DOWNHOLE FLUID SOLUTIONS

DFS

ROCKWELD™

THE NEW, PATENTED LCM & REMOVABLE WELLBORE STRENGTHENER

FOR THE RESERVOIR IN MATURE, PRESSURE DEPLETED FIELDS

& OTHER MAJOR APPLICATIONS

DFS Ltd was granted a patent for ROCKWELD™

on 20th February 2008

UK Patent GB 2431 949

THE PROBLEM:

In mature, pressure depleted fields low **pressure / low strength** strata exist in **reservoir** (and non-reservoir) **structures**.

Drilling becomes difficult as **induced fractures are created** in the low pressure areas causing **loss of drilling fluid** which can **rise to unacceptable levels**.

ROCKWELD™

ROCKWELD™ has been specially developed to answer the ever-growing need for a

LOST CIRCULATION &

WELLBORE STRENGTHENING MATERIAL

in these weak reservoir formations.

(In loose sand/sandstones, **ROCKWELD™** has the ability to consolidate these structures as well as preventing losses and increasing the strength of the near wellbore.)

The design requirements set by operators included:

- .. set hard, similar to cement.
- .. a wide range of temperatures.
- .. be mixable in normal mud pits.
- .. be easily mixed, user friendly.
- .. held pre-mixed on surface indefinitely
- ..be 'GREEN', all components NON-TOXIC & NON-HAZARDOUS.
- .. NOT set up/flash set accidentally in the drillpipe/casing/wellbore/pits.
- .. NOT need specially trained personnel.

ROCKWELD™ MEETS **ALL** THESE CRITERIA:

- It sets to a sufficiently hard, resilient consistency.
- It works reliably from 40°C ->160°C.
- it is mixed in the mud pits or any tank
- Can be mixed very rapidly and kept in advance of requirement.
- No special equipment or personnel required.
- Will NEVER setup/flash set accidentally.
- All components are Environmentally Friendly and pose no threat to biological life, nor are they hazardous.

PLUS

ROCKWELD™

possesses

2 very important,
additional properties:……

FIRSTLY:

IT REMAINS **SLIGHTLY MALLEABLE** AT WORKING TEMPERATURES

This means that it **will not shrink like cement** but will **continually, but very slowly, alter its shape** as the pressures change under downhole conditions.

The benefit is that ROCKWELD™ will have a **constant bond** with the surface of the formation it sets in.

This will prevent:

> further lost circulation

> flow of formation gas or liquids.

and SECONDLY:

'ROCKWELD™ ' can be

100% REMOVABLE

by produced reservoir fluids

NO ACIDISING!

NO OTHER INTERVENTION!

ROCKWELD™

...is **100% removable** by produced reservoir fluids where there is **oil and water** present.

Once placed in the weakened formation to strengthen it, it will remain **solid, but slightly flexible/malleable** during the drilling and completion phases.

Once production starts both the **oil and water soluble components** of

ROCKWELD™ will slowly begin to dissolve –- **the greater the flow the faster the removal.**

PACKAGING:

ROCKWELD™ comes as a dry powder blend consisting of:

a) **A synthetic organic compound** that acts as a **binder** when subjected to temperature, pressure and the presence of the activators.

b) **An inert inorganic material** that acts as the filler in the final aggregate.

c) **Activator** .

d) High quality xanthan gum suspension polymer

..once the sacked powder material has been mixed a '**Liquid activator**' is added.

MIXING:

ROCKWELD™ is mixed in saturated brine or drillwater.

Example bbl formulation:

a) NaCl brine 10ppg/1.2SG: 0.65bbl

b) ROCKWELD™: 200ppb

c) Liquid activator: 0.8litre/bbl

continued...

MIXING....

1) Add the required volume of water/brine to the mud pit/tank.

2) Add the ROCKWELD™, via the mix hopper as fast as is practicable – the polymer is dry dispersed in the bag and 'fish eyes' will not be a problem.

3) Allow to continue to mix through the mix lines for at least 60 minutes or if only low speed mixing is available, for a minimum of 4 hours.

4) Add the 'Liquid Activator' through the grating.

5) The ROCKWELD™ suspension is ready to be used or can be held for prolonged periods, just ensure it does not become contaminated.

