circumstances where injury was less apparent than in this. *Landis* v. *North American Co.*, 299 U. S. 248. The holding of the court below and the contention of the appellee here that the Government is not entitled to so apply the statute as to bring multiple actions designed to destroy a business before it can be heard in its own defense is not frivolous, to say the least.

I am constrained to withhold assent to a decision that passes in silence what I think presents a serious issue.

GRAVER TANK & MFG. CO., INC. ET AL. *v.* LINDE AIR PRODUCTS CO.

ON REHEARING.

No. 2. Argued March 30, 1950.—Decided May 29, 1950.

1. This Court affirms the finding of the two courts below that, under the doctrine of equivalents, certain flux claims of Jones patent No. 2,043,960, for an electric welding process and for fluxes, or compositions, to be used therewith were infringed. Pp. 606–612.
2. The essence of the doctrine of equivalents is that one may not practice a fraud on a patent. P. 608.
3. The doctrine of equivalents is founded on the theory that, if two devices do the same work in substantially the same way and accomplish substantially the same result, they are the same, even though they differ in name, form or shape. Pp. 608–609.
4. In determining equivalents, consideration must be given to the purpose for which an ingredient is used in a patent, the qualities it has when combined with other ingredients, the functions which it is intended to perform, and whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was. P. 609.
5. A finding of equivalence is a determination of fact to be made by the trial court; and the trial court's decision should not be disturbed unless clearly erroneous. Pp. 609–610.
6. On the record in this case, involving a claim of a combination of alkaline earth metal silicate and calcium fluoride, the trial court was justified in finding that the substitution in the accused composition of manganese silicate (which is not an alkaline earth metal

silicate) for magnesium silicate (which is an alkaline earth metal silicate), where the two compositions were substantially identical in operation and result, was so insubstantial, in view of the technology and the prior art, that the patent was infringed under the doctrine of equivalents. Pp. 610–612.

The history of the case is summarized in the first paragraph of the opinion. On the aspect of the case involved in the rehearing, *the prior decision of this Court is adhered to,* p. 612.

Thomas V. Koykka argued the cause for petitioners. With him on the brief were *John F. Oberlin, Ashley M. Van Duzer, James R. Stewart* and *Charles L. Byron.*

John T. Cahill and *Richard R. Wolfe* argued the cause for respondent. With them on the brief were *James A. Fowler, Jr.* and *Loftus E. Becker.*

Mr. Justice Jackson delivered the opinion of the Court.

Linde Air Products Co., owner of the Jones patent for an electric welding process and for fluxes to be used therewith, brought an action for infringement against Lincoln and the two Graver companies. The trial court held four flux claims valid and infringed and certain other flux claims and all process claims invalid. 75 U. S. P. Q. 231. The Court of Appeals affirmed findings of validity and infringement as to the four flux claims but reversed the trial court and held valid the process claims and the remaining contested flux claims. 167 F. 2d 531. We granted certiorari, 335 U. S. 810, and reversed the judgment of the Court of Appeals insofar as it reversed that of the trial court, and reinstated the District Court decree. 336 U. S. 271. Rehearing was granted, limited to the question of infringement of the four valid flux claims and to the applicability of the doctrine of equivalents to findings of fact in this case. 337 U. S. 910.

At the outset it should be noted that the single issue before us is whether the trial court's holding that the four flux claims have been infringed will be sustained. Any issue as to the validity of these claims was unanimously determined by the previous decision in this Court and attack on their validity cannot be renewed now by reason of limitation on grant of rehearing. The disclosure, the claims, and the prior art have been adequately described in our former opinion and in the opinions of the courts below.

In determining whether an accused device or composition infringes a valid patent, resort must be had in the first instance to the words of the claim. If accused matter falls clearly within the claim, infringement is made out and that is the end of it.

But courts have also recognized that to permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing. Such a limitation would leave room for—indeed encourage—the unscrupulous copyist to make unimportant and insubstantial changes and substitutions in the patent which, though adding nothing, would be enough to take the copied matter outside the claim, and hence outside the reach of law. One who seeks to pirate an invention, like one who seeks to pirate a copyrighted book or play, may be expected to introduce minor variations to conceal and shelter the piracy. Outright and forthright duplication is a dull and very rare type of infringement. To prohibit no other would place the inventor at the mercy of verbalism and would be subordinating substance to form. It would deprive him of the benefit of his invention and would foster concealment rather than disclosure of inventions, which is one of the primary purposes of the patent system.

