

Make `std::make_from_tuple` SFINAE friendly

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1 Introduction

This paper introduce constraints for `std::make_from_tuple` to make it SFINAE friendly.

2 Motivation

LWG3528 introduce constraints `requires is_constructible_v<T, decltype(get<I>(declval<Tuple>()))...>` for `constexpr T make-from-tuple-impl(Tuple&& t, index_sequence<I...>)`. When someone write SFINAE code like the following to check whether T can make from tuple, they may meet hard errors like “no matching function for call to ‘make-from-tuple-impl’...”.

```
template <class T, class Tuple, class = void>
inline constexpr bool has_make_from_tuple = false;

template <class T, class Tuple>
inline constexpr bool has_make_from_tuple<
    T, Tuple,
    std::void_t<decltype(std::make_from_tuple<T>(std::declval<Tuple>()))>> =
    true;

struct A {
    int a;
};

static_assert(!has_make_from_tuple<int *, std::tuple<A *>>);
```

Even If the effects are “Equivalent to” calling a constrained function, the constraints has not apply to `std::make_from_tuple`. This is somehow unclear when the constraints are not literally specified with “Constraints:” in the standard wording ([16.3.2.4 [\[structure.specifications\]](#)/p4]). At least “Equivalent to” doesn’t propagate every substitution failure in immediate context. In the case of `std::make_from_tuple`/[LWG3528], the constrains of `make-from-tuple-impl`, the constraints were introduced via a `requires`-clause but not literal “Constraints”. Some implementors believed the `requires`-clause should be treated same as Constraints, but this is not explicitly stated.

3 Impact on the Standard

This proposal is a pure library improvement.

4 Implementation Experience

I've implemented this improvement in:

- [libc++](#): [libc++] Implement LWG3528 (make_from_tuple can perform (the equivalent of) a C-style cast).
- [microsoft/STL](#): <tuple>: Make std::make_from_tuple SFINAE friendly.

5 Proposed Wording

Modify §22.4.6 [tuple.apply] of [N4971] as indicated:

```
template<class T, tuple-like Tuple>
constexpr T make_from_tuple(Tuple&& t);
```

- 3 Mandates: If tuple_size_v<remove_reference_t<Tuple>> is 1, then reference_constructs_from_temporary_v<T, decltype(Tuple)> is false.
- 4 Effects: Given the exposition-only function template:
- 3 Let I be the pack 0, 1, ..., (tuple_size_v<remove_reference_t<Tuple>> - 1).
- 4 Constraints:
- is_constructible_v<T, decltype(get<I>(declval<Tuple>()))...> is true.
 - If tuple_size_v<remove_reference_t<Tuple>> is 1, then reference_constructs_from_temporary_v<T, decltype(Tuple)> is false.
- 5 Effects: Given the exposition-only function template:

```
namespace std {
    template<class T, tuple-like Tuple, size_t... I>
        requires is_constructible_v<T, decltype(get<I>(declval<Tuple>()))...>
        constexpr T make-from-tuple-impl(Tuple&& t, index_sequence<I...>) { // exposition only
            return T(get<I>(std::forward<Tuple>(t))...);
        }
}
```

Equivalent to:

```
return make-from-tuple-impl<T>(
    std::forward<Tuple>(t),
    make_index_sequence<tuple_size_v<remove_reference_t<Tuple>>>{});
```

[Note 1: The type of T must be supplied as an explicit template parameter, as it cannot be deduced from the argument list. — end note]

6 Acknowledgements

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7 References

- [LWG3528] Tim Song. 2023. make_from_tuple can perform (the equivalent of) a C-style cast. <https://wg21.link/LWG3528>
- [N4971] 2023. Working Draft, Standard for Programming Language C++. <https://www.open-std.org/jtc1/sc22/wg21/docs/papers/2023/n4971.pdf>