PUMPING & PLACEMENT:

The following procedure is for guidance only and can be modified as conditions indicate:

1) Before displacing make up a '**hi-viscosity' displacement pill** by adding 1- 2ppb Xanthan Gum to some of the water based mud being used for drilling. If OBM is in use a water based displacement pill formula will be provided on request.

2) Pump the required volume of ROCKWELD™,
   NB: **50bbls will provide +/- 16.5bbls of solid, compressed ROCKWELD™.**

3) Follow the ROCKWELD™ with +/- 5-10bbls of the 'hi-viscosity' pill.

continued...

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4) Displace the ROCKWELD™ to the weak zone to be strengthened.

5) Pull the bit above the top of the ‘hi-vis’ displacement pill.

6) Slowly increase the pressure on the ROCKWELD™ pill till it starts to enter the formation to be strengthened.

7) Continue to displace 9O% / 45bbls of the ROCKWELD™ into the formation.

8) Stop pumping but maintain minimum pressure to hold the ROCKWELD™ in place for a minimum of 30minutes.

continued.....

Continued….

9) The ‘ROCKWELD™’ will now have ‘de-watered’, leaving the separated solids in the induced fracture.

10) After 30 minutes increase the differential pressure slowly to 300psi and hold for 60 minutes.

11) After 60 minutes increase the differential pressure to 600psi and hold for a further 60 minutes.

12) During this time the ‘ROCKWELD™’ solid material will have become **aggregated** and **compressed** until it becomes …

FUSED

.. together to form a **solid irreversible mass but which will still be MALLEABLE.**

continued...

Continued.....

13) Carry out pressure test to see if strengthening has been completed satisfactorily.

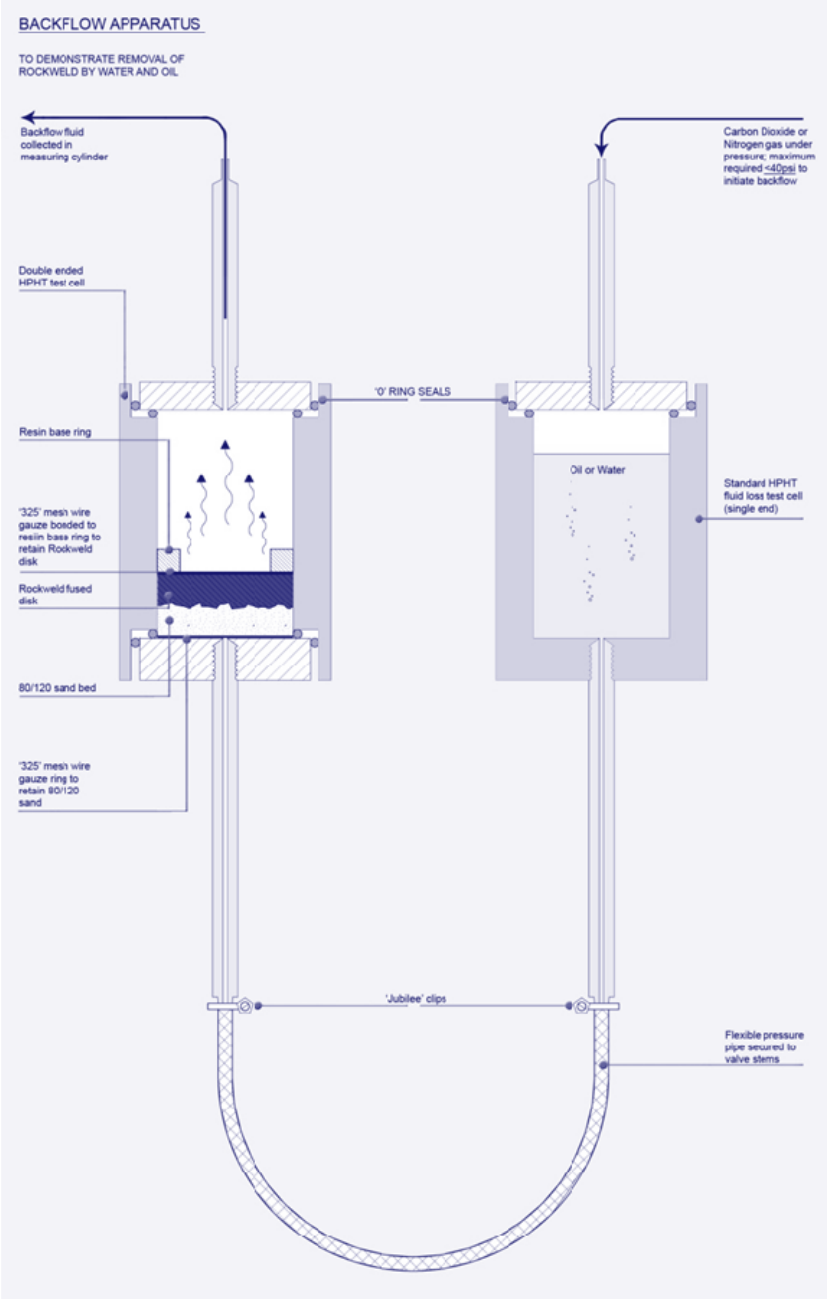
14) Any 'ROCKWELD™' left in the wellbore, i.e. not displaced into the formation,

