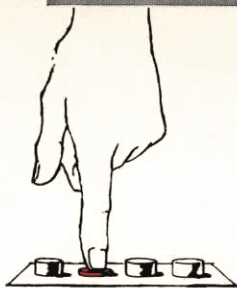# basic
circuits

RELAYS · SWITCHES · CONTROL SYSTEMS

AUTOMATIC ELECTRIC

NORTHLAKE, ILLINOIS
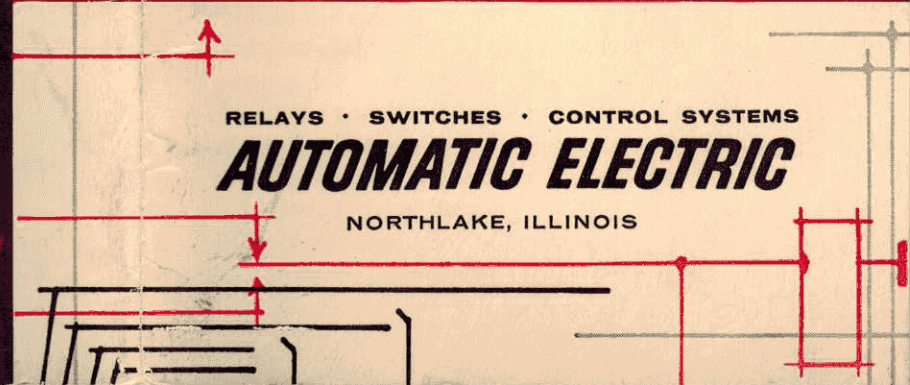
AE
CAN
DO

MAKING IDEAS WORK
AUTOMATICALLY

basic circuits

Certain basic relay combinations and characteristics achieve specific circuit results in telephony. These basic circuits have become the building blocks of automatic telephone switching. Adaptable to other automated tasks, they are finding new and increasing use in industry every day. This book depicts a few such basic circuits.

We recommend that the information in this book be used only as a guide to determine the availability of a circuit and its components. Remember, even the best and most time proven circuit may fail because of the wrong choice of equipment. For this reason we make no attempt to define specific electrical parameters or component values.

Automatic Electric pioneered automatic telephone switching more than 60 years ago. Along with our growth in telephony, we have designed and furnished relays and switches for many industrial applications, making us uniquely qualified to advise our customers.

Our service extends to the expert engineering and manufacture of entire control systems. Call on our experienced staff engineers and salesmen to help you with control circuitry, engineering details, and component selection. If you prefer, address requests for such guidance to the home office: Automatic Electric Company, Director, Control Equipment Sales, Northlake, Illinois.

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IDENTITY
OF RELAYS
OPERATED
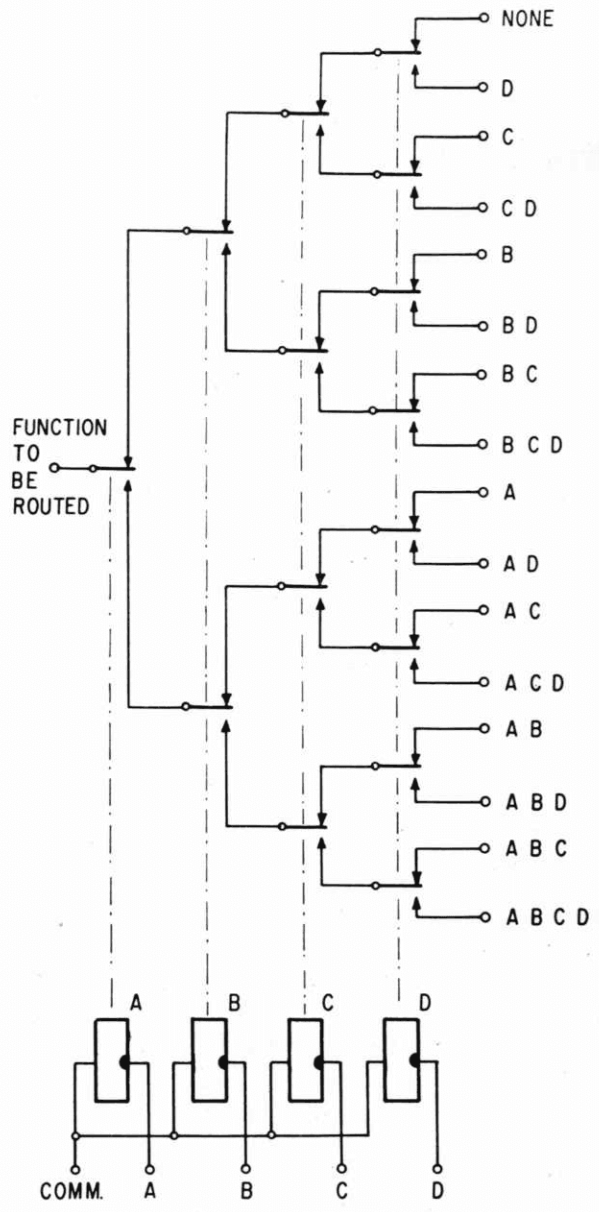TO SECURE
FUNCTION
ON OUTPUT
LEADS
INDICATED

Fig. 1. Basic four-relay transfer tree. Single input is connected to any chosen output.

