Paper No. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte NORMAN C. FAWLEY

Appeal No. 1999-2145
Application No. 08/781,605

ON BRIEF

Before CALVERT, ABRAMS and FRANKFORT, Administrative Patent Judges.

ABRAMS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 33-51 and 53-63, as amended after the final rejection, which are all of the claims remaining of record in the application.

We REVERSE.

BACKGROUND

The appellant's invention relates to a method for restoring the burst strength of a pipe having an unbreached weakened region. An understanding of the invention can be derived from a reading of exemplary claim 33, which appears in the appendix to the appellant's Brief.

The references of record relied upon by the examiner in rejecting the appealed claims are:

Shaw	2,924,546	Feb. 9, 1960
Stark	2,955,642	Oct. 11, 1960
Medkeff et al. (Medkeff)	3,358,898	Dec. 19, 1967
Schumacher	4,511,626	Apr. 16, 1985
Fawley	4,700,752	Oct. 20, 1987

Pipeline Reinforcement brochure (4 pages), Nov. 10, 1987

Reinforcement Digest No. 46, "A new family of composite products stops cracks in line pipe, extends life of pipelines, improves safety," pages 2-5, Jan. 1989

The admitted prior art set forth on pages 1 and 2 of the appellant's specification

Claims 33-40, 43-50, 53-58 and 61-63 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Reinforcement Digest and Fawley in view of the admitted prior art, Shaw, Stark and Medkeff, and optionally further in view of Pipeline Reinforcement.

Claims 41, 42, 51, 59 and 60 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the references cited against claim 33 et al., taken further with Schumacher.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellant regarding the above-noted rejections, we make reference to the Answer (Paper No. 17) for the examiner's complete reasoning in support of the rejections, and to the Brief (Paper No. 16) and the Reply Brief (Paper No. 18) for the appellant's arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellant's specification and claims, to the applied prior art references, and to the respective positions articulated by the appellant and the examiner. As a consequence of our review, we make the determinations which follow.

The appellant's invention is directed to the problem of restoring the burst strength of a pipe(line) such as those used to transmit liquids and/or gases under pressure which has an unbreached weakened area having at least one depression in the outer surface of the pipe. As manifested in claim 33, the invention comprises the steps of detecting the weakened region, providing a load-transferring filler material, filling the depression with the filler material, and wrapping around the pipe in the weakened region a strip of high tensile strength material comprising high tensile strength filaments in a cured matrix and defining a coil band with a plurality of elastic convolutions, including placing a first elastic convolution around the pipe and subsequent convolutions around underlying convolutions

such that opposite side faces are in radial alignment, and securing the convolutions from movement so that they do not move relative to one another when the pipe is pressurized.

In rejecting claim 33, the examiner has interpreted the teachings of the applied references in the following manner. Reinforcement Digest discloses a CLOCK SPRING[1] strip of high tensile strength memory matrix composite material that is wrapped around a pipe for use as a crack arrestor, but also states on page 2 that it "can be wrapped around deteriorated sections of line pipe" to allow it to be capable of operating at its original design pressure. However, the reference does not describe the details of the material that are recited in the claim nor does it teach that the deteriorated sections constitute unbreached weakened sections or that filler can be used in depressions in the weakened sections. Fawley, which appears to be directed to the crack arrestor described in Reinforcement Digest, discloses the claimed material and explains that it is adhered to the pipe by means of an adhesive. The admitted prior art recognizes that it was known at the time of the appellant's invention to restore a deteriorated pipeline by digging it up and covering the damaged area with sleeves installed around the pipe. Shaw and Stark teach that a repair can be made by applying filler to a depression and then wrapping it with resin or plastic impregnated tape, and Medkeff that adhesive can be used in addition to tension to secure a repair strip to a pipe and subsequent convolutions of the strip to one another.

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[1]CLOCK SPRING is a trademark of NCF Industries, Inc.

