THE SPORTPLANE BUILDER

BY TONY BINGELIS, 8509 GREENFLINT LANE, AUSTIN, TEXAS 78759

USEFUL ELECTRICAL WIRING DETAILS

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I have elected the latter option as being the least messy of the two. Besides, some amplification of the matter may be of interest.

The idea of forming a removable fuse bus bar (shown ..s Figure 2 in the May 1984 issue) is a good one. It is the method I used in both my first and second Emeraudes. By assembling the fuse block, as illustrated, it is possible to separate the entire assembly from the panel and lower it for maintenance and/or the easy addition of other circuits. Unfortunately, the flawed detail shows an improperly located bus wire soldered across the end terminals of the fuse holders rather than across the rigidly anchored side terminals. Seems that I found it easier to draw the bus the way I did even though both my Emeraude installations were not done that way.

What difference does that make, you may well ask. Well, under ideal conditions, not much. But, as we all know, conditions do not always remain ideal. You see, that type fuse holder (as originally illustrated) has a spring-loaded end terminal. The purpose of the spring is to exert adequate contact pressure against the end of the fuse inside. Old World War II surplus fuse holders had an extremely strong spring to do the job. whereas the current production fuse holders contain a very puny (weak) spring. Therein lies the problem.

There is little doubt that the installation would work well initially either way. However, in-flight vibration could cause intermittent or failed circuits even though everything checks out O.K. on the ground.

As you know, fuses are simply low melting point links that respond to heat. A faulty connection will usually create a localized hot spot that can result in the fuse failing. Troubleshooting logically leads away from the fuse, not toward it. So, naturally, your radio wiring, or ·tever, would be suspect and not the fuse holder. As a ..sequence, you might find yourself reworking the wir-*g*, and so on, without finding the actual problem (intermittent electrical problems are the most difficult type to analyze). This is not to say that this will happen in all installations fabricated as originally depicted. It could though, especially if the currently produced type of fuse holders with weak springs are installed.

I would like to call your attention to another type of fuse holder (Figure 1). It is a fuse holder containing a spring loaded cap. When using this type fuse holder, it matters little which terminal is used for the bus bar attachment.

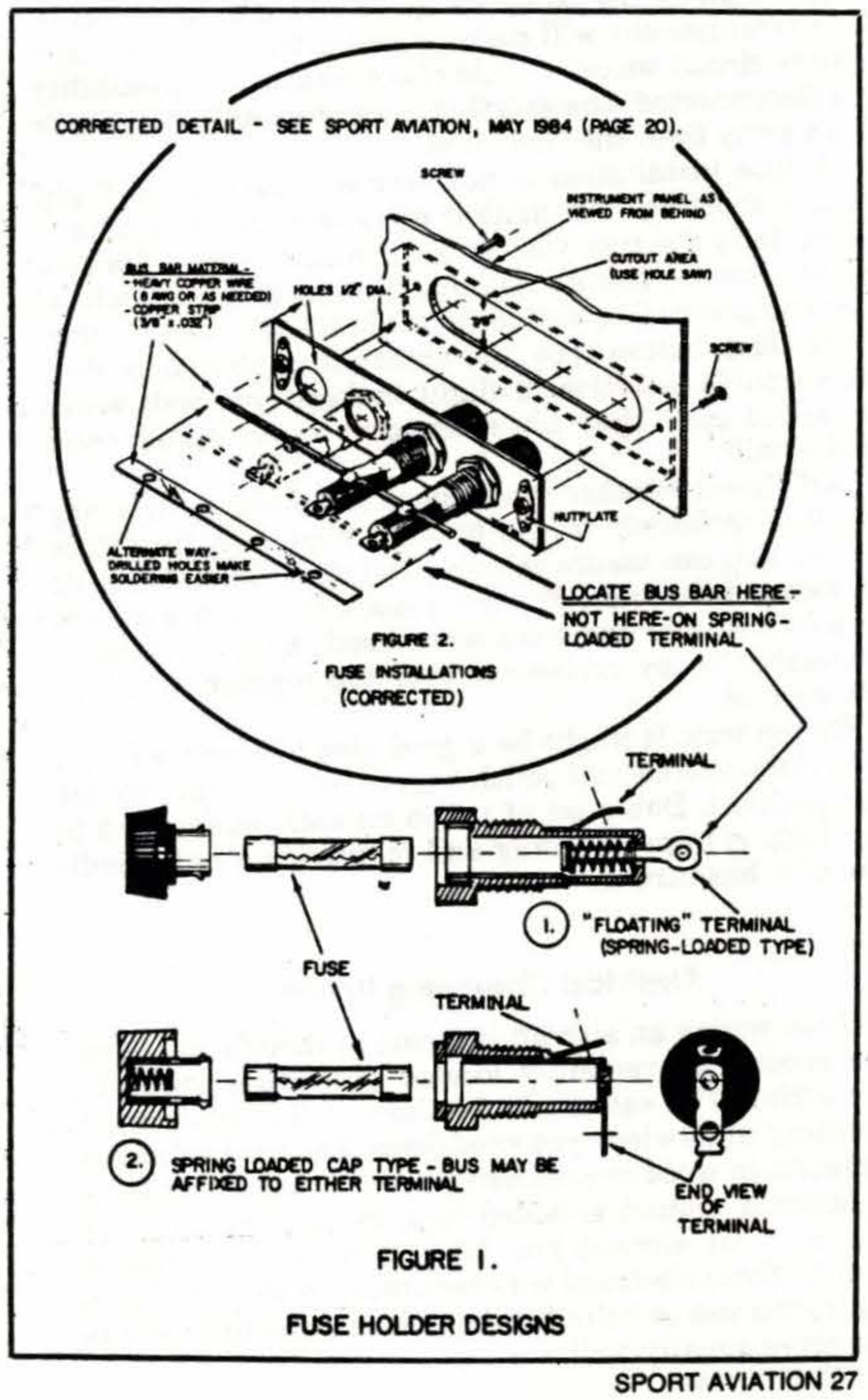

FIGURE 1.

FUSE HOLDER DESIGNS

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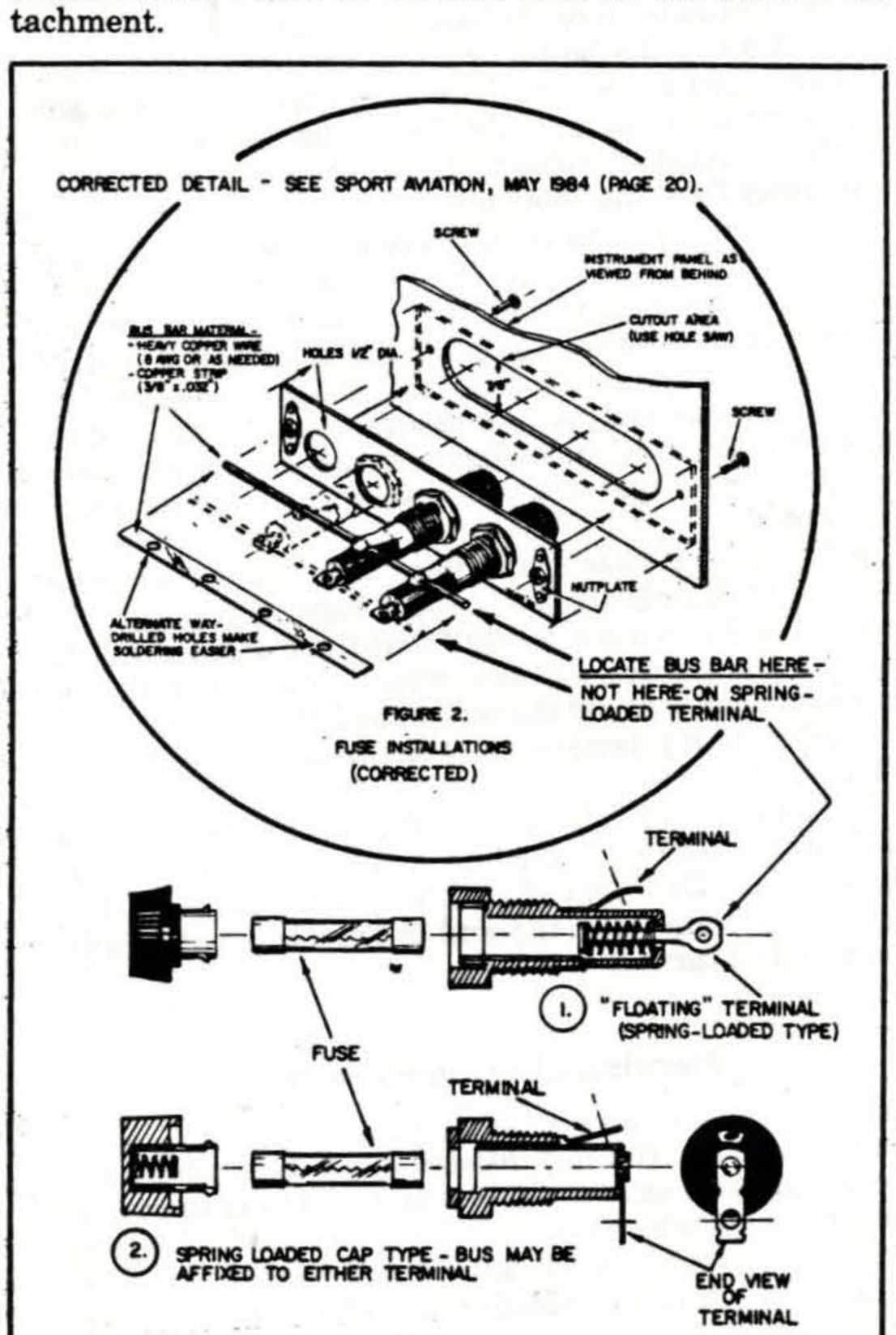

