overtravel.

## Additional Servos

Additional Servos may be added to provide simultaneous operation with any already installed Servo simply by paralleling all the wires from the selected control Servo with the wires from the added Servo such as operating a wheel brake Servo in coordination with the elevator Servo. Such a brake Servo installed in the wing will provide proportional brake action without any complicated mechanical apparatus. Similarly, throttle Servos may be parallelled for synchronized multi-engine operation without elaborate linkages. Individual aileron Servos may be paralleled with one Servo mounted at each aileron, avoiding extended linkages on large planes. This unique SPACE CONTROL feature opens horizons to heretofore impossible applications. Auxiliary controls such as flaps and/or other operations may be obtained by use of an actuator (a wheel collar makes a good one), and a microswitch operating on any selected pushrod. (Example: throttle linkage operates a microswitch controlling trimmable Servo for flaps, etc.)

## ADJUSTMENTS

In making adjustments, do not attempt to operate the receiver when the rear cover of the transmitter is off, or without installing Transmitter antenna. For close range checkout operation, the antenna may be fully collapsed.

## Trim Adjustments, General

Trim adjustments should be made one command at a time, fully completing that adjustment before starting the next.

Trim control determines the position of the aileron and elevator surfaces when the transmitter "stick" is in neutral.

## Elevator Trim Adjustment

Turn on Transmitter and Receiver.

With the Transmitter control stick in neutral position, adjust Trim Control Knob to each extreme of rotation, noting the corresponding extreme movement of the Elevator Servo drive disc. Then adjust trim control knob until the servo drive disc is at the mid-point of the trim range. If the elevator is not now in neutral position, loosen the two setscrews marked "A" in figure 11, slip bracket "C" off of shaft "B", and adjust to neutral by turning the potentiometer shaft "B". Then replace bracket "C" in neutral position and tighten screws "A". In this manner you will adjust to a neutral wherein elevator trim control and elevator control will coincide.

You will note that the center position of the servo drive disc may not correspond with the center position of the trim control knob. Use as a reference the center position of the servo drive disc rather than the center position of the trim potentiometer.

## Aileron Trim Adjustment

Adjust Aileron Trim control knob until aileron servo drive disc is at the mid-point of the trim range, just as you did with the Elevator Trim control. If the aileron is not now in neutral position, loosen the two setscrews marked "D" in figure 11, and slip bracket "E" off of shaft "F". Adjust shaft "F" until the aileron is neutral. Then replace bracket "E" in neutral position and tighten setscrews "D".

## Rudder Neutral Adjustment

Loosen setscrew "H" on rudder control shaft collar. Rotate shaft "J" until rudder is in neutral position. Tighten screw "H" after making sure that spring "G" has not been displaced.

Recheck all controls to make sure that the flying surfaces are in neutral when all controls are in neutral. If not, readjust the incorrect control.

## Throttle

No provision has been made for adjusting the position of the throttle control servo. The "Throttle Closed" position is determined by the placement of the pushrod hole in the throttle servo drive disc. Additional holes may be drilled in the servo drive disc to suit the owner's requirements.

## Total Trim Movement

The trim range is set at the factory to be approximately 25% of the total control travel. Some flyers prefer more movement, and some prefer less. The amount of trim travel may be changed to the individual's preference by changing the size of the resistor mounted on the trim potentiometer. Increasing the resistance will increase the amount of trim travel, and decreasing the resistance will decrease the amount of trim travel. Resistance values can vary from 2K minimum to 25K maximum. If the amount of trim travel is changed by this method, it will be necessary to readjust the corresponding trim function to netural as explained previously.

# PREPARATION FOR FLYING

All Transmitter controls are designed to simulate as closely as possible the controls of a conventional prototype aircraft. The principal variation is in the rudder control, which is in the form of a knob on the end of the control stick, whereas the conventional full-sized aeroplane control is in the form of foot pedals.

All flight controls are mounted on the Transmitter; rudder, elevator, ailerons, and throttle, as well as the in-flight trim controls for aileron and elevator.

If the equipment has been properly installed, pushing the control stick forward will produce "down" elevator, and pulling it back will produce "up" elevator. Moving the stick to the left will raise the left aileron and lower the right, and pushing the stick to the right will raise the right aileron and lower the left. Rotating the knob on the end of the stick to the left will give you "left" rudder, and rotating it to the right will give you "right" rudder. Rotation of the knob on the top of the Transmitter in a clockwise direction will open the throttle, and rotating it counterclockwise will close it. These controls may be operated

independently of each other, or any or all of them may be operated simultaneously.

The trim controls, located on the end of the Transmitter, may be operated while on the ground, or in flight, as required. Adjustment of these controls is explained under Section 4.

The controls may be released at any time, and all flying surfaces will return to their neutral trim positions. The Throttle control must be restored to "closed" position manually.