IDENTITY OF RELAYS
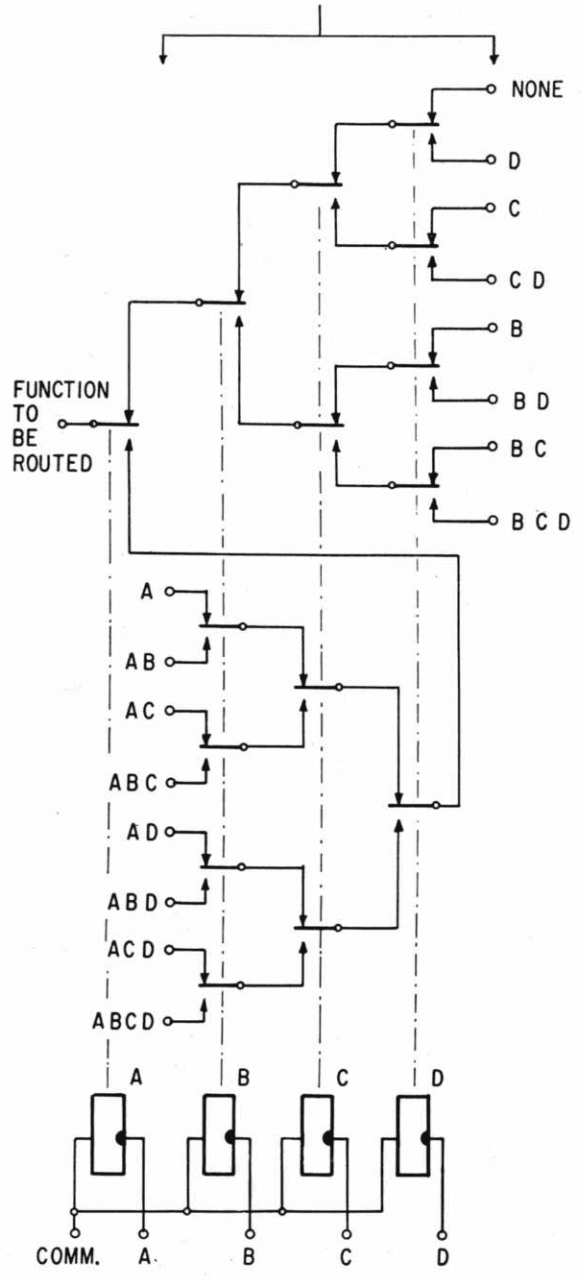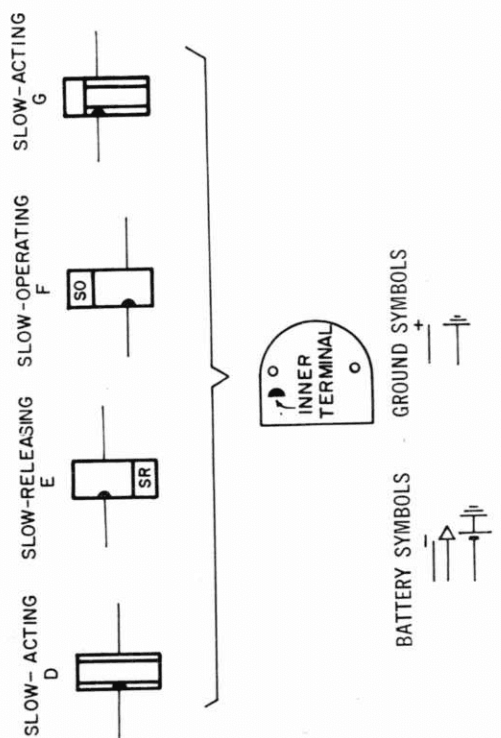OPERATED TO SECURE
FUNCTION ON OUTPUT
LEADS INDICATED

Fig. 2. Rearrangement of transfer tree to equalize contacts.

Fig. 3. Relay coil symbols and coil connections.

SLOW-ACTING G

SLOW-OPERATING F — SO

SLOW-RELEASING E — SR

SLOW-ACTING D

INNER TERMINAL

GROUND SYMBOLS

BATTERY SYMBOLS

QUICK-ACTING

A

B

C

TWO-SECTION

MULTI-WOUND COILS

CONCENTRIC

INNER TERMINAL

1-1 = ARM. END WDG.
2-2 = HEEL END WDG.

1-1 = INSIDE WDG.
2-2 = OUTSIDE WDG.

SLOW RELEASE
BY
NON-INDUCTIVE SHUNT

R

A

Fig. 4. _____

SLOW RELEASE
BY
SHORTED
HEEL-END WINDING

B

Fig. 5. _____

SLOW-OPERATE
BY
SHORTED
ARMATURE-END WINDING

C

Fig. 6. _____

SLOW-OPERATE
AND RELEASE
BY
SERIES RESISTOR AND
SHUNT CONDENSER

C

R_1

D

Fig. 7. _____

SLOW-OPERATE
BY
SWITCHED
CONDENSER SHUNT
AND SERIES
RESISTOR

E

R_1

R_2

C

Fig. 8.

Fig. 9. (a) Locking on operating winding.
(b) Locking on auxiliary winding.
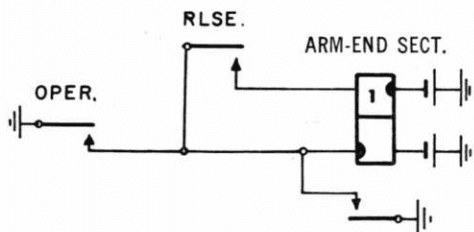
Fig. 10. Forced release of double-wound relay.
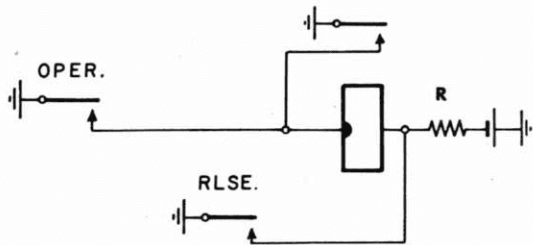
Fig. 11. Shunt release of single-wound relay.

