Destroying of Word War II Metallic Land Mines by the use of Stray Current Electrolysis

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Abstract: Based on corrosion action caused by stray current electrolysis, it is possible to use such concept as a new technique to destroy metallic structure of the land mines. This new technique saves a lot of money, effort and time. The idea of this new technique is to corrode the metallic material of a group of cascaded land mines at one time by the acceleration of the corrosion action. Then, the charge, the explosive material, will expose to the surrounding soil which in turn will be spoiled by humidity.
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1. Introduction

Dating minefields to World War II, the focus of mine in Egypt in the Western Desert, El-Alamein, as well as some in the Sinai from the remnants of war. Those vast fields of others and a clear cause of many accidents and fallen because many of the victims, as they prevent the development and use of this land in agriculture or prospecting for oil and mineral wealth. There is a project Qattara Depression, which examine the possibility of generating electricity through the construction of the course conducts the Mediterranean Sea with Qattara Depression, but the project is not so far because of the following: The problem of mines (abandoned in the area of El Alamein since World War II) impede the implementation of the project

2. Landmines

2.1 Anti-personnel mines

Perhaps this type of mine is the most dangerous of all, which is a fundamental problem, and was the signing of the global conventions, which criminalize the use of anti-personnel mines but it is still a problem. Exploding anti-personnel mine if the weight of a certain weight, say not less than 80 kg for an adult, and over time due to factors rust and moisture and erosion, a minimum weight required for the mine to be exploded. Then mine explosion shall be at any weight going through it. There are also types of mines have a wire connecting with each other and to stumble by a person unleash, and that there were several explosive charges.

Change the location of minefields and by the time of the floods in the desert and the movement of vegetative growth in the region so it is extremely difficult to determine the beginning and the end of the mine sites to be exact. Issued an international treaty to ban the manufacture of anti-personnel mines, but the problem still exists in most parts of the world. Figure 1 shows an example of anti-personnel mine.

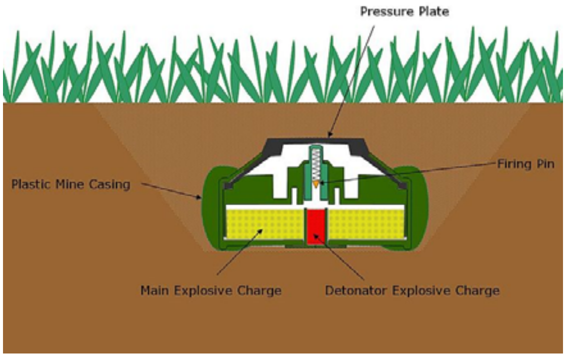

Figure 1: Anti-Personnel Mine Components


Figure 2: Anti-tank mine

2.2 Anti-tank mines

Those mines are usually addressed to repel tanks explode in practice if it had been passed by the higher weight of 150 kg, so it is possible for the soldiers and people to pass it safely without exploding. As well as exploding if passed by the carriers and to other equipment. Figure 2 shows an example of anti-tank mines

3. Composition of land mine

Consists of landmines in the structure of plastic or material non-corrosive (structure was a metal in word war II), above an area of broad bottom pressure plate linked to «Yai» starts when step on the individual to blow up a shipment bombing initial in the middle (red zone in figure 1), which broke the explosive device core (on the sides). In this way, similar to the way the bombing of the regular bullet and increase the effectiveness of the mine increased age. Configuration consists of the detailed mine filling fast ignition of gunpowder and Kheradeg toxic, fuse, spring and needle, and when the needle hit the ground vibration spring triggering fuse and this leads to the rapid explosion and this process takes one moment.

4. Removal of Land mines

Require operations to remove mines a lot of time in light of the widening scope of the minefields and the absence of maps that have been developed on the basis of the minefields in times of war or change the terrain. Usually assume the units of military engineers, mine-clearance tasks, at the outset open a safe road by minesweepers and then comes the role of the engineering teams art that clear the area, after cutting areas to equal areas, by the use of regular detectors for metal and explosives, and are dealing with mine all Separately, a process which involves a lot of risk, since in some cases, be mine booby traps in the form of mines on top of each other, so that continues to mine the top until they snap the bottom because it is not apparent, and that experience is very important in this area and caution in addition to Security commitment to safety rules and wear protective equipment when available to reduce the risks as much as possible.

