CLAIMS

1. A burner wherein a MILD combustion takes place, comprising a system for sucking the recycling flue gases directly from a combustion chamber by means of an ejector fed with a comburent, a heat exchange system suitable for heat exchange between recycling flue gases and a comburent, systems for injecting a fuel directly into recycling flue gases, the latter comprising or not comprising a comburent, and formation of a mixture of fuel-recycling flue gases-comburent in the zone around an outlet of a comburent ejector and following introduction of the mixture into a combustion chamber
wherein the burner comprises:
an annular duct 12, sucking system of the recycling flue gases, a transit chamber 2,
fuel injection systems 5 and 8,
ejector 1 of a comburent formed of tubes 1a which are parallel in their outletting parts, and
an outlet cone 11 of a burner.

2. A burner according to claim 1 comprising an annular duct 12; a heat exchange system suitable for heat exchange between recycling flue gases and a comburent, coaxial to an annular duct 12; fuel injection systems 5 and 8 for feeding the fuel directly into the recycling flue gases, positioned both inside and outside a transit chamber 2 and coaxial to the outletting parts of tubes 1a forming ejector 1; with formation in a zone around a front section of the outletting parts of tubes 1a forming ejector 1 of a mixture of fuel-recycling flue gases-comburent and following introduction of the mixture into the combustion chamber.

3. A burner according to claim 1 wherein an annular duct 12, an heat exchange system between recycling flue gases and a comburent and a transit chamber 2 are coaxial with respect to a longitudinal burner axis.

4. A burner according to claim 3 comprising:
suction intakes 7 for sucking the recycling flue gas from a combustion chamber; an annular duct 12;
a comburent annular distribution chamber 13,
radial ducts 14; a transit chamber 2; fuel injection systems 5 and 8; an ejector 1 of the comburent; an outlet cone 11; a case 20;
wherein annular duct 12, in communication through suction intakes 7 with a combustion chamber, delimits externally and posteriorly a comburent annular distribution chamber 13;
a comburent annular distribution chamber 13 is anteriorly in communication with ejector 1 and posteriorly with radial ducts 14 and delimits externally a transit chamber 2;
a transit chamber 2 is anteriorly delimited by an outletting front section of ejector 1 and posteriorly by the wall formed by the case 20;
an outletting front section of ejector 1 is perpendicular with respect to a comburent annular distribution chamber 13 that anteriorly is in contact with an outlet cone 11;
a fuel injection system 5 is positioned on a back wall of case 20 of the burner upstream ejector 1; a fuel injection system 8 is positioned downstream an outletting front section of ejector 1;
wherein recycling flue gases,
directly sucked from a combustion chamber through suction intakes 7,
flow through an annular duct 12,
heat a comburent flowing in countercurrent into a comburent annular distribution chamber 13,
enter a transit chamber 2 and, driven by the depression created by a comburent outletting a front section of ejector 1,
mix downstream an outletting front section of ejector 1 with a comburent, being a comburent the entraining flu-

id and recycling flue gases the entrained fluid, a fuel being directly injected upstream ejector 1 into recycling flue gases by injection system 5 and/or downstream an outletting front section of ejector 1 by injection system 8 into a comburent-recycle-flue gas mixture, in the latter case recycle flue gases containing already a fuel when injection system 5 is also used.

5. A burner according to claim 4 wherein a fuel is fed by the injection system 5.

6. A burner according to claim 5 wherein a fed fuels is a liquid fuel.

7. A burner according to any of claims 4-6 wherein an outlet cone 11, suction intakes 7, an annular duct 12 and a comburent annular distribution chamber 13 are positioned circumferentially and longitudinally around a burner longitudinal axis.

8. A burner according to any of claims 4-7 wherein transit chamber 2 and ejector 1 are positioned along a burner longitudinal axis.

9. A burner according to any of claims 4-8 wherein tubes 1a of ejector 1 comprise inlets connected to a fuel annular distribution chamber 13 and radially positioned thereto, and the outletting parts of said tubes 1a are parallel to a burner longitudinal axis with their outlets directed towards an outlet cone 11; said outletting parts of tubes 1a being positioned axially and circularly with respect to a burner longitudinal—axis.

