

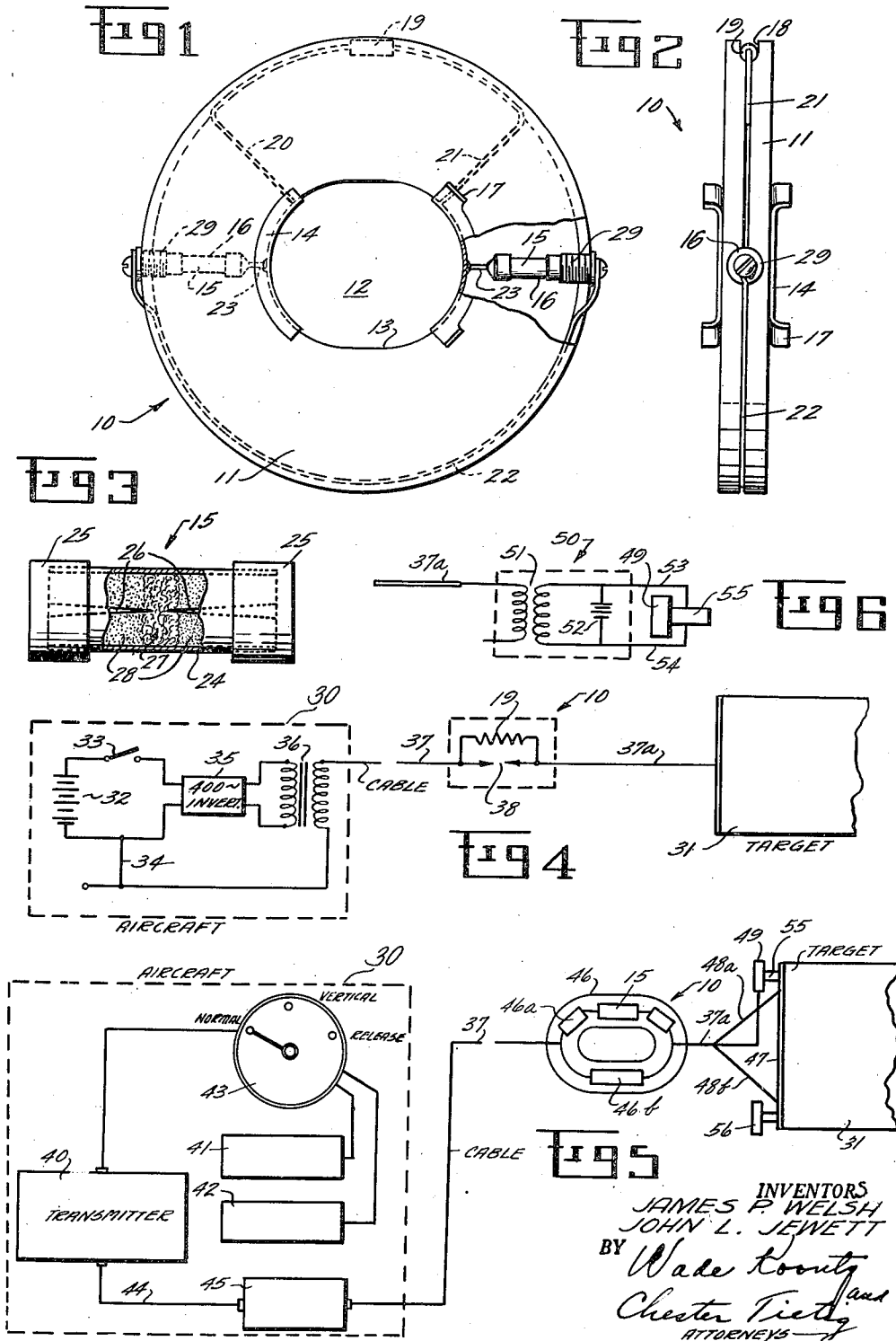
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TOW TARGET CARRIER

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TOW TARGET CARRIER

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9 Claims. (Cl. 244—1)

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The invention described herein may be manu-
factured and used by or for the Government for
governmental purposes without payment to me
of any royalty thereon.