Should the model fly out of range, turning off the transmitter power switch will restore ALL controls to neutral position, and the throttle will go to the low speed position. If the model is properly trimmed out, it will glide down to a landing rather than continue flying farther away.

Simultaneous proportional operation provides a smoothness and response that has never been achieved by any other radio control system. Practice will result in an unbelievable smoothness of flight and the ability to perform any type of aerobatic maneuver with precision.

FIG.2

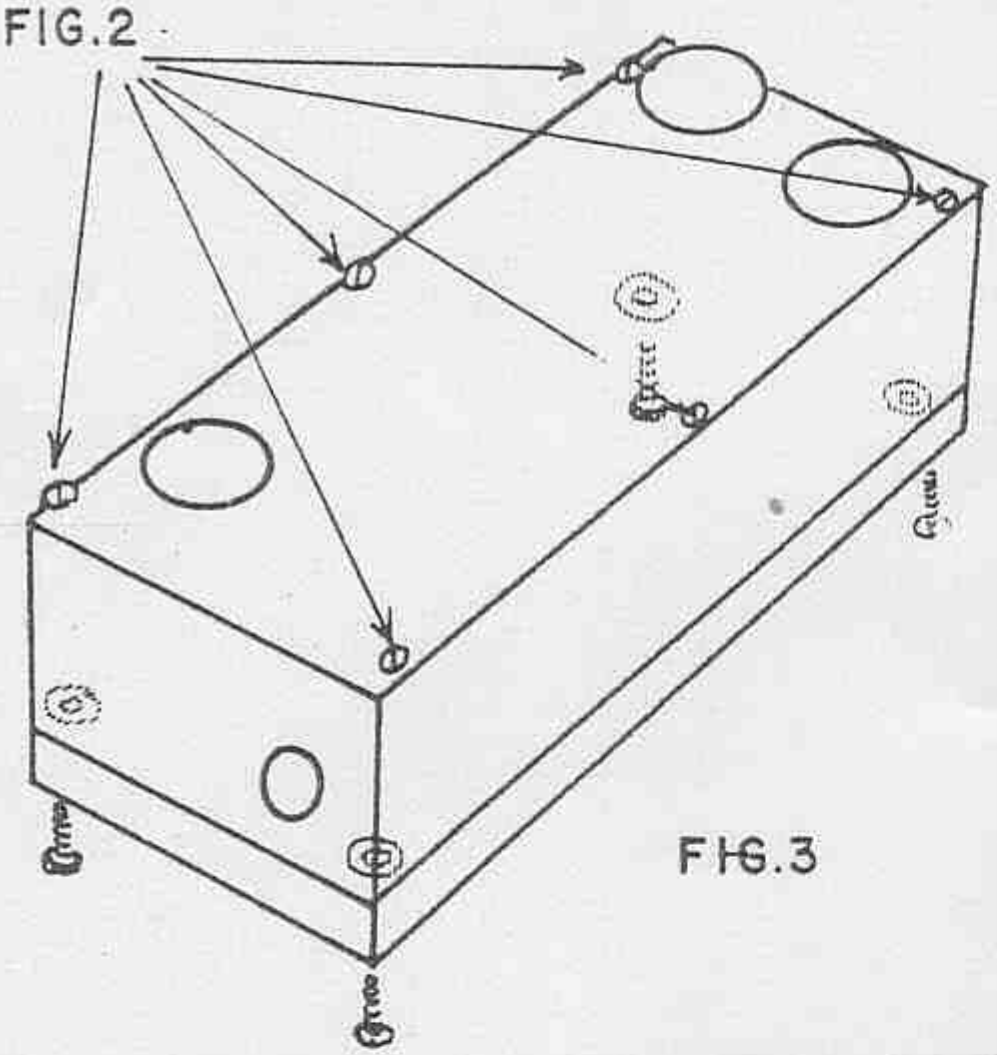


FIG.3

FIG.4

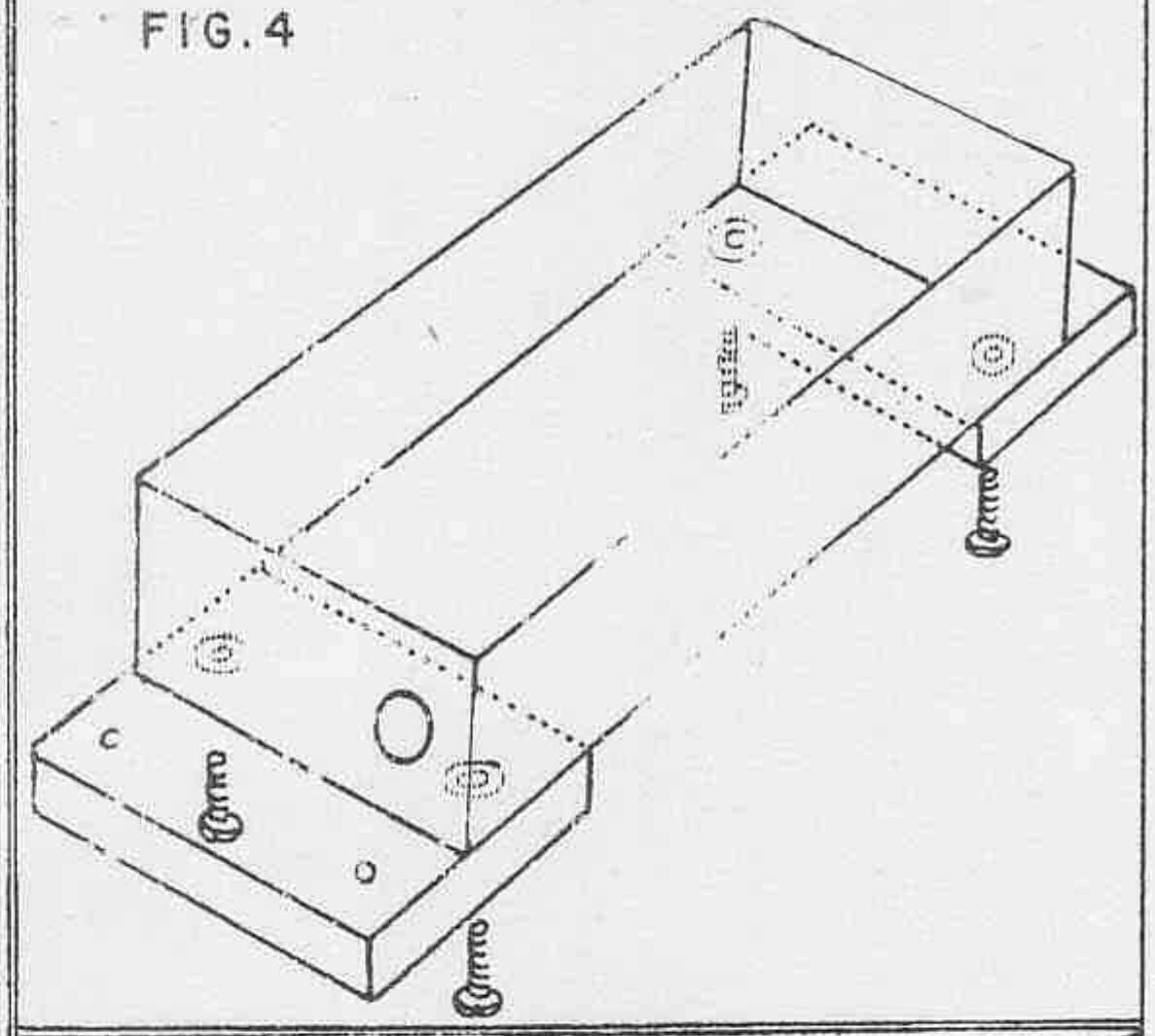


FIG. 5

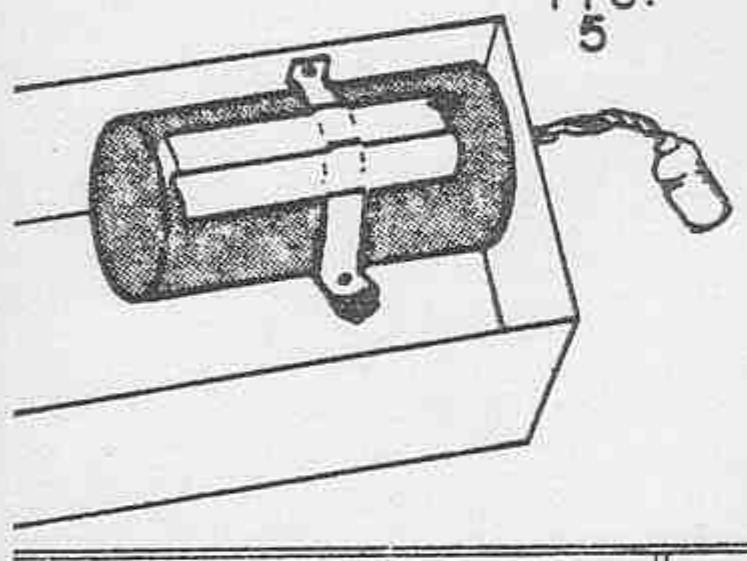


FIG. 6

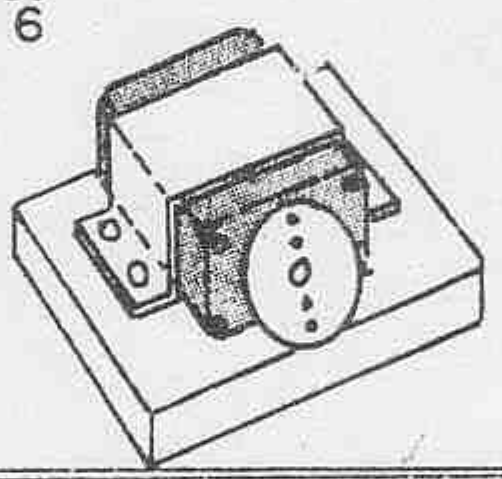
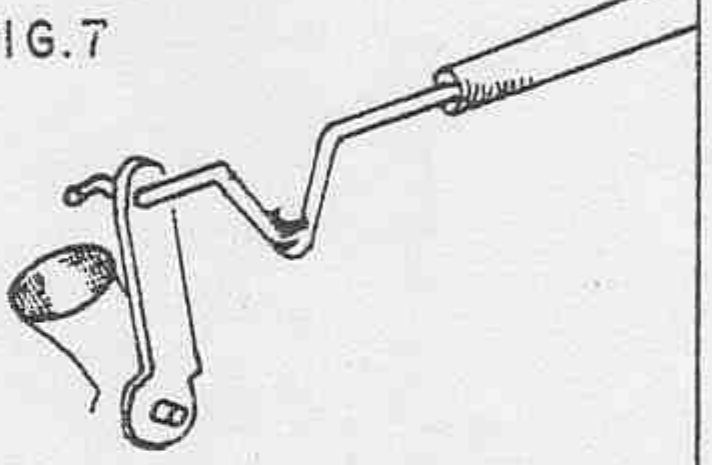


