Europäisches Patentamt
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European Patent Office
Boards of Appeal

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Chambres de recours

T145'

Case Number: T147 / 82

DECISION

of the Technical Board of Appeal 3.5.1

of 5 April 1984

Appellant: Hitachi Ltd.
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Japan

Representative: Peter Strehl
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Decision under appeal: Decision of Examining Division 062 of the European Patent Office dated 19 April 1982 refusing European patent application No 79100288.4 pursuant to Article 97(1) EPC

Composition of the Board:

Chairman: G. Korsakoff
Member: J. van Voorthuizen
Member: P. Ford

Summary of Facts and Submissions

I. European Patent Application No. 79 100 288.4 filed on 31.01.79 (Publication No. 0 003 559) claiming a priority of 03.02.78 (JP) was refused by a decision of the Examining Division 062 of the European Patent Office of 19.04.82. That decision was based on claims 1 to 4 as submitted on 09.09.81.

II. The reason given for the refusal was that the subject-matter of the claims did not involve inventive step having regard to "Radio Fernsehen Elektronik", Vol. 26, No. 8, April 1977 pages 245-247 and "Valvo Berichte", Band XIX, Heft 3, 1974 pages 104-114.

III. The applicant lodged an appeal against this decision on 29.06.82. The Statement of Grounds was filed on 30.08.82. The appeal fee was duly paid. An amended set of claims was also filed on 30.08.82.

IV. In the Statement of Grounds and in the oral proceedings held on 05.04.84 the applicant argued essentially as follows: The application is concerned with the problem of providing a minute, precisely controlled, current by an I^2L-compatible circuit having a small integration area, which problem is not dealt with in any of the documents cited by the Examining Division in the course of the procedure. Admitting that the article in IEEE Transactions on Computers, vol. C-26, No. 12, December 1977, pages 1233-1241 represents the nearest state of the art, there are still several differences from the circuit according to the application. The article in Radio Fernsehen Elektronik is rather vague in its teachings, in particular as far as the applications shown in

Figs. 9 and 10 are concerned. These figures show level translators where the problem to be solved is quite different, namely to obtain a high gain. Even if some features of the invention are disclosed they have a different purpose and, moreover, it is not said specifically which transistor circuits would or could replace resistances. Therefore, although all of the features mentioned in claim 1 may be known by themselves, the combination which solves the problem stated above was not obvious to the person skilled in the art.

V. In the course of the oral proceedings the applicant presented an amended claim 1. The Board however, decided not to accept this claim because it was filed too late (Rule 86(3) in conjunction with Rule 66(1) EPC).

The applicant thereupon requested that a European Patent be granted on the basis of claims 1-4 filed on 30.08.82 which read as follows:

1. A logical circuit of I^2L construction comprising

(a) a current mirror stage (20) serving as a current source for providing a minute constant output current and including a first transistor (201) having a first collector connected to its base, a second collector connected to an output terminal, and an emitter connected to a power supply (Vcc);

(b) an I^2L load stage (30) serving as a load for the current mirror stage (20) to determine the value of the output current and including

(b1) a second transistor (203) having its emitter grounded and having a plurality of collectors (34...36), of which the first (36) is connected to the base (33) of

the second transistor (203) and the second (35) is connected to the first collector of the first transistor (201), and

(b2) a third, lateral transistor (204) of a conductivity type opposite of that of the second transistor (203), having its base grounded and its collector connected to the base (33) of the second transistor (203);

(c) a logical circuit stage (40) of I^2L construction having its injector (32) connected to the emitter (31) of the third transistor (204), and at least one further circuit stage of I^2L construction having its injector connected to the output terminal of the current mirror stage (20),

wherein the area of the second collector of the first transistor (201) is m-time (m:positive integer or fraction) the area of the collector thereof, and the area of the second collector of the second transistor (203) is n-times (n:positive integer or fraction) the area of the first collector thereof, so that the constant output current (I33) supplied to said further circuit stage is m x n-times the constant output current (I31) supplied to said logical circuit stage (40).