More About Bus Bars and Circuit Breakers

All of your circuit breakers/fuses do not need to be connected by the same bus bar. You can separate the bus in two or more units and locate them in a different area of the instrument panel or elsewhere more convenient to your installation.

When split bus bars are used, one bus is usually used for the general aircraft electrical circuits and the other for the audio/radio circuits.

The two bus bars must be interconnected by either a wire conductor large enough to carry the current load, or a relay. A relay, when used, is of the normally closed (NC) type that automatically opens the circuit when you hit the starter switch. This cuts off the power to the second bus bar and radio circuitry, only during starting, to protect the equipment from electrical surges.

Having an audio/radio bus is a good idea, especially for those of us who are prone to forget to turn off the radio(s) after a flight. The only drawback to installing this feature is that I have been unable to locate a suitable normally closed relay. And since I don't hanker to buy and cannibalize an old Cessna, I'll probably never install one. Shucks!

Since we are getting more and more into electronic systems for our homebuilts, I am convinced that the added weight and expense of circuit breakers may well be worth their installation. Unlike some fuse holders, you can always connect your bus bar to either terminal of the circuit breakers. Best of all, you do not have to solder the terminals as small machine screws are used.

Connecting the bus bar across the top terminals of circuit breakers will permit easier access to the bottom row of terminals since the circuit breakers are normally installed along the bottom edge of an instrument panel. This arrangement will make it easier for you to add and remove circuit wires. It could also minimize the possibility of a disconnected wire shorting the system as it will dangle down away from the "hot" bus.

A fuse installation is not very adaptable to in-flight trouble shooting. But neither are some circuit breakers, particularly the type you cannot manually turn off or pull out to open the circuit. Although the price of the switch-type and protruding button circuit breakers is double that of the flush button type, the ability they provide to do a little trouble isolation in flight makes them well worth the added cost. They can even serve as an infrequently used switch.

All circuit breaker connections are made by securing the wire terminals to the breaker lugs with tiny little screws. You can assure yourself that these connections do not loosen in service. For this reason you should always use a lock washer under the screw head. An internal (star) lockwasher is my preference over the regular split-type lock washer.

By the way, it might be a good idea to divert a bottle of brightly colored nail polish to your own use (no, not for your pinkies). Dab a bit of polish on each screw head to help keep it from loosening and to provide a quick indicator if it has turned.

Electrical Grounding Points

When wiring an aircraft it seems as though you never have enough conveniently located grounding points for your wiring. The easiest fix for the vexation is to install grounding studs where you need them. The need, of course, is greatest in wood or composite aircraft that do not enjoy the common ground provided by a metal structure. But even in metal aircraft you have to have someplace to fasten all those electrical wire terminals. Although Figure 2 shows the use of bolts for the purpose, machine screws could serve equally well.

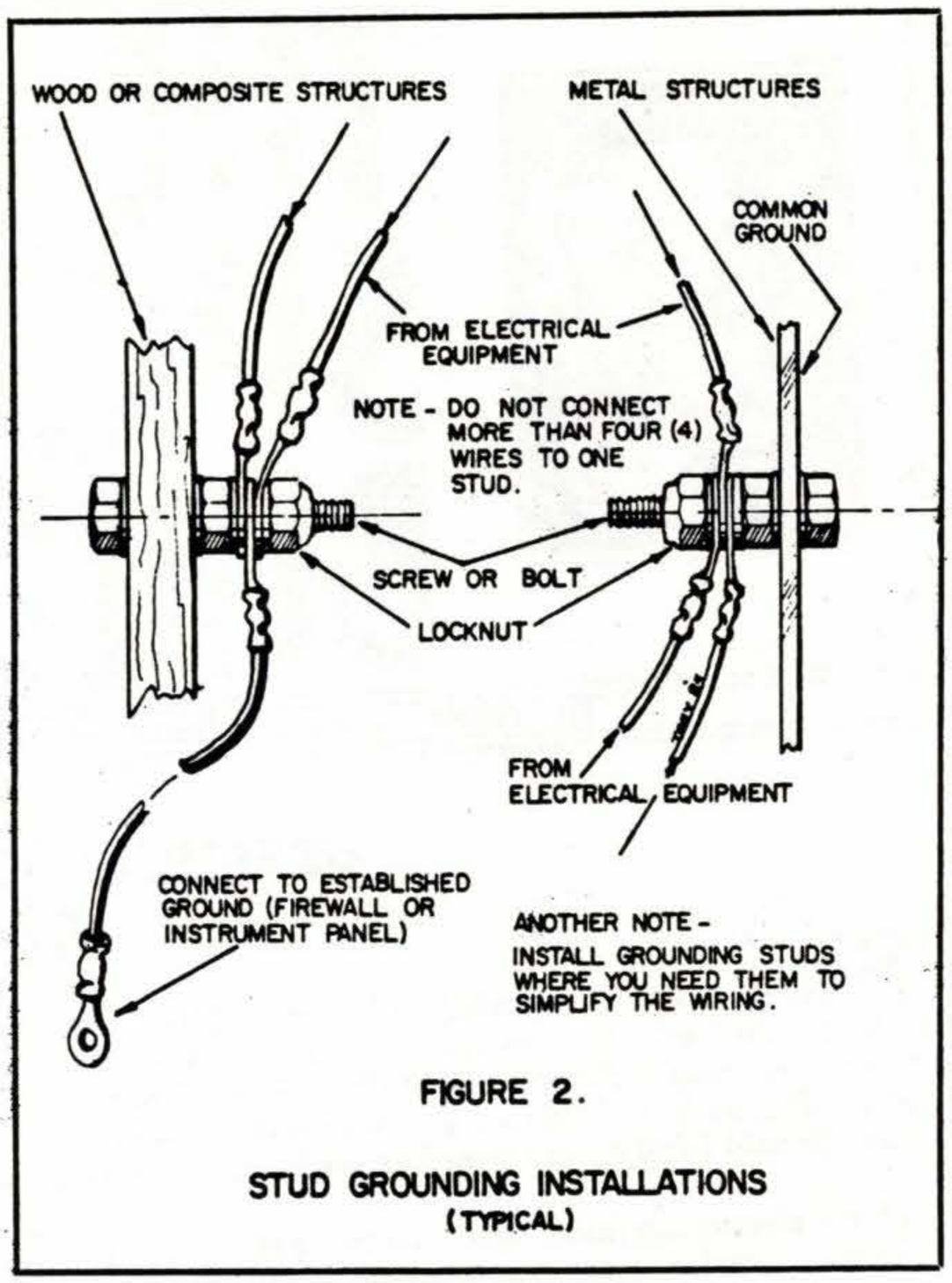

FIGURE 2.