From these teachings, the examiner concludes that the applied prior art would have suggested to one of ordinary skill in the art that it would have been obvious to construct the coiled band disclosed by Reinforcement Digest of the material required by claim 33 and to utilize it in conjunction with filling depressions in a weakened region of a pipe to restore the burst strength of the pipe in the manner of the method recited in the claim. The examiner further points out, in support of this conclusion, that Pipeline Reinforcement, which also discloses the CLOCK SPRING crack arrestor, states on the last page that the coiled strip can be used to restore a damaged region of a pipe to its original pressure capabilities.

We do not agree with the examiner's conclusion, and to appreciate both the appellant's invention and the reasons why we have not sustained the rejection, it is necessary to understand the evolution of the invention, as derived from the appellant's specification, the applied references, and the evidence submitted by the appellant in the Fawley declarations and their accompanying exhibits.

In December of 1985, the appellant filed a patent application directed to crack arrestors for stopping a propagating ductile fracture in pipes such as those used in pipelines, which matured into the Fawley patent that has been applied as a reference against the claims in the present application. The disclosed pipe arrestor was in the form of a spiral band of an elastic high tensile strength material. It is described in the patent as being made of a composite material containing high tensile strength fibers arranged

parallel to one another along the length of the web and encapsulated in a resin mix which, when cured in a coil spring configuration, returns to the same configuration after being uncoiled (columns 3 and 4). The crack arrestor is installed around the pipe in such a manner as to provide several layers of wrapping, which layers are biased into frictional contact with one another over their entire areas by the "memory" present in the spiral band. Installation is facilitated by securing with adhesive the inner end of the spiral to the pipe and the outer end to the next inner layer, and by the application of globs of adhesive at a few discrete points along the length of the spiral. It is explained that the device is prevented from expanding when exposed to a propagating crack in the pipe by the friction developed between the adjacent layers, which could be enhanced by utilizing a resin that remained tacky even after being cured. See column 5. There is no mention in the patent of using the device to solve the problem to which the present application is directed, that is, reinforcing a pipeline which carries gas or liquid under pressure and has deteriorated to the point where it has an unbreached but weakened region that has reduced its ability to withstand the pressure of the fluid within. In this regard, in the declaration dated October 30, 1995, Mr. Fawley stated it was not obvious to him to use the coil band crack arrestors of his '752 patent to take the place of conventional steel sleeves in reinforcing weakened sections in pipelines but that he did think it was possible that these devices might be adapted to do so, and that experiments began to explore this use, the task being

accomplished after three years of work and the expenditure of millions of dollars (pages 1 and 2).

The Pipeline Reinforcement brochure, which was disseminated in 1987, not only described the CLOCK SPRING crack arresting device as being capable of stopping propagating cracks in pipelines, but also stated that it could be used to repair or reinforce pipe segments that had been damaged by corrosion or other forces and could restore a damaged area to its original pressure capabilities (page 4). No additional method was set forth by which this use was to be accomplished. Reinforcement Digest, published in 1989, contains similar statements regarding the use of the crack arrestor for repairing deteriorated sections of pipeline. In the declaration of Mr. Fawley dated January 9, 1997, the inventor states on page 2 that although Reinforcement Digest says that the CLOCK SPRING crack arrestor also could be used to enable a damaged pipeline to operate at its original design pressure, he believed at the time of the publication that such could not be accomplished when installed in the manner disclosed for use as a crack arrestor, but that the device itself could be utilized to repair an unbreached but weakened pipe (page 7). The declaration explains that tests conducted with the device being secured by adhesive on each end and with discrete globs between adjacent layers, that is, in accordance with the instructions for its use as a crack arrestor, did not secure the convolutions from movement relative to one another under simulated pipeline burst conditions, and thus this

method failed to restore a damaged section of a pipeline to its original burst strength. The apparent causes were failure of the adhesive, compression of the adhesive allowing the pipe to expand, and breaking of certain layers due to inadequate transfer of force between layers. See pages 5-7. It is our view that the information provided in this Fawley declaration also is applicable to the device and method as disclosed in Pipeline Reinforcement.