10. A burner according to any of claims 4-9 wherein injection system 8 is circularly positioned around a burner longitudinal axis and is placed at the end of tubes, parallel to a burner longitudinal axis, that from a

back wall of the burner cross a transit chamber 2 and an outletting front section of ejector 1.

11. A burner according to any of claims 4-10 wherein injection system 5 is on a back wall of case 20 of a burner and positioned on a burner longitudinal axis and circularly thereto.

12. A burner according to any of claims 4-10 wherein case 20 is refractory or ceramic lined in its inner part.

13. A burner according to any of claims 4-11 comprising an adduction flange 3, an annular feeding drum 4 for a comburent, adduction flanges 6 for a fuel to injection system 5.

14. A burner according to any of claims 4-11 wherein case 20 is formed of a muffle 9 and a jacket 10; a muffle 9 and an annular feeding drum 4 are circularly and longitudinally positioned around a burner longitudinal axis; suction intakes 7 being delimited externally by muffle 9; adduction flanges 6 being positioned externally with respect to a back wall of case 20 of the burner, flange 3 providing a comburent inlet into an annular feeding drum 4 connected to a fuel annular chamber 13 through radial ducts 14.

15. A burner according to any of claims 1-14 wherein a comburent is selected from atmospheric air, enriched air, oxygen and technical oxygen.

16. A burner according to any of claims 1-15 wherein fuels used are selected from liquid and/or gaseous, or solid fuels made liquid or gaseous under the operating conditions of a burner.

17. A process of operating a burner according to any of claims 1-16, wherein a MILD combustion takes place, comprising:
sucking of recycling flue gases directly from a combustion chamber by means of an ejector fed with a comburent,
heating of a comburent by thermal exchange with the recycling flue gases,
direct injection of a fuel in recycling flue gases by one or more injection systems,
formation of a fuel-recycling flue gas-comburent mixture,
introduction of the mixture into the combustion chamber.

18. A process according to claim 17, comprising the following steps:
a) sucking of recycling flue gases from the combustion chamber by an ejector 1 fed with a comburent,
b) heat exchange between recycling flue gases and a comburent,
c) injection of a fuel by means of injection systems 5 and/or 8 into recycling flue gases inside and/or outside a transit chamber 2,
d) formation of a mixture fuel-recycling flue gases-comburent, a comburent being injected into a burner by injector 1,
e) inlet of a mixture into the combustion chamber.

19. A process according to claims 17-18 wherein recycling flue gases enter a burner through suction intakes 7 and, sucked by a depression formed of a comburent outletting ejector 1, they flow through an annular duct 12, heat by thermal exchange a comburent entering from radial ducts 14 and, flowing in counter-current with respect to the recycling flue gases, they flow into a comburent annular distribution chamber 13, enter into a

transit chamber 2 and, downstream ejector 1, they mix with a comburent; a fuel being directly injected into recycling flue gases by injection system 5 and/or injection system 8.

20. A process according to claims 17-19 wherein injection system 5 and/or injection system 8 are used when a gaseous fuel is fed to a burner.

21. A process according to claims 17-19 wherein injection system 5, optionally injection system 8, are used when a liquid fuel is fed to a burner.

22. A process according to claims 17-19 wherein injection system 5 is used for a liquid fuel and injection system 8 for a gaseous fuel when a liquid fuel and a gaseous fuel are simultaneously fed to a burner.

23. A process according to claims 17-22 wherein the oxygen amount in flue gases (% by volume on the dry), is equal to or lower than 1.2% when using liquid fuels and lower than 0.4% when using gaseous fuels.

24. A process according to claims 17-23 wherein the flow rate ratio recycling flue gases/comburent, expressed as per cent by volume, ranges from 30% up to about 60%.

25. A process according to claims 17-24 wherein at the start of burner operation a fuel is injected by injection system 8; when a burner operates in steady conditions injection system 5 and/or injection system 8 is/are used.

26. Use of a burner according to claims 1-16 to operate industrial steam generators to produce process steam or electric power by using the process according to claims 17-25.