2. The circuit of claim 1, wherein the feedback of the first collector of said first transistor (201) to said base thereof is effected through a fourth transistor (202), the collector of which is grounded, the base of which is connected to said first collector of said first transistor (201) aad the emitter of which is connected to said base of said first transistor (201).

3. The circuit of claim 1 or 2, wherein said second transistor (203) is an NPN transistor, said third transistor (204) is a lateral PNP transistor, and said first

and fourth transistors (201,202) are PNP transistors.

4. The circuit of any of claims 1 to 3, wherein said base (33) of said second transistor (203) is provided with a switching element or switching circuit (50') which is connected to either an earth terminal or an open terminal.

Reasons for the Decision

1. The appeal complies with Articles 106-108 and Rule 64 EPC and is, therefore, admissible.

2. From FR-A-7 715 912, a circuit arrangement is known for feeding a first and a second group of I^2L-circuits with injection currents of different magnitudes. In this arrangement a CHIL device is used to obtain the small injection currents to the second group. CHIL devices are mentioned as devices related to I^2L circuits in the article "I^2L Schaltungstechnik" in Radio, Fernsehen, Elektronik, Volume 26, No. 8, April 1977, pages 245-247. It is observed in this article that the switching speed of these devices is relatively small (clearly in comparison to that of I^2L-circuits). It is therefore self-evident that the man skilled in the art will look for other I^2L circuits not having this disadvantage, to solve the same problem.

3. It is generally known that current mirrors are ideally suited as controlled constant current sources, see e.g. Valvo Berichte, Band XIX, Heft 3, 1974, pages 108-114. A current mirror identical to 20 in Figure 3A of the application is shown in Figure 11 of this article, reference being made to Figure 5.

A simpler current mirror, not comprising the transistor Tv (which corresponds to 202 in the application) is shown in Figure 11 with reference to Figure 1.

4. It is also known from this article that the reference current for the current mirror can be determined by means of a resistance or by feeding the current mirror from the collector of a transistor (page 108, lines 12-16). Indeed, in IEEE Transactions on Computers, Volume C-26, No. 12, December 1977, pages 1233-1241, Figure 3, a current mirror is shown in which the reference current is delivered by the collector of a further transistor of opposite conduction type, as is also the case in the circuit according to the application.

5. It is obvious that this further transistor in its turn could form part of an I^2L circuit. Such a circuit configuration is shown in the article in RFE cited above at Figure 9b, where T_1 corresponds to the I^2L load circuit 30 and T_2 to the current mirror 20.

6. It is known in this art to establish a feedback loop in an I^2L circuit by connecting one of the collectors of the multiple collector transistor to its base (see T_2 in Figure 9c, and T_1 in Figure 10b of the article in RFE). This connection is equivalent to the same connection applied in current mirror circuits.

7. The article in question aims to give an overview of I^2L-techniques and shows in Figs. 9 and 10, as examples, I^2L-TTL level converters. The person skilled in the art will appreciate, however, that the teachings

from these examples are not limited to the specific circuits which are described but that certain details of these circuits may be used in other applications.

8. Moreover, a collector-base feedback in an I^2L-circuit is known from the article in IEEE Transactions to obtain output currents which are replicas of an input current (page 1234, left column, 3rd paragraph and Fig. 2).

9. Finally, it is common practice to vary the collector areas to obtain currents of different magnitudes: see the article in IEEE Transactions and the article in Valvo Berichte.

10. The problem which the application sets out to solve does not involve an inventive step having regard to FR-A-7 715 912. Its solution consists in a combination of means which are known as such and in several sub-combinations and no unexpected effect is apparent. The Board of Appeal therefore, considers that Claim 1 does not involve an inventive step and thus is not allowable.

None of the claims 2, 3 and 4 adding further known characteristics is allowable for the same reason.

Order

It is decided that:

The appeal is dismissed.

J. Rhe

G. Korsakoff

P.F.