As the examiner has impliedly admitted in the Answer, none of these references teach filling a depression in the weakened area with a filler material prior to installing the CLOCK SPRING device on the pipe, which steps are present in the method of claims 33 and 47.

From our perspective, the evidence provided in the Fawley declarations establishes that the crack arrestor disclosed in the Fawley patent, Pipeline Reinforcement and Reinforcement Digest, when installed in accordance with the methods disclosed therein, not only was not capable of restoring the burst strength of a pipe having an unbreached weakened region to a level at which the pipe can withstand its original pressure, but that the inventor believed prior to the testing that such was the case.

Accompanying the 1995 Fawley declaration are selected pages from a report by Southwest Research Institute and Battelle Columbus Division regarding the testing that was done, and which succeeded in developing a method whereby the CLOCK SPRING

device could be utilized to restore the burst strength of a pipe having an unbreached weakened area, the problem to which the present application is directed. As stated on page 2 of that report:

> Assuming a repair is feasible using the composite reinforcement technology, the defect is filled with a filler that allows load transfer between the pipe and the composite reinforcement. The composite is then wound around the pipe over the defect. Adhesive is applied between the composite layers as wrapping proceeds such that an essentially monolithic reinforcement is formed after the adhesive has cured. The pipeline is then returned to its approved operating pressure (emphasis added).

This is different from the method of placing discrete adhesive globs between the convolutions which was disclosed as the method of installing the device as a crack arrestor, and appears to be the reason that it can successfully be used to restore the burst strength of an unbreached but weakened section of a pipe. We note that the date of this report has not been stated on its face or in the declaration, but it can be presumed to be prior to the filing date of the present application, in that the letter from Mr. Wilke of the Gas Research Institute (Exhibit B to the 1995 Fawley declaration) congratulating Mr. Fawley on developing this repair technique is dated March 20, 1995, and the waiver allowing the use of the invention in the field granted by the Department of Transportation Research and Special Programs Administration (Exhibit F to the 1995 Fawley declaration) was issued in February of 1995. It also is noteworthy, in this regard, that in the Oct. 9, 1995, issue of Oil & Gas Journal (Exhibit G to the 1995 Fawley declaration) there appears an article on the

invention in which the method is explained as having "the individual layers . . . bonded to each other . . . to form, upon curing, a monolithic unit" (page 68), and a photograph is provided showing the installation crew applying the adhesive to the exposed surface of the convolutions during wrapping.

The method recited in independent claims 33 and 47 includes wrapping the pipe with the convolutions of the coil band such that an initial convolution is placed around the pipe and subsequent convolutions are placed around underlying convolutions in radial alignment therewith. This step further includes "securing the convolutions from movement so that the convolutions do not move relative to one another when the pipe is pressurized" (emphasis added). As explained on page 4 of the specification, in the summary of the invention:

> A coating of the adhesive is applied to the outer surface of each convolution of the band as the band is wound around the pipe so that a continuous layer of adhesive is defined between adjacent convolutions of the band (emphasis added).

On page 9 of the specification, in the detailed description of the preferred embodiments of the invention, it is stated with reference to Figure 7 that

> after the first convolution is applied to the pipe 1, the outer surface of the convolution is coated with the adhesive 9 for the reception of the next convolution, and then that convolution is coated with the adhesive, and so on, until the final convolution is reached. The final convolution need not be coated. The adhesive coating 9 of each convolution is sprayed with water, or a catalyst activated with water, for activation of the adhesive before the next convolution is brought into contact with the adhesive. One or more

> bands of tape, for example, fiber tape, are placed around the reinforcement band 10 to hold the band 10 tightly in place until the adhesive 9 cures. (Emphasis added.)