STUD GROUNDING INSTALLATIONS
(TYPICAL)

Switch Monitor Lights

Have you ever considered installing warning (reminder) lights for certain switches? It is easy to do and could save you from having a rundown battery or worse.

A good use for such a switch monitor light is the one shown in Figure 4 for a fuel pump switch. Seeing the light would be a constant reminder that the fuel pump is on. This could be especially important in a fuel system where you have a tank that must be transferred to the main tank. If you forget to turn the fuel pump off in time, you might pump all the excess fuel overboard through the main tank vent.

I'll bet that just about everyone at some time in his flying career has forgotten to turn off the master switch. The result? A dead battery the next time you go out to fly. This same type of installation can be used for it too, except that some folks wouldn't want to have a light shining all the time that the master switch is on while flying. Actually, I see nothing wrong with that if it is a blue light or an amber or even a green light.

If the light bothers you, you could install the light so that it is wired to an oil pressure switch. The light would then come on any time the master switch is on and the oil pressure is low (engine not running) and go off when the pressure is up. This, of course, means that you will have to have to obtain an oil pressure switch and the necessary plumbing to hook it to your engine.

The lights I am using are produced for Radio Shack and reportedly have a 10,000 hour lamp life! Two lamps come in each package (red, green, amber and blue are the choices) for less than $2.00! (See Figure 4)

Shielded Wire Circuits

The most notorious noise producer in aircraft radios is the ignition system. To overcome that offending interference we use shielded spark plugs and a shielded ignition wire harness. In addition, the "P" leads from the ignition switch to the magnetos must be fabricated of shielded

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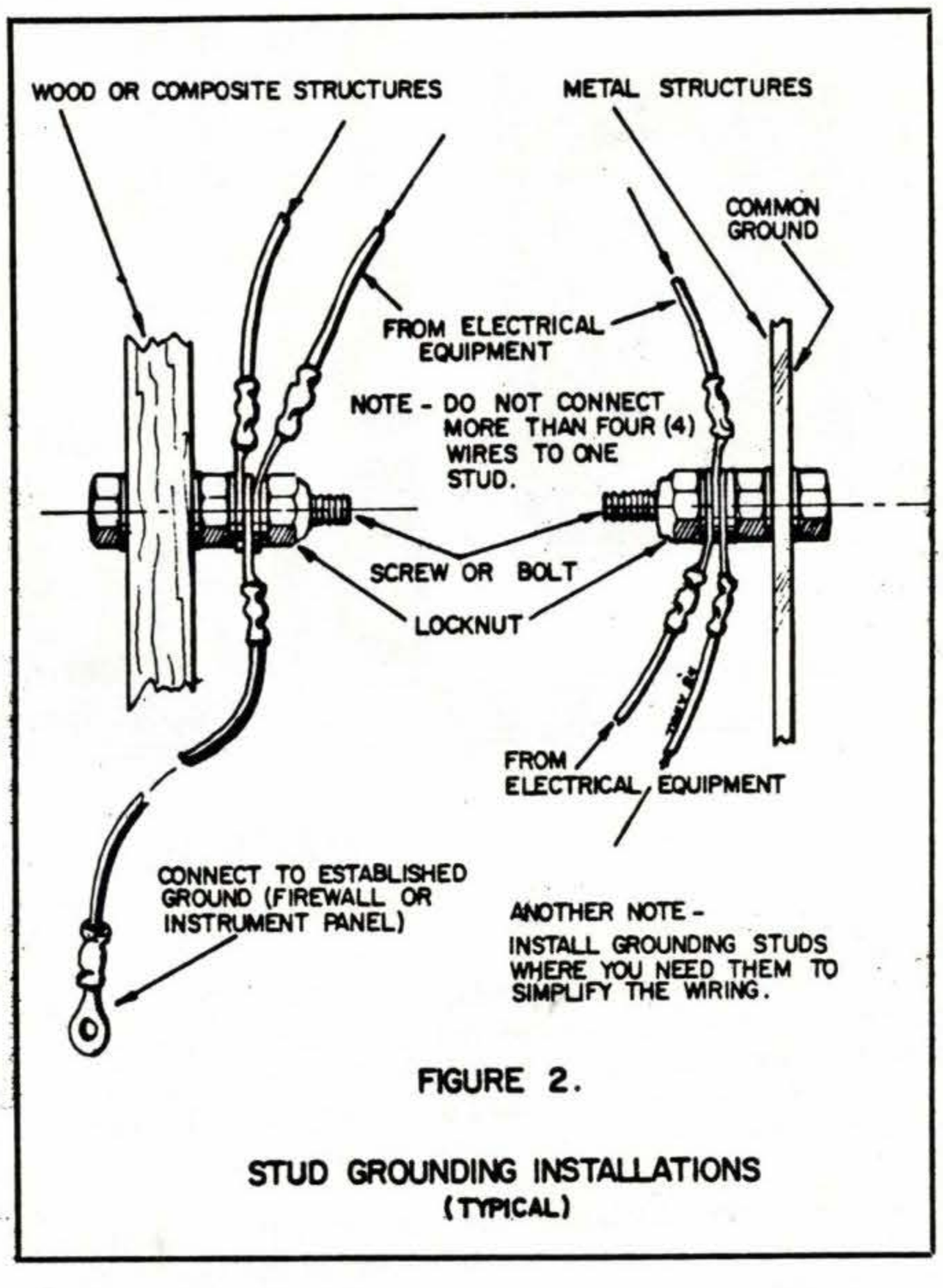

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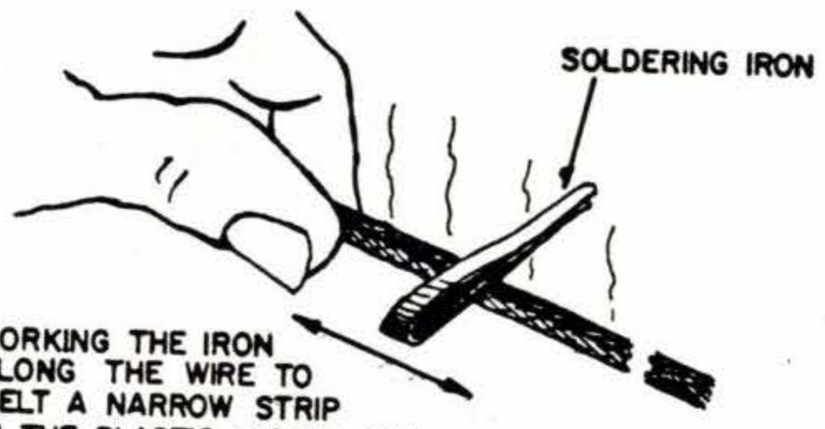
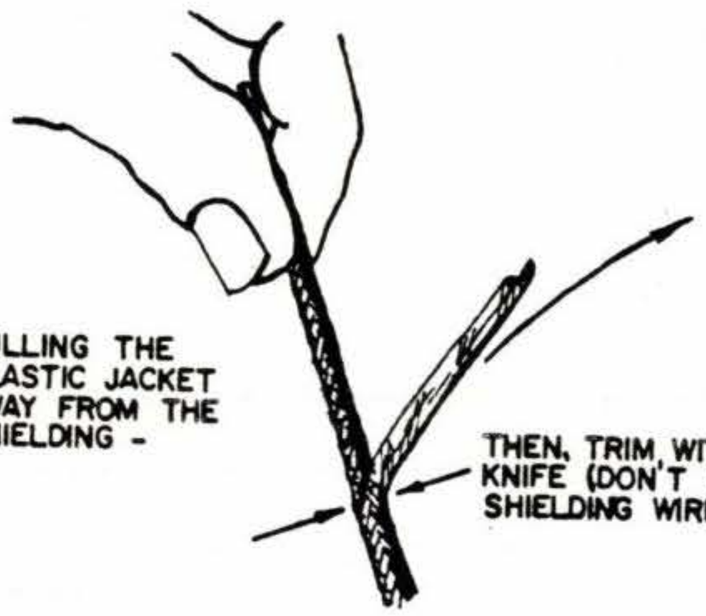