FIG.7



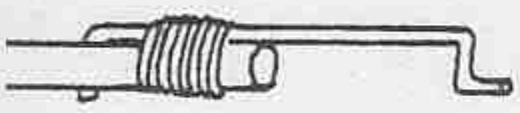


FIG.8

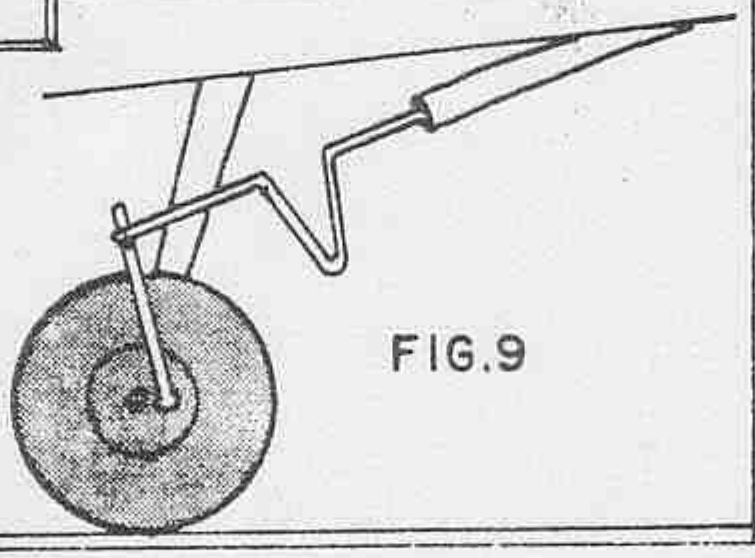


FIG.9

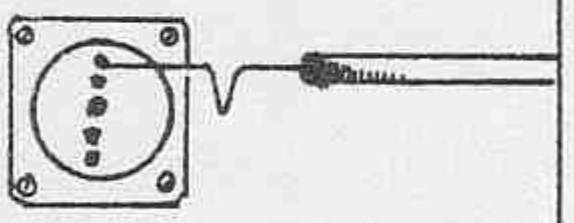


FIG. 10

FIG. 11

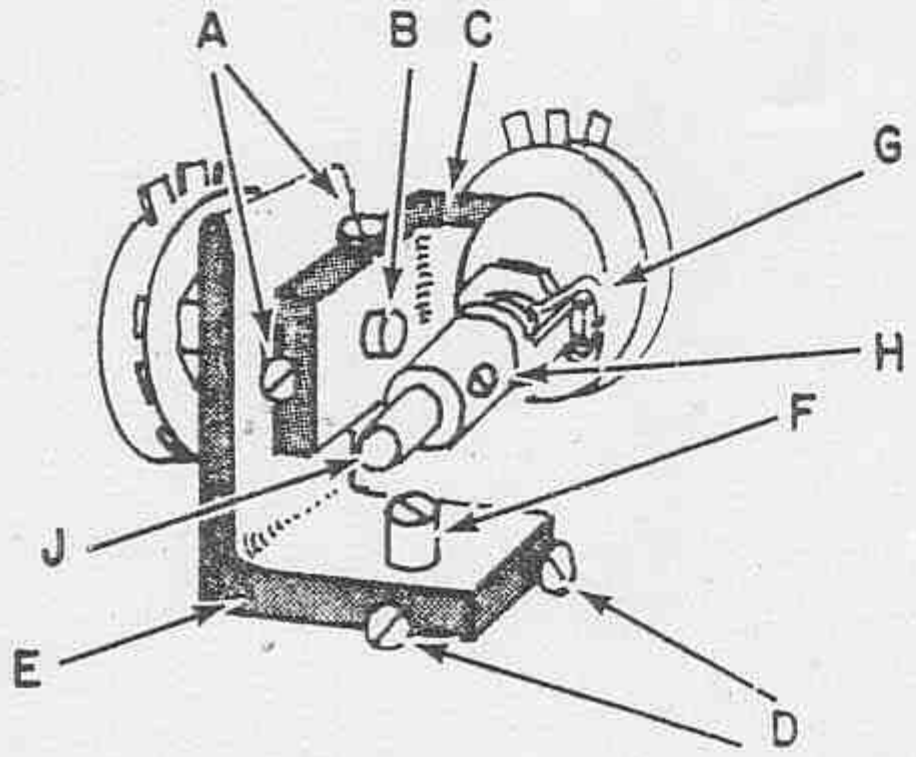
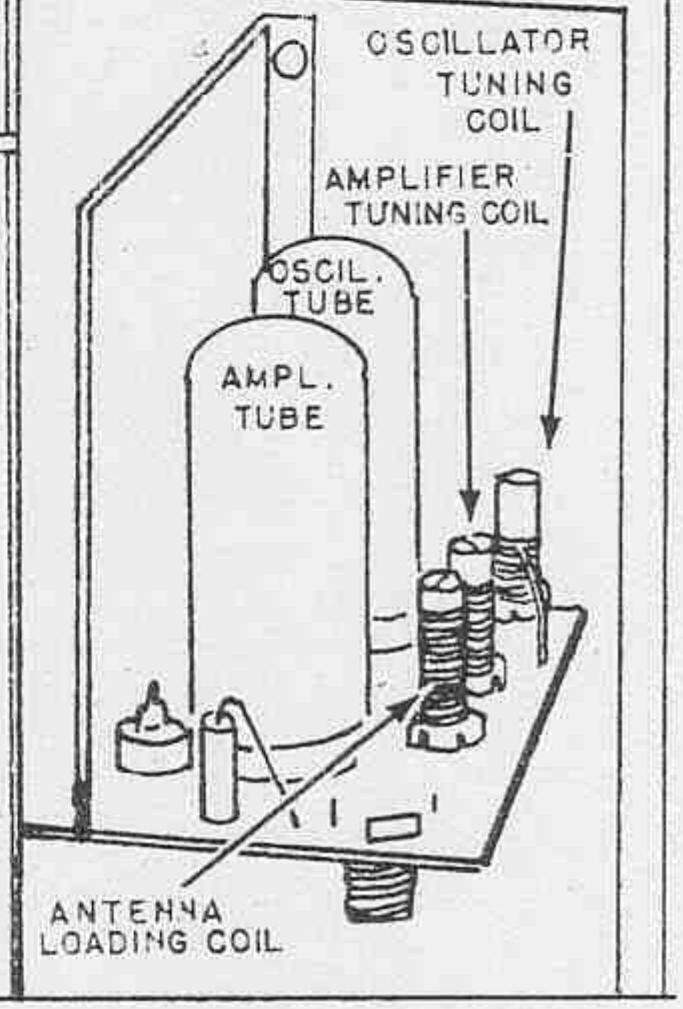