This invention relates to a remotely actu-
able control for a towed object, more particularly an
airplane-towed target. The invention is, how-
ever, capable of general application.

One object of the invention is to provide an
explodable connector for a cable by which an
object is towed, such connector being explodable
through the cable without other conductor circuit
being necessary.

Another object is the provision of an explodable
connector for insertion in a tow cable, in com-
bination with such an electric circuit that the
connector is explodable only by an electric current
of pre-selected frequency.

Another object is the provision of explodable
means by which the position of an airplane-
towed target may be altered from horizontal to
vertical or vice-versa.

Another object is the provision of remote-con-
trolled means for selectively inverting a jettison-
ing a towed object.

In the drawings:

Fig. 1 is a side elevation of the explodable con-
nector, partly in section.

Fig. 2 is an edge view of the connector.

Fig. 3 is a detail of the ignition.

Fig. 4 is a diagrammatic representation of an
electric current embodying my invention in that
form in which a steel tow cable can be used for
transmission of an exploding signal.

Fig. 5 is a diagrammatic representation of an
electric circuit between a towing airplane and a
towed target in which means are provided to turn
or to jettison the target selectively.

Fig. 6 is a diagrammatic detail of the assembly
of a weight on the target, which weight may be
jettisoned. An explosive charge and frequency
responsive means for exploding the charge to
jettison the weight are also shown.

Referring now to Figs. 1 and 2, the explodable
connector 10 comprises a flattened ring 11 of a
tough, strong, synthetic linear polyamid polymer
plastic. A central opening 12 is slightly elongated
as to one of its axes, i. e. the horizontal one, in
the present showing. At each arcuate end of the
elongated axis there is attached over the inner
surface of the opening edge 13, a metallic highly
conductive shoe 14 over each of which is intended
that a hook (not shown) attached to the tow
cable, be fitted. One such hook is the outer
terminal of the cable extending from the air-

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craft and the other is the inner terminal of the
cable connecting the explodable connector 10
and the towed target. The purpose of the hooks
and the shoes 14 is to furnish an electrical path
for the ingress of signal to a pair of exploders 15
which are mounted radially in holes 16 formed in
the ring 11. The shoes 14 are preferably formed
with outwardly extending fins 17 as is best shown
in Fig. 2, which serve to retain the hooks in po-
sition in case momentary slack occurs in the
cable.

The edge of ring 11 has a groove 18 in which
there is positioned a bleeder resistor 19 (see Fig.
2) which may be preferably of the carbon type.
A 7.5 megohm $\frac{1}{2}$ watt resistor with leads 2.75"
long has been found satisfactory. The leads 20
and 21 make contact with one of the shoes 14 and
to do so are radially embedded in the ring 11.
A conductive wire 22 connects the two exploders
15—15 around the lower half of the groove 18
and rivets 23 connect the exploders to the shoes
14.

Since there is a spark gap, as will be later de-
scribed, in each exploder, the bleeder-resistor 19
and conductors 20 and 21 offer a leakage path,
although a high resistance one, for any stray
high-voltage static charges which might other-
wise build upon the cable and shoes 14 and so
explode the connector prematurely. A high volt-
age power signal along the tow cable will, how-
ever have enough potential and power to jump
the exploder gaps as well as to dissipate itself to
a certain extent through the high resistance
leakage path.

Referring now to Fig. 3, the structure of an
exploder 14 is shown. It is in general, similar
to that of a cartridge fuse, having a non-con-
ductive cylindrical body 24, copper caps 25 on
each end thereof and central electrodes 26 in con-
tact with respective caps. The electrodes have
sharp ends, which are about $\frac{3}{8}$ " apart. The gap
38 is filled with photographer's negative gun-
cotton 27 which serves to hold apart two charges
28 of about 1.8 grains of small grain smokeless
powder around each electrode. As will be seen
from Fig. 1, the exploders 15 about the conductive
rivets 23 and brass retaining screws 29 which are
compound so as to be able to make contact
with the connecting wire 22.

In Fig. 4 the dashed box 30 indicates the air-
craft which will tow the target 31. Within the
aircraft are a 24 volt battery or generator 32, a
switch 33 to energize the exploder circuit and a
ground connection 34 to the airframe. An in-
verter 35 converts the 24 v. D. C. to 400 cycle A. C.

and delivers the output to a step-up transformer 36 which delivers its approximately 10 M. A. output at 20,000-45,000 volts to the tow cable 37 in which there is the explodable connector 10. A spark gap 38 and a bleeder resistor 19 for the connector 10 are shown. 37a is that part of the tow cable which joins the connector 10 and the target 31.

In operation, the switch 33 is closed, thereby sending a high-tension power signal along cable 37, due to the capacity effect distributed between the connected parts of the tow cable and the airplane, which acts as a ground. The signal jumps the gap 38, ignites the gun cotton 27 which ignites the smokeless powder charges 28, resulting in the fragmentation of the ring and the release of the tow target 31 together with cable section 37a.

Fig. 5, which shows a frequency-respective selective system, contemplates the use of a two frequency channel radio transmitter 40 on the aircraft. The transmitter 40 has preferably an output of 50 to 100 watts. The two frequency channels may be derived from frequency generators 41 and 42 which are selectively connectible to the transmitter 40 through a control box 43 which is manually operable. A coaxial transmission line 44 or a wave guide connects the transmitter 40 with an antenna tuning unit 45 which may be a manually variable inductance (loading coil). A tow cable 37 joins an explodable connector 10 as before with a tow target 31 and a second section 37a of a tow cable. There is the difference in the construction of the connector 10 however, that a high-low pass (band rejection) resonant filter 46 is incorporated to shunt the spark gap. The inductance in filter 46 has a low D. C. resistance and a high impedance at the frequency at which it is to be used. Radio frequency is preferred and the frequency should be chosen in relation to the cable length so that current nodes will be developed. 493 kc. or whole harmonics thereof have been found to be satisfactory.

As shown in Fig. 5, the tow target 31 is provided with a stiff spreader 47, to which two spreader cables 48a and 48b are attached. These cables are pulled by rear cable portion 37a. The latter continues past the point at which cables 48a and 48b are attached to it, to contact electrically a weight 49 which can be jettisoned by the explosion of an explosive charge attached thereto. The exploding signal follows the cable 37a through an electrical filter 50 shown in Fig. 6, to an exploder (not shown) which may be attached to the weight fastenings (not shown).

The filter 50 is a conventional one, but of small proportions. It comprises an inductance 51 and a capacitance 52. Its circuit leads 53 and 54 connect to an exploder (not shown), the explosive capacity of which is sufficient to tear loose the fastenings 55 of the weight 49 to the spreader 47 but is insufficient to damage the latter. The filter 50 is proportioned so that it will pass an exploding signal to the weight exploder at the frequency of tap 2 on the control dial 43. In such case the current will go through the lower loop 46b of the filter 46 and will not go through the upper loop 46a which contains the exploder 15.

As long as there are two weights, 49 and 56, which in the aggregate, weigh the same, on opposite ends of the spreader 47, the target will fly horizontally. If weight 46 is jettisoned by explosion, then weight 56 will assume the lowermost position and the target 31 will fly vertically.

If it is now desired to jettison the entire target, the control dial 43 is set at position 3 and a

different frequency sent over the cable 37 which frequency will be able to go through loop 46a and exploder 15. Explosion then occurs and the target 31 and cable section 37a drop off. The cable 37 can then be reeled in and another target attached. By the use of the antenna tuning unit 45 it may be possible to vary the wave length of the R. F. current passing over the cable 37 so that only one frequency generator 41 or 42 is necessary.

A ground for the circuit is not necessary since there is sufficient static dissipation and corona loss to allow enough current to pass to fire the exploders. If the cable is 1000 feet long, the wave length of the signal should be about 2000 feet (493 kc.) so that the exploders will be located at a point where there is current and voltage, not at a node where both are absent or of low value. Competent electrical engineers can design selective filters for any given wave length.

We claim as our invention:

1. An explodable connector comprising a ring of tough plastic resinous material, conductive metallic shoes at opposite sides of the hole therein gripping the rim thereof, a pair of exploders having outer terminals, said exploders being embedded in the ring, each one extending substantially from one shoe to the outer rim of said ring, an embedded electrical circuit connecting the outer terminals of the said exploders and a second electric circuit of high resistance value connecting said shoes with each other.

2. An explodable connector according to claim 1 in which the exploders are of the type which can be energized by the pass of an electric spark through them.

3. An explodable connector which comprises a ring of a tough synthetic linear polyamid plastic, contact means for a pair of hooks on opposite sides of the opening in said ring, a high resistance static-dissipating shunt connecting said shoes, a pair of electric-spark-explodable devices embedded in said ring, one extending substantially radially from each shoe to the outer rim of said ring, a low resistance electric circuit joining the outer ends of said explodable devices, said devices being capable, on the explosion of one or both, of destroying the connecting power of the said ring.

4. An explodable connector comprising a strong frangible ring, a pair of conductive shoes attached on opposite sides of said ring to the inner rim surfaces thereof, a pair of exploders radially arranged on said ring at opposite ends thereof, said exploders being in metallic contact with said shoes, an electric circuit arranged around one side of the rim of said ring and including the shoes and exploders, another electric circuit arranged around the other side of said ring and connecting only the said shoes, each of said circuits being conductive to an electrical signal of substantially different frequency, the exploder circuit being inoperable by a signal which will pass through the remaining circuit.

5. In combination, an airplane, a tow cable trailable from said airplane, a tow target attached to said cable at the outer end thereof, an explodable connector responsive to an electrical current of a certain frequency in said tow cable in the neighborhood of said tow target and means on said airplane for applying an electrical signal of such frequency through said cable to said explodable connector to explode the latter.

6. In combination, an airplane, a tow cable trailable therefrom, a tow target attached to the

outer end of said cable, a pair of weights attached to the inner end of said tow target, electrical and explosive means attached to one of said weights, actuable from said airplane, for jettisoning said weight.

7. In combination, an airplane, a tow cable trailable from said airplane, a tow target attached to said cable at the outer end thereof, a pair of weights near the inner end of said tow target and attached thereto, one of said weights including an electrical frequency responsive exploding device, an electrical frequency-responsive explodable connector in said cable in the neighborhood of said tow target, means on said airplane for generating and applying electrical signals of a plurality of frequencies to said tow cable, a signal one of said frequencies being capable of exploding the weight-associated exploding device and of passing the explodable connector without exploding same and a signal of the second frequency being capable of exploding the connector to jettison the tow target.

8. In combination, an airplane, a tow cable trailable therefrom and a tow target attached to the outer end of said tow cable, a spreader on the inner end of the tow target, a weight attached to each end of said spreader, a band pass filter attached between the end of said tow cable and one of said weights, an explosive charge containing a spark-responsive exploder attached between said filter and said weight and means on said airplane for generating and applying an electrical signal to said tow cable to pass said

filter and to explode said explosive charge whereby to jettison said weight.

9. In combination, an airplane, a tow target, a conductive tow cable for the latter, a pair of weights associated with the target for holding it horizontal when towed, electrically frequency-responsive explosive means associated with one of said weights and said cable for jettisoning said weight whereby to cause said target to be vertically inclined, electrical frequency responsive explosive connecting means carried on said cable between said weight and said airplane but near said tow target, said connecting means being able to pass a signal of a frequency which will jettison the weight without exploding the connecting means, and means on the airplane for generating and selectively applying electrical signal of a frequency which will either jettison the weight or explode the connecting means.

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