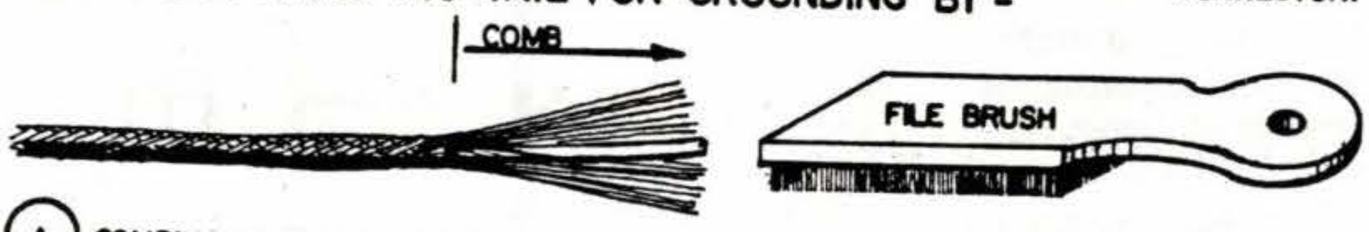
(A.) WORKING THE IRON ALONG THE WIRE TO MELT A NARROW STRIP IN THE PLASTIC JACKET AND -



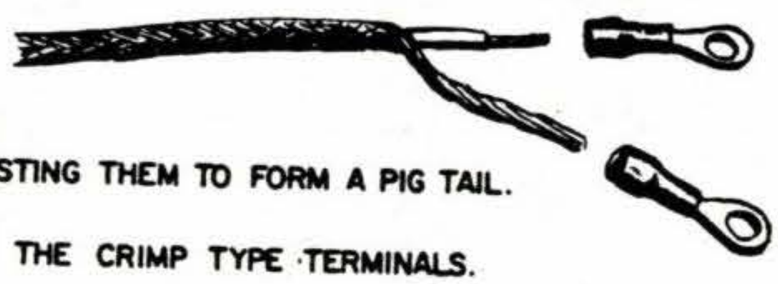
(B.) PULLING THE PLASTIC JACKET AWAY FROM THE SHIELDING -

THEN, TRIM WITH A KNIFE (DON'T CUT ANY SHIELDING WIRES).

2. PREPARE A BRAID PIG TAIL FOR GROUNDING BY -



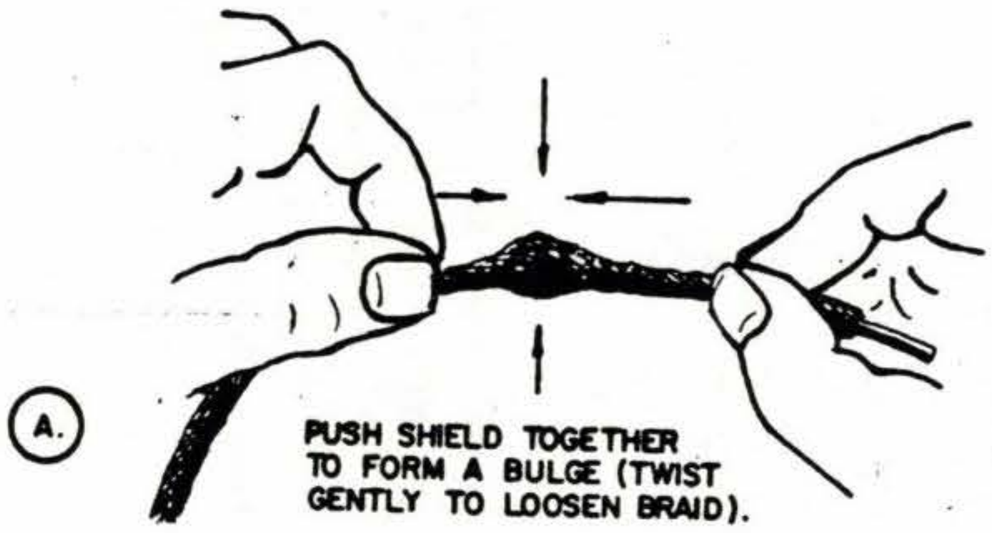
(A.) COMBING OUT THE SHIELD STRANDS AND -



(B.) TWISTING THEM TO FORM A PIG TAIL.

(C.) ADD THE CRIMP TYPE TERMINALS.

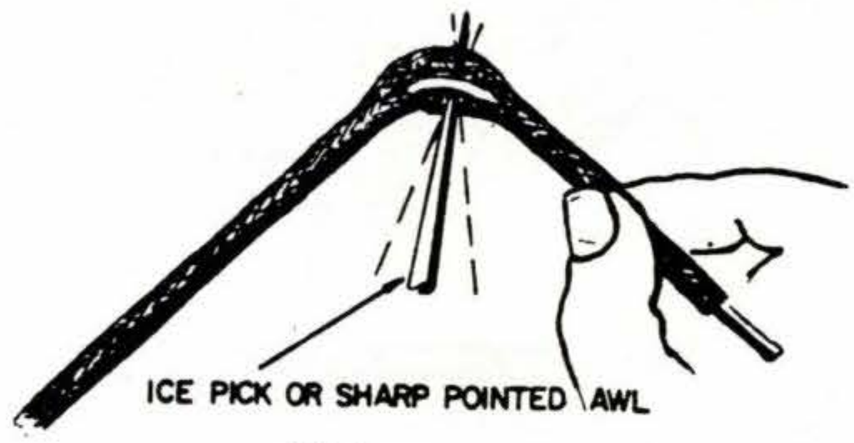
3. NEED A LONGER PIG TAIL ? TRY THIS -

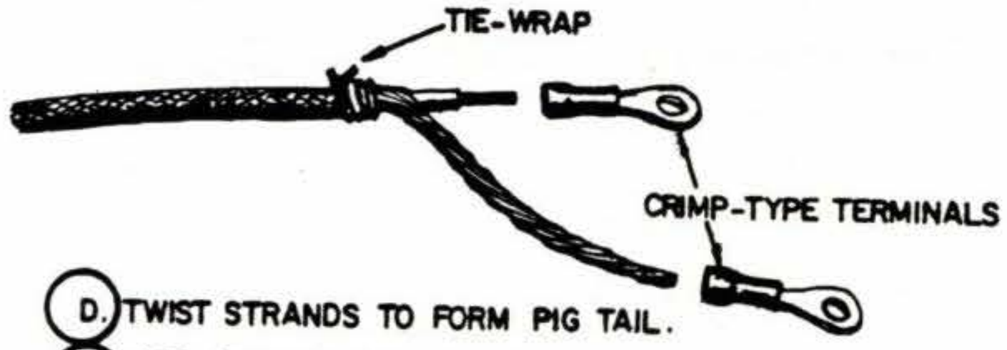


(A.) PUSH SHIELD TOGETHER TO FORM A BULGE (TWIST GENTLY TO LOOSEN BRAID).

(B.) WORK SHIELD (BRAID) AWAY FROM CONDUCTOR.

(C.) PRY CONDUCTOR OUT WITH POINTED TOOL AS SHOWN.

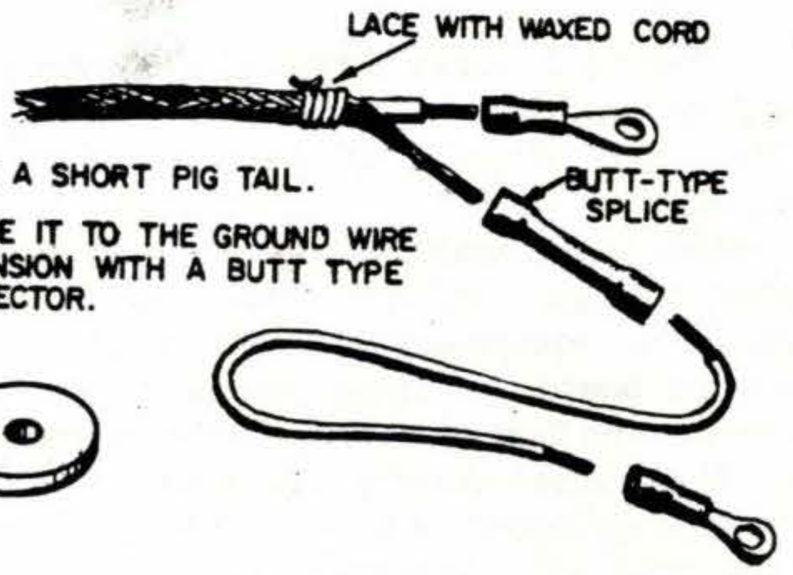




(D.) TWIST STRANDS TO FORM PIG TAIL.