FIG.12



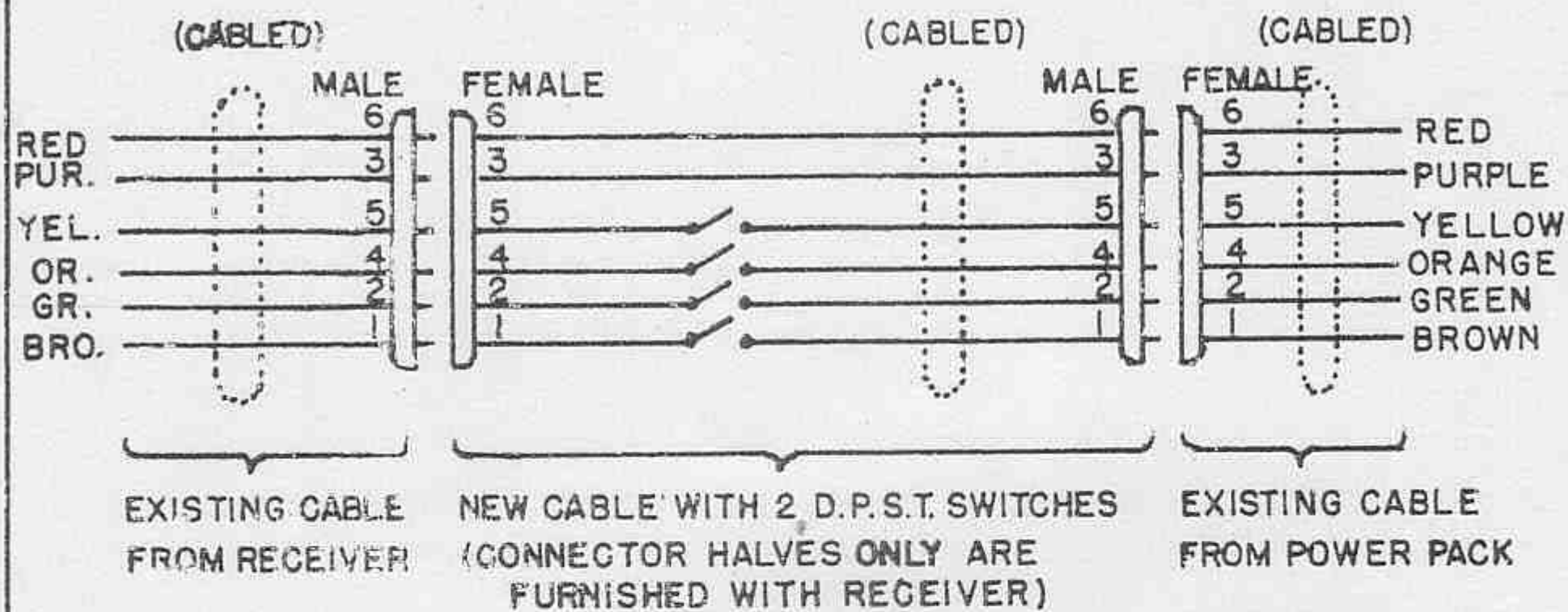