<u>will remain as a safe fluid suspension</u>.

It will not have any unwanted affect on OBM or WBM and can be mixed with either type of mud, or displaced from the well.

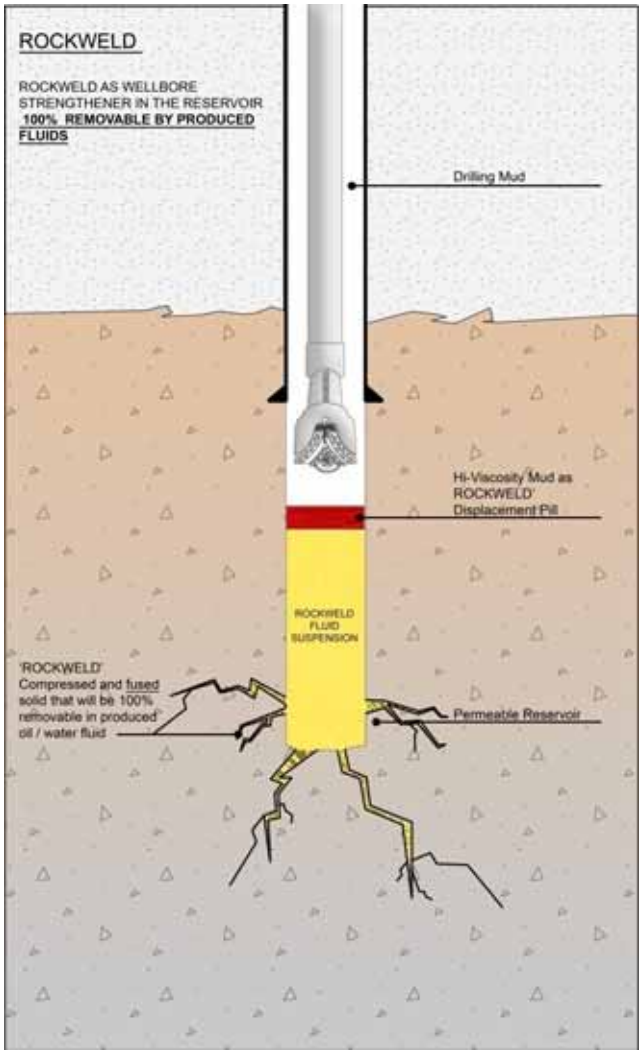
The procedure may repeated as required.

APPARATUS USED TO DEMONSTRATE THE REMOVABILITY OF ROCKWELD™



‘ROCKWELD™’

REMOVABLE RESERVOIR WELLBORE STRENGTHENER



ADDITIONALLY>>>

ROCKWELD™ can also be used for:

A) SAND/FORMATION CONSOLIDATION.

B) CEMENT REPAIR, eg ‘L.O.T.’ FAILURE AT CASING SHOE after CEMENTING.

C) AS AN LCM IN ITS OWN RIGHT OR **AS A BONDING AGENT FOR CONVENTIONAL** LCM.

D) WATER SHUT OFF.

E) ZONE ISOLATION.

F) DIVERTER.

G) TOP HOLE STABILISER.

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