(E.) ADD CRIMP TERMINALS AND, TIE-WRAP SHIELD.

4. NEED A LONGER LEAD TO THE NEAREST GROUND POINT ?

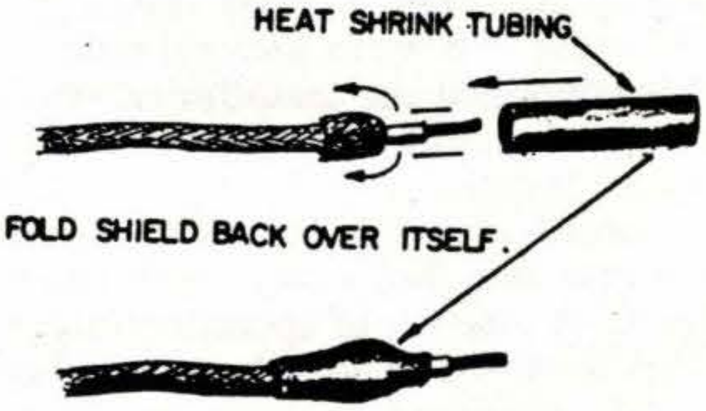


(A.) FORM A SHORT PIG TAIL.

(B.) SPLICE IT TO THE GROUND WIRE EXTENSION WITH A BUTT TYPE CONNECTOR.

5. DEAD ENDING SHIELDING BRAID.

SOMETIMES ONE END OF THE SHIELDING NEEDS NOT BE GROUNDED - METHODS SHOWN REQUIRE NO SPECIAL HARDWARE.



(A.) LOOSEN AND FOLD SHIELD BACK OVER ITSELF.

(B.) HEAT SHRINK SLEEVE OVER FOLDED-BACK SHIELD.

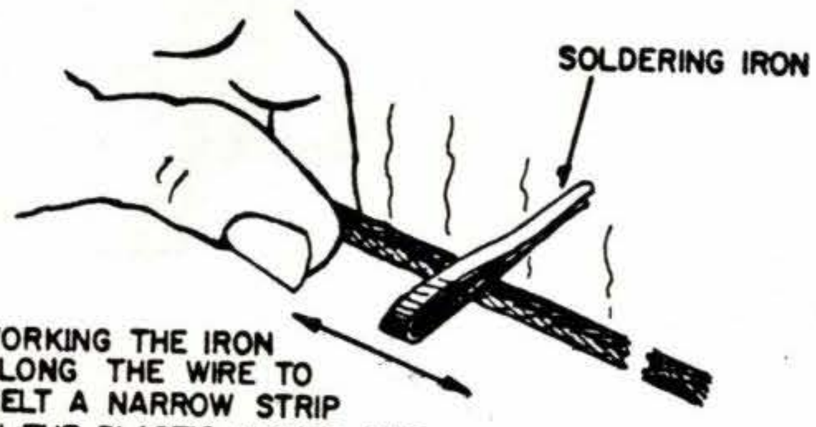
- OR -

(C.) WRAP SHIELD FOLD WITH VINYL TAPE AND HEAT-SEAL TAPE END WITH A SOLDERING IRON OR TIE-WRAP AS SHOWN (WAXED CORD).

FIGURE 3.

WORKING WITH SHIELDED WIRES

1. MOST SHIELDED WIRE HAS A PROTECTIVE PLASTIC JACKET. REMOVE IT BY -



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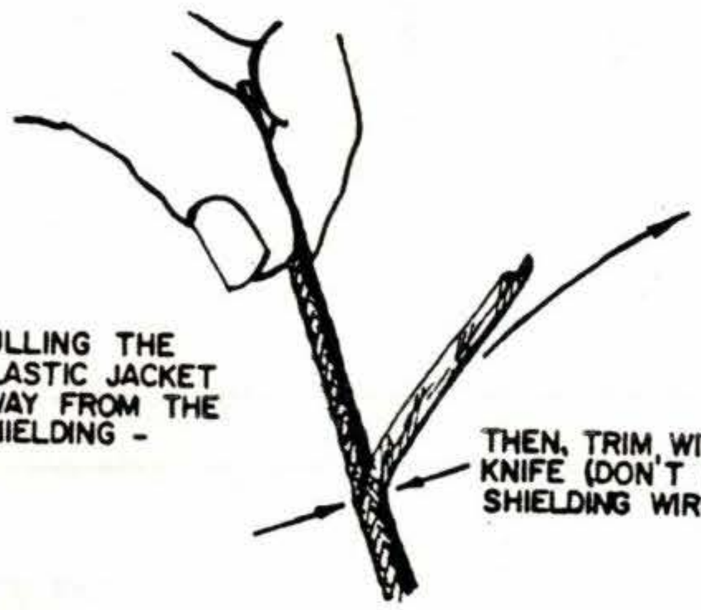
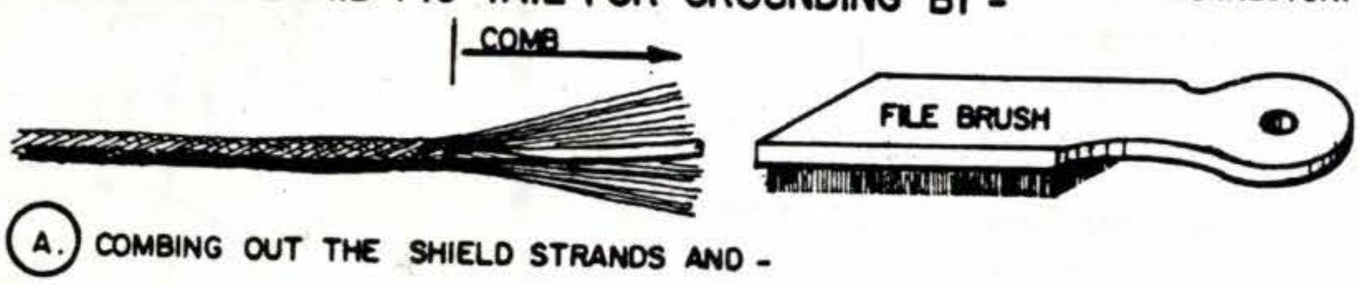


(B.) PULLING THE PLASTIC JACKET AWAY FROM THE SHIELDING -

2. PREPARE A BRAID PIG TAIL FOR GROUNDING BY -



(A.) COMBING OUT THE SHIELD STRANDS AND -

(B.) TWISTING THEM TO FORM A PIG TAIL.

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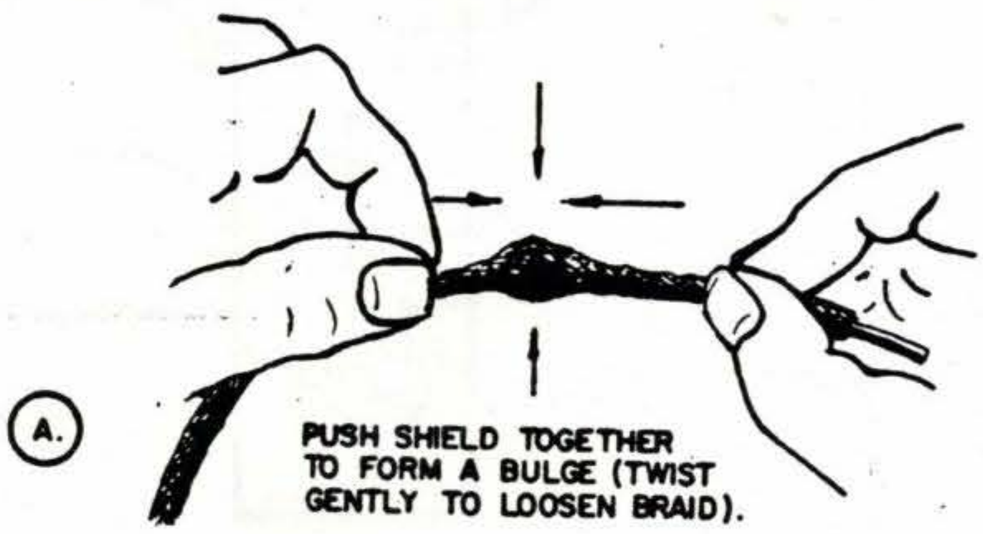