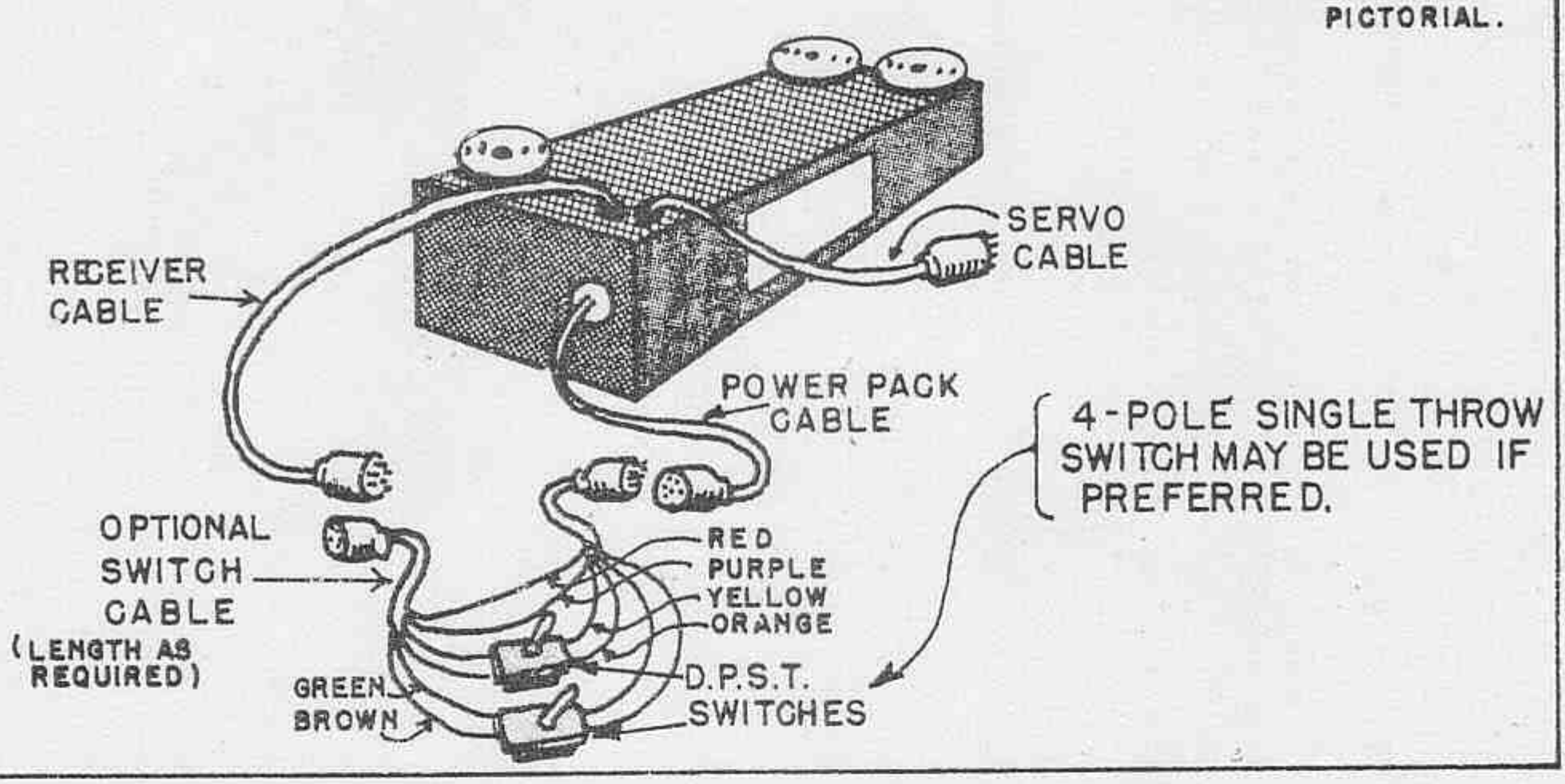



FIG. 1
SCHEMATIC.

FIG. 1
PICTORIAL.



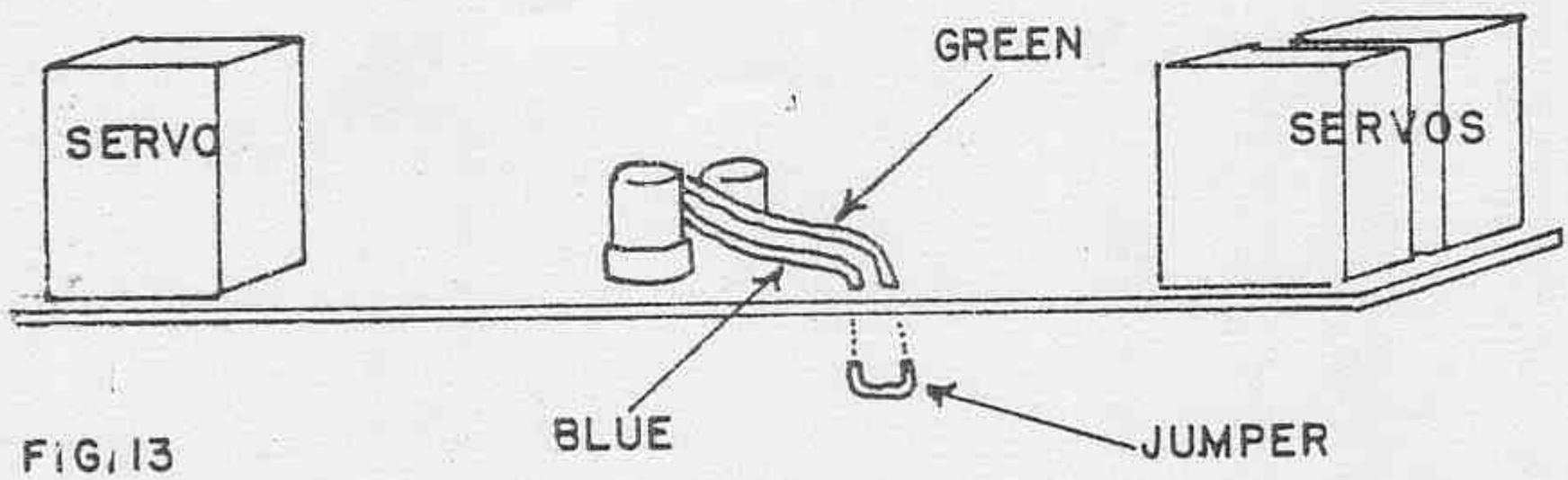




FIG. 13

# I N S T R U C T I O N S
## For Adapting the Space Control Transmitter For Dry Battery Operation

The Space Control Transmitter has been designed for operation with the 6D135A nickle cadmium Rechargeable Power Pack. This Power Pack will provide optimum performance for the System because of the constant voltage output under all operating conditions. However, dry battery operation may be performed. If dry batteries are used, frequent checks should be made to see that the batteries are in good condition. (Dry battery operation may be unsatisfactory in cold weather). Batteries may be checked with the meter on the front of the Transmitter. The following instructions cover dry battery operation of the Transmitter.

The Space Control Battery Adapter Cable is available from the factory on special order at a list price of $4.95. If the user prefers to make his own, the accompanying wiring diagram will fully explain the assembly of standard parts which are obtainable from most any radio supply store.

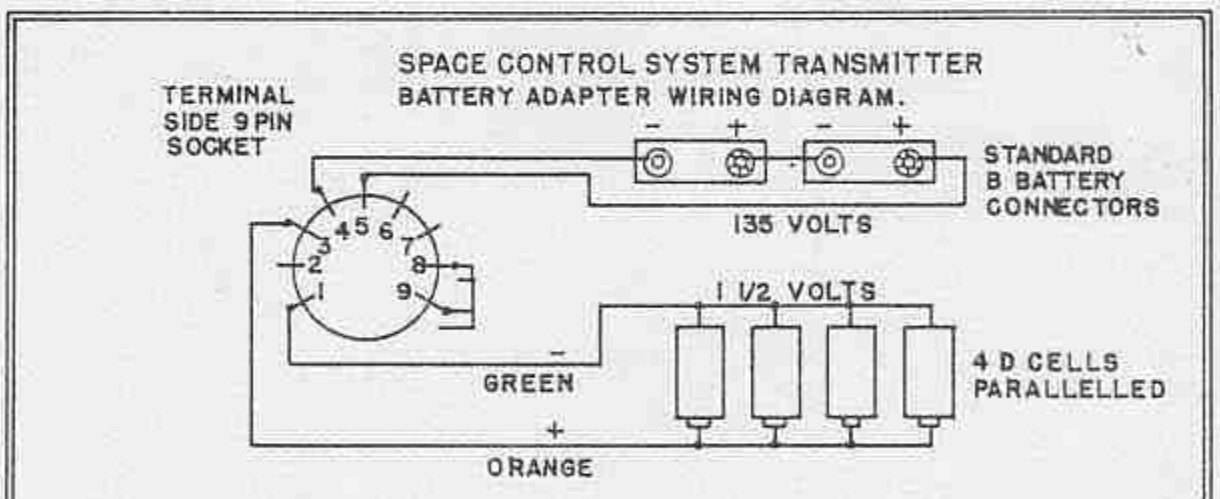
Two standard 67½ volt batteries such as the Burgess XX45, (NEDA 200) and four regular D size flashlight batteries are required. The D batteries should be wired in parallel, as shown.