5. Stray Current Electrolysis

Dissimilar buried metals such as copper and steel can function as the poles of a galvanic cell, using moist soil as the electrolyte. Stray direct currents in soil may counteract the anti-corrosion effect of a cathodic protection system. Design of high voltage direct current transmission systems must take care so that current flowing in the earth does not cause objectionable corrosion to buried objects such as pipelines. Typically an electric railway will have at least one of the rails used as a return conductor for the traction current.

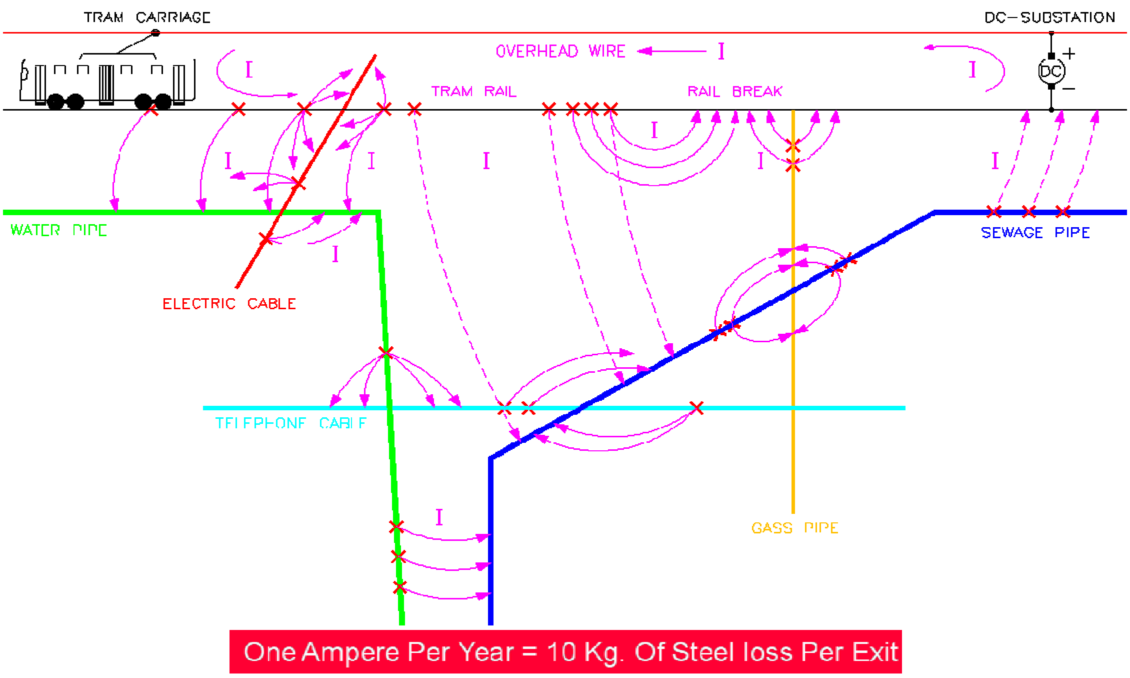

Figure 3: Damage caused by stray current electrolysis

This rail is in contact with the earth at many places throughout its length. Since current will follow every parallel path between source and load, some part of the traction current will also flow through the earth. Where the railway uses direct current, this stray current can cause damage to other buried metallic objects by electrolysis and accelerate corrosion of metal objects in touch with the soil. Figure 3 shows an example of damage may takes place due to stray current electrolysis.

Stray current problems on pipelines arising from direct current transit systems and mining operations can be very severe. Solving such problems is more complicated. This is because of the continuously varying nature of exposure as the load on the DC power sources varies. This type of problem is limited to relatively small areas in Egypt "Cairo, Alexandria". Electrified railroads operate on DC transit system, are operated normally overhead insulated feeder connected to positive bus of DC substation. The load current (which may be thousands of amperes) is supposed to return to the substation via tracks, which are connected to the negative bus at the substation. A common operating potential for transit system is 600 Volts. Because tracks are laid at the ground level and not insulated completely from earth. Some part of the load current will enter the ground where the tracks are most positive and take an earth back to substation. Pipelines in the area constitute a good return path for a portion of the earth current. Such a pipeline will carry the current to location in the vicinity of the DC substation where it will flow from the pipeline to earth and return to the negative bus of the substation. Severe pipe corrosion will result if corrective measure are not used. Where the pipeline is picking up current it is receiving *cathodic protection.* In severe cases, the pipeline may be many volts negative to adjacent earth in this area and, at the same time, many joints in the pipeline, there may be enough driving voltage to force current to bypass the joint and corrode the pipe on the side where the current leaves the pipe. The best solution to this problem is to know the area where the current leave the pipe and connect it with a feeder to the negative bus on the substation. This means that no current will leave passing in the ground "i.e. electrolyte", no ionization will arise.

