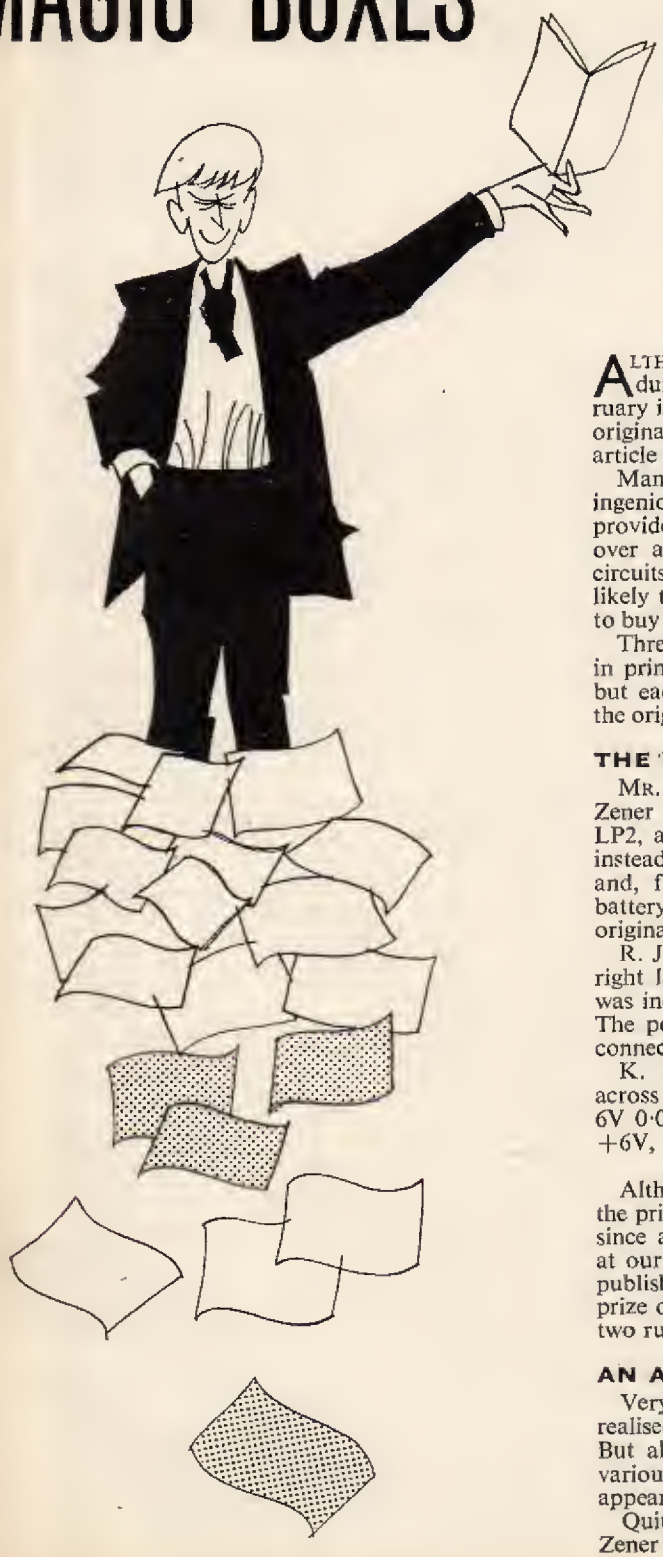
MAGIC BOXES

Ingenuity Unlimited!



ALTHOUGH over five hundred solutions were sent in during the week following publication of our February issue, no one provided an exact duplicate of our original circuit as shown in Fig. 2 of last month's article "Magic Boxes".

Many and varied were the circuits devised by our ingenious readers. Most of these would undoubtedly provide the required function, i.e. control of two lamps over a single pair of wires, but in many cases the circuits suggested were unduly complex, and indeed likely to provide exceedingly uneconomical if one had to buy all the components called for!

Three readers submitted circuits that were correct in principle and would perform entirely satisfactorily, but each of these differed in some minor detail from the original design explained below.

THE WINNER

MR. C. W. JOLLY, HORNCHURCH, connected the Zener diode D1 across LP1 (green) instead of across LP2, and gave the rating of one lamp as 6·5V 0·02A instead of 6V 0·06A. His supply voltages were correct and, furthermore, by using only three taps on the battery, appears to have improved somewhat on the original design.

R. J. WARD, WARWICK, placed the Zener across the right lamp but with reversed polarity. A 9V supply was included but tapped at +7·5, +6, 0, and −1·5V. The polarity of the supply was in accord with Zener connection.

K. WILSON, OLDHAM, also connected the Zener across LP2 but in reverse. His lamps were rated at 6V 0·04A and 6V 0·3A, and the supply provided was +6V, −6V, and +12V.

Although these three were very close contenders for the prize, it was easy to declare C. W. Jolly the winner, since apart from being the first of this trio to arrive at our office, his answer does more closely match the published circuit than the other two. A consolation prize of one guinea has been awarded to each of these two runners-up.

AN ABUNDANCE OF DIODES

Very hot on the trail were the thirty-odd readers who realised the secret lay in the use of a Zener diode. But alas, they were not content with only one, and various combinations of Zeners and ordinary diodes appeared.

Quite a few who had not seen the light concerning Zener breakdown put their trust and hope in the

common or garden diode—a single specimen, or any number up to five.

Most of the above mentioned arrangements would appear to work, but all certainly required more components than the original design.

BY BATTERY ALONE

In the highly commended class come economically minded readers who eliminated diodes entirely. With three identical batteries, two lamps, and a three-way switch they almost got there: but not quite, for with this arrangement (see Fig. 1) no "off" position can be provided and therefore the lamp box is not completely under the control of the switch box. Furthermore, in the "Green and Red" position, the lamps glow with but half their normal brightness.

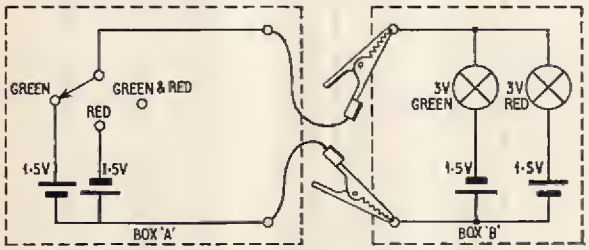


Fig. 1. This arrangement relies on all battery voltages being identical. Unfortunately this circuit will not permit both lamps to be extinguished at the same time

Perhaps a note should be added here to explain that while no "off" position was indicated in the published circuit, it is nevertheless quite practical to incorporate one if one substitutes a four-way switch for S1. In fact this has been carried out on the original model in our possession—see photographs.

A.C. HELPS OF COURSE

Now to refer to the largest category of answers received. At least 180 readers stipulated an a.c. supply. This, they suggested, was to be fed in from some external source—despite the fact that no additional leads or connections were indicated in our photograph of the "Magic Boxes". Of course, once a.c. is permitted, the remainder is easy!

Most of this group voted for a pair of diodes in each box, connected up as shown in Fig. 2, although sometimes the diodes would be in parallel with the lamps. The individualistic approach was also apparent: some used a battery for single lamp operation and a.c. for dual operation, while some used C and L filters in place of some of the diodes, and so on.

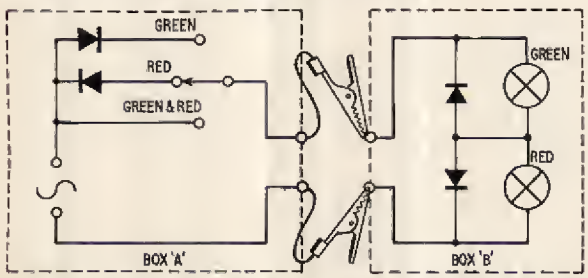


Fig. 2. No real problem if a.c. is allowed, as this typical circuit makes clear. Many variations of this ideo are, of course, possible

An alternating or pulsating supply was very much in favour by another large group, of about 100—but these were independent characters who devised the means for generating the desired waveform *inside* the box. Much enterprise was shown here naturally. We had phase shift oscillators, valve and transistor multivibrators, electro-mechanical vibrators, binary counters, variable frequency oscillators—anyhow you name it, we have it!

Quite a few alert readers "appropriated" the transistor inverter circuit described in the previous page to that carrying the announcement of the "Magic Boxes". And some admitted it too!

[We will have to be more careful with our page arrangement in future—Editor.]

RELAYS IN STRENGTH

The second largest group was composed of the relay devotees. Yes, we know you can do almost everything with relays, but what about the cost?—and don't forget the boxes are supposed to be quite portable. Perhaps you will forgive us if we were a trifle disappointed at this un-electronic approach!

Our spirits were restored however by the small band who suggested *bona fide* electronic means to achieve our end. These included transistors operated as on/off switches, and the humble neon also employed as an on/off device.

MISCELLANY

You think we have about now exhausted all the ideas brought forward? Not in the least. However, it is possible to mention just one or two of the more unusual suggestions.

The problem imposed by the limitation to a pair of wires was tackled with some resolution it must be conceded. A third "wire" was conjured up by a few readers who made both boxes of metal. Unfortunately they completely overlooked the practical attribution of the "Magic Boxes" as a means of *remote* control.

Rather more subtle was the introduction of a screened lead as one connection; this involved a modification to the crocodile clip and an additional stud on Box B. Sorry, but that's cheating.

Oh yes, we did also get a pair of double-cored leads.

A Wheatstone bridge arrangement was suggested and looked feasible.

The adoption of a moving coil meter, so that its needle would act as a switch wiper arm making contact with various points according to the amount of current fed down the lines, appeared more than once.

Electro-mechanical engineering was well represented, quite a few ideas coming from model control enthusiasts we suspect. One of the more intriguing ideas in this department was a motor driven drum with metal segments which would produce three different kinds of signal according to speed and direction of rotation.

THANK YOU ALL!

The circuits submitted often showed considerable attention to detail both technically and from a drafting point of view, with circuit values carefully worked out. Many circuits were accompanied by clear explanations of how the particular arrangement functioned.

Thanking all who participated in this little electronic exercise, we would emphasise that although the vast numbers involved make it impossible to acknowledge each entry individually, each idea submitted received careful scrutiny. ★