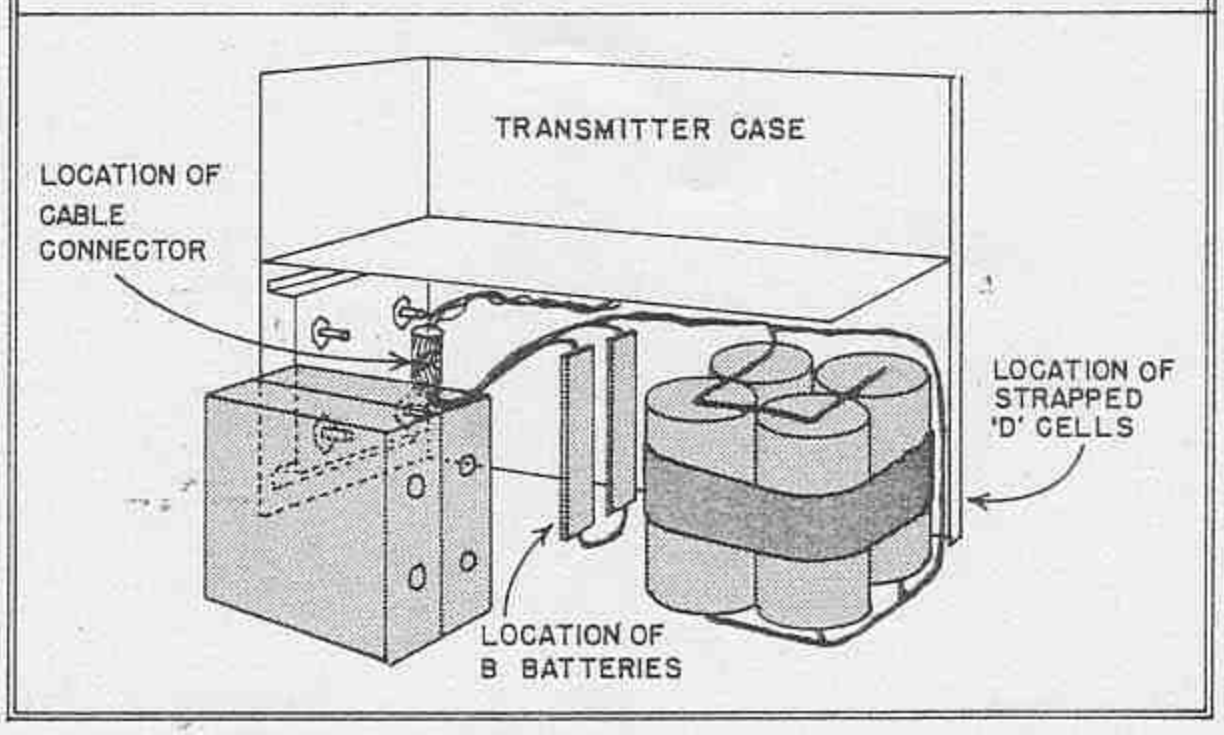
Remove the cover of the Power Pack retaining bracket, and retain for future use with the Rechargeable Power Pack.

Wrap the four D batteries into a "square" formation, using suitable tape, so as to insulate them from the transmitter circuitry.

Solder the two leads from terminals 1 and 3 to the D batteries, being extremely careful to observe the correct polarity. (Orange to positive, green to negative).

Snap the B battery connectors to the two 67½ volt batteries.




Place the batteries in the Transmitter case in the manner illustrated, placing the 9 pin connector vertically behind the innermost potentiometer shafts. It will be found desirable to use some sort of soft packing material to prevent shifting of the batteries.

When changing to the Space Control Rechargeable Power Pack 6D135A, it is only necessary to disconnect the cable connector, remove the batteries, insert the Power Pack and plug in the connector, and snap the retaining cover into place. The Pack never need be removed, as it can be recharged in the Transmitter Case.