The return path of the stray current will not only be a pipeline but also, telephone cable, power cable, bridges, …etc. Any buried structures will suffer from it.

N.B. One Ampere per year will cause a loss of steel equal to approximately 10kg.

6. This Patent

1. To handle all mines in a filed as one unit instead of handling each mine alone.
2. That's to say, to destroy all mines in the field together in one time.
3. Time to destroy all mines in the field, in one time by using this new technique, is too much less than the sum of all individual time removal for each one by the old techniques
4. Cost of destroying all mines together in the field in one time is too much less than that of old techniques
5. Perimeter of mines' field is a must to be defined by safe roads.

6.1 Patent Idea

Acceleration of corrosion process by considering all land mines in a field to be in the cathodic zone of a system of cathodic protection for an artificial metallic structure, say a pipeline. The control in cathodic protection current of this artificial pipeline will equal to the control of the stray current outgoing from the land mines metallic material. That's to say that: the corrosion rate of land mines in the cathodic zone will be controlled by the cathodic protection current flow to protect the pipeline. Equation 1 governs the corrosion process of land mines by stray current electrolysis which is equal to:

One DC Ampere Per Year = 10 Kg. Of Steel loss per each landmine exit (1)

In other words:

If rectifier output is 10 A DC per year, this will equal to:

= (10×10)/1 = 100 kg of metal loss per each landmine exit / year.
= (10×10)/2 = 50 kg of metal loss per each landmine exit / 6 months
= (10×10)/4 = 25 kg of metal loss per each land mine exit / 3 months
= (10×10)/12 = 8.3 kg of metal loss per each land mine exit / month

Again, the distance between the CP ground bed and the scrap pipeline to be cathodically protected contain cascaded landmines. Landmines lie in cathodic zone which means corrosion takes place at each landmine current exit as per figure 5.

To understand the concept one time - landmines destroying technique, let us consider 10 cascaded land mines only for simplicity.

Then, if rectifier output is 10 A DC per year, this will equal to:

= (10×10×10)/1 = 1000 kg of metal loss for all 10 cascaded landmines exit / year.
= (10×10×10)/2 = 500 kg of metal loss for all 10 cascaded landmines exit / 6 months
= (10×10×10)/4 = 250 kg of metal loss for all 10 cascaded landmines exit / 3 months
= (10×10×10)/12 = 83 kg of metal loss for all 10 cascaded landmines exit / month

Now, if the rectifier current is increased to be 100 A DC per year, this will equal to, as we will consider the 10 cascaded landmines:

= (100×10×10)/1 = 10 ton of metal loss for all 10 cascaded landmines exit / year.
= (100×10×10)/2 = 5 ton of metal loss for all 10 cascaded landmines exit / 6 months
= (100×10×10)/4 = 2.5 ton of metal loss for all 10 cascaded landmines exit / 3 months
= (100×10×10)/12 = 833.33 kg of metal loss for all 10 cascaded landmines exit / month

A proper design of this corrosion system such that the DC rectifier output will be according to time required for landmines metal loss in a field and of course it will be according to both landmines types and enclosure weight. And so on, by increasing rectifier output DC current the acceleration rate of metal loss (corrosion) of landmines in the field is increased.

6.2 Procedures to Destroy Land Mines:

One time - landmines destroying technique**,** please refer to figures 4 & 5

Steps:

1. Determine the perimeter of the land mines field
2. Create save roads such that to split the mines field into suitable equal areas
3. By the use of impressed current system, build up a proper cathodic protection system for a pipeline such that land mines in one area to be located in the cathodic zone of the pipeline.
4. Destroying time calculation: adjust CP rectifier output to control the corrosion rate of metallic parts of land mines in the pipeline cathodic zone.
5. Then filling with sea water or fresh water each area, after complete land mines metal loss, until humidity reaches the explosive charge of the land mines.

6.3 Example of Real Metal loss Due To Stray Current Electrolysis

Concrete rebars of a road crossing were corroded to great extent because of the reinforced concrete lies in the cathodic zone of the Arab Petroleum Pipe Line Company SUMED. Figure 6 & 7 show the corroded rebars while figure 8 compares the original size of rebar and the corroded one.