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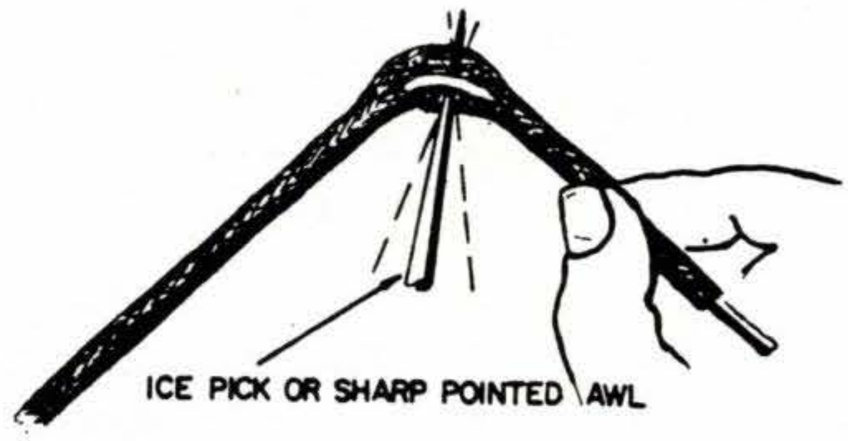

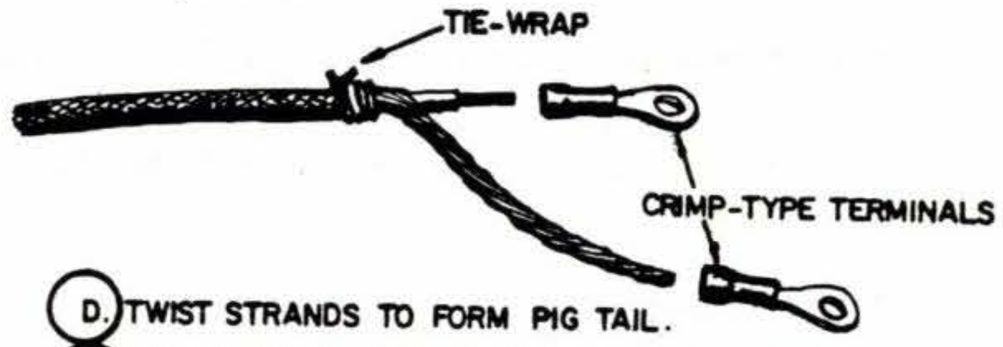

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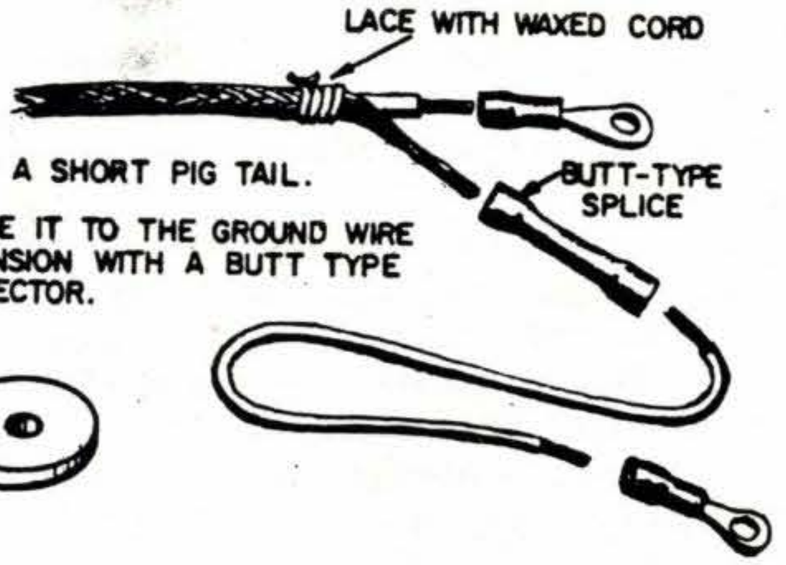

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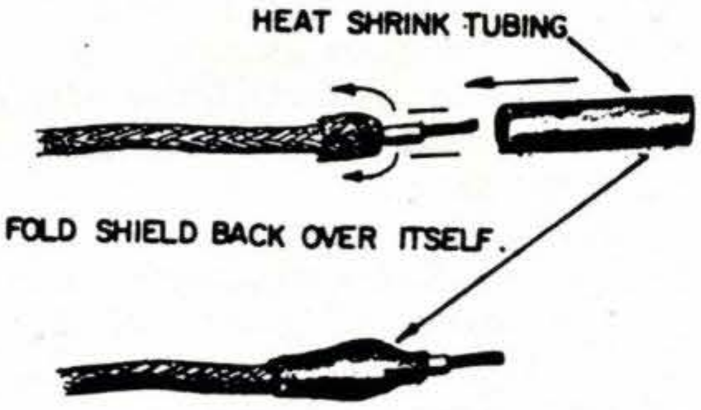

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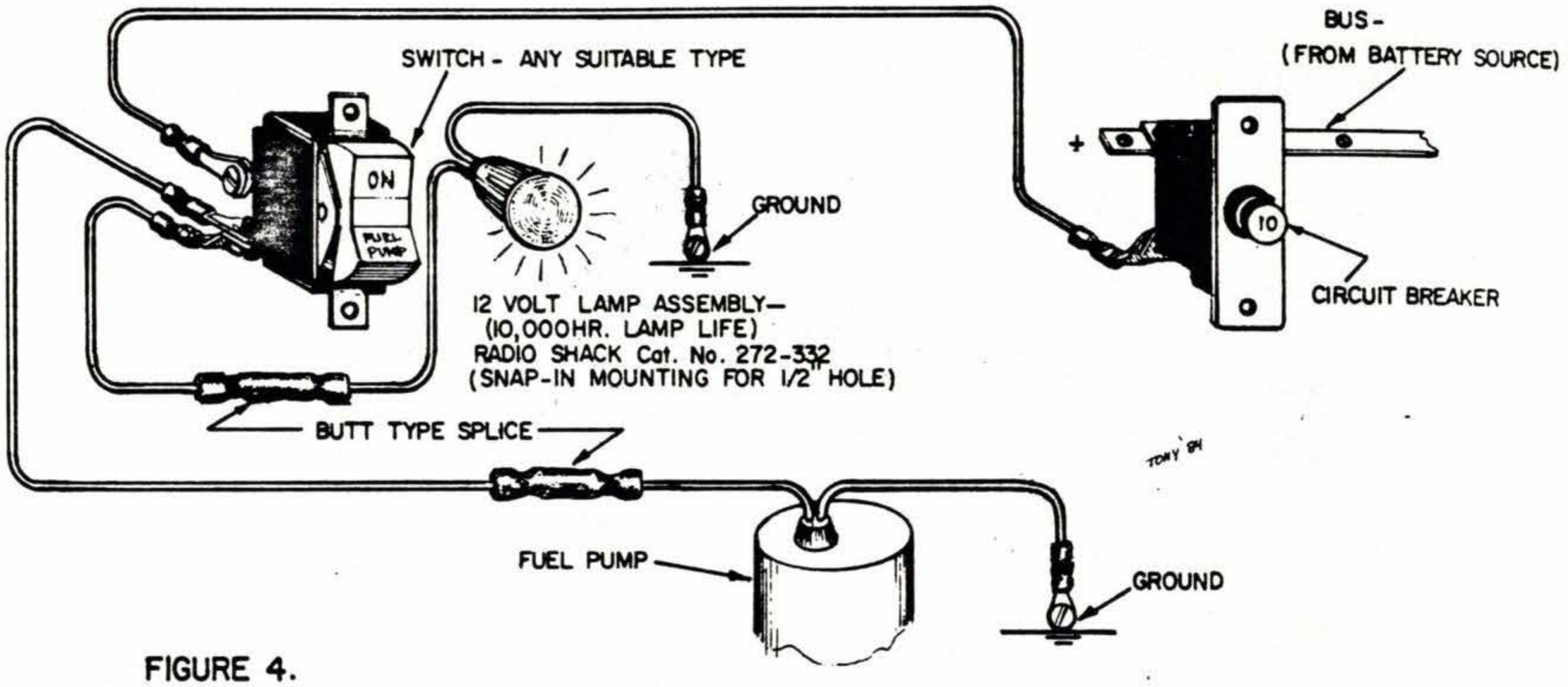


FIGURE 4.