The doctrine of equivalents evolved in response to this experience. The essence of the doctrine is that one may not practice a fraud on a patent. Originating almost a century ago in the case of *Winans* v. *Denmead,* 15 How. 330, it has been consistently applied by this Court and the lower federal courts, and continues today ready and available for utilization when the proper circumstances for its application arise. "To temper unsparing logic and prevent an infringer from stealing the benefit of an invention" [1] a patentee may invoke this doctrine to proceed against the producer of a device "if it performs substantially the same function in substantially the same way to obtain the same result." *Sanitary Refrigerator Co.* v. *Winters,* 280 U. S. 30, 42. The theory on which it is founded is that "if two devices do the same work in substantially the same way, and accomplish substantially the same result, they are the same, even though they differ in name, form, or shape." *Machine Co.* v. *Murphy,* 97 U. S. 120, 125. The doctrine operates not only in favor of the patentee of a pioneer or primary invention, but also for the patentee of a secondary invention consisting of a combination of old ingredients which produce new and useful results, *Imhaeuser* v. *Buerk,* 101 U. S. 647, 655, although the area of equivalence may vary under the circumstances. See *Continental Paper Bag Co.* v. *Eastern Paper Bag Co.,* 210 U. S. 405, 414–415, and cases cited; *Seymour* v. *Osborne,* 11 Wall. 516, 556; *Gould* v. *Rees,* 15 Wall. 187, 192. The wholesome realism of this doctrine is not always applied in favor of a patentee but is sometimes used against him. Thus, where a device is so far changed in principle from a patented article that it performs the same or a similar function in a substantially different way, but nevertheless falls within the

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[1] L. Hand in *Royal Typewriter Co.* v. *Remington Rand,* 168 F. 2d 691, 692.

literal words of the claim, the doctrine of equivalents may be used to restrict the claim and defeat the patentee's action for infringement. *Westinghouse* v. *Boyden Power Brake Co.*, 170 U. S. 537, 568. In its early development, the doctrine was usually applied in cases involving devices where there was equivalence in mechanical components. Subsequently, however, the same principles were also applied to compositions, where there was equivalence between chemical ingredients. Today the doctrine is applied to mechanical or chemical equivalents in compositions or devices. See discussions and cases collected in 3 Walker on Patents (Deller's ed. 1937) §§ 489–492; Ellis, Patent Claims (1949) §§ 59–60.

What constitutes equivalency must be determined against the context of the patent, the prior art, and the particular circumstances of the case. Equivalence, in the patent law, is not the prisoner of a formula and is not an absolute to be considered in a vacuum. It does not require complete identity for every purpose and in every respect. In determining equivalents, things equal to the same thing may not be equal to each other and, by the same token, things for most purposes different may sometimes be equivalents. Consideration must be given to the purpose for which an ingredient is used in a patent, the qualities it has when combined with the other ingredients, and the function which it is intended to perform. An important factor is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was.

A finding of equivalence is a determination of fact. Proof can be made in any form: through testimony of experts or others versed in the technology; by documents, including texts and treatises; and, of course, by the disclosures of the prior art. Like any other issue of fact, final determination requires a balancing of credibility,

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persuasiveness and weight of evidence. It is to be decided by the trial court and that court's decision, under general principles of appellate review, should not be disturbed unless clearly erroneous. Particularly is this so in a field where so much depends upon familiarity with specific scientific problems and principles not usually contained in the general storehouse of knowledge and experience.

In the case before us, we have two electric welding compositions or fluxes: the patented composition, Unionmelt Grade 20, and the accused composition, Lincolnweld 660. The patent under which Unionmelt is made claims essentially a combination of alkaline earth metal silicate and calcium fluoride; Unionmelt actually contains, however, silicates of calcium and magnesium, two alkaline earth metal silicates. Lincolnweld's composition is similar to Unionmelt's, except that it substitutes silicates of calcium and manganese—the latter not an alkaline earth metal—for silicates of calcium and magnesium. In all other respects, the two compositions are alike. The mechanical methods in which these compositions are employed are similar. They are identical in operation and produce the same kind and quality of weld.

The question which thus emerges is whether the substitution of the manganese which is not an alkaline earth metal for the magnesium which is, under the circumstances of this case, and in view of the technology and the prior art, is a change of such substance as to make the doctrine of equivalents inapplicable; or conversely, whether under the circumstances the change was so insubstantial that the trial court's invocation of the doctrine of equivalents was justified.

Without attempting to be all-inclusive, we note the following evidence in the record: Chemists familiar with the two fluxes testified that manganese and magnesium were similar in many of their reactions (R. 287, 669). There is testimony by a metallurgist that alkaline earth

metals are often found in manganese ores in their natural state and that they serve the same purpose in the fluxes (R. 831–832); and a chemist testified that "in the sense of the patent" manganese could be included as an alkaline earth metal (R. 297). Much of this testimony was corroborated by reference to recognized texts on inorganic chemistry (R. 332). Particularly important, in addition, were the disclosures of the prior art, also contained in the record. The Miller patent, No. 1,754,566, which preceded the patent in suit, taught the use of manganese silicate in welding fluxes (R. 969, 971). Manganese was similarly disclosed in the Armor patent, No. 1,467,825, which also described a welding composition (R. 1346). And the record contains no evidence of any kind to show that Lincolnweld was developed as the result of independent research or experiments.

It is not for this Court to even essay an independent evaluation of this evidence. This is the function of the trial court. And, as we have heretofore observed, "To no type of case is this . . . more appropriately applicable than to the one before us, where the evidence is largely the testimony of experts as to which a trial court may be enlightened by scientific demonstrations. This trial occupied some three weeks, during which, as the record shows, the trial judge visited laboratories with counsel and experts to observe actual demonstrations of welding as taught by the patent and of the welding accused of infringing it, and of various stages of the prior art. He viewed motion pictures of various welding operations and tests and heard many experts and other witnesses." 336 U. S. 271, 274–275.

The trial judge found on the evidence before him that the Lincolnweld flux and the composition of the patent in suit are substantially identical in operation and in result. He found also that Lincolnweld is in all respects equivalent to Unionmelt for welding purposes. And he concluded that "for all practical purposes, manganese silicate

can be efficiently and effectually substituted for calcium and magnesium silicates as the major constituent of the welding composition." These conclusions are adequately supported by the record; certainly they are not clearly erroneous.[2]

It is difficult to conceive of a case more appropriate for application of the doctrine of equivalents. The disclosures of the prior art made clear that manganese silicate was a useful ingredient in welding compositions. Specialists familiar with the problems of welding compositions understood that manganese was equivalent to and could be substituted for magnesium in the composition of the patented flux and their observations were confirmed by the literature of chemistry. Without some explanation or indication that Lincolnweld was developed by independent research, the trial court could properly infer that the accused flux is the result of imitation rather than experimentation or invention. Though infringement was not literal, the changes which avoid literal infringement are colorable only. We conclude that the trial court's judgment of infringement respecting the four flux claims was proper, and we adhere to our prior decision on this aspect of the case.

Affirmed.

MR. JUSTICE MINTON took no part in the consideration or decision of this case.

MR. JUSTICE BLACK, with whom MR. JUSTICE DOUGLAS concurs, dissenting.

I heartily agree with the Court that "fraud" is bad, "piracy" is evil, and "stealing" is reprehensible. But in

[2] Rule 52 (a), Federal Rules of Civil Procedure, provides in part: "Findings of fact shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge of the credibility of the witnesses."

this case, where petitioners are not charged with any such malevolence, these lofty principles do not justify the Court's sterilization of Acts of Congress and prior decisions, none of which are even mentioned in today's opinion.

The only patent claims involved here describe respondent's product as a flux "containing a major proportion of alkaline earth metal silicate." The trial court found that petitioners used a flux "composed principally of manganese silicate." Finding also that "manganese is not an alkaline earth metal," the trial court admitted that petitioners' flux did not "literally infringe" respondent's patent. Nevertheless it invoked the judicial "doctrine of equivalents" to broaden the claim for "alkaline earth metals" so as to embrace "manganese." On the ground that "the fact that manganese is a proper substitute . . . is fully disclosed in the specification" of respondent's patent, it concluded that "no determination need be made whether it is a known chemical fact *outside* the teachings of the patent that manganese is an equivalent . . . ." Since today's affirmance unquestioningly follows the findings of the trial court, this Court necessarily relies on what the specifications revealed.[1] In so doing, it violates a direct mandate of Congress without even discussing that mandate.

R. S. § 4888, as amended, 35 U. S. C. § 33, provides that an applicant "shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery." We have held in this very case that this statute precludes invoking the specifications to alter a claim free from ambiguous language, since "it is the claim which measures the grant

[1] For this reason the tidbits of evidence painstakingly selected from the record by this Court have no significance, since the trial court avowedly did not look beyond the specifications themselves.

to the patentee." [2] *Graver Mfg. Co.* v. *Linde Co.,* 336 U. S. 271, 277. What is not specifically claimed is dedicated to the public. See, *e. g., Miller* v. *Brass Co.,* 104 U. S. 350, 352. For the function of claims under R. S. § 4888, as we have frequently reiterated, is to exclude from the patent monopoly field all that is not specifically claimed, whatever may appear in the specifications. See, *e. g., Marconi Wireless Co.* v. *United States,* 320 U. S. 1, 23, and cases there cited. Today the Court tacitly rejects those cases. It departs from the underlying principle which, as the Court pointed out in *White* v. *Dunbar,* 119 U. S. 47, 51, forbids treating a patent claim "like a nose of wax which may be turned and twisted in any direction, by merely referring to the specification, so as to make it include something more than, or something different from, what its words express. . . . The claim is a statutory requirement, prescribed for the very purpose of making the patentee define precisely what his invention is; and it is unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms." Giving this patentee the benefit of a grant that it did not precisely claim is no less "unjust to the public" and no less an evasion of R. S. § 4888 merely because done in the name of the "doctrine of equivalents."

In seeking to justify its emasculation of R. S. § 4888 by parading potential hardships which literal enforcement might conceivably impose on patentees who had for some reason failed to claim complete protection for their discoveries, the Court fails even to mention the program for alleviation of such hardships which Congress itself

[2] This Court's approval of the trial judge's resort to specifications is ironic as well as unfortunate. In its original opinion this Court rejected respondent's contention that the very language invoked here to support infringement should be applied to validate a claim otherwise too broad to be upheld. 336 U. S. 271, 277.

has provided. 35 U. S. C. § 64 authorizes reissue of patents where a patent is "wholly or partly inoperative" due to certain errors arising from "inadvertence, accident, or mistake" of the patentee. And while the section does not expressly permit a patentee to expand his claim, this Court has reluctantly interpreted it to justify doing so. *Miller* v. *Brass Co.*, 104 U. S. 350, 353–354. That interpretation, however, was accompanied by a warning that "Reissues for the enlargement of claims should be the exception and not the rule." *Id.* at 355. And Congress was careful to hedge the privilege of reissue by exacting conditions. It also entrusted the Patent Office, not the courts, with initial authority to determine whether expansion of a claim was justified,[3] and barred suits for retroactive infringement based on such expansion. Like the Court's opinion, this congressional plan adequately protects patentees from "fraud," "piracy," and "stealing." Unlike the Court's opinion, it also protects businessmen from retroactive infringement suits and judicial expansion of a monopoly sphere beyond that which a patent expressly authorizes. The plan is just, fair, and reasonable. In effect it is nullified by this decision undercutting what

[3] "This provision was inserted in the law for the purpose of relieving the courts from the duty of ascertaining the exact invention of the patentee by inference and conjecture, derived from a laborious examination of previous inventions, and a comparison thereof with that claimed by him. This duty is now cast upon the Patent Office. There his claim is, or is supposed to be, examined, scrutinized, limited, and made to conform to what he is entitled to. If the office refuses to allow him all that he asks, he has an appeal. But the courts have no right to enlarge a patent beyond the scope of its claim as allowed by the Patent Office, or the appellate tribunal to which contested applications are referred. When the terms of a claim in a patent are clear and distinct (as they always should be), the patentee, in a suit brought upon the patent, is bound by it. *Merrill* v. *Yeomans*, 94 U. S. 568." *Keystone Bridge Co.* v. *Phoenix Iron Co.*, 95 U. S. 274, 278.

the Court has heretofore recognized as wise safeguards. See *Milcor Steel Co.* v. *Fuller Co.*, 316 U. S. 143, 148. One need not be a prophet to suggest that today's rhapsody on the virtue of the "doctrine of equivalents" will, in direct contravention of the *Miller* case, *supra*, make enlargement of patent claims the "rule" rather than the "exception."

Whatever the merits of the "doctrine of equivalents" where differences between the claims of a patent and the allegedly infringing product are *de minimis*, colorable only, and without substance, that doctrine should have no application to the facts of this case. For the differences between respondent's welding substance and petitioners' claimed flux were not nearly so slight. The claims relied upon here did not involve any mechanical structure or process where invention lay in the construction or method rather than in the materials used. Rather they were based wholly on using particular materials for a particular purpose. Respondent's assignors experimented with several metallic silicates, including that of manganese. According to the specifications (if these are to be considered) they concluded that while several were "more or less efficacious in our process, we prefer to use silicates of the alkaline earth metals." Several of their claims which this Court found too broad to be valid encompassed manganese silicate; the only claims found valid did not. Yet today the Court disregards that crucial deficiency, holding those claims infringed by a composition of which 88.49% by weight is manganese silicate.

In view of the intense study and experimentation of respondent's assignors with manganese silicate, it would be frivolous to contend that failure specifically to include that substance in a precise claim was unintentional. Nor does respondent attempt to give that or any other explanation for its omission. But the similar use of manganese in prior expired patents, referred to in the Court's opinion, raises far more than a suspicion that its elimina-

tion from the valid claims stemmed from fear that its inclusion by name might result in denial or subsequent invalidation of respondent's patent.

Under these circumstances I think petitioners had a right to act on the belief that this Court would follow the plain mandates of Congress that a patent's precise claims mark its monopoly boundaries, and that expansion of those claims to include manganese could be obtained only in a statutory reissue proceeding. The Court's ruling today sets the stage for more patent "fraud" and "piracy" against business than could be expected from faithful observance of the congressionally enacted plan to protect business against judicial expansion of precise patent claims. Hereafter a manufacturer cannot rely on what the language of a patent claims. He must be able, at the peril of heavy infringement damages, to forecast how far a court relatively unversed in a particular technological field will expand the claim's language after considering the testimony of technical experts in that field. To burden business enterprise on the assumption that men possess such a prescience bodes ill for the kind of competitive economy that is our professed goal.

The way specific problems are approached naturally has much to do with the decisions reached. A host of prior cases, to some of which I have referred, have treated the 17-year monopoly authorized by valid patents as a narrow exception to our competitive enterprise system. For that reason, they have emphasized the importance of leaving business men free to utilize all knowledge not preempted by the precise language of a patent claim. *E. g., Sontag Stores Co.* v. *Nut Co.*, 310 U. S. 281, and cases there cited. In the *Sontag* case Mr. Justice McReynolds, speaking for a unanimous Court, said in part: "In the case under consideration the patentee might have included in the application for the original patent, claims broad enough to embrace petitioner's accused machine, but did not.

This 'gave the public to understand' that whatever was not claimed 'did not come within his patent and might rightfully be made by anyone.' " *Id.* at 293.

The Court's contrary approach today causes it to retreat from this sound principle. The damages retroactively assessed against petitioners for what was authorized until today are but the initial installment on the cost of that retreat.

MR. JUSTICE DOUGLAS, dissenting.

The Court applies the doctrine of equivalents in a way which subverts the constitutional and statutory scheme for the grant and use of patents.

The claims of the patent are limited to a flux "containing a major proportion of alkaline earth metal silicate." Manganese silicate, the flux which is held to infringe, is not an alkaline earth metal silicate. It was disclosed in the application and then excluded from the claims. It therefore became public property. See *Mahn* v. *Harwood,* 112 U. S. 354, 361. It was, to be sure, mentioned in the specifications. But the measure of the grant is to be found in the claims, not in the specifications. *Milcor Steel Co.* v. *Fuller Co.,* 316 U. S. 143, 145, 146. The specifications can be used to limit but never to expand the claim. See *McClain* v. *Ortmayer,* 141 U. S. 419, 424.

The Court now allows the doctrine of equivalents to erase those time-honored rules. Moreover, a doctrine which is said to protect against practicing "a fraud on a patent" is used to extend a patent to a composition which could not be patented. For manganese silicate had been covered by prior patents, now expired. Thus we end with a strange anomaly: a monopoly is obtained on an unpatented and unpatentable article.