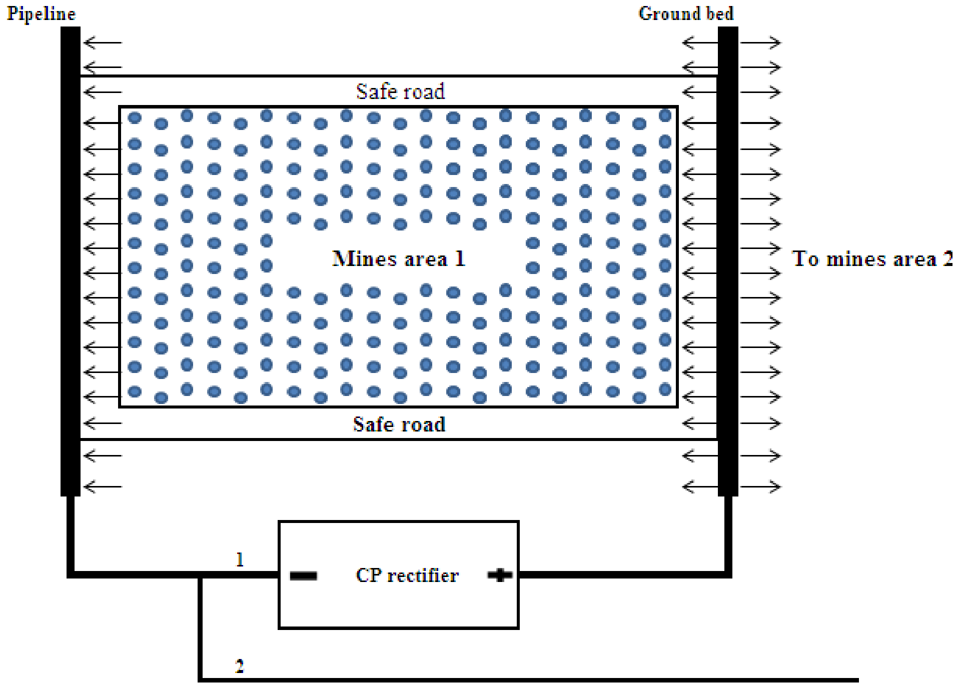

Figure 4: General landmines area layout

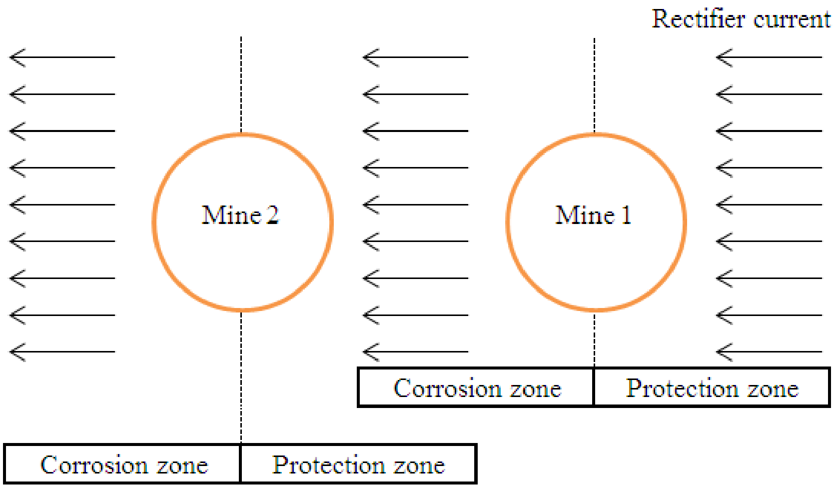

Figure 5: how mines corroded in one time

Figure 6: corroded rebars were subjected to the cathodic zone of SUMED pipeline

Figure 7: Example of corroded rebar

Figure 8: Comparison between rebars before and after metal loss due to stray current electrolysis

7. Conclusion

We can use the concept of metal loss in rebars due to stray current electrolysis to apply it to destroy the word war II metallic land mines. The metallic land mines field will be within the cathodic zone of a cathodically protected of any other metallic structure, say scrap pipeline. Acceleration of corrosion process of the metallic body of word war II land mines could be managed by the cathodic protection rectifier output in a system to protect this scrap pipeline cathodically. After metal loss process, explosion charge should be spoiled by suitable source of humidity say, by seawater feeding to the landmines field.

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