Fig. 12. Remote impulse control including reset over two wires (A B function).
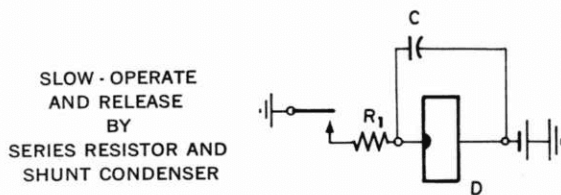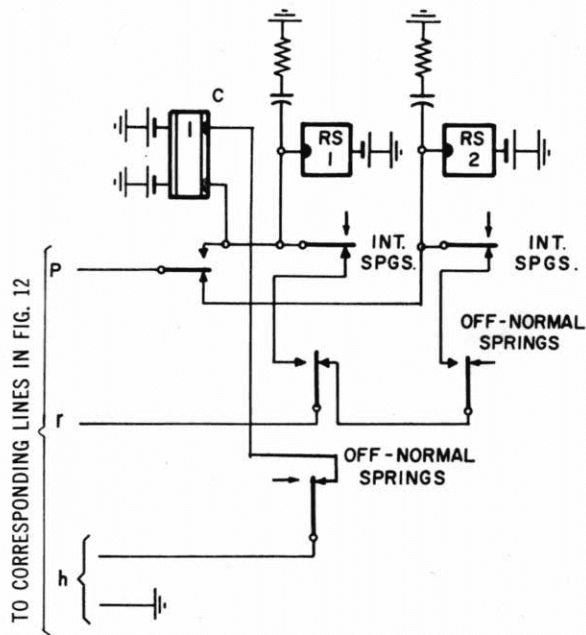

Fig. 13. Remote switching of groups of impulses (A B C function).
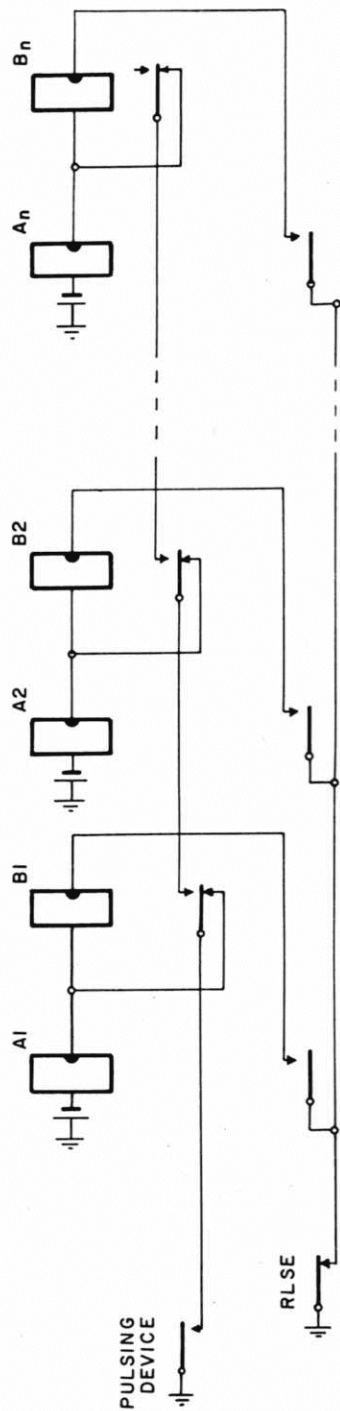
Fig. 14. Simple counting chain, two relays per step.
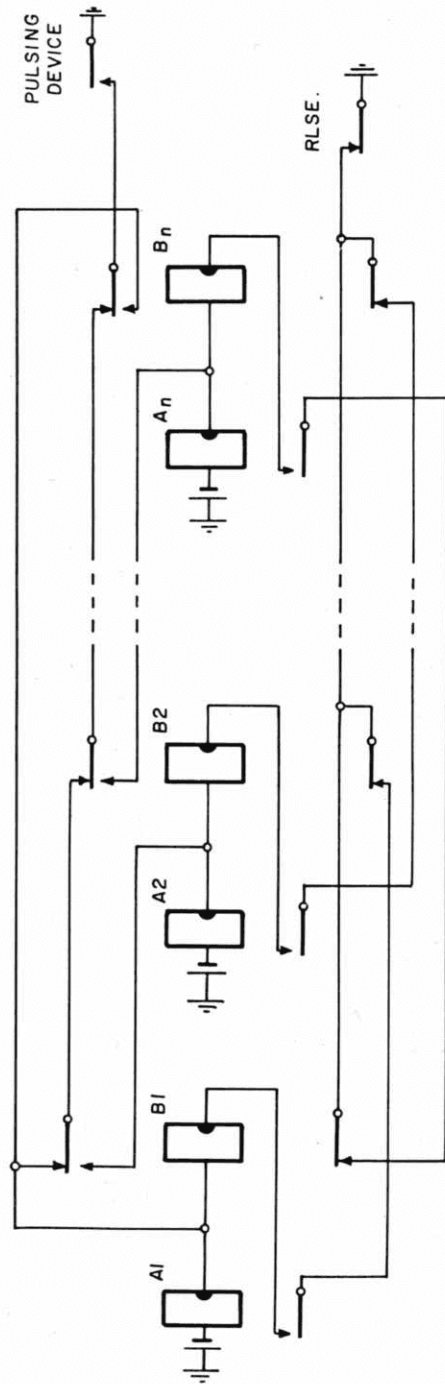
Fig. 15. Endless counting chain, two relays per step.
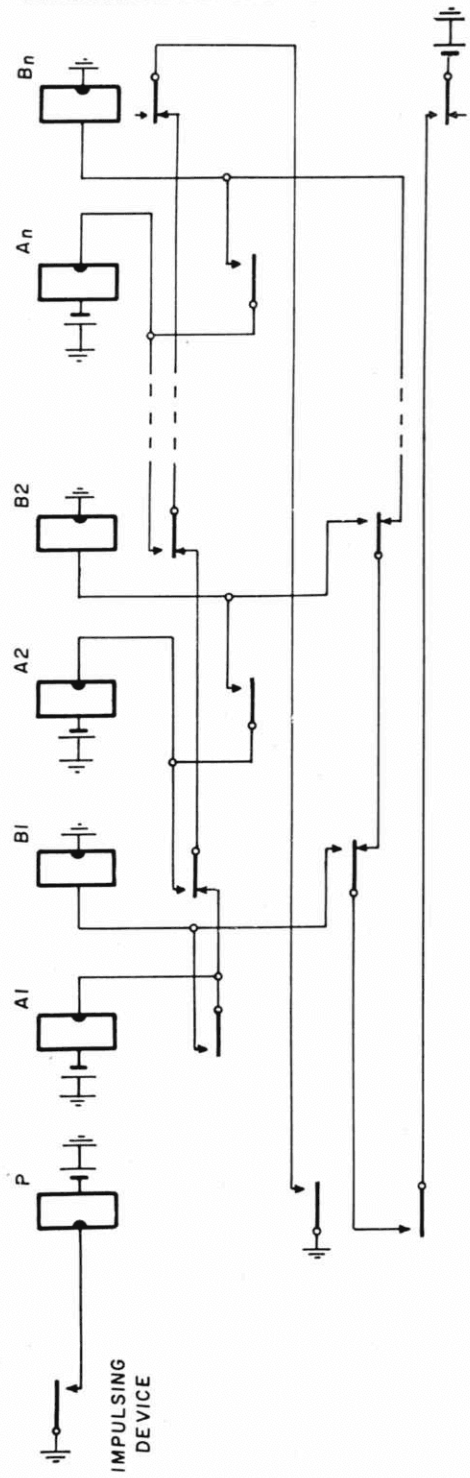
Fig. 16. Count up, count down chain, two relays per step.
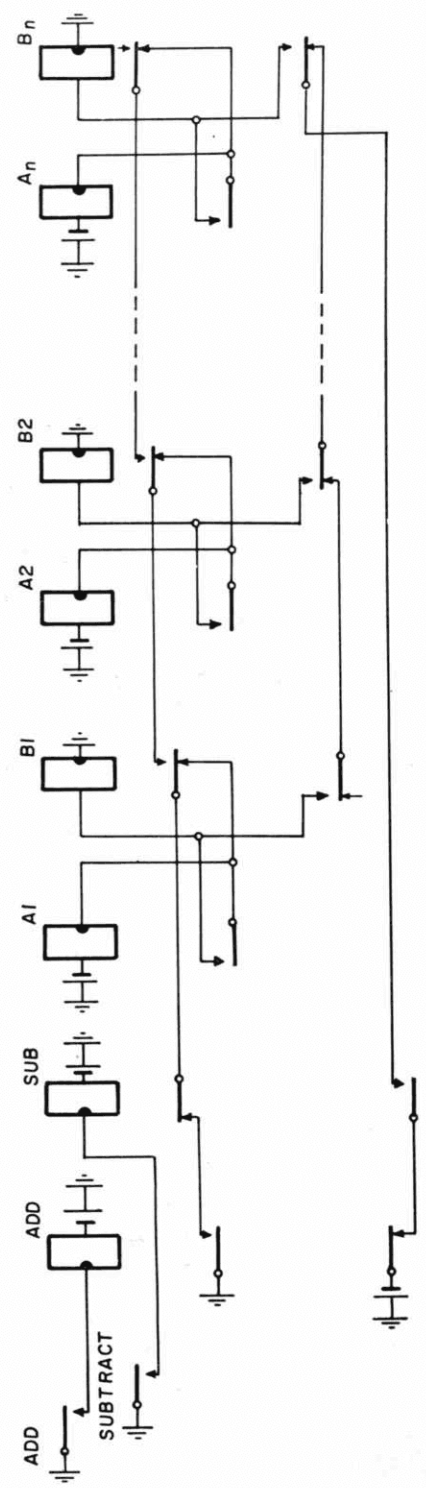
Fig. 17. Bi-directional counting chain, add and subtract input, two relays per step.
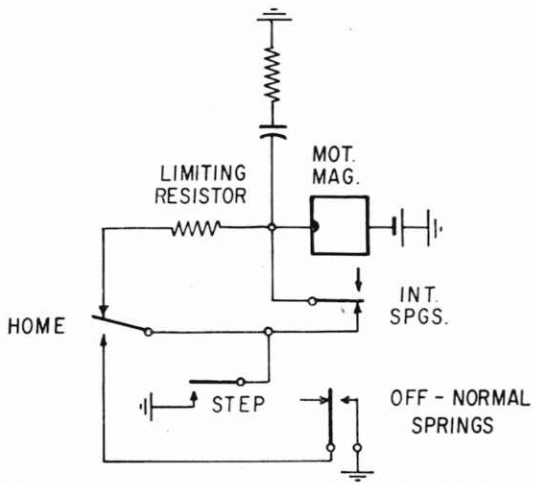
Fig. 27. Current limiting resistor for long pulse duration, to avoid overheating coil.
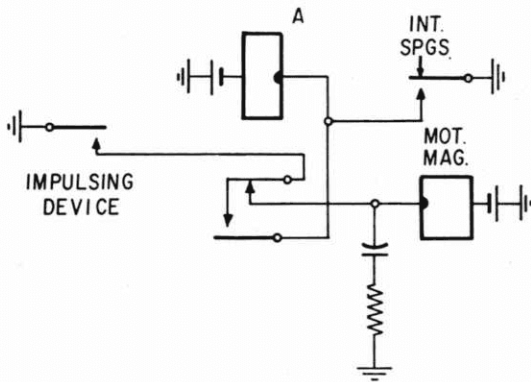
Fig. 28. Pulse inversion circuit for rotary switch "direct drive", to step switch on pulse closure.
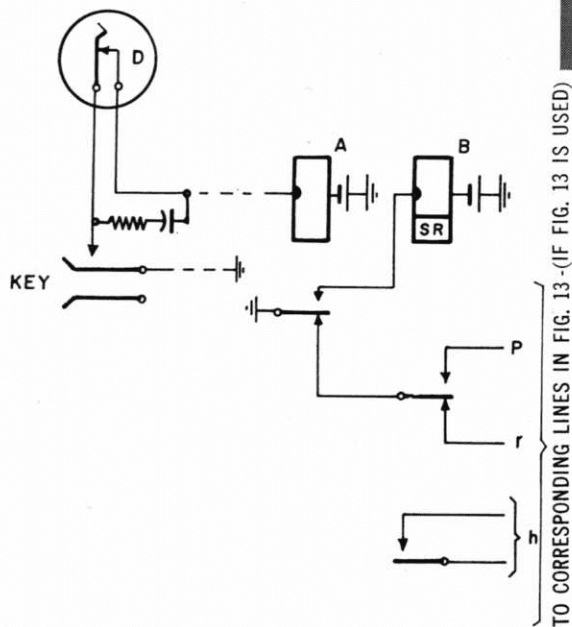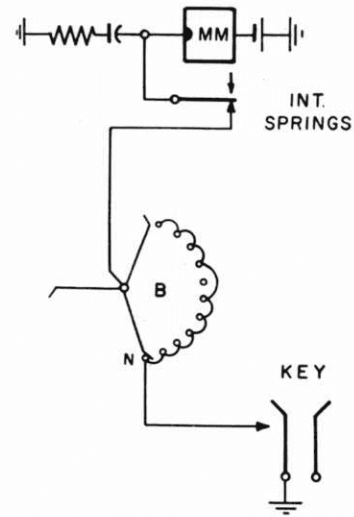
Fig. 29. Self-interrupted searching, to stop on absence of potential.
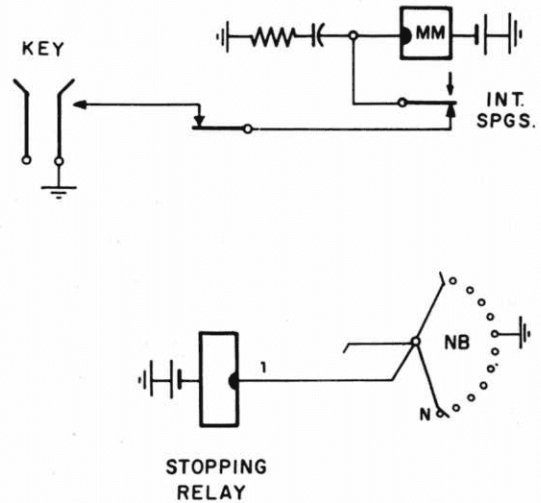
Fig. 30. Self-interrupted searching, to stop on presence of potential.
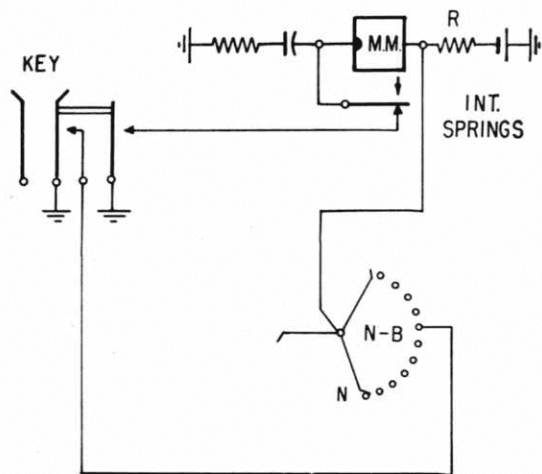
Fig. 31. Self-interrupted stepping, shunt stopping.

Fig. 33. Lock pulsing to insure stepping on inadequate or irregular-shaped pulse.

Fig. 32. Self-stepping, relay interrupted.
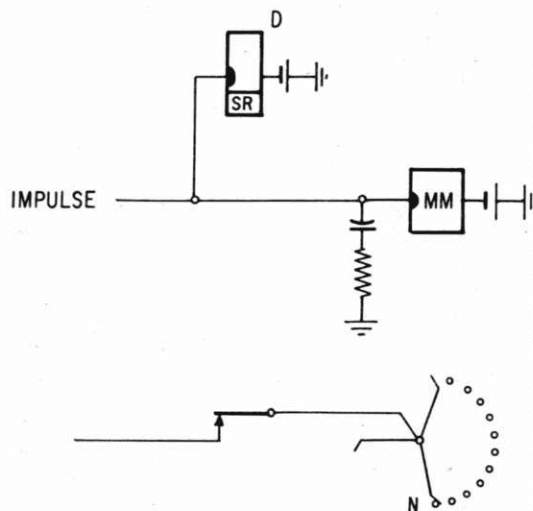
Fig. 34. Wiper disconnect circuit during stepping, to avoid energizing circuits wiped over.
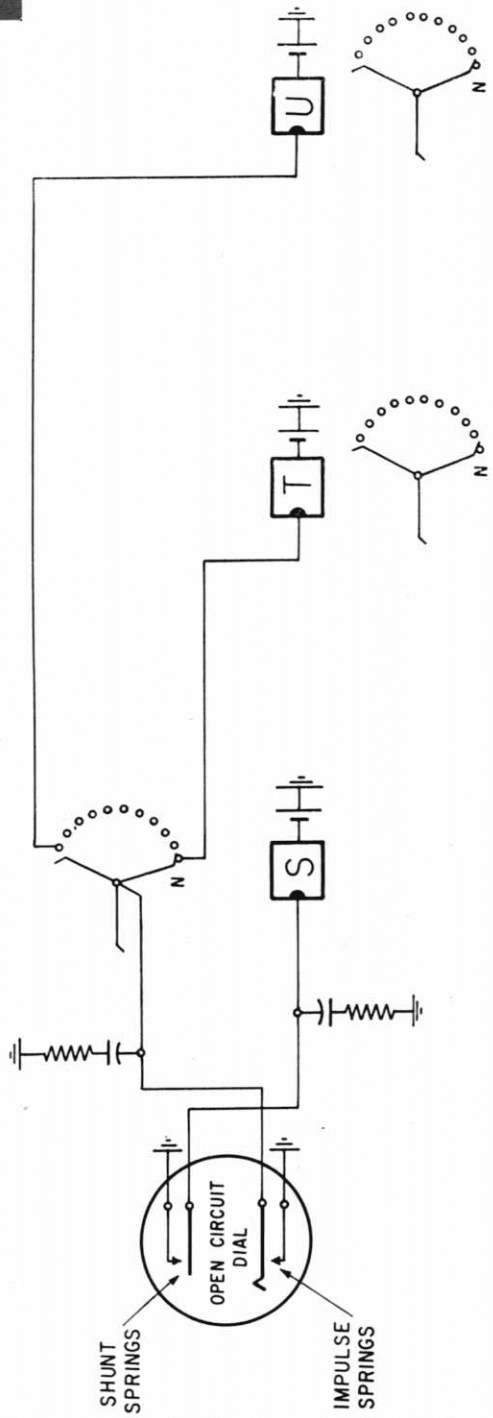
Fig. 35. Local sequential stepping switch control without relays. (See Fig. 12 and 13 for remote operation.)
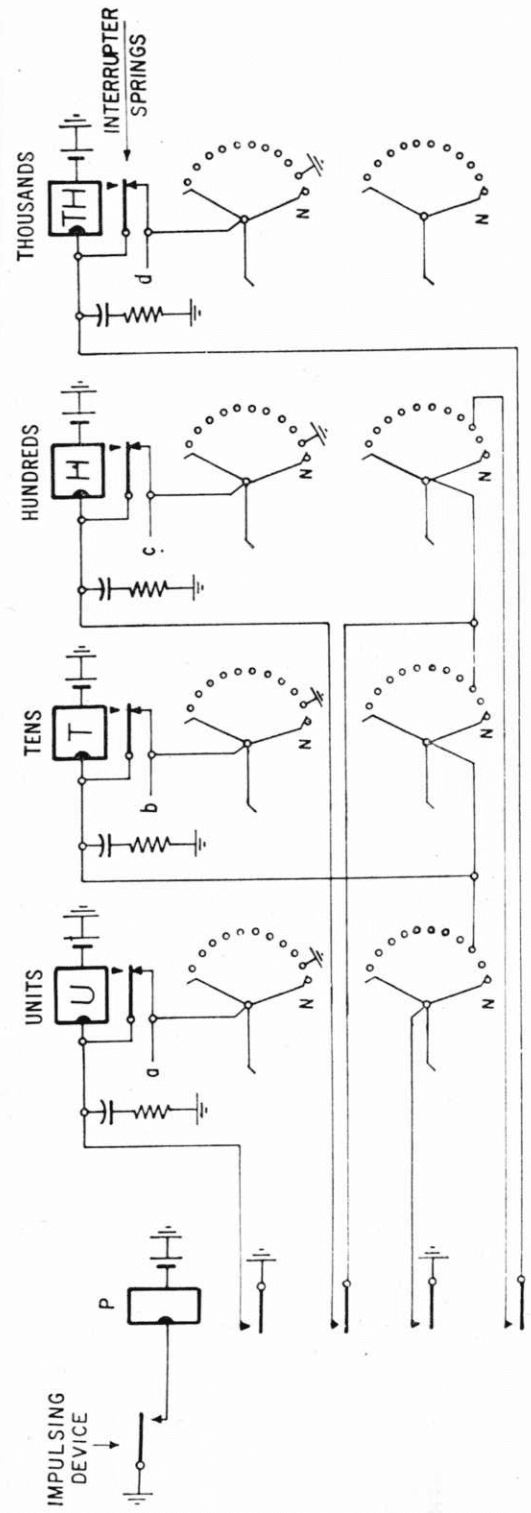
Fig. 36A. Decimal count and carry.

Fig. 36B. Predetermined count chain circuit.
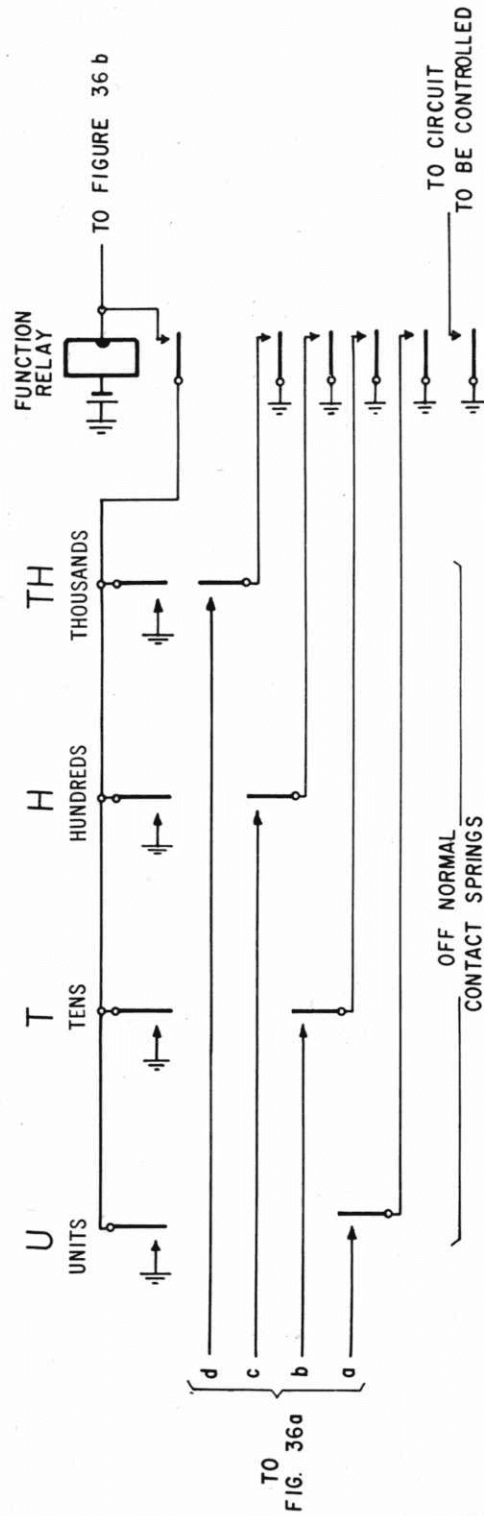
Fig. 36C. Count complete function output and reset circuit.
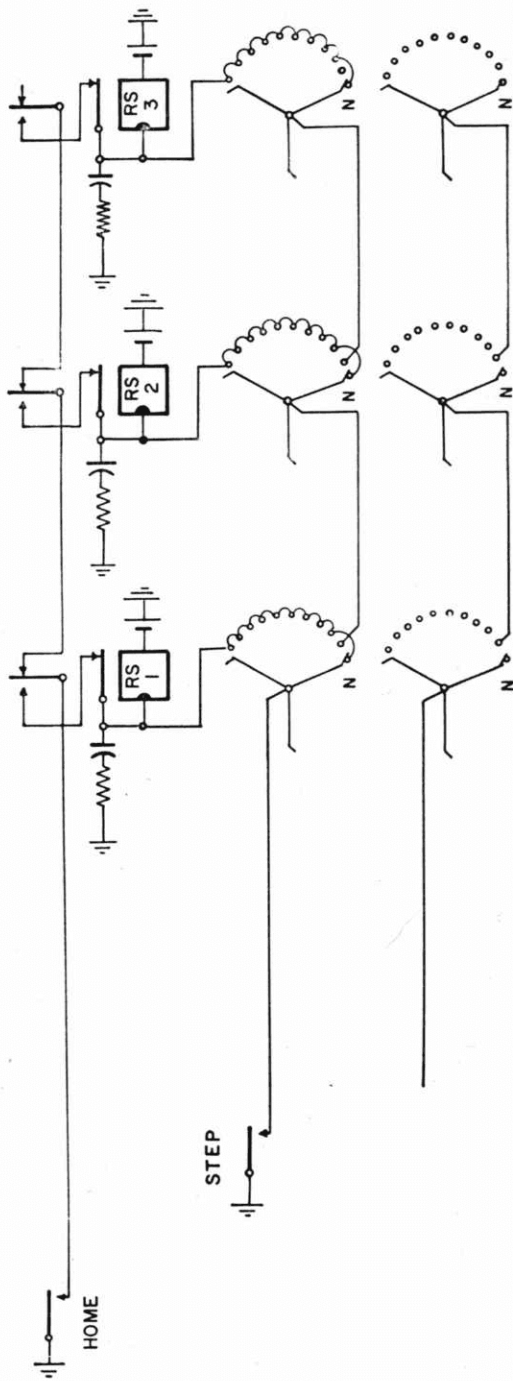
Fig. 37. Sequential or tandem stepping of rotary switches.
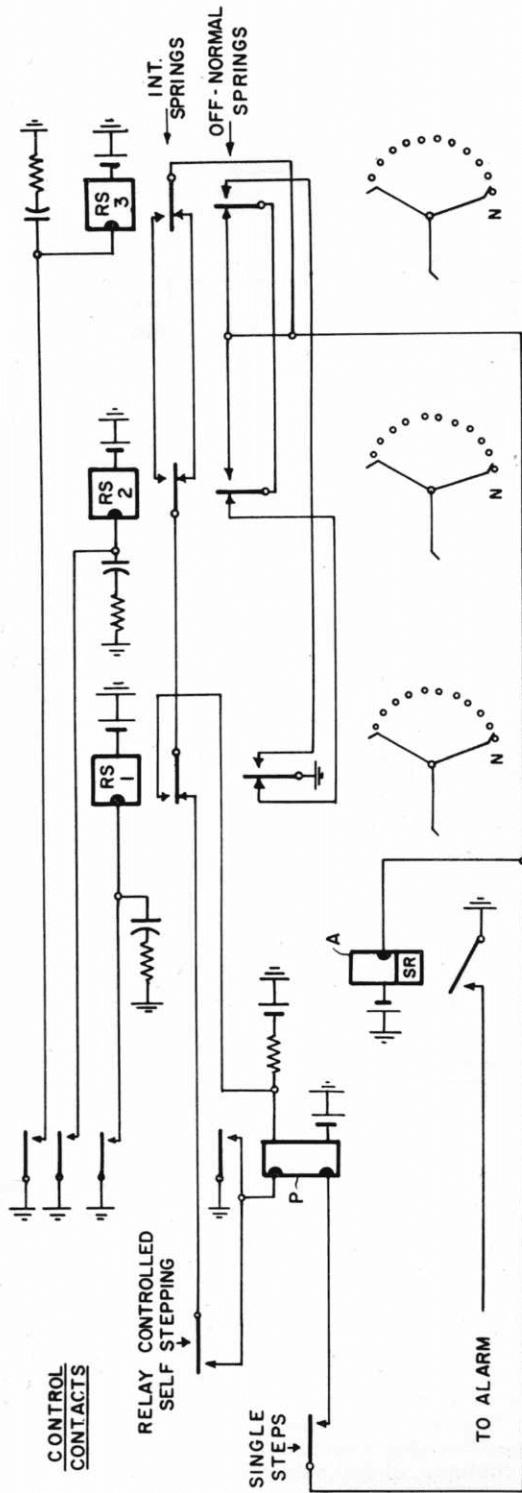
Fig. 38. "Lock step" synchronization of rotary stepping switches for simultaneous stepping.

COUNT, CONNECT, RECYCLE CIRCUIT
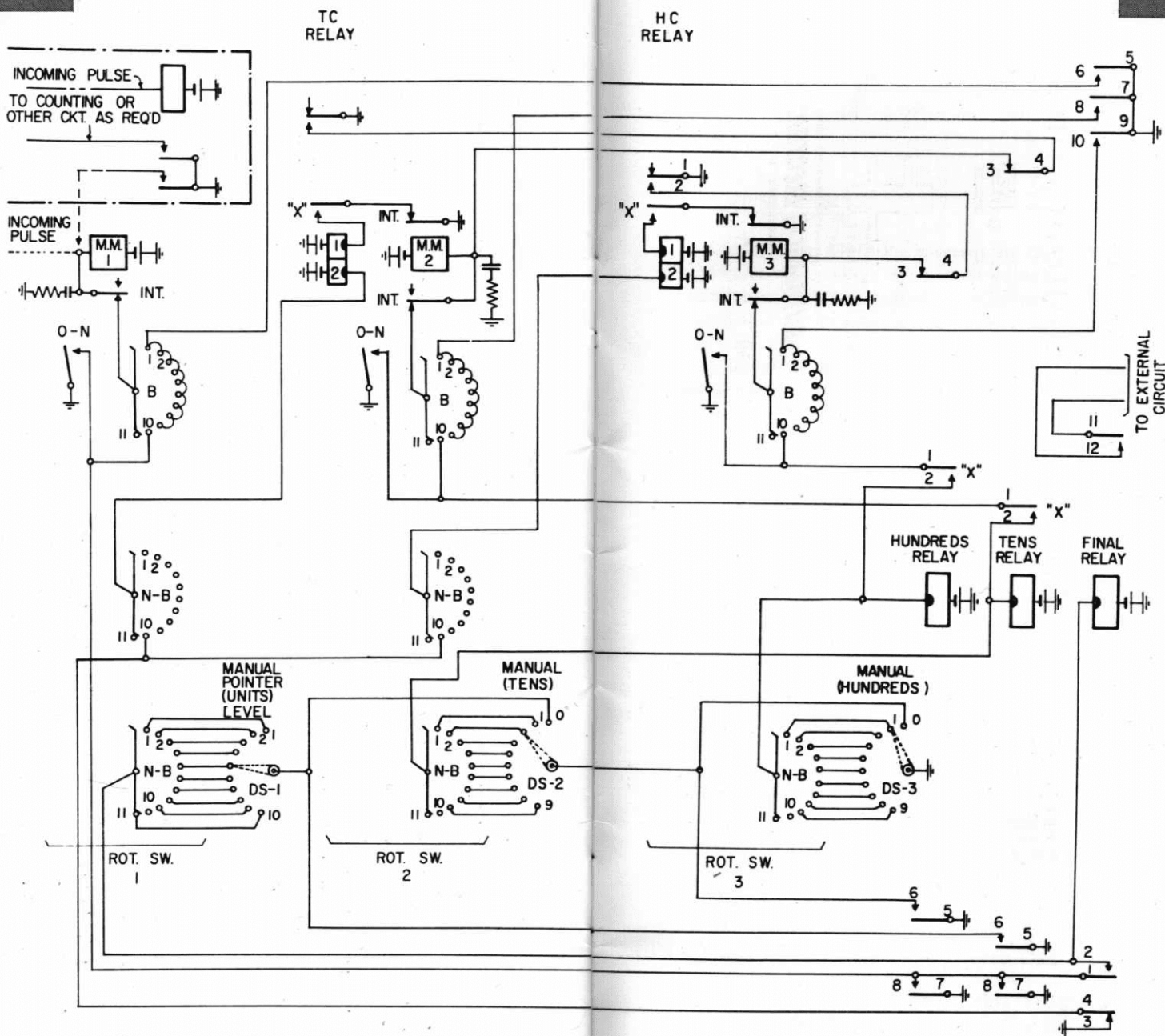
Fig. 39. Typical count, connect, recycle circuit. Manual decade switches DS-1, DS-2, and DS-3 are set to the desired count. Stepping Switch 1 is externally pulsed, stepping commences in sequence, and final relay operates when exact count is reached. If signal pulses continue, circuit automatically recommences cycle. Key: MM, motor magnet—steps rotating contactors below it; INT, interrupter contacts—open each time MM armature is energized; O-N, off-normal contacts—operated by a lobe on rotating contactor assembly, stays closed 1 to 10, opens at 11; B, bridging, and N-B, non-bridging wipers.

CIRCUIT DESIGNERS!

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