SWITCH MONITER LIGHT INSTALLATION

wire. Figure 5 shows a typical magneto external wiring installation. Although none are shown, some builders find it necessary to install filters (noise suppressors) at each magneto.

Other noise producers include your generator or alternator, voltage regulator, strobe lights, most any motor and digital equipment (clocks, computers, etc.) you might have on board. All these pieces of electrical equipment generate the type of alternating or interrupted direct current that causes interference in radios. A Loran C unit is particularly sensitive to stray electrical fields. Therefore, if the installation of a radio, especially a Loran, is anticipated, you would be well advised to initially install shielded wires to service these avionics troublemakers. Figure 5 illustrates the circuits that are typically fabricated with shielded wire.

A strobe light installation definitely requires the use of shielded wires. Regular installation kits are available consisting of 3 wires encased within an electrical shield. This simplifies the installation considerably as you only have one conduit to route from the wing tips to the cockpit control center.

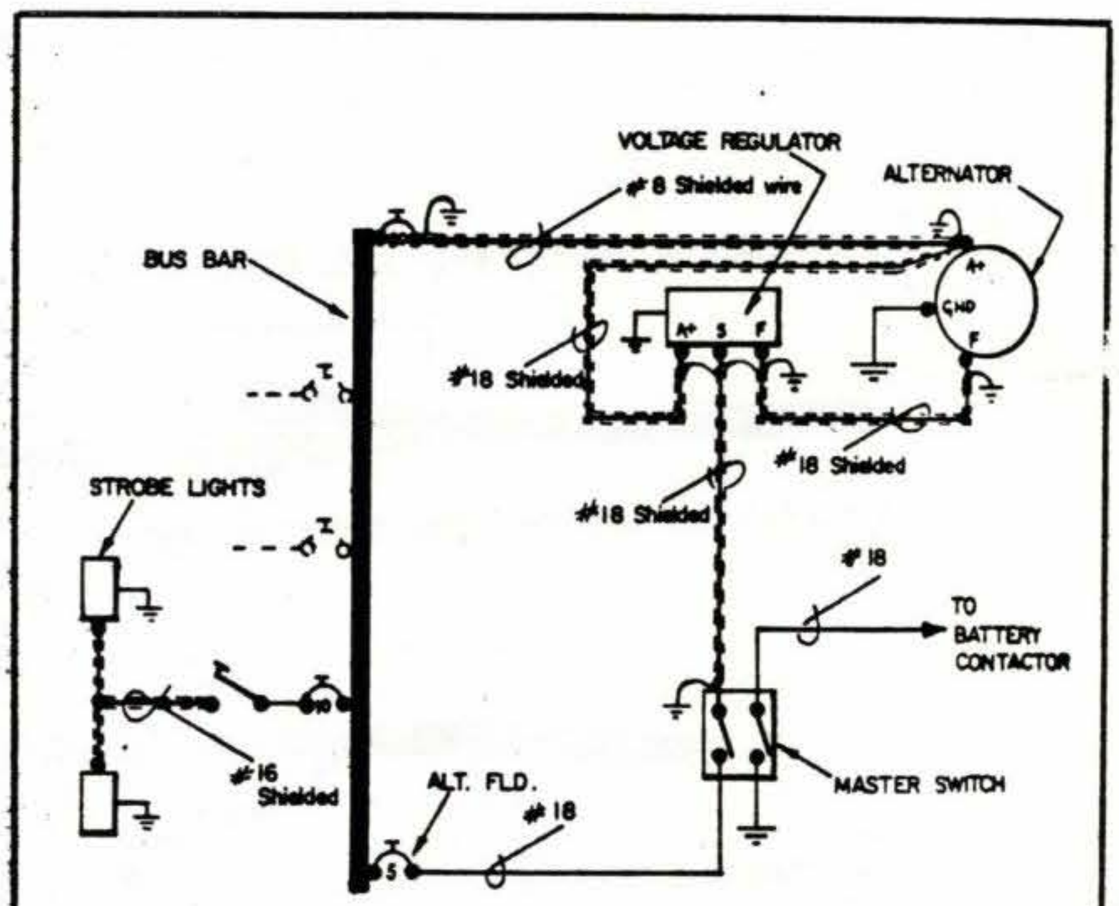
Some builders might want to install their landing light and gear and flap motors with shielded wires. However, the short interval of operation might make the shielding effort for these units to be something less than essential. Less troublesome, perhaps, would be the installation of filters at the motors.

Actually, some builders would go so far as to say they intend to install all of their wiring with shielded wire because they will have a Loran. There again, that might be just a bit extreme . . . sort of like swatting a gnat with a sledge hammer.

Homebuilts are being retrofitted with Lorans that operate successfully without any drastic modifications to the aircraft. Anyway, the wiring options are yours to exercise to whatever degree you deem necessary.

I've said it before, all this is important only if you have a radio installed. No radio? Don't bother with shielding and bonding . . . but, what if you do decide to install one, later . . .?

Technical Advisors this month were Mike McDonald, Milwaukee, WI and Darryl Phillips, Heavener, OK.



ALTERNATOR SYSTEM CIRCUITS

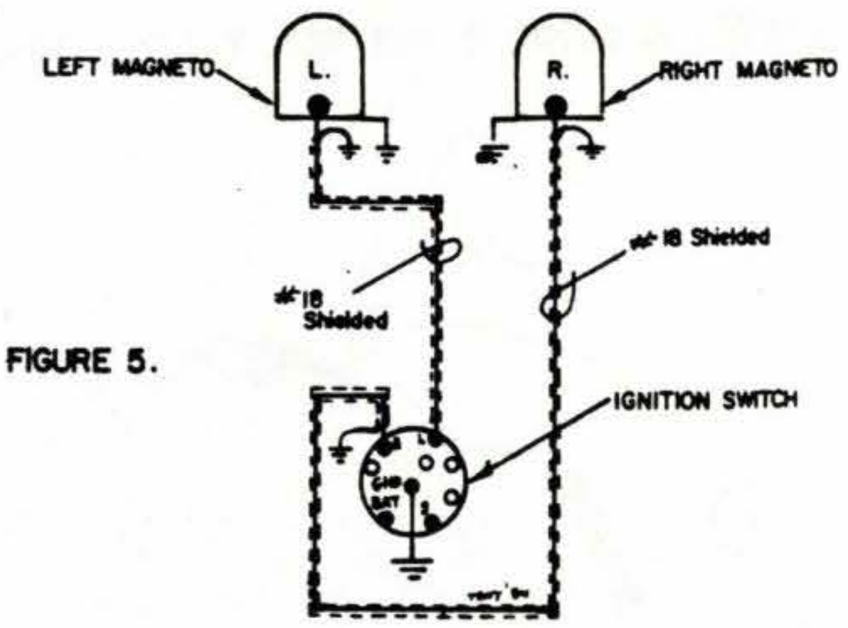


FIGURE 5.

MAGNETOS CIRCUITS

SHIELDED ELECTRICAL CIRCUITS
(SCHEMATICS)

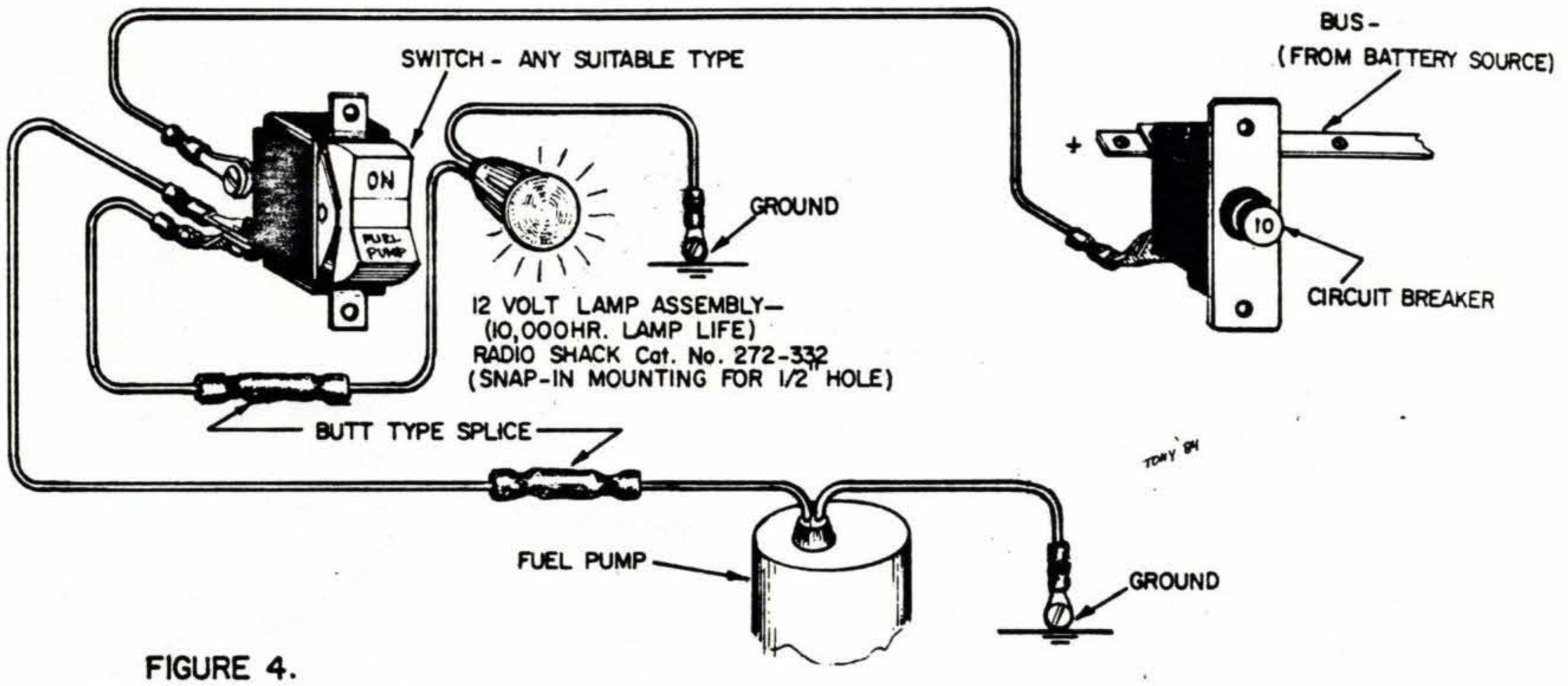


FIGURE 4.

SWITCH MONITER LIGHT INSTALLATION

wire. Figure 5 shows a typical magneto external wiring installation. Although none are shown, some builders find it necessary to install filters (noise suppressors) at each magneto.

Other noise producers include your generator or alternator, voltage regulator, strobe lights, most any motor and digital equipment (clocks, computers, etc.) you might have on board. All these pieces of electrical equipment generate the type of alternating or interrupted direct current that causes interference in radios. A Loran C unit is particularly sensitive to stray electrical fields. Therefore, if the installation of a radio, especially a Loran, is anticipated, you would be well advised to initially install shielded wires to service these avionics troublemakers. Figure 5 illustrates the circuits that are typically fabricated with shielded wire.

A strobe light installation definitely requires the use of shielded wires. Regular installation kits are available consisting of 3 wires encased within an electrical shield. This simplifies the installation considerably as you only have one conduit to route from the wing tips to the cockpit control center.

Some builders might want to install their landing light and gear and flap motors with shielded wires. However, the short interval of operation might make the shielding effort for these units to be something less than essential. Less troublesome, perhaps, would be the installation of filters at the motors.

Actually, some builders would go so far as to say they intend to install all of their wiring with shielded wire because they will have a Loran. There again, that might be just a bit extreme . . . sort of like swatting a gnat with a sledge hammer.

Homebuilts are being retrofitted with Lorans that operate successfully without any drastic modifications to the aircraft. Anyway, the wiring options are yours to exercise to whatever degree you deem necessary.

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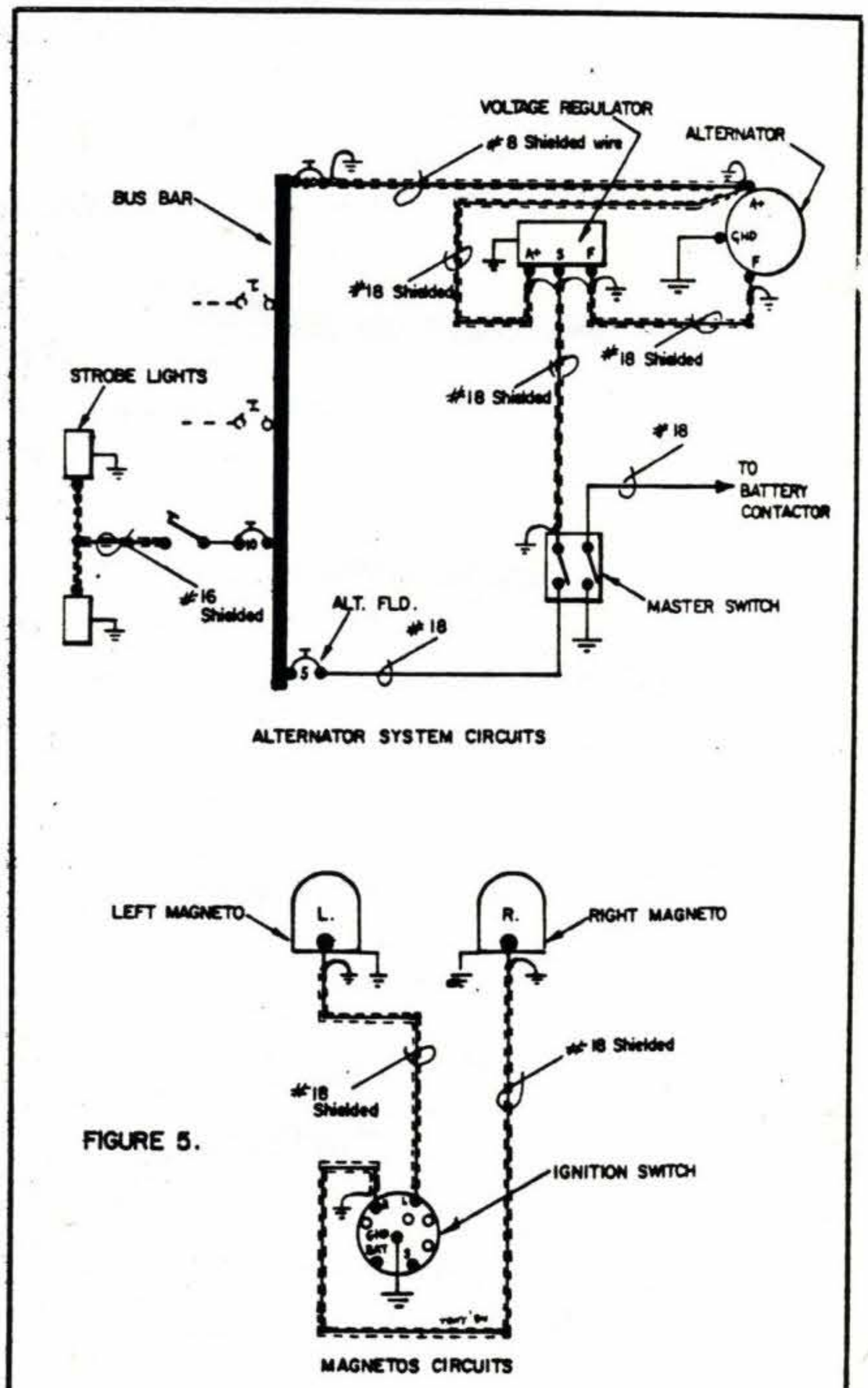

FIGURE 5.

SHIELDED ELECTRICAL CIRCUITS
(SCHEMATICS)