In view of these passages from the specification, taken in the light of the evidence of the failure of the discrete applications of adhesive to perform in the manner required by the claimed method and which established that the claimed method was successfully performed when the convolutions were bonded to one another to form a monolithic unit, we interpret "securing" as used in claims 33 and 47 to mean secured to such an extent that no slippage can occur between adjacent convolutions when the pipe is pressurized to the degree required by the claims, for example, as is provided when the adjacent convolutions are bonded together into a monolithic unit. Considering the rejection in the light of this interpretation, it is our conclusion that the combined teachings of Reinforcement Digest, Fawley, the admitted prior art and Pipeline Reinforcement, which we have discussed above and which were combined by the examiner with regard to this feature of the invention, fail to teach such "securing."

Nor, in our view, would such have been suggested by the other references applied against these claims. Shaw is directed to repairing a rigid hollow article such as a pipe by placing a patch over a breach in the article and then wrapping it with multiple helical turns of a flexible tape of glass fiber cloth which is impregnated with a self-curing resin as it is being installed. When the resin cures, the material is converted to a hard, solidified state

(column 3, line 49). Shaw further teaches that a filler can be used prior to tape installation to repair irregularities in the surface. Medkeff discloses a similar method of repair, using flexible copper tape and solder or the like, in which the tape may be spring loaded so it attempts to conform to the surface of the pipe as it is wound thereon (column 2, lines 58-65). Basic to the methods disclosed in both of these references is that an uncured flexible tape be helically wrapped about the pipe, and that the resulting patch then be cured into a hardened, solidified mass. Stark discloses a method of repairing structures, including pipe, in which a filler is covered with a single layer of glass fiber cloth that is fused into the surface of the structure after installation by the curing of an epoxy or the like.

The objective of all three of these references is to provide a hardened solidified mass from a helically wrapped flexible material. None of them install on the damaged article a material comprising unidirectional high tensile strength filaments in a cured resin matrix, and none is concerned with securing convolutions that are arranged in radial alignment against movement with respect to one another when pressure is applied from within the repaired structure. The mere fact that the prior art structure could be modified does not make such a modification obvious unless the prior art suggests the desirability of doing so.[2] In the present case, we fail to perceive any teaching, suggestion or incentive in the applied references which would have led one of ordinary skill in the art to modify the

[2]See In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984).

method of installing the CLOCK SPRING device disclosed in Reinforcement Digest, Fawley, and Pipeline Reinforcement by replacing the discrete globs of adhesive used to facilitate the installation of the device with a continuous adhesive of sufficient strength and presence to "secure" the convolutions to the extent that they do not move relative to one another when the pipe is pressurized. From our perspective, suggestion for combining the references in the manner proposed by the examiner is found only in the hindsight afforded one who first viewed the appellant's disclosure. This, of course, is not a proper basis for a rejection under
35 U.S.C. § 103.[3]

It is our conclusion that the applied references fail to establish that the subject matter recited in independent claims 33 and 47 would have been obvious under 35 U.S.C. § 103(a) to one of ordinary skill in the art,[4] and we will not sustain the rejection of these claims or of claims 34-40, 43-46, 48-50, 53-58 and 61-63, which depend therefrom.

Claims 41, 42, 51, 59 and 60 stand rejected on the basis of the references applied against claim 33 et al., taken further with Schumacher, which was cited for its teaching of

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[3]In re Fritch, 972 F.2d 1260, 1264, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992).

[4]The test for obviousness is what the combined teachings of the prior art would have suggested to one of ordinary skill in the art. See, for example, In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981).

utilizing a moisture activated urethane adhesive. Be that as it may, Schumacher does not alleviate the deficiency in the basic combination of references which was discussed above. We therefore will not sustain the rejection of these claims.

SUMMARY

Neither rejection is sustained.

The decision of the examiner is reversed.

REVERSED

IAN A. CALVERT Administrative Patent Judge	)
NEAL E. ABRAMS Administrative Patent Judge	) BOARD OF PATENT) APPEALS AND) INTERFERENCES
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APPEAL NO. 1999-2145 - JUDGE ABRAMS
APPLICATION NO. 08/781,605

APJ ABRAMS

APJ FRANKFORT

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DECISION: **REVERSED**

Prepared By:

DRAFT TYPED: 20 Mar 